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Destabilisation of bank deposits
across destinations: assessment
and policy implications

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Abstract

Rapid and large deposit outflows from banks have regained attention in the context of the March 2023 demises of Credit Suisse, SVB and other regional US banks. Moreover, the possible introduction of CBDC or a marked success of stablecoins are perceived as additional clouds over the future of deposit funding. While the bank run literature rarely pays attention to *where* bank deposits can flow to, this paper distinguishes the different flow of funds mechanics across all possible destinations and reviews for each the current and prospective future factors that may contribute to the observed increase of the speed and size of bank runs. While some of these factors can be contained through policy measures, others, like the intensified competition between banks will inevitably stay, and bank balance sheet management and liquidity regulation need to accept the new normal of somewhat less stable and more expensive sight deposits.

JEL Classification: E42, E51, G21, G23

Key Words: bank funding, bank runs, flows of funds, financial stability, liquidity crisis

Non-technical summary

The March 2023 demise of a number of US regional banks and of Credit Suisse suggests that contrary to expectations, the additional regulatory frameworks introduced after 2008, notably in the field of liquidity requirements, have not overcome the problem of bank runs and the need for central banks to act forcefully as lender of last resort. Quite the contrary, the observed bank runs were of unprecedented speed, and central bank measures were equally unprecedented, such as providing liquidity against collateral at nominal value without a haircut.

While the bank run literature rarely pays attention to where bank deposits can flow to, this paper distinguishes the different destinations of bank deposit leakages as a starting point of the analysis. It explains the flow of funds mechanics across all possibilities and reviews for each the current (and prospective future) changes that may contribute to the recently observed increase of the speed and size of bank runs. The flow of funds mechanics in a closed system of financial accounts allows to understand and classify the different options for the migration of bank deposits within the financial system. Bank deposits do not simply disappear but are converted into a claim against a different entity or are absorbed when a bank issues debt or equity or does not renew a loan at maturity. We propose the following list of five types of outflows of deposits from a commercial bank.

A. Transfer of deposits to an account with another bank. This is the classic modern electronic bank run out of one bank perceived to be a bad credit into another bank being perceived to be less credit-risky, as experienced in the cases of SVB and Credit Suisse.

B. Investment into non-bank financial institutions that have no access to central bank liabilities, resulting in a shift of the deposits indirectly to another bank. This would include investing in a money market fund, buying e-money or a stablecoin, or investing into (already issued) securities directly or indirectly (i.e. into a security fund).

C. Investment into a non-bank financial institution which has access to central bank liabilities and indeed holds its inflows in this form. Such a non-bank entity could be a money market fund, e-money issuer or stablecoin-issuing entity which is allowed to hold its fund with the central bank.

D. Conversion of deposits directly into central bank money, be it banknotes or hypothetical future retail central bank digital currency (CBDC). Moreover, some entities, like foreign central banks or sovereign wealth funds, can transfer their bank deposits directly to their account at the central bank.

E. Deposit absorption through bank operations, notably by issuing new bank debt (or equity) to a non-bank, by a borrower repaying a bank loan, or by a (central) bank selling assets to a non-bank.

The paper concludes that direct and indirect outflows of deposits to other banks will continue to play an important, and even further growing role in making bank deposit collection more competitive, expensive, and potentially less reliable. There are no convincing arguments to generally suppress competition for deposits across individual banks, and there would anyway be no good tools to do so. New technology has made it easy for everyone to open several bank accounts and to shift funds from one account to the other quickly and without cost or risks, and, moreover, banks can leverage their access to the central bank through BigTech and other innovative conduits (including e-money institutions or stablecoins who are constrained in their access to the central bank balance sheet), and, finally, social media have supported the dispersion of news leading to more correlated depositor behaviour.

At the same time, central banks can avoid becoming excessive destinations for commercial bank deposit outflows through the access of non-banks to their balance sheet. Non-banks financial institutions (NBFIs like electronic money institutions, stablecoins, narrow banks or MMFs), governments, and sovereign wealth funds should not have unlimited *and* financially attractive access to central bank deposits. If they have access, the value of funds deposited by them should remain sufficiently limited, be it through eligibility criteria, quantitative limits, or incentives such as a sufficiently unattractive remuneration of the relevant positions in the central bank balance sheet. Payment institutions which anyway cannot build up large balance sheets through deposits with the central bank are not an issue from this perspective, while they may be able to contribute to competition and innovation to payments.

Finally, the relative role of banknotes as a destination of bank runs is likely to decrease further, as the drawbacks of holding large amounts of banknotes at home remain, while alternative destinations of deposit outflows (and in particular into other banks) have become more and more easy and appealing in a digitalised society. As central banks have acknowledged that they will apply per-person limits (or other control instruments) to retail CBDC holdings, also this future form of direct access to the central bank balance sheet for all will not be amongst the major factors contributing to less stable bank deposits.

1. Introduction

Recently, the potential instability of banking has re-emerged as a concern following the demise of a number of US regional banks as well as of the globally operating Credit Suisse. While the runs were triggered by traditional concerns, they were much faster than previous runs, which was attributed not only to a low granularity of deposits, but also to structural technological change, such as online banking, faster payments, and information spreading via social media. (e.g. Bowman, 2023).

Moreover, the prospects of new forms of money, including means of payments issued by e-money institutions, narrow banks, or stablecoins and central bank digital currency (CBDC) are said to further threaten the stability of cheap bank funding via sight deposits in the future, potentially weakening the business model of commercial banking and its relative importance for financial intermediation.

While the likelihood and severity of bank runs appear to have changed over time, the basic economic logic of bank runs seems to remain unchanged. At least since the 19th century, it is understood that banks can in principle be in three states (for a recent restatement see e.g. Rochet and Vives, 2004, 1133; or Bindseil and Lanari, 2022): (i) a bank can be solid in terms of solvency *and* liquidity so that their deposit basis and access to funding markets are stable; (ii) a bank can be solvent conditional on sufficient liquidity, but insolvent conditional on certain negative liquidity scenarios because of the implied asset fire sales to be undertaken to address the possible liquidity gaps and related fire sale losses; i.e. the bank is in a multiple equilibrium situation, in which a run could take place or not; (iii) a bank can be insolvent regardless of liquidity scenarios, and in this case, a run of depositors and a loss of funding market access are quasi certain (once the solvency situation is known).

Banks can be pushed from state (i) into state (ii) or (iii) by a negative asset value shock. Banks can also be pushed from state (i) to state (ii) when asset *liquidity* alone deteriorates, or if the central bank suddenly narrows its collateral eligibility or increases haircuts. Vice versa, the central bank can, by making its collateral framework more supportive, push banks from state (ii) into state (i), but never from state (iii) to state (i) or to state (ii). Therefore, the lender of last resort (LOLR) should only be considered for solvent institutions. Depending on whether an individual bank or group of banks are in the run equilibrium of state (ii) or in state (iii), or if a significant portion of the banking system is in one of these states, the respective bank runs can be categorized as either *idiosyncratic* or *systemic*. In the first case, bank (group) specific financial problems or a loss of confidence due to insufficient (risk) management, fraud or scandal are typically the cause for the run, as has been the case recently with Credit Suisse, the US regional banking crisis (see Caglio et al, 2023) or the 1984 run on Continental Illinois. In the second case, a larger number of banks come under stress due to a deteriorating macro-financial environment that often results from a burst credit boom (Schularick and Taylor, 2011, Boissay

et al, 2019), a balance of payment crisis or another adverse macro shock. Such systemic runs occurred in several countries in 2008 but also more recently in Greece in 2015.

The changes discussed in the present paper do *not* alter this overall economic logic of bank runs, but matter in particular for the speed of bank runs in state (ii) and (iii) and for the likelihood that in state (ii) the run equilibrium will prevail. For policy makers this matters a lot because central banks must be even more well prepared to take the right decisions *quickly* in case banks migrate because of exogenous shocks out of state (i): act forcefully as LOLR in state (ii) and close the bank in case of (iii).

While some authors have discussed the factors contributing to the intensity of recent bank runs, this paper is the first to start from a systematic classification of factors on the basis of the different *destinations* of deposit runs. Section 2 explains these different destinations of deposit outflows and provides complete flow of funds for each of them. Sections 3-7 each review one case in more detail, and also provide illustrations from recent episodes in addition to including new developments in this field which are expected to become potentially relevant as a source of deposit outflows in the coming years, such as stablecoins and CBDC. Section 8 assesses the different factors and outlines possible policy responses. Section 9 concludes.

2. A comprehensive list of flow of fund destinations of deposit runs

The bank run literature rarely looks at where deposits can run to. The seminal paper by Diamond and Dybvig (1983) detaches itself from this question right at the beginning by using a hypothetical all-purpose asset that can be invested and consumed, and which customers want to receive from the bank in the event of a run. At the same time, the two 2022 Nobel Laureates, like Gorton (1988), likely have a run for physical cash in mind as they refer to a conversion of deposits into cash. Yet, the authors do not show the associated flows of funds explicitly. More recent efforts to examine bank runs do not address this question either. Gertler and Kiyotaki (2015, p.2014), for example, build a macroeconomic model for bank runs, but do not cover deposit leakages, and in addition mix up sectors that, in our view, clearly must be separated, namely banks (“One can interpret banks in our model as shadow banks and households as an aggregation of individuals and commercial banks.”)

The flow of funds approach provides a way to consistently analyse deposit outflows. The original idea goes back at least to Copeland (1949), the founding father of modern flow of funds statistics:

“[To] summarize money-flows usefully we must divide our economy into a number of sectors or groups of transactors and prepare a separate balancing statement for each sector. We need an exhibit that will report each money-flow both as an inflow to some one sector and as an outflow from some other.”

Such an approach has since been used for various research questions and models (Godley and Lavoie, 2006; Winkler et al, 2013; Lipton, 2016). This paper follows the logic of Rochet and Vives (2004), which has a bank run model with a realistic balance sheet for banks, and more directly of Bindseil and Fotia (2021, Chapter 6), where the transfer of deposits to another bank in a run is explicitly shown.¹

The flow of funds mechanics in a closed system of financial accounts allows us to understand and classify the different options for the migration of bank deposits within the financial system. Bank deposits, a claim of the depositor on a specific bank, do not simply disappear, but are converted into a claim against a different entity or are absorbed when a bank issues debt or equity or does not renew a loan at maturity. There always needs to be some secondary flow of funds which counterbalance the accounts of the affected financial entities. In this context, the key sectors need to be included in our flow of funds model to understand and classify the various cases of deposit losses. Moreover, some sectors need to be disaggregated into at least two entities as flows *within* one sector can matter as well.

We propose the following list of five types of outflows of deposits from a commercial bank.

- A. **Transfer of deposits to an account with another bank.** This is the classic modern electronic bank run out of one bank with bad credit perception into another bank being perceived to be less credit-risky, as experienced in the cases of SVB and Credit Suisse.
- B. **Investment into non-bank financial institutions that have no access to central bank liabilities,** resulting in a shift of deposits indirectly to another bank. This would include investing in a money market fund, buying e-money or a stablecoin, or investing into (already issued) securities directly or indirectly (i.e. into a security fund). The case **B1** below assumes that the fund invests the inflow of funds into a deposit with another bank. The eventual flow of fund implications of the case that the fund invests into a security will depend on the seller of the bond. Below we assume for this case **B2** that the securities come from Depositor/Investor 2 (DI2), who will then itself deposit the cash with Bank 2 (as we are always interested in the case in which Bank 1 loses the funding and increases its dependence on the central bank). Last but not least, the depositor can also directly purchase a security with his deposits with Bank 1. We assume that the seller of the securities is DI2 and call this flow **B3**.
- C. **Investment into a non-bank financial institution which has access to central bank liabilities and indeed holds its inflows in this form.** Such a non-bank entity could be a money market

¹ A recent exception that briefly draws on the flow of funds approach is Acharya et al (2023, 19). The authors discuss the macroeconomic causes of the March 2023 banking stress and in this context explicitly show how the balance sheets of banks and non-banks evolve if the Federal Reserve purchases assets from them.

fund, e-money issuer or stablecoin-issuing entity which is allowed to hold its fund with the central bank.

- D. **Conversion of deposits directly into central bank money.** Case **D1** shows the flows for the classical run on banknotes, but also represents the hypothetical future case of a run on retail CBDC. Moreover, some entities, like foreign central banks or sovereign wealth funds, can transfer their bank deposits directly to their account at the central bank (case **D2**). Somewhat similar cases, which we do not cover here (while they could be easily added), are the ones that the deposits will be used to pay taxes, or to buy a newly issued Government bond, and be transferred for this purpose to the account of the government with the central bank.
- E. **Deposit absorption through bank operations, notably by issuing new bank debt (or equity) to a non-bank or by a (central) bank selling assets to a non-bank.** On aggregate, the banking system would not seem to suffer a negative liquidity effect from this since in the first case the banking system switches to a more long-term funding (which could even appear positive from a stability perspective) while in the second, the banking system shortens its balance sheet and therefore also reduces its funding needs. If we disaggregate the banking system and look at individual banks, deposit absorption both through new bank debt issuance and through asset sales remains neutral as long as it is an “internal matter” for one bank, i.e. a liability switch for one bank which issues debt being paid by investors in deposits held with the same bank, or assets purchased from the bank by depositors with the bank paying with these deposits. But realistically, many such investments with deposits (in newly issued bank debt or into assets held previously by a bank) are across banks, i.e. the deposits come from another bank than the one who issues new debt or sells assets. We distinguish the following cases: depositor buys with deposits of Bank 1 newly issued bonds and equity issued by Bank 2 (case **E1**); Depositor buys assets from Bank 2 with deposits at Bank 1 (case **E2**). We also include here the cases to buy with deposits at Bank 1 securities from the central bank, i.e. if the central bank reduces its securities portfolio (including the case in which the central bank does not roll over a maturing debt, and therefore the issuer, needs to place the re-issued debt with a private non-bank investor) (case **E3**). Last but not least, deposits of Bank 1 are destroyed if a depositor of Bank 1 uses its deposits to repay a loan it had received from Bank 2 (case **E4**). We include this case under category E as it is somewhat similar to the case that depositor buying an asset from that bank (E2). Deposits of Bank 1 are destroyed in all these four cases.

We show all options in a simple stylized representation (Figure 1), and then again all options in more detail in one system of accounts (Figure 2).² In the latter, as usual, assets of the individual actors are shown on the left, their liabilities on the right. The flows with index “1”, “2”, or “3” are shown *in parentheses* whenever only one of the several cases applies at once in a balance sheet. The outflows have eventually, i.e. directly or indirectly, only three destinations: either ending as deposits with other banks (A and B), or ending as central bank liabilities (C and D), or being absorbed through certain transactions with banks, such as through the purchase of newly issued bank debt or via the purchase of assets from (central) banks, or via repayment of a loan (E). In the following we review the five cases with their sub-cases one by one with a view to identify which of the possible destinations has played (and will play in the future) a growing role.

Figure 1: Stylized representation of all different cases

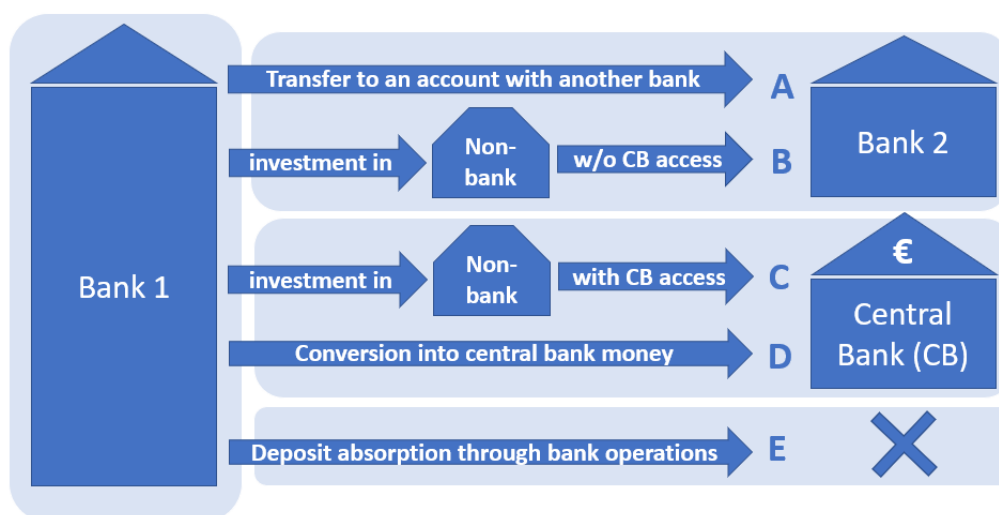


Figure 2: Flow of funds represented in a closed system of financial accounts

DI1 (Depositor/Investor 1 who runs, e.g. a wealthy individual)				
Banknotes or CBDC	X	+D1	Equity	X
Investment FV1	X	(+B1) (+B2)	Loans with Bank 2	X (-E4)
Investment FV2	X	+C		
Deposits Bank 1	X	-A -B -C -D1 -E		
Deposits Bank 2	X	+A		
Securities	X	(+B3) (+E2) (+E3)		
DI2 (Depositor/Investor – who sells securities as an implied flow)				
Deposits Bank 2	X	(+B2) (+B3)	Equity	X
Securities	X	(-B2) (-B3)		
DI3 (Depositor/Investor who has access to CB and runs – e.g. a foreign sovereign wealth fund)				
Deposits Bank 1	X	-D2	Equity	X
Deposits with CB	X	+D2		
FV1 (A financial vehicle without access to CB, e.g. an equity fund)				
Securities	X	(+B2)	DI 1	X +B
Deposits Bank 2	X	(+B1)		

² Figure 2 can be seen as an integrated visualization of several T-accounts. See for example Nelson (2021) for an analysis of quantitative easing using T-accounts.

FV2 (A financial vehicle with access to CB, e.g. a stablecoin allowing to deposit its fund at CB)							
Deposits with CB	X	+C		DI 1	X	+C	
Bank 1				Bank 2			
				Deposits DI 1	X	-A -B -C -D -E	
				Credit from CB	X	+A +B +C +D +E	
Securities	X		(-E2)	Deposits DI1	X	+A	
Loans	X		(-E4)	Deposits DI2	X	(+B2) (+B3)	
				Deposits of FV1	X	(+B1)	
				Credit from CB	X	-A -B (-E1) (-E2) (-E4)	
				Debt issued	X	(+E1)	
CB (Central Bank)				CB (Central Bank)			
Credit to Bank 1	X	+A +B +C +D +E		Banknotes / CBDC	X	(+D1)	
Credit to Bank 2	X	-A -B (-E1) (-E2) (-E4)		Deposits FV2	X	+C	
Securities	X		(-E3)	Deposits DI3	X	(+D2)	

Figure 2 assumed that banks have no excess reserves with the central bank, and therefore in- and outflows of deposits are directly compensated by a change of recourse to central bank credit (assuming for the sake of simplicity the absence of interbank funding markets). If instead the banks are in excess liquidity towards the central bank, then the accounts of the banking system are affected as described in Figure 3.

Figure 3: Flow of funds in the banking system if the banks hold excess reserves

Bank 1				Bank 2			
Deposits with the CB	X	-A -B -C -D -E		Deposits DI 1	X	-A -B -C -D -E	
Bank 2				Central Bank			
Securities	X		(-E2)	Deposits DI1	X	+A	
Loans	X		(-E4)	Deposits DI2	X	(+B2) (+B3)	
Deposits with the CB	X	+A+B (+E1) (+E2) (+E4)		Deposits of FV1	X	(+B1)	
				Debt issues	X	(+E1)	
Securities	X		(-E4)	Banknotes/CBDC	X	(+D1)	
				Deposits Bank 1	X	-A -B -C -D -E	
				Deposits Bank 2	X	+A +B (+E1) (+E2) (+E4)	
				Deposits FV2	X	+C	
				Deposits DI23	X	(+D2)	

3. Transfer of deposits to another bank (A)

The electronic run out of one bank or banking group into other banks seems to have recently emerged as the dominant flow underlying modern bank runs. Such deposit withdrawals require simply to initiate online a credit transfer between two bank accounts. Over the last two decades, online access to banks has become the normal, most countries have now fast payment systems in operation in which credit transfer between bank accounts are immediate (Bowman, 2023), and the number of bank accounts per capita has increased with the ease of opening bank accounts online. The 2023 bank runs in the US and for Credit Suisse have indeed very likely been dominated by transfer of deposits to other banks: Caglio et al (2023) use deposit growth rates from weekly balance sheet data to analyze the

recent regional banking crisis in the US and conclude that in early 2023, depositors moved large amounts of funds from small and regional banks *towards large banks* and that the differences in deposit growth rates across bank types were substantial.

In the case of Credit Suisse, depositors withdrew CHF 111 billion (\$121 billion) in the last quarter of 2022, most of which in October, and CHF 67 billion (\$75 billion) in the first quarter of 2023.³ Without transaction data it is difficult to determine the exact destination of the deposits. Swiss residents appear to have reallocated their deposits mainly to other Swiss banks. According to SNB data, UBS and CS lost a combined CHF 61 billion in domestic deposit funding from Q2 2022 to Q1 2023, while regional, cantonal and Raiffeisen banks gained CHF 42 billion over the same period.⁴ The remaining deposits from domestic residents likely went abroad, as UBS and CS together lost CHF 16 billion and 8 billion, respectively, in USD and EUR funding from Swiss residents.⁵ SNB data further shows that foreign depositors appear to have played an even bigger role. International wealth management clients, for example, typically have several bank relationships and can easily transfer deposits to another (globally active) bank. US dollar deposit accounts held by foreigners at both Swiss globally systemically important banks, Credit Suisse and UBS combined, declined by CHF 107 billion from CHF 229 billion in Q2 2022 to CHF 122 billion in Q1 2023, while Euro-denominated deposits declined by CHF 25 billion. It is unclear to what extent these outflows are related to the demise of Credit Suisse, but the outflows of Credit Suisse's foreign currency deposits from foreign clients could be larger than these numbers if some clients run to then rival UBS.⁶

Overall, foreign currency funding needs of Credit Suisse have been eased by the Swiss National Bank (SNB): In Q1, the SNB appears to have provided foreign currency funding worth CHF 43 billion to Credit Suisse, because SNB's liabilities in foreign currencies increased by that amount (SNB, 2023). Total lending from SNB to CS peaked at CHF 168 billion on March 20, 2023 (SNB, 2023c, 25).

As also argued in more general terms in the introduction, the *causes* of these recent runs do not appear to be new compared to previous runs in recent centuries (see also theoretical framework in introduction): CS suffered a loss of confidence, and its relatively sound but illiquid asset side of the balance sheet could not serve the run. Repeated incidents involving legal breaches and inadequate risk management led to financial losses and large fines. Also, CS admitted to material weaknesses in its financial reporting in the first quarter of 2023, and the guarantees provided by the government to

³ See quarterly statements or CNN article [here](#), accessed May 25, 2023.

⁴ See SNB data [here](#).

⁵ Balance of payments data suggests that part of these deposits could have been invested in NBFIs, which in turn increased portfolio investment abroad, indirectly channeling deposits to other banks (see BIS 2023, 45).

⁶ Source: SNB data, see [here](#).

UBS as part of the takeover show that the asset side of the balance sheet entails potentially undisclosed risks. Nevertheless, the asset side was relatively sound and did not suffer from a systemic macro shock such as excessive credit defaults experienced by many banks during the global financial crisis. SVB, on the other hand, had a problematic asset side with low-coupon long-term bonds that would have contributed negatively to income for years to come because of the increased interest rate in funding markets. The event of a run leads to forced fire sales of these assets, translating the negative carry into immediate losses and a reduction in the capital of SVB.

However, the *intensity* of recent (and future) bank runs may be higher than in the past, as competition across banks for deposits seems to have intensified. One could argue that higher competition in itself does not necessarily lead to more volatile deposits (quantity changes) because the price of deposits could as a consequence of competition simply move to a higher equilibrium level as all banks adjust their rate offer as needed. Yet, higher competition means that depositors have better information and access to not one but two or more bank accounts. In the event of a run, depositors are not limited to withdrawing cash from a single bank but have relatively good access to other deposit accounts. Consequently, in a more competitive world and conditional on having a run, the run will be faster and more intense (less stable deposit funding). The FSB (2023, 25) discusses lessons learned from 2023 bank runs and reaches similar conclusions, that bank runs “when they happen, happen faster” due to social media and banking apps.

Empirical evidence for the run on regional banks in the US confirms that the speed and intensity have increased compared to previous runs (Table 1). Similarly, with regard to the case of Credit Suisse, the Swiss National Bank states that “the scale and pace of deposit outflows [...] were unprecedented and more severe than assumed” (SNB, 2023c, 8).

Table 1: Largest daily deposit withdrawals during different bank runs in the US, based on FED (2023b).

Year	Bank	Largest daily deposit withdrawal (percentage of total pre-run deposits)
1984	Continental Illinois	8%
2008	Washington Mutual	2%
2023	SVB	25%
2023	Signature Bank	20%

Why have the speed and intensity of recent bank runs increased? We will first look at two drivers that are specific to the recent bank runs, before discussing more general factors that may have contributed to increased competition for deposits between banks.

First, many of the banks in trouble in March 2023 had **disproportionally concentrated large depositors**, i.e. different from a traditional commercial bank serving a large number of average individuals and small firms holding granular deposits. The larger the deposits of a single party, the (i) higher the uninsured part of the deposits; (ii) the higher the likelihood that the depositor has several bank accounts, (iii) the higher the likelihood that the depositor monitors the credit riskiness of the bank and is prepared to transfer deposits away to other depositors. At least in the case of SVB, it appears that their deposit funding strategy was aggressive and paid too little attention to the likely instability of such concentrated deposits in the case of negative headlines. The 10 largest depositors of SVB held deposits amounting to 7% of the balance sheet (or \$13 billion in absolute terms).⁷ Therefore, the exceptionally fast deposit outflows in the case of SVB and others are partially due to external factors, partially due to the imprudent approach of these banks towards relying on attracting large and concentrated deposits, without thinking that these can leave as fast (or even much faster) than they come. Similarly, Credit Suisse also appeared to have had disproportionately large depositors that turned out to be risky as the bank experienced deposit outflows “in particular by wealth management clients” (SNB, 2023c, 39).

Second, and related to the role of concentrated large depositors, recent bank runs appear to have been characterized by **homogeneity and correlation across depositors**. Rose (2023) discusses which factors would have mainly led to the observed high speed and size of US bank runs in 2023 also by providing historical comparisons with previous decades in the US. Relative to Bowman (2023), he puts particular emphasis on the homogeneity and correlation of depositors of the affected US banks in 2023, as already for many decades, electronic transfers between banks would have been possible and used for bank runs.

Beyond these two factors that might have been specific to the March 2023 bank runs, the following six more universal factors explain why competition across banks for deposits appears to have intensified.

(i) Private and firm depositors with larger amounts of money are today very likely to have several bank accounts. First, they can choose from a wide range of different banks, including foreign ones, and hold different accounts for different purposes. Second, deposit insurance is capped (at EUR 100,000 in the Euro Area and \$ 250,000 in the US), and a simple legal way to circumvent this limit and to continue enjoying full protection beyond these thresholds is to distribute money over as many accounts as possible. Caglio et al (2023) show that banks with higher shares of uninsured deposits

⁷ See Martin Gruenberg, Chairman of the Federal Deposit Insurance Corporation during the US Committee Hearing, March 28, 2023 ([here](#)).

experienced stronger outflows than other banks during the recent regional banking crisis in the US. Third, there is evidence that large-scale deposits in the US have grown more than overall deposits: “the growth of deposits is, at least in part, driven by banks exposed to the root causes of the saving glut: banks located in states in which wealth inequality is large or increasing, and banks located in counties where intangible-intensive firms (such as tech firms, which are more prone to large savings) are more present.” (Vuilleme, 2023). Having several accounts can also be considered a risk management tool to prepare for the case that the credit of one bank deteriorates as it then facilitates the shifts to another account. This is particularly risky if a small number of depositors hold a significant proportion of all deposits and can thereby quickly endanger the bank in a run.

(ii) Some banks (relying on an online banking model) have started in the last decades to specialize on deposit collection at somewhat better competitive rates than the sight deposit transactional accounts in standard banks. Therefore, many have opened such a remunerated deposit account for investment purposes. Other banks have attracted systematically new clients by claiming to offer special services or be more efficient and innovative, such as so-called neo-banks in Europe. These banks typically have no branches, only work via apps and offer real-time international payments or multicurrency deposits. The Wall Street Journal recently substantiated the argument, that “online banks are winning the deposit war”⁸, while overall deposits in the US are declining, including at some bigger banks like Bank of America and Wells Fargo.

(iii) With the **internet and banking apps**, the opening of new bank accounts and the transfer of money between bank accounts have become very easy and fast compared to a few decades ago. A society that is becoming more internet-savvy is also increasingly demanding these services. The number of Americans who do not have a bank account, for example, has fallen to a record low.⁹ Moreover, with the lift-off from the zero lower bound and the increasing number of bank accounts earning positive interest, the internet has also become increasingly convenient for comparing interest rates on different bank accounts. Online comparison portals such as bestmoney.com in the USA or Verivox in Germany are also supporting increased competition for deposits, and social media can help spread (mis)information about accounts as well as the credit situation of banks more quickly. In addition, Erel et al (2023, abstract) argue that financial technology has already reshaped banking, and document that online banks experienced “inflows, while traditional banks experience outflows during monetary tightening in 2022.” Moreover, the Swiss “report of the expert group on banking stability - need for reform after the demise of Credit Suisse” (Eggen et al, 2023, 5) state that “digitization has additionally

⁸ See Wall Street Journal, June 3, 2023, “Online Banks Are Winning the Deposit War”, ([here](#)).

⁹ See FDIC survey data [here](#).

increased the likelihood and speed of bank runs” (translation by the authors). Along these lines, Benmelech et al (2023) report a decline in bank branches in the US and an increase in digital banking that turns deposits into “hot money”. The term “hot money” can be applied in particular to the growing speed of payments. Traditionally, banks process payments mostly during office hours - not at night, on weekends or holidays. Fast Payment Systems (see BIS CPMI, 2021) allow for money transfers instantaneously 24/7 and also some RTGS have moved towards 24/7 (BIS CPMI, 2022a). In the words of Abate (2023), just-in-time payments “might also mean that deposit runs occur faster and at all hours”. The FSB (2023, 25) also observes that the use of 24/7 payment systems exacerbated deposit outflows at Credit Suisse.

(iv) Recently, **BigTechs started to offer themselves as facilitator to channeling deposits to specific collaborating banks** via their customer interface offering quasi-immediacy of opening a new bank account accessible strictly through the BigTech firm. According to the Financial Times, Apple teams up with Goldman Sachs on high-yield savings accounts. According to Forbes¹⁰, Apple’s savings account attracted within its first day USD 400 million and in its first four days USD 990 million. In the same sense, US community banks that specialize in banking-as-a-service (BaaS) have also recently benefitted from deposit inflows. A sample of 42 community banks that partner with technology companies such as PayPal to set up highly transactional accounts, for example, saw deposit growth of 4.0 percent in the first quarter of this year, compared with only 0.2 percent growth for all community banks.¹¹

(v) **Demand for excess reserves** and **dormant interbank markets** make obtaining reserves through deposit inflows relatively attractive. The demand for excess reserves, i.e. for reserves beyond a minimum reserve requirement, has increased in recent years. First, the regulatory response after the Lehmann crisis was that lending markets, in particular money markets, should use both more and safer collateral. However, this regulatory approach was not a golden bullet either because the overall supply of collateral might be limited (see for example Levels and Capel, 2012) and because even collateral like government bonds can become illiquid in a systemic event, as illustrated by the March 2020 US government bond turmoil¹² as well as the UK gilt crisis in autumn 2022. Although central banks supported government bond markets in these crises, reserves remain the highest form of credit and may have become more important for banks’ risk management purposes as a result of this experience. Second, prepositioning of liquidity for central counterparties (CCPs), and sometimes for other

¹⁰ Forbes, May 1st, 2023, Emily Manson, “Apple’s new savings account draws nearly \$1 Billion in deposits in first four days”

¹¹ See analysis by SPglobal “Banking-as-a-service providers grow deposits despite Q1 turmoil” ([here](#)).

¹² “Between March 15 and March 31, the Fed purchased \$775 billion in Treasury securities and \$291 billion in agency MBS.”, see [here](#), which represents around five percent of all marketable Treasuries.

counterparties, are substantial, as illustrated by the recent demise of Credit Suisse. The bank had met regulatory liquidity requirements until shortly before its downfall, but “a large part of the liquidity buffers held to fulfil the Liquidity Coverage Ratio (LCR) requirement served to cover operational liquidity needs and additional prepositioning requirements imposed by payment agencies and clearing institutions.” (SNB, 2023c, 8).

Even if there are sufficient reserves at the system level - a situation still prevalent in most advanced economies - they are unequally distributed and would require a functioning interbank market to be re-distributed. Since interbank markets also require (in the post-Lehman world) collateral and are not very active after years of monetary policy at the zero-lower bound (ZLB) for various reasons including institutional memory loss (Borio 2023, 5), banks’ access to high quality liquid assets tends to narrow down to borrowing from the central bank (using illiquid but central bank eligible assets) or attracting deposits – in which case the latter is cheaper. Alternatively, banks could change the composition or size of their assets.

(vi) Lastly, **changes to the monetary policy implementation framework of central banks in combination with the recent lift off of interest rates from the zero lower bound** might have also contributed to a more aggressive behavior of banks in seeking to attract deposits from other banks. That renewed competition for deposits – although overall still at a relatively low level as measured by deposit betas (ECB, 2023, 56) – could be linked to the lift off from the zero lower bound. This seems at least to some extent be assumed in the ECB’s spring 2023 Financial Stability Review (ECB, 2023, 59), which indicates a sharp increase in competition for term and sight deposits among euro area banks.

Before the 2008 financial crisis, central banks of most advanced economies (and also of many emerging economies and developing countries) applied a so-called “symmetric corridor” framework for monetary policy implementation. In this framework, explained for example by Borio (1997) or Bindseil and Fotia (2021, 43-47), the central bank steers the short-term interbank interest rate in the middle of a corridor set by a deposit facility and a lending facility (e.g. a “discount facility” as called in the UK and in the US, or “marginal lending facility” in the terminology of the ECB) available to banks. For example, in 2004, the European Central Bank (ECB) offered its deposit facility at 1% and its marginal lending facility at 3% and steered the market for bank reserves with the central bank in a neutral manner, so that the interbank overnight interest rate fluctuated around 2%. In view of its costs, banks rarely used the deposit facility, and therefore essentially held reserves to fulfil just their reserve requirements, and not more. There was therefore a significant economic disincentive of banks to act somewhat in the direction of a narrow bank and to collect large amounts of deposits at the expense of other banks to hold these reserves as excess reserves with the central bank. This of course

did not prevent competition between banks in the sense that one may seek to collect more deposits such as to have a larger share of deposits as funding source, relative to the average share of such deposits across all banks (but not for the purpose of holding them as reserves with the central bank). During the Lehman financial crisis, the majority of central banks (including the Fed, the Bank of England, the Bank of Japan, the ECB etc.) moved towards a so-called floor system, in which the banking system as a whole holds large excess reserves, and holding excess reserves is no longer disincentivised – as depicted above in Figure 2. This was not an issue when central bank interest rates were close to zero, as that levelled out deposit interest rates and made specialized financial intermediation between central bank reserves and non-bank depositors less viable as a business idea. This however changed with the “lifting off” of monetary policy interest rate from the zero lower bound, which restored the pre-crisis situation in which sight deposits tended to have a significantly lower remuneration than short term market interest rates and the rate of remuneration of excess reserves (note that the US Fed did not remunerate excess reserves before 2008, i.e. it introduced “IOR” only in the context of the crisis related monetary policy framework). This may suggest that when short term market interest rates are sufficiently away from zero, then a floor system of monetary policy implementation might contribute to competition between banks for deposits with a view to benefit from the spread between the sight deposits they issue and the remuneration rate of their own deposits with the central bank.

4. Investments into non-bank financial intermediary that have no access to central bank liabilities (B)

A depositor can withdraw deposits by transferring them into a form of investment with a non-bank financial intermediation (NBFi) entity, typically by purchasing some form of liability of the respective financial vehicle, be it the share of an investment fund, a money market fund (MMF), or the payment means issued by a stablecoin.¹³ The depositor can also directly buy securities in the secondary market (see case E where the seller is a bank). In all these cases, the deposits leak into the deposits with another bank – implying a relatively similar outcome to the one under the bank-to-bank electronic run (case A). It should be noted that NBFi entities do not necessarily have to hold their deposits with another bank but can also provide wholesale funding to banks through various instruments. For example, prior to 2008, MMFs played an important role in providing wholesale funding to certain US banks through commercial papers (CP) or certificates of deposit (CD), so that the purchase of MMF shares could lead to a conversion of deposits into other funding instruments. More recently, brokered

¹³ In this paper we only look at stablecoins that are backed by commercial bank deposits or liquid assets, or that might be backed by central bank reserves in the future (section 5). Non-backed or “algorithmic” as well as debt backed stablecoins are not discussed, particularly since they are now generally considered unviable (see Chanson and Senner, 2023).

deposits as well as subordinate debt and repos have played an important role in wholesale funding for US banks.¹⁴ In the US, advances from the Federal Home Loan Banks (FHLB) can also be an important source of wholesale funding for banks. The FHLB system raises funds in debt markets and lends to its members, particularly banks. Since FHLB bonds are eligible for government MMFs, the purchase of MMF shares may ultimately re-channel funds back to banks through yet another non-bank entity, the FHLB system.

This type of run may materialise if some depositors perceive that banking risks are increasing across the board for all banks, and therefore do not want to shift deposits from one to the other bank – or if depositors only have access to a broker but not another bank. In recent years, public debt MMFs with daily redemptions appear to be the NBF entity that provides a relatively close substitute for bank deposits (see case C for the special case where MMFs have access to the central bank). Already during the Lehmann crisis (i.e. before money market funds could access the Fed balance sheet via the reverse repo facility), MMFs received large inflows (FSB 2021, p.18, figure 4)

On the other hand, three features may appear to make this type of bank run somewhat less relevant: (i) if the transfer is only settled with a delay, say T+1 or even T+2; (ii) the assets may be less close substitutes for deposits (if the run is from bank to bank, then there is no need to change at all the nature of the asset held); (iii) if there is indeed a general perception of vulnerability of the entire banking system,.

However, some developments in the future may facilitate also this type of run: first, stablecoins are close substitutes to deposit money and transferring funds to them may in the future be instantaneous. Also, the time for the settlement for securities investments are decreasing. For example, the US is currently moving all securities settlements from T+2 to T+1 (SEC, 2023).

Now, did investments into NBF entities, which in turn provided wholesale funding to banks, contribute to the recent banking crisis in the US? CPs and CDs of US MMFs declined, but MMF repos increased by USD 240 billion in March 2023.¹⁵ This likely contributed to the funding stress of smaller and regional banks, as these banks tend to rely less on such funding. In other words, inflows into NBF entities that provide repo funding re-distributes funding unevenly across banks, benefitting larger banks that rely more heavily on repo funding.

¹⁴ See SPglobal data [here](#). Moreover, note that while the purchase of subordinate debt is similar to case E1 (purchase of bank bonds), we discuss wholesale funding in this section because repo funding is classified as “other deposits” in the European System of Accounts.

¹⁵ See ICI data based on SEC Form N-MFP Data Sets [here](#).

Moreover, government MMFs received significant inflows and re-channeled some of these funds back to banks through the FHLB system (see Cecchetti et al 2023, 199).

However, compared to other forms of wholesale funding, FHLB advances are readily available to almost all banks in the US by design, as the vast majority of banks are members of the FHLB system.¹⁶ In March 2023, smaller and regional banks used FHLB advances to reduce their funding stress. Cecchetti et al (2023, 198) conclude that the “FHLB borrowings by SVB, Signature Bank, and First Republic Bank were critical in keeping the banks afloat”. From the perspective of an individual bank, such as SVB, the following two different flow of funds can be distinguished: First, some of the deposits at SVB flowed into government MMFs and (part of them) effectively circled back to SVB through the FHLB system, while other deposits ended up with other destinations, e.g. as repo funding at a large bank, and thus were effectively lost to SVB. Second, deposits from *other* banks flowed into government MMFs, and some of these funds were advanced to SVB through the FHLB system. Empirically, the two channels cannot be separated, but taken together, SVB outflows in the second half of 2022 were apparently fully offset by FHLB advances, see Cecchetti et al (2023, 195). Because SVB collapsed during the first quarter of 2023, data are not available to estimate the role of FHLB advances during the period of greatest outflow. In any case, some of the deposits that flowed into government MMFs redistributed funds in a way to benefit small and regional banks through FHLB loans.

That the **deposits of stablecoins with banks** are potentially highly unstable and in any case less stable than traditional granular bank deposits has been emphasized repeatedly by policy makers, such as Panetta (2021):

“For example, one of the most widespread stablecoins promises “stability” by investing in low-risk assets such as commercial paper and holds a large proportion of the stock of these instruments in circulation. In a situation of stress, large-scale sales of assets in response to a sudden increase in redemptions could generate instability throughout the commercial paper market. This phenomenon could spread to other stablecoins and related sectors, eventually finding its way to the banks that hold the stablecoins’ liquidity.”

Coste (2023) analyses regulatory factors which will contribute to shaping the flows of funds triggered by stablecoins without access to central bank accounts. While his analysis is specifically geared at stablecoins in the EU, regulatory treatment will be relevant for the potential scale of any type of NBFIs and for any jurisdiction. The author considers specifically how banks collecting deposits from stablecoin issuers are affected in terms of their prudential capital and liquidity ratios and related policy considerations, such as exempting central bank reserves from leverage ratio calculations and offering

¹⁶ At the end of 2022, there were 4136 FDIC insured banks in the US (see FDIC data [here](#)), while the FHLB system had 3999 commercial and savings banks members (see FHFA data [here](#)).

direct central bank cash accounts to stablecoin issuers (as covered in the section below). Coste concludes inter alia that collecting stablecoin deposits weakens the bank's LCR due to the very high outflow rate of these deposits, even if the bank re-invests them in low-risk assets, and that issuing stablecoins transforms stable retail deposits, which can serve as source of funding and support the transmission of monetary policy, into volatile deposits that need to be kept as central bank reserves or re-invested in low-risk assets.

5. Investments into financial vehicles that have access to central bank liabilities (C)

In the following, we review the discussion on central bank access and their potential role as destabilizing banks' deposit funding for a number of non-bank financial vehicles. The mechanics of flows of deposits into these vehicles (if having central bank access) are identical, but for each of them, a separate debate on central bank access can be reported, with some having, and others having not (yet) contributed to deposit outflows.

E-money and Payment Institutions

Taking the example of the euro area, E-money and payment institutions have no access to central bank balances yet, but the matter is intensively debated. **'Payment institutions'** (PI) are legally defined in Article 4(4) of the revised Payment Services Directive (PSD2) as a legal person that has been granted authorisation in accordance with Article 11 to provide and execute payment services throughout the Union. Payment services means any business activity as set out in Annex 1 of the PSD2 text. **'Electronic money institutions'** (EMI) are legally defined in Article 2(1) of EMD2: 'electronic money institution' means a legal person that has been granted authorisation under Title II to issue electronic money; 'electronic money' means electronically stored monetary value as represented by a claim on the issuer which is issued on receipt of funds for the purpose of making payment. E-Money Institutions can issue electronic money - in addition to the list of Payment Services that a PI may conduct. Both EMIs, PIs, and banks provide payment accounts and can be used for the execution of payment transactions. Payment accounts issued by a PI require a standing order based on which the funds will arrive to and leave from the account. Payment accounts issued by an EMI can also hold permanently funds and payments in and out can also be initiated at the discretion of the account holder. This means that EMIs build up balance sheets, while PIs cannot offer a store of value function that seems to be an inherent part of the definition of money (next to the means of payment function). Both EMI and PI are currently seeking to obtain access to the Eurosystem balance sheet. As explained by Commission (2021; "Targeted consultation on the review of the Directive on settlement finality in payment and securities

settlement systems”) in the context of a consultation on the review of the Settlement Finality Directive (SFD), E-money institutions under the E-Money Directive (EMD 2) and payment institutions under the Payment Services Directive are not currently eligible participants under the SFD. In its Retail Payment Strategy, the Commission announced that it would consider, in its SFD review, extending the scope of the SFD to include e-money and payment institutions, subject to appropriate supervision and risk mitigation.

EMIs and PIs have articulated their arguments in favour of obtaining access to central bank accounts in an open letter to Commissioner McGuinness (European Fintech Association, 1 February 2023; Joint industry letter on amending the Settlement Finality Directive), arguing that “a true level playing field can only exist if non-banks are granted access to the payments infrastructure”.

In its consultative paper, the Commission had not referred to the possible financial stability implications of granting access of EMIs (potentially issuing large volumes of electronic money) to the central bank balance sheet, and the possible implied disintermediation of banks. While indeed PIs would not contribute to such risks, EMIs could, as they would offer a quasi “narrow bank” (see below) access to central bank liabilities and issue some sort of pseudo-central bank money.

On the basis of the feedback to the consultative paper, the Commission evaluated PSD2 and decided to revise PSD2 by issuing on 28 June 2023 a draft legislative proposal for a new directive and a regulation (see the *Report from the Commission to the European Parliament, the Council, the European Central Bank and the European Economic and social Committee, Brussel, 28 June 2023*). The Commission’s proposal revising PSD2 contains measures to allow central banks to provide account services to non-bank PSPs, “at their discretion”. The Commission is also proposing to amend the SFD to include PIs (and EMIs) as possible participants in designated payment systems. Moreover, the draft PSD2 amendments as published in June 2023 propose to merge the PI and EMI regimes, bringing them together in one single legislation and harmonising them, while still leaving room for specificities where justified.

Some central banks have already allowed access of non-bank payment institutions to central bank accounts. For example, the Reserve Bank of India (RBI) has allowed non-bank payment system providers to participate in its RTGS system. According to RBI (Press release, 28 July, “Access for Non-banks to centralised payment systems”¹⁷), a direct access for non-banks to CPS would lower the overall risk in the payments ecosystem and would bring advantages to non-banks like reduction in cost of payments, minimising dependence on banks, reducing the time taken for completing payments,

¹⁷ <https://rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=12133>

eliminating the uncertainty in finality of the payments as the settlement is carried out in central bank money, etc..

At the same time, the RBI appeared to be prudent with regards to what type of PSPs would be authorised: “To start with, access to non-banks in CPS will be enabled in a phased manner. In the first phase, only the following authorised non-bank PSPs shall be provided access – Prepaid Payment Instrument (PPI) Issuers; Card Networks; and White Label ATM Operators.” This would suggest that an equivalent to e-money institutions would not be eligible.

In the UK, the Bank of England announced that it was allowing access to its RTGS accounts to non-bank Payment Services Providers on 19 July 2017 (see Bank of England press release), also quoting similar advantages analogous to those noted by the European Fintech Association and the RBI. In principle the term “Payment services provider” encompasses both PIs and EMIs, although most of the time PIs are meant when reference is made to PSPs. The Bank of England however explicitly included authorised EMIs in its enlarged RTGS access policy, see page 6 of “Access to UK Payment Schemes for Non-Bank Payment Service Providers December 2019” by the Bank of England, FCA, and pay.uk¹⁸).

In China, the leading E-money platforms Alipay and WeChat Pay would have been requested to deposit their customer funds with the People’s Bank of China (PBoC) at a zero interest rate, which according to a Bloomberg opinion would be a “strangling” of these firms as the firms would lose their ability to earn an interest rate spread (Opinion by Christopher Balding, “China is strangling its private champions”, 10 March 2019¹⁹). The article mentions that the PBoC would have referred to risk management considerations to justify their decision. The negative perception of the mandatory depositing of funds with the central bank seems to be in contradiction with the struggle of e.g. EU EMIs and PIs to obtain access to central bank accounts for depositing their funds. In China, the two e-money institutions presumably had the trust of their customers regardless of the way they employed their funds, and at the same time the prevailing interest rate level in China (which has always remained in solid positive territory) makes a non-remunerated central bank account relatively unattractive.

¹⁸ <https://www.bankofengland.co.uk/-/media/boe/files/markets/other-market-operations/accessfornonbankpaymentserviceproviders.pdf>

¹⁹ See <https://www.bloomberg.com/opinion/articles/2019-03-10/pboc-s-move-to-control-alipay-wechat-pay-deposits-is-power-grab#xj4y7vzkg> “Chinese electronic-payment providers like Alipay are just the type of innovative, technology-driven, consumer-focused enterprises Beijing wants to nurture. New regulations on almost \$200 billion of their deposits will do just the opposite. In the name of risk management, the People’s Bank of China in January officially became the custodian of all deposits from third-party payment groups, a transition that started in 2017. Before then, the likes of Ant Financial’s Alipay and Tencent Holdings Ltd.’s WeChat Pay had piles of cash accumulating on their platforms, which they’d invest to generate returns – without always paying interest to users. That didn’t sit well with the central bank and spurred regulation requiring the money to move into non-interest-bearing accounts under its purview.”

In Switzerland, the Swiss parliament has introduced a new FinTech licence in 2019 to boost innovative financial companies. Such FinTechs can access the Swiss Interbank Clearing (SIC) system, and credit their own account at the SNB, but only up to CHF 100 million.²⁰

Finally, also the BIS CPMI (Committee on payments and market infrastructures) has advocated in the context of its work on improving cross border payments to open the central bank RTGS accounts to non-bank payment institutions (BIS CPMI, 2022). Accordingly, granting access could lead to greater competition and innovation by levelling the playing field and reducing barriers to entry, and it could improve financial stability and allow for a more resilient ecosystem through mitigation of settlement, liquidity, credit and tiered participation risks. The report also lists a number of financial stability risks, including that “where deposit facility access is provided, this could lead to direct competition with commercial banks, which have traditionally provided deposit services to PSPs”.

Stablecoins with access to central bank accounts

Actually, e-money institutions are economically rather similar to stablecoins, but for the facts that (i) they do not rely on Distributed Ledger Technology (DLT²¹) and (ii) regulators have considered that their regulation should be done separately. Stablecoins would also appreciate being able to access the central bank balance sheet directly in order to have a risk free asset and thereby also be able to present their liabilities as quasi risk-free.

In its second White paper, Diem (2020) suggested that it would eventually prefer to be allowed to deposit its funds with the central bank, similar to a bank, so as to avoid the liquidity risks associated with the possible need to liquidate large amounts of securities or deposits with banks in case of outflows of its own liabilities. This would according to Diem also reduce negative systemic externalities in case of asset sales. Also, other stablecoin projects have aimed at obtaining access to central bank deposits in order to facilitate their liquidity management and to be considered to be a low credit risk and thereby be able to provide attractive means of payments.

The ECB published in January 2022 a “prefunding” policy towards non-banks (ECB, 2022) in view of the prefunding of payment systems and other ancillary systems linked to the Eurosystem RTGS (real-

²⁰ See FINMA press release [here](#) and Instruction sheet on admission to the SIC system and sight deposit accounts from the SNB [here](#).

²¹ See e.g. Malekan (2022) for a comprehensive discussion of the technical merits of DLT. Technological differences may support in the future a large success of stablecoins relative to non-DLT based electronic money institutions, but this does not change that from the economic perspective taken in this paper, the two can be hardly distinguished. Panetta (2021) explains risks associated with stablecoins. The fact that policy makers emphasise these risks prominently for stablecoins but less so for e-money institutions is not because e-money would per se be more stable, but because of the expectation that stablecoins could be significantly more successful than e-money institutions, and that their different scales also imply significantly higher risk.

time gross settlement) system T2. The policy also explicitly addresses stablecoins and similar arrangements (emphasis added):

“[The purpose of TARGET2] was not for the custody of assets that back the issuance of means of payment or other assets to the public. Accordingly, access to TARGET2 will not be granted to ancillary systems to back stablecoins (or any other means of payment or assets) issued to the public.”

Specifically with regards to central bank money-backed stablecoins and other endeavors aiming at issuing means of payment (or a store of value, like narrow banks – see below), central bankers’ concerns also stem from the fear that these would (i) blur the distinction between central bank- and commercial bank money (as indeed they try to issue a sort of money with the credit quality and liquidity of central bank money), and that (ii) they would lead to fragmentation as they would create (non-interoperable) silos of pseudo-central bank money. These concerns come on top of the financial stability concerns which are the main theme of this paper. Moreover, in the words of Panetta (2021):

“The risks posed by stablecoins would be reduced if reserve assets could be held entirely in the form of risk-free deposits at the central bank. However, this would limit monetary sovereignty as one of the key tasks of the central bank – money creation – would in effect be delegated to private operators. They would perform that task with the aim of maximising profits, rather than fulfilling public interest objectives such as inflation control and the cyclical stabilisation of the economy.”

One solution to the problem of liquidity losses to non-banks via stablecoins (or similar non-DLT constructs aiming at offering payment and settlement services) is to prescribe that only parties who have anyway access to central bank accounts can have access to the means of payments (or accounts) offered by the stablecoin (or non-DLT payment system). This is what the Bank of England prescribed for omnibus accounts it would grant to such endeavors (“The only entities that can hold an overnight entitlement in the account are the participants in the Sterling Monetary Framework (SMF) that hold reserves accounts at the Bank of England”; Bank of England, 2021, 6). This is consistent with the ECB’s pre-funding policy which explicitly rules out granting accounts to stablecoins “issued to the public”.

Narrow banks

Narrow banks aim at issuing safe deposits, while not doing any asset side banking business except depositing their funds with the central bank (Fisher, 1936, Benes and Kumhof, 2012). In contrast to stablecoins and e-money institutions, they do not focus on issuing means of payment, but store of value functions of money to their depositors. They start from the idea to run such a narrow and focused business model via a banking license (and therefore could also have been discussed in section 3). According to its website, the US-based The Narrow Bank (TNB) “seeks to serve institutional customers by offering safe depository services at attractive interest rates.” It would essentially be a pass-through vehicle of which the balance sheet would almost at 100% consist of the liability side of

non-bank deposits and on the asset side of deposits with the Fed. The Fed New York refused to open the bank a FED Master Account, which led TNB to take the matter to court. In the related 2019 court case at the US District Court of the Southern District of New York, the Memorandum of Law in support of the Fed NY notes that:

“The Federal Reserve has serious concerns that TNB’s novel business model could interfere with its ability to carry out its policy mandates to maintain financial stability and promote a healthy economy. Specifically, the business model would give investors access to the IOER rate currently available only to certain banks, which could limit the rate’s effectiveness as a policy tool and have other negative consequences, including amplifying financial crises and increasing the costs of consumer borrowing.”

Fed Reverse repo facility

The Fed however granted access to its liability side to money market funds via its Overnight Reverse Repo Facility (ON RRP). The New York Fed acknowledges on its website that the reverse repo transactions when used by money market funds, drain liquidity from banks, as suggested by the flow of fund in case C in the financial accounts above.²²

Already in 2015, Federal Reserve Researchers discussed potential secondary effects of making ON RRP available to a broad set of actors including nonbank institutions (Frost et al 2015, 12):

“However, a facility that could allow a very rapid and unexpected expansion of ON RRP might exacerbate disruptive flight-to-quality flows during a period of financial stress and thus could undermine financial stability. Market observers and policymakers both have described such risks. For example, the Minutes of the June 2014 FOMC meeting state that “[m]ost participants expressed concerns that in times of financial stress, the facility’s counterparties could shift investments toward the facility and away from financial and nonfinancial corporations, possibly causing disruptions in funding that could magnify the stress” (FOMC 2014a).”

Since mid-2022, the total volumes deposited in the reverse repo facility stand at around 2.2 trillion euro on average and mainly belong to money market funds.²³ Observers have wondered why the Fed would facilitate a drain on bank deposits by opening the liability side of its balance sheet to money market funds (e.g. Baer and Nelson, 2023). The Economist (2023) considers that “there is one obscure way in which money-market funds may suck deposits from the banking system: the Federal Reserve’s reverse-repo facility, which was introduced in 2013. The scheme was a seemingly innocuous change to the financial system’s plumbing that may, a decade later, be having a profoundly destabilising impact on banks.”

²² See <https://www.newyorkfed.org/markets/domestic-market-operations/monetary-policy-implementation/repo-reverse-repo-agreements>, accessed May 21, 2023.

²³ Office of Financial Research, [here](#), based on SEC and FED data.

Similarly, Arsov et al (2022, 6) warned in December 2022 that the second quantitative tightening cycle, which has started in the summer of 2022, would have a greater impact on bank funding than the first round of QT from 2017 to 2019 because the RRP “increases competition for reserve balances at the Fed and, by extension, deposit competition.”

Baer and Nelson (2023) consider, on the basis of Fed publications, that when the operation was launched, “many FOMC members expressed concern that the facility would worsen financial stability and disrupt the financial system by pulling money out of the banking system and commercial paper market.” As a policy solution, they suggest increasing the spread between the ON RRP rate and the interest on reserve rates applicable to banks from 10 to 25 basis points, as this spread would be sufficient to incentivize again the money market funds to deposit their funds with banks, and not with the Fed.

The Fed NY has instead somewhat restricted the type of (non-bank) firms that can access its reverse repo facility, while referring also to financial stability (Statement Regarding the Policy on Counterparties for Market Operations and Reverse Repurchase Counterparties, April 25, 2023).

The update would however be expected to “not impact the participation of current RRP counterparties”, i.e. does not appear to be a reversal of the previous approach (see also Nelson, 2023).

In any case, it is noteworthy that the total recourse to the RRP has not really increased since July 2022²⁴, implying that it is unlikely that the RRP has been an important destination in the March 2023 US banking turmoil. At the same time, the relatively high balance of the RRP reduced deposits in the system prior to the run and therefore may have contributed to both deposit destabilization and a drainage of liquidity buffers throughout the banking system.

It may be noted that also the Eurosystem foresees in its monetary policy framework as one possible instrument of monetary policy the issuance of ECB debt certificates (Guideline (EU) 2015/510 on the implementation of the Eurosystem monetary policy framework). It would be expected that the Eurosystem would offer to issue such debt certificates in a way to control its quantity.

Generally, such operations of central banks can be designed either in a way that the central bank controls directly the quantity (e.g. by conducting a so-called variable rate tender when issuing a fixed amount of such instruments) or controls the interest rates at issuance (in the extreme by offering a “full allotment” at the fixed interest rate). From the perspective of this paper, it could seem preferable to ensure that the central bank controls the total amount for any such instrument that can be

²⁴ See FED data <https://www.newyorkfed.org/markets/desk-operations/reverse-repo>

purchased by non-banks. In the absence of unlimited safe assets provided by the central bank, “opportunities to run may be constrained by a limited supply of risk-free assets [such as Treasury securities], and greater demand for those assets is likely to push up their prices and make running more costly” (Frost et al 2015, 15). Even in that case, the availability of such a safe and liquid financial asset might contribute under some circumstances to making bank deposits less stable. The central bank could also restrict the set of eligible holders of central bank issued securities to commercial banks, which would by definition prevent the instrument from being an entry gate for non-banks into the central bank balance sheet.

6. Runs into banknotes and into CBDC (D1)

The most classic, traditional bank run as frequently experienced since the dawn of banking in the middle-ages is the one of depositors taking physical recourse to the convertibility promise inherent in financial money (other than central bank money not relying on any convertibility promise, i.e. post Bretton Woods central bank money). The convertibility promise associated with bank deposits referred primarily to precious metal coins until the second half of the 19th century, and since the 20th century primarily to central bank money in the form of cash, although as discussed in this paper, the convertibility promise is also frequently tested through a conversion of deposits into securities via securities purchase orders, or transfers to interoperable accounts with other banks.

Banknote growth was also exceptionally high in 2008 in the context of the Lehman crisis. For example, Lalouette and Esselink (2018) estimate that the stock of euro banknotes in circulation increased by EUR 37 billion in the context of that crisis, reaching an unprecedented annual growth rate of 13% in 2008. Also, banknote issuance significantly increased regionally in the context of the sovereign debt crisis in the euro area. The table below provides some relevant numbers for Greece in the years of the second wave of the Greek crisis, i.e. of 2015.

Table 2: End of year domestic deposits with Greek commercial banks and banknotes issued by Bank of Greece during the Varoufakis era, in billions of euro.

	End 2014	End 2015	End 2016
Domestic deposits with MFIs (excl. Bank of Greece)	173.2	133.8	132.1
Euro banknotes (inc. Eurosystem liability item 9.2*)	32.4	48.4	43.2

Deposits with Greek banks dropped between the end of 2014 and the end of 2015 by EUR 38.4 billion (more than 20%), with banknote withdrawals of EUR 16 billion in this period explaining thus around 42% of the total drop. With a population of around 10 million, around 1500 euro were withdrawn in

cash per person in 2015. In 2016, despite a further slight decline of deposits, close to one third of the 2015 increase of banknotes were returned, illustrating the inconvenience of holding large amounts of cash at home for a longer period.

The relative attractiveness of physical bank runs, i.e. conversion of deposits into cash through ATMs and over the desk of a branch (e.g. when ATM withdrawal limits are reached or ATMs are emptied) has declined, as the ease of electronic runs in all the forms discussed in this paper has improved enormously. This holds particularly true for idiosyncratic bank runs, where non-affected banks as well as transferring money to them are still perceived to be safe. Physical bank runs into cash has always had the inconvenience of requiring individuals to hold unusual amounts of cash as a consequence of the withdrawal, with implied risks of destruction or theft. In the recent bank run episodes (e.g. SVB and Credit Suisse), cash withdrawals are indeed very unlikely to have played a material role in deposit losses, and it seems plausible that the role of banknotes as destiny of idiosyncratic bank runs is in general declining. Banknotes in Switzerland have declined continuously since July 2022 until today, i.e. also during the period when Credit Suisse had high liquidity outflows (in the period before that, holdings had risen steadily, mainly due to low interest rates and the Covid pandemic). In the US, currency in circulation is rising steadily, but the USD 12 billion increase in March of this year was not unusual. However, future systemic bank runs, provided that there is no (or limited) CBDC and assuming that primarily retail and commercial customers without access to a central bank account are affected, may well once again assign a non-negligible role to physical cash, as it is then the only way for these depositors to move up in the hierarchy of money, i.e. to obtain central bank money as the highest form of credit money.

The majority of central banks of the world are considering issuing **central bank digital currency**. The flow of fund mechanics of runs into CBDC are exactly the same as for banknotes, which allowed to treat the two as one in the financial accounts system of section 2. That CBDC may facilitate bank runs relative to a world in which central bank money can only be accessed (by non-banks) in the form of banknotes has been recognized at an early stage by central banks. For example, CPI-MC (2018, 15) already noted that:

“A general purpose CBDC could have a large impact on financial intermediation patterns. ... For example, a flow of retail deposits into a CBDC could lead to a loss of low-cost and stable funding for banks, with the size of such a loss in normal times depending on the convenience and costs of the CBDC. banks might have to shrink their balance sheets, with possible adverse consequences.”

Central banks have since acknowledged that they would need to limit potential flows into CBDC through some tools (Bindseil, 2020), and most central banks envisaging to issue CBDC, such as the Bank of England and the ECB have confirmed that they would plan to set limits on the usage of CBDC

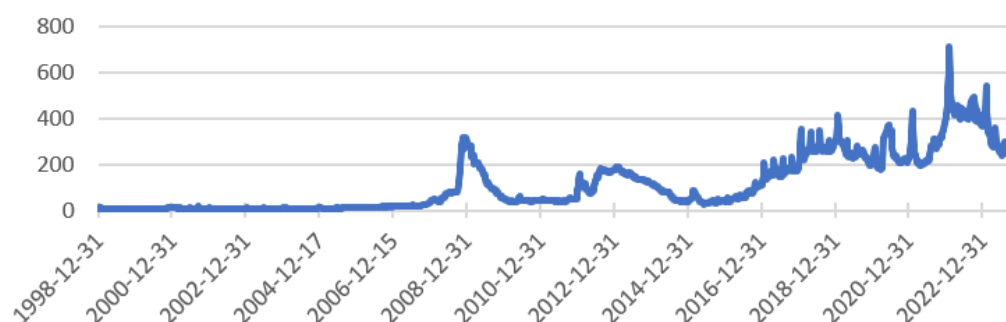
per holder, implying the need to associate all holdings of CBDC with an identified holder, so as to be able to monitor the application of such limits. For example, Panetta (2022) clearly states the point for the digital euro:

“[It] is indeed possible to design a digital euro with effective tools to prevent it from being used as a form of investment rather than solely as a means of payment. One such tool entails quantitative limits on individual holdings. Another involves discouraging its use as a form of investment by applying disincentivising remuneration above a certain threshold, with larger holdings subject to less attractive rates. We intend to embed both types of tool – limits and tiered remuneration – in the design of a digital euro.”

7. Entities that can directly shift deposits to the central bank (D2)

Over the last decades, the size and composition of global reserves have changed considerably. Foreign exchange crises, such as those in Asia in the 1990s, prompted central banks to hold foreign reserves not only for operational or payment purposes, but increasingly as precautionary buffers. Several countries, notably those who accumulated exceptionally large foreign reserves, have moved beyond such precautionary motives to seek active investment returns (Schanz 2019) or to support export-oriented macroeconomic growth strategies (Senner and Sornette 2021). Globally, central banks and sovereign wealth funds (SWFs) have become important investors.²⁵ These central banks and Sovereign Wealth Funds usually hold most of their reserves in the form of deposits with banks and securities. However, many of them also have accounts with the central banks issuing the reserve currency, i.e. they can access CBDC in some sense already now. In normal times such accounts appear to be unattractively remunerated, but in times of stress, central bank deposits can be perceived as a safe haven.

Figure 4: Eurosystem liabilities to non-euro area residents in EUR billion. Source: ECB.²⁶



²⁵ The total amount of foreign reserves is around USD 13 trillion while SWFs manage more than USD 11 trillion. Foreign reserve data end-2021 from [statista.com](https://www.statista.com), Sovereign Wealth Fund end-2022 data estimated by [globalswf.com](https://www.globalswf.com).

²⁶ See [here](#).

Bindseil (2020, 15-16; figure 3) recalls the role of inflows of deposits into the Eurosystem balance sheet of foreign central banks and sovereign wealth funds during the Lehman crisis. After the Lehman default in September 2008, such deposits went up from below EUR 50 billion to 300 billion within two weeks (see figure 4). After the Lehman default the price disincentives to not deposit high amounts at the Eurosystem were obviously insufficient, as the perceived relative safety of central bank deposits outweighed the interest rate spread. The Eurosystem's liabilities to non-euro area residents have continued to be relatively volatile since 2008 (see Figure 4). The procyclical behavior of depositors and central banks is discussed by Pihlman and Van der Hoorn (2010), who conclude that:

“When the global financial crisis started in 2007, the composition of central bank reserves was riskier than ever before, following a decade-long diversification process. During the crisis many central banks joined the flight to quality and acted procyclically by reducing their exposure to the banking sector and agencies in their reserves. We estimate that reserve managers pulled out at least the equivalent of US\$500 billion of deposits and other investments from the banking sector, mainly in an effort to protect their investments from default risk.”

Next to foreign central banks and sovereign wealth funds, governments are another important sector with access to central bank deposits. When taxes are paid, or government bonds issued, the account of the government at the central bank is credited. Normally, the government does not hoard large amounts of deposits because the latter are collected for the purpose of being spent again. Nevertheless, the size of these accounts and the amplitude of their variations can potentially be significant because the government is responsible for such a large part of the overall spending in advanced economies. The US Treasury's deposits at the FED, for example, have been declining since the summer of 2022 because of the debt ceiling crisis,²⁷ and thus clearly did not contribute to deposit volatility in March 2023 (on the contrary). However, now that another debt ceiling deal has been reached and the government is once again allowed to issue more bonds, the account balance is likely to rebound to an operational level, similar to the way the Treasury increased its balance after the debt ceiling agreement of December 2021.

To avoid that fluctuation of government accounts with the central bank having excessive effects on commercial banks' liquidity, central banks often disincentivise large balances through unattractive remuneration beyond some threshold. In this spirit, the ECB has recently lowered the remuneration of euro area government deposits (ECB, 2023b).

In the context of the recent bank runs in Switzerland and the US, there is no evidence that foreign central banks, sovereign wealth funds or governments shifted funds from these banks into their central bank accounts. First, recent bank runs were not driven by a macro shock, such as the Lehman

²⁷ See FED data H.4.1 [here](#).

crisis in 2008 or the outbreak of Covid, that would typically motivate such entities to shift deposits. Second, CS and SVB were not the typical bank for such entities, but rather for high-net-worth individuals and crypto investors. Finally, deposit liabilities of the Federal Reserve System towards foreign officials stayed roughly constant during March 2023.²⁸

8. Deposit absorption through bank operations (E)

For case **E1**, i.e. the purchase of newly issued debt or equity from Bank 2 with deposits from Bank 1, it does not appear plausible that this would have been a driving force behind the unprecedented speed of deposit runs in March 2023. Banks rarely issue significant amounts of new debt or equity in the short run, as investors need to be prepared and have a limited appetite to increase quickly exposures to a certain bank which enters the market with significant new issuance volumes. There is also no reason to believe that technology has changed this. Investing into debt instruments requires trust and is typically subject to careful risk management procedures (concentration limits; approval processes). Moreover, aggressive debt issuance is disincentivised in times of stress because it is typically more costly and may be interpreted by markets as a sign of weakness. In line with this, there was *no* issuance of subordinated, senior or even covered bonds by euro area banks in the last 3 weeks of March 23.

This holds even more for case **E4**, the redemption of bank loans, which is not a quick ad hoc decision that can be taken to absorb deposits that are considered risky, but typically follows a pre-scheduled time plan. Even the (emergency) loans or drawn credit limits that often rise sharply in times of crisis (Li et al 2020) are not repaid just as quickly, but more gradually. If at all, it would be somewhat accelerated in case of some interest rate developments (e.g. if interest rate levels drop and there is optionality of early repayments, which does not seem to have been applicable in March 2023). Alternative destination of deposit runs are much faster and simpler.

Sub-type **E2**, the sales of securities by Bank 2 to a non-bank which uses deposits held previously with Bank 1, did not act as a driving force behind the recent bank runs either, but might have exacerbated the situation. While US commercial banks have gradually reduced their securities holdings since early 2022, the reduction in March 2023 has so far been unprecedented (USD 113 billion or a 10% annual decline, while securities holdings have declined significantly in recent decades only in 1995 and 2008 by 6% resp. 3%).²⁹ SVB itself sold securities worth USD 21 billion in early 2023 to respond to the run (Silicon Valley Bank 2023). However, the magnitude of total US banks' securities holdings reductions suggests that also relatively sound banks have liquidated securities and in the sense of the flow **E2**

²⁸ See FED H.4.1 statistics, line "Foreign official" deposits in the liability sections.

²⁹ See FED, H8 release [here](#).

may have facilitated outflows from the most vulnerable banks like SVB. More liquid assets such as bonds are typically sold first, but banks can also sell part of their loan portfolios to private investment companies in order to generate liquidity. The bank PacWest Bancorp, for example, entered into agreements in June with real estate firm Kennedy Wilson and asset manager Ares Management to sell loan portfolios worth USD 5.7 billion and USD 3.5 billion, respectively.³⁰

Case **E3**, the sales or non-rollovers of securities by the central bank, could also have been somewhat relevant. After many years of balance sheet growth, central banks have begun to reverse this process since 2022. Specifically, the Federal reserve system reduced its total balance sheet between July 2022 and March 2023 through the only incomplete re-investment of securities by around USD 600 billion, or approximately USD 40 billion per month, with a close to linear pattern. In Switzerland, the SNB has sold foreign currency assets in the recent past. In Q4 2022, the SNB sold CHF 27 billion for monetary policy reasons (to strengthen the CHF and thus dampen inflation, SNB 2023b). Moreover, in Q1 2023, foreign exchange investments fell, probably again due to sales. Although the SNB's CHF deposit absorption was larger than the FED's absorption (compared to the amount of all deposits), and probably less linear as the SNB reacts to market developments in the foreign exchange market, this was not a significant driver of the run on CS. First, in Q4 2022, it was mainly wealth management clients who left, which in turn hold a significant portion of deposits in foreign currencies. Second, the runs on CS accentuated in a few days, whereas the sales of the SNB did not. Consequently, central bank securities sales do not appear to have been an important *destination* during the run, but the gradual cumulative drain of deposits from the banking system that preceded the runs had built up vulnerabilities in particular for those banks which had invested the excess reserves which were initially created by quantitative easing (QE). In other words, would all banks have kept uninvested the excess reserves which were created by QE, then quantitative tightening (QT) could have simply restored the positions pre-QE, but as in the meantime the excess reserves had migrated across banks (because of heterogeneous policies of banks to preserve excess reserves instead of investing them), QT contributed to the vulnerability of a part of the banking system (see also Acharya, et al 2023).

9. Assessment and policy responses

Designing adequate policy responses requires ideally a thorough understanding of the welfare consequences of more volatile (and possibly structurally lower) bank deposits which themselves

³⁰ See Bloomberg reporting [here](#) and [here](#).

presumably also depend on the factors driving this volatility. Consider these main factors again one by one.³¹

More intensive competition for bank deposits amongst banks (A and B)

It is not obvious to argue that a **more intense competition between banks for deposits (direct – case A, or indirect - case B)** is negative from a social welfare perspective. First, competition is in general considered the very basis of an efficient market economy, and economic scenarios believed to suffer negative consequences of increased competition require thorough and convincing justification. Carletti and Hartmann (2002) and OECD (2011) draw an ambiguous picture of the related literature which, while accepting that banking is special, would not allow to conclude that competition between banks regarding deposits is destabilising per se and likely welfare-negative. OECD (2011, 29) considers that “competition and stability can co-exist in the financial sector... The results of the empirical studies linking competition and stability are ambiguous, however.”. In addition to this lack of compelling conceptual and empirical evidence that competition for deposits would be undermining financial stability and economic welfare, it seems that, anyway there are no attractive policy options to curb competition between banks in large, advanced economies in the age of online banking.

However, regulators should avoid creating an uneven playing field that can make deposit funding less stable. The recent deposit flows from regional banks to larger banks in the US, discussed in section 3, have arguably also been driven by the greater protection of deposits at entities that are perceived as too big to fail. Similarly, segregated access to different funding sources, such as wholesale funding, contributes to a two-tiered structure of the US banking system that can exacerbate deposit flows in times of stress. Credible resolution plans for larger banks and a financial market structure that is readily accessible to different banks help level the playing field.

Moreover, it could be considered to adjust again at some stage in the future the monetary policy framework in a way to provide incentives against banks hoarding large amounts of bank reserves, i.e. to specialise artificially in bank deposit collection for the sake of intermediating with the central bank balance sheet (instead of with the real economy). In section 3 it had been explained that after the lift off of monetary policy interest rates from the zero lower bound and the normalisation of spreads between various deposit-, short term market- and monetary policy interest rates, a floor system might create incentives for banks to aim at an intermediation model somewhat similar to a narrow bank or stablecoin (although without fully specialising on it and therefore without blurring the distinction

³¹ This section discusses policies to address recent factors that contributed to the destabilization of bank deposits. For more general policies to address bank runs, like deposit insurance, see for example Diamond and Dybvig (1983) or Bindseil and Fotia (2021).

between central bank money and commercial bank money), i.e. collect deposits to place them at a higher rate with the central bank. This factor which might also have contributed somewhat to the destabilisation of deposits could be removed by eventually restoring the symmetric corridor system applied by many central banks before 2008. It could be argued that banks' competition in a floor system for this type of deposit collection (including with the leverage of BigTechs, like the Apple/Goldman Sachs savings accounts) might be net negative for society as it is a rather elementary arbitrage which weakens the ability of banks to rely on maturity transformation, which is a complex and important economic function. In a symmetric corridor system, banks may still compete for deposits and end with a lower or higher share of deposit-based funding in total funding. But if deposits are treated adequately by liquidity regulation in terms of their somewhat deteriorated stability, and/or if banks recognize the new economic realities of deposits as a means of funding, then the incentives for banks to seek a very over-proportional share of deposit funding – absent a backing with liquid excess reserves held with the central bank – are rather limited. In a floor system in which banks seek to channel reserves from other banks to themselves for depositing them with the central bank and earning a spread, they are less constrained by liquidity considerations to do so as they can liquidate the reserves with the central bank as quickly as depositors may liquidate deposits with them (as indeed this simple form of intermediation does not involve maturity transformation).

Non-bank financial entities with access to the central bank balance sheet (C)

Regarding non-bank financial entities who aim to issue quasi-central bank money to their customers for payment or investment purposes **(including e-money institutions, stablecoins, narrow banks and money market funds depositing funds with the central bank)**, central banks may want to generally take a prudent stance and foresee safeguards against them building up considerable positions in central bank money. These entities blur the distinction between central bank money and commercial bank money and lead to a fragmentation of (quasi-central bank) money, and if very successful obtain market power that they could abuse. Neither central bank money, nor commercial bank money (which is interoperable) share these properties of leading to fragmentation, a possible abuse of market power, and a blurring of the distinction between private and public money. The economic activity to simply build a bridge between the central bank balance sheet and the rest of the economy which normally has no access to the central bank balance sheet seems basic and a better outcome could be achieved for example if the central bank would instead issue retail CBDC. In some sense these non-

bank financial entities seem to arbitrage the current architecture of the financial system without particular benefits for society.³²

More recently, Diamond and Rajan (2001, 318) support the merits of banking and explicitly identify narrow banking as undermining liquidity creation and maturity transformation. Similarly, Freixas and Rochet (1997, 197) conclude that “the narrow banking proposal is exactly antagonistic to the efficient provision of liquidity insurance” (see also the further survey on the topic in Rochet, 1997, 262-263).

What matters is the capacity of such entities to build up balance sheet volume supported by access to the central bank, i.e. with a high share of central bank reserves. Therefore, for example the access to central bank accounts of Payment Institutions (in the sense of the EU PSD2 regulation) which are not EMIs, would not be problematic. Regarding entities that can build up large central bank reserves to issue backed liabilities, the central bank could consider (i) to generally exclude such entities; (ii) to limit the potential deposits with central bank accounts; (iii) to provide economic incentives against building up large volumes by remunerating the relevant accounts in a sufficiently unattractive way (while still not disincentivising activities which require some relatively low or no reserve holdings). Such measures would both constrain their capability to contribute to increased volatility of bank deposits, and to structurally disintermediate the banking system.

Banknotes (D1)

The relative role of banknotes as a destination of bank runs is likely to decrease further, as the drawbacks of holding large amounts of banknotes at home remain, while electronic alternatives for deposit outflows (and in particular into other banks) have become more and more easy and appealing in a digitalised society. This holds particularly true for idiosyncratic bank runs, while the decline in the importance of cash may be less pronounced in systemic bank runs, and will mainly depend on deposit insurance, the related possibility to run safely to other banks, as well as the possibility of alternative access to the central bank balance sheet.

³² The assessment of the welfare implications of liquidity outflows from banks into such vehicles will of course depend on the economic merits associated with fractional banking and the combination of deposit collection and loan provision, which is a debate that has been ongoing for many decades if not since the dawn of banking in renaissance Venice (e.g. Kohn, 1999). Schumpeter’s theory of economic development (1911, 692) rejects proposals to narrow banks because he sees liquidity creation by banks as a necessity for innovative entrepreneurship, and because restricting the deposit creation of banks would inevitably lead to a shift in the business model to other actors (“the difficulty that all such schemes meet stands out very clearly: preventing banks from creating near-money will not prevent the trade from doing so.”). Empirically, the latter argument can be supported by analyzing periods and geographic areas where banks were relatively less developed. For example, maritime trade in Europe in the 18th century relied mainly on private credit (IOUs) and bills of exchange – instruments that became less important once banks expanded across the region (Chanson and Senner, 2023, 13).

Central bank digital currency (D1)

As explained in section 6, central banks working on **CBDC** all affirmed their willingness to constrain deposit flows into CBDC by setting limits per resident, although central banks have mentioned different levels of possible limits (e.g. the ECB has referred to 3000 euro as example, while the Bank of England to 10-20,000 pounds). Central banks do not want to offer central bank money as a large-scale investment asset since this would disintermediate banks and increase considerably the central bank balance sheet and would tend to increase the footprint of the central bank on securities and credit markets (unless the lengthening of the central bank balance sheet can be easily accomplished by holding more central government bonds, although even this conclusion is controversial).³³

If one concludes, like central banks have, that large shifts of commercial bank money into central bank money is undesirable as it underestimates the benefits of a decentralised financial system and of the maturity transformation by banks, setting holding limits per capita is an effective policy instrument to contain negative effects of introducing CBDC on bank stability.

The following two tables aim at summarising the impact assessment of opening the central bank balance sheet to non-bank financial entities and of issuing CBDC, encompassing also, but going beyond the effect of contributing a destination to deposit outflows from banks and therefore contributing to the volatility of deposits. The columns cover the main types of entities which have gained or may gain access to the central bank balance sheet (1. Governments, foreign central banks, sovereign wealth funds; 2. Narrow banks (NBs), Electronic money institutions (EMI), stablecoins (SC); 3. Money market funds (MMF); 5. Retail CBDC, implying access for everyone to electronic central bank balances, i.e. including citizens and any firm. The rows cover the different policy issues identified.

³³ Some progressist researchers outside central banks have concluded in favour of CBDC to allow for large shifts of commercial bank money into central bank money, even going as far as to achieve “sovereign” money in which banks would no longer offer any sight deposits for payment purposes. In the view of these authors, this would improve welfare as the banks could no longer be causing financial crises in the case of deposit runs which would require rescues of banks with taxpayer money. Drees and Sharma (2023), for example, argue along these lines and describe the new role of the central bank as follows, without discussing possible side-effects of a more centralised investment process: “Central banks would “back-up” their CBDC issuance with a range of high-quality assets, including government paper. They could also provide and, if needed, ‘recycle’ funds into the financial system by investing in high-quality private assets or by lending to financial institutions against good collateral.”

Table 3 - Opening the central bank balance sheet – potential negative implications

	1. Govts, foreign CBs, SWFs	2. NBs EMI, SC	3. MMF	4. Retail CBDC
Contribute a destination for deposit outflows from banks, thereby increasing volatility of bank deposits	X	X	X	X*
Blur distinction between public and private means of payment; fragmentation of means of payment; potential abuse of market power		X		
Blur distinction between CB money and private investments as store of value	X	X	X	
Increase CB balance sheet and centralise credit provision	X	X	X	X*
Disintermediate banks and weaken their ability to provide a service to society (maturity transformation; credit selection)	X	X	X	X*

**All these effects will be limited since the central banks announced to limit the size of possible CBDC holdings*

Table 4: Opening the central bank balance sheet – potential positive implications

	Govts, foreign CBs, Sov. WFs	NBs EMI, SC	MMFs	Retail CBDC
Less credit risk for respective money holders	X	X	X	X
Less financial instability issues relating to the fluctuation of credit riskiness of private money issuers	X	X	X	X
Allow for more competition and innovation in the field of payments		X		
Simpler architecture of payment system (in the extreme single layer; at least co-existence of single layer)				X
Overcome fragmentation and possible abuse of market power of private closed loop payment providers				X

Central bank access of foreign central banks and sovereign wealth funds (D2)

Central bank access of foreign central banks and sovereign wealth funds should be managed in a way to deter large holdings with the central bank, similar to case C, and thereby incentivise sovereign wealth funds and central banks to seek other options to invest their foreign reserves. This ensures that the accounts with the reserve currency central bank are limited to serve transaction purposes, and not large-scale store of value functions. While the data does not suggest that this channel has played a significant role in March 2023 (section 7), in acute financial crises, the foreign sovereign depositors are likely to exert pressure on the reserve currency central bank to be allowed to deposit larger amounts with the reserve currency central bank without having to accept harsh penalty interest rates. Central banks must find solutions that protect the domestic financial system against large additional deposit outflows. It is easy in any case to set the incentives right through a sufficiently

unattractive pricing of these deposits, including a worsening of remuneration into negative territory if needed, or even a limitation on further inflows.

Deposit absorption by issuing new bank debt (or equity) to a non-bank or by a (central) bank selling assets to a non-bank (E).

One policy conclusion relates to case **E3**, i.e. if deposits are used to purchase securities from the central bank: obviously central banks should not implement quantitative tightening too aggressively and concentrated to short periods of time, and certainly not to periods of bank stress. Instead, the reduction in the central bank's securities portfolio should be smoothed over time and be predictable to allow the financial system to prepare for the implied absorption of deposits. Central banks generally apply this prudence, as the reduction of securities portfolios is relatively slow and gradual (section 8). However, the cumulated reduction of commercial bank deposits, even if smooth, may lead to deposit stress at banks, especially those that had invested the excess reserves created by QE (i.e. moving them to other banks) before QT started. Therefore, QT is more than just reversing QE, and should be accompanied by close monitoring and an a priori robust liquidity regulation.

For sub-type **E2**, the sales of securities by Bank 2 to a non-bank which uses deposits held previously with Bank 1, a policy conclusion is the importance of avoiding that in a banking crisis, also the relatively sound banks have incentives to liquidate aggressively securities (at the expense of deposits or the weakest banks being subject to an acute deposit flight). This policy is well-known and has typically been derived from the negative externality of fire sales in terms of depressing further securities prices, triggering book losses and weakening capital buffers, etc.. A supportive LOLR framework seems key in this respect. Indeed, the Fed granted its special liquidity facility, the Bank Term Funding Program (BTFP) (FED, 2023) to all banks in the 2023 banking crisis, therefore also discouraging *other* banks to start selling assets for the sake of prudence, i.e. the Fed would have applied this policy conclusion. In the same spirit, a joint statement by the Department of Treasury, the FED and the FDIC declared on March 12, that all deposits at SVB as well as Signature Bank will be insured, not only those up to USD 250 000.³⁴

For cases **E1** and **E4**, deposit absorption through the purchase of bank debt/equity as well as through loan repayment, no policy responses are needed because these flows are unlikely to have contributed to the size and magnitude of recent bank runs.

³⁴ See press release [here](#).

Overarching policy recommendations that are relevant for several cases.

Finally, in view of the result that bank deposits will likely remain in any case less stable, both the treatment of bank deposits in liquidity regulations as well as the effectiveness of the lender of last resort (LOLR) should be revisited. Similarly, Restoy (2023) concludes that recent bank failures “indicate that a scenario in which banks and their regulation would need to adapt to a less stable deposit base cannot be ruled out”. See also Cecchetti and Schoenholtz (2023) for another discussion of how the banking system could be made safe.

Consider in more detail both the liquidity regulation and the effectiveness of the LOLR:

Regarding the **regulatory treatment of deposits**, the Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR), i.e., the most widely used regulatory metrics under the Basel Committee’s recommendations, do not seem to adequately reflect the new nature of less stable deposits. Credit Suisse, for example, fulfilled regulatory liquidity requirements until shortly before its demise (see section 2). This assessment appears to be in line with Andrea Enria, Chair of the Supervisory Board of the ECB (Enria, 2023):

“But these indicators [LCR and NSFR] alone don’t provide enough visibility for phenomena that could appear very quickly, which was what happened with the deposit outflows from SVB and Credit Suisse.”

Consequently, the assumptions about the share and speed of deposit outflows in a stress scenario, in particular in the 30-day LCR scenario, could be adjusted upward and downward, respectively, for uninsured, very large, and potentially correlated deposits. Banks can respond to such adjustments by adjusting either their asset or liability side of the balance sheet. Given that central banks are shrinking their balance sheets, i.e., draining central bank money from the banking system, and that other liquid assets like government bonds are neither in unlimited supply nor fully liquid during systemic events, a widespread and significant upward adjustment of HQLA levels could be challenging. Drawing on the experience of Credit Suisse, the (currency) composition and operational readiness of liquid assets should, however, be carefully reviewed in any case (“Credit Suisse’s access to the foreign exchange swap market had become limited due to the loss of confidence” SNB, 2023c).

While individual banks cannot control the system-wide level of HQLA, they have substantial influence on their funding side. More equity as well as long-term wholesale funding are obvious candidates. In addition, banks define the terms and conditions of their accounts and have the following instruments at hand to reduce fast and large deposit outflows in times of stress – somewhat analogous to the tools that a central bank can use to control balances in central bank accounts (see section 9 case C): (i) generally exclude certain depositors (most European banks, for example, have never accepted

deposits from crypto-related firms in contrast to SVB); (ii) limit the size of potential deposits in bank accounts, as well as potential out- and inflows; (iii) provide economic incentives against building up large volumes by remunerating the relevant accounts in a sufficiently unattractive way.

The BCBS (2023, 20) observes that “limits on the amount of online credit transfers have been introduced by banks in response to digital fraud incidents, which may potentially reduce the speed and magnitude of outflows.” Cipriani et al (2023) discuss another policy proposal to reduce uninsured depositors’ incentives to run where “a small fraction of each depositor’s uninsured deposit, which we call the minimum balance at risk, would be available for withdrawal only with a delay.”

Moreover, the timely availability of liquidity data appears essential for the prudential supervision of deposit-taking institutions, not least to be able to prepare, implement or communicate LOLR measures in a timely manner (see below).³⁵ Reporting with a higher frequency appears technically feasible – and is something that banks should have internally anyway. Again, this appears to be in line with the lessons learned by the ECB’s supervisory board, as communicated by Enria (2023) (“The problem also concerns the data. For example, LCR data are available on a monthly basis, with a lag of a few weeks.”)

Finally, it is worth mentioning that higher competition for deposits not only has an impact on the bank’s liquidity situation, but also influences funding costs and therefore interest margins and profitability (Arsov and Cetina, 2023; SNB 2023c, 9). As interest rates move away from the zero bound, interest margins and bank profitability can initially improve. However, increased competition for deposits could eventually offset these benefits. Supervisors should therefore analyse this interplay closely.

In terms of **adjustments to central banks’ LOLR tasks**, the increased speed of deposit outflows has important consequences, which all relate to the implied need to react faster. Within the LOLR, it is important to distinguish between the general elasticity of liquidity provision through regular monetary policy operations and relying on the associated collateral framework, and the emergency support to one or few specific financial institutions against collateral which would be ineligible for regular operations. The first does address systemic liquidity issues, but also individual ones in the sense that a bank with specific liquidity issues can take additional recourse to regular central bank credit operations and thereby gain time to rectify underlying causes or to prepare, if unavoidable, for individual emergency liquidity assistance. Therefore, sufficient unincumbered collateral buffers for regular operations are one important factor for a better ability of banks and authorities to react to the

³⁵ In Switzerland, for example, systemically important institutions are required to report the respective monthly LCR data survey within 15 days (instead of the usual 20 days that apply to all other banks). However, given the speed of recent bank runs, 15 days appear long.

increased speed of bank runs (apart of course from the fact that larger liquidity buffers are in themselves helping to make bank runs less likely). Ensuring that the banks have on average sufficient collateral buffers for regular operations relies on two components: first a broad list of eligible collateral (and without extremely high haircuts) and second an aggregated structural liquidity position of the banking system vis-à-vis the central bank that does not imply a regular recourse to liquidity providing credit operations of the central bank which is so high that the very large part of the eligible collateral buffer is consumed to cover for this necessary recourse to central bank credit.³⁶ Central banks may want to consider the second factor when deciding on the size of their outright securities portfolio holdings as these impact on the structural need of banks to take recourse to central bank credit.

Turning to the second form of LOLR, namely the provision of emergency liquidity to individual institutions against non-standard collateral, the timeline for the following tasks needs to be even tighter than it already was in a less digitalised age:

- the confirmation of solvency of the candidate financial institution
- the identification of suitable collateral, its valuation and mobilisation
- the possible agreement with the government on a government guarantee to support the potential amount of emergency liquidity assistance
- the decision making by the central bank governing bodies

This tightening of the timeline can only be achieved with additional preparations, in general, and for vulnerable banks in particular which can be identified at a relatively early stage via more systematic horizon scanning. This is in line with recommendations made by the IMF in the context of FSAP missions, also before the March 2023 episodes, but having now become more pertinent (e.g. IMF, 2018, which relates to the euro area FSAP, although it is not specific to the euro area).³⁷

"52. "Horizon scanning" involves looking for potential liquidity and other risks before they materialize, thereby allowing for advanced preparations. ... 54. Supervisory actions should start before buffers are exhausted and even before ELA [emergency liquidity assistance] is deemed necessary. ... 55. Harmonized ELA collateral pre-verification processes should be developed as a complementing exercise. This process involves pre-identifying and pre-checking by the relevant NCB—from an operational and legal perspective—the eligibility of portfolios of assets well in

³⁶ In recent years, collateral was also encumbered in a number of currency areas through long term central bank credit operations which were priced very attractively such that the banks' recourse to them went beyond the structural liquidity needs of the banks. Such operations of course also encumbered collateral.

³⁷ Note that recommendation 54, i.e. that supervisory action should start before buffers are exhausted, should not imply that the use of buffers is to be disincentivised or stigmatised.

advance of ELA drawdown. This can and should be done without encumbering the collateral.”

Additional preparation is not for free and requires resources. Both the horizon scanning in itself, and the subsequent preparatory work with identified vulnerable banks (like the work on earmarking, valuing and preparing for the potential mobilisation of non-standard collateral) are demanding. Accepting the related costs may be an adequate adjustment to the changed environment, i.e. the increased speed of deposit outflows in bank runs in a digital age.³⁸

Moreover, the idea of “constructive ambiguity” to prevent moral hazard should be given up as it by nature prevents preparation.³⁹ Preventing moral hazard needs to be achieved through other means, such as associating the recourse to emergency liquidity assistance of individual banks to costs relating to additional supervisory scrutiny and higher interest rates. Also, the reputational damage of having to take recourse to individual liquidity assistance remains as a deterrent to moral hazard.

10. Conclusions

Seven conclusions can be highlighted from our analysis.

First, central banks can avoid becoming excessive destinations for commercial bank deposit outflows through the access of non-banks to their balance sheet. Non-banks financial institutions (NBFIs like electronic money institutions, stablecoins, narrow banks or MMFs), governments, and sovereign wealth funds should not have unlimited *and* financially attractive access to central bank deposits. If they have access, the value of funds deposited by them should remain sufficiently limited, be it through eligibility criteria, quantitative limits, or incentives such as a sufficiently unattractive remuneration of the relevant positions in the central bank balance sheet. Payment institutions which

³⁸ This assessment seems to be in line with the Swiss expert group on the demise of Credit Suisse. Eggen et al (2023) state that there are “gaps in the provision of liquidity to banks in distress that need to be addressed” (p. 5, translation by the authors), and therefore recommend that the government “should also develop a regulatory basis for early intervention by FINMA” (p.65, translation by the authors), that FINMA needs additional resources (p.59), and that the identification of the risk of bank insolvency needs to be improved, for example by relying on market signals (p.62). Note that in Switzerland, the financial market authority FINMA has to confirm the solvency of a bank before the SNB can provide emergency liquidity, i.e. the LOLR function relies on both institutions.

³⁹ This seems to be broadly in line with the ideas of former Bank of England Governor Mervyn King, who also supported in 2016 a more rule based approach to individual bank liquidity assistance (Financial Times, “Central banks as pawnbrokers of last resort”, May 31, 2016, <https://www.ft.com/content/e4931794-2696-11e6-8b18-91555f2f4fde>) that “Central banks would still act as lenders of last resort. But they would no longer be forced to lend against virtually any asset, since that very possibility must create moral hazard. Instead, they would agree the terms on which they would lend against assets in a crisis, including relevant haircuts, in advance. The size of these haircuts would be a “tax on alchemy”. They would be set at tough levels and could not be altered in a crisis. The central bank would have become a “pawnbroker for all seasons”. The value of liquid assets would then be known. They would consist of reserves at the central bank plus the agreed collateral value of any other assets. In the long run, argues Lord King, liquid assets, so defined, should match an institution’s liquid liabilities, defined as loans of a year’s maturity or less.”

anyway cannot build up large balance sheets through deposits with the central bank are not an issue from this perspective, while they may be able to contribute to competition and innovation to payments.

Second, the relative role of banknotes as a destination of bank runs is likely to decrease further, as the drawbacks of holding large amounts of banknotes at home remain, while alternative destinations of deposit outflows (and in particular into other banks) have become more and more easy and appealing in a digitalised society.

Third, as central banks have acknowledged that they will apply per-person limits (or other control instruments) to retail CBDC holdings, also this future form of direct access to the central bank balance sheet for all will not be an important factor for the destabilisation of bank deposits.

Fourth, direct and indirect outflows of deposits to other banks will continue to play an important, and likely even further growing role in making bank deposit collection more competitive, expensive, and potentially less reliable. There are no convincing arguments to generally suppress competition for deposits across individual banks, and there would anyway be no good tools to do so. New technology has made it easier for everyone to open several bank accounts and to shift funds from one account to the other quickly and without cost or risks, and, moreover, banks can leverage their access to the central bank through BigTech and other innovative conduits (including e-money institutions or stablecoins who are constrained in their access to the central bank balance sheet), and, finally, social media have supported the dispersion of news leading to more correlated depositor behaviour. Regulators should however contribute to a level playing field so that there are no unnecessary deposit flows to banks because they are perceived to be too big to fail or market segregations. Also, the incentives set by the regulatory treatment of a redirection of deposits via non-bank financial intermediaries are important and need to be studied carefully (like e.g. by Coste, 2023).

Fifth, the lift-off of monetary policy interest rates from the zero lower bound has probably also contributed somewhat to a destabilisation of deposits across banks, as it has become attractive again for banks to intermediate between the rates at which non-banks deposit with banks and the rates at which the banks can deposit at the central bank. This attractiveness implies competition between banks for it, a factor missing for the years of zero or close to zero interest rates. In this context the current discussions on the optimal monetary policy implementation framework come into play, and how the relative benefits of a floor and symmetric corridor approach depend on the level of interest rates. The benefits of a floor system when offered at the zero lower bound may be stronger before than after lift-off from the zero lower bound. In this context, the health of interbank markets as well

as collateralization policies should also be reviewed, in order to facilitate reserve distribution across the system so that banks do not have to rely too heavily on deposit inflows to get reserves.

Sixth, with regards to asset sales (i.e. quantitative tightening), central banks should, from the perspective of bank deposit stability, avoid too aggressive and concentrated sales of securities. But policy makers should obviously not consider limiting the ease and speed of investment of bank deposits into securities sold by private investors.

Finally, in view of the result that intensified competition between banks for deposits will remain in any case because of the proliferation of online banking, instantaneous payments and multiple bank accounts, policy makers should think through both ex ante and ex post measures that, while accepting this change, would prevent it from having unnecessarily negative consequences for financial stability and for social welfare more generally. These measures may include: (i) recognising the new properties of (some types of) bank deposits in an updated **regulatory treatment of bank deposits** in liquidity regulation, such as to avoid that too favourable assumption on the stability of bank deposits undermine the overall adequacy of required liquidity ratios and the relative treatment of different bank liabilities (which in particular should apply to large non-granular deposits); in this context also revisit the regulatory treatment of deposits by non-bank financial institutions in order to ensure that it does not contribute to deposit destabilisation (e.g. Coste, 2023) (ii) revisit the **effectiveness of the lender of last resort** by better preparedness and enhanced capacity. Obviously more work is needed to develop these policy responses in the interest of preserving, despite intensified competition between banks for deposits, the ability of banks to provide maturity transformation, which is one of the essential functions of banking for the economy.

Funding via sight deposits will likely remain or become even less stable and eventually more expensive for banks in the future than it has been in the past. This would seem to imply that bank-based maturity transformation becomes somewhat more challenging, and that the comparative advantages of banks relative to a market-based funding of the real economy deteriorates somewhat. At the same time, a stronger competitive discovery process, and therefore better services and innovations could moderate the above-mentioned effects.

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