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Technical Paper

Digital euro: short-term effects on the liquidity of German banks considering holding limits

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Non-technical summary

Research Question

After a two-year investigation phase, the Governing Council of the ECB started the first part of the preparation phase of the introduction of a digital euro on October 18, 2023. The ECB's plans for the digital euro reflect the growing trend of the economy going digital. As an additional payment method based on central bank money, the digital euro would be available to all residents in the euro area alongside cash and complement it with digital functions.

If the digital euro is introduced, users resident or established in the euro area will be able to exchange cash or bank deposits for digital euro. The exchange of bank deposits would lead to an outflow of liquidity from banks. In order to rule out any possible negative impact on the banking system and financial stability, the European Commission's current draft regulation on the digital euro stipulates that the ECB may place holding limits for the digital euro.

We examine the impact of introducing a digital euro, as currently conceptualized in the proposal by the European Commission, on the liquidity situation of the German banking sector. The analyses are the basis for assessing the effects of a digital euro on banks' liquidity, as presented in the 11th Annual Report of the German Financial Stability Committee.

Contribution

In this paper we present the technical details of the analyses and substantiate the robustness of the discussed findings. Our analysis focuses on short-term effects. In this environment, deposits are instantly converted into digital euros, leaving banks with limited opportunities to adapt. We consider a scenario where users fully utilize the holding limit of the digital euro, along with additional scenarios that account for risk-mitigating factors. We employ a unique dataset that combines supervisory reports on bank balance sheets and on payment transactions.

Results

Our analysis demonstrates that particular savings banks and cooperative banks may experience retail deposit outflows from exchanges into digital euro. However, no savings bank and cooperative bank would experience a liquidity shortfall based on a holding limit of €3,000 if liquidity in the form of high-quality liquid assets could be redistributed within the banking associations (liquidity balancing). Furthermore, our analysis indicates that based on a holding limit of €3,000 the liquidity shortfall measured by the Liquidity Coverage Ratio remains relatively small in aggregate compared to the level of high-quality liquid assets of the entire banking system in all scenarios (up to 2%).

Nichttechnische Zusammenfassung

Fragestellung

Nach einer zweijährigen Untersuchungsphase startete der EZB-Rat am 18. Oktober 2023 den ersten Teil der Vorbereitungsphase für die Einführung eines digitalen Euro. Mit den Planungen zum digitalen Euro trägt die EZB dem zunehmenden Trend einer sich digitalisierenden Wirtschaft Rechnung. Als zusätzliche Zahlungsmethode auf Basis von Zentralbankgeld wäre der digitale Euro für alle Einwohnerinnen und Einwohner im Euroraum verfügbar und würde Bargeld ergänzen, indem er digitale Funktionen bietet.

Wird der digitale Euro eingeführt, können Nutzer mit Aufenthalt oder Niederlassung im Euroraum Bargeld oder Bankeinlagen in digitalen Euro tauschen. Der Umtausch von Bankeinlagen würde zu einem Abfluss von Liquidität bei den Banken führen. Um mögliche negative Auswirkungen auf das Bankensystem und die Finanzstabilität auszuschließen, sieht der aktuelle Verordnungsvorschlag der Europäischen Kommission zum digitalen Euro vor, dass die EZB Haltegrenzen für den digitalen Euro erlässt.

Wir untersuchen die Auswirkungen der Einführung eines digitalen Euro, wie er derzeit im Vorschlag der Europäischen Kommission vorgesehen ist, auf die Liquiditätssituation des deutschen Bankensektors. Diese Analysen bilden die Grundlage der Einschätzung zu den Effekten eines digitalen Euro auf die Liquidität der Banken, die im elften Jahresbericht des Ausschusses für Finanzstabilität vorgestellt werden.

Beitrag

In dem vorliegenden Papier behandeln wir die technischen Details der Analysen und belegen die Robustheit der dort diskutierten Ergebnisse. Unsere Analyse konzentriert sich auf kurzfristige Effekte. In den betrachteten Szenarien werden Einlagen unmittelbar in den digitalen Euro umgewandelt, wobei Banken kaum Möglichkeiten haben sich an das geänderte Umfeld anzupassen. Bei einem Maximalszenario nehmen wir an, dass Nutzer die Haltegrenze des digitalen Euro vollständig ausnutzen, sowie weitere Szenarien, die risikomindernde Faktoren berücksichtigen. Wir nutzen einen einzigartigen Datensatz, der regulatorische Meldungen zu Bilanzinformationen der Banken und zum Zahlungsverkehr kombiniert.

Ergebnisse

Unsere Analyse zeigt, dass insbesondere Sparkassen und Genossenschaften Abflüsse von Kundeneinlagen durch Umwandlungen in den digitalen Euro verzeichnen. Allerdings würden bei einer Haltegrenze von 3.000 € keine Verbundinstitute eine Liquiditätslücke aufweisen, wenn die Liquidität in Form hochwertiger liquider Aktiva innerhalb der Bankenverbünde kurzfristig umverteilt werden könnte (verbundinterner Liquiditätsausgleich). Darüber hinaus zeigt unsere Analyse, dass bei einer Haltegrenze von 3.000 € die aggregierte Liquiditätslücke, basierend auf der Liquidity Coverage Ratio im Vergleich zum Bestand erstklassig liquider Vermögenswerte des gesamten Bankensystems, in allen Szenarien auf relativ niedrigen Niveau verbleibt (bis zu 2 %).

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Abstract

We examine the impact of introducing a digital euro, as currently conceptualized in the proposal by the European Commission, on the liquidity situation of banks in Germany. The analyses are the basis for assessing the effects of a digital euro on banks' liquidity, as presented in the 11th Annual Report of the German Financial Stability Committee. This paper extensively addresses the technical details of the analyses and substantiates the robustness of the discussed findings. Our analysis focuses on short-term effects. In this environment, deposits are swiftly withdrawn and converted into digital euros, leaving banks with limited opportunities to adapt. We consider a scenario where users fully utilize the holding limit of the digital euro, along with additional scenarios that account for risk-mitigating factors. We employ a unique dataset that combines banking supervisory data with payment transaction information. Our analysis demonstrates that particular savings banks and cooperative banks are vulnerable to retail deposit outflows from exchanges into digital euro. However, only few banks would experience a liquidity shortfall if liquidity in the form of high-quality liquid assets could be redistributed within the banking associations (liquidity balancing). Furthermore, our analysis indicates that based on a holding limit of €3,000 the liquidity shortfall based on the Liquidity Coverage Ratio remains relatively small in aggregate compared to the level of high-quality liquid assets of the entire banking system in all scenarios (up to 2%).

Keywords: Central bank digital currency, holding limits, bank liquidity, systemic risk

JEL codes: G21, G32, G38

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1 Introduction

After a two-year investigation phase the ECB Governing Council decided on October 18, 2023, to prepare for possibly introducing the digital euro. The ECB's decision reflects the economy's digital shift, aiming to offer a digital euro (D€) as a central bank-backed means of payment alongside cash, adding digital functionalities. If the D€ is introduced, people in the euro area can exchange cash or bank deposits for it. Yet, to avoid large liquidity outflows from banks due to the exchange of deposits, which may endanger financial stability, the European Commission's current proposal suggests the ECB may place limits on use of the D€ as a store of value. Currently discussed are holding limits around €3,000 per person.

The introduction of the D€ could affect the risk of system-wide deposit withdrawals. On the one hand the introduction of a D€ should not have a significant impact on the dynamics of individual bank runs. Digital and instant transfers between banks have been possible for many years. Additionally, the use of the D€ is restricted to private individuals, which predominantly hold insured deposits. Therefore, the credibility of the statutory deposit insurance remains crucial in preventing bank runs. However, the introduction of the D€ could influence the latent risk of system-wide bank runs if the D€ is perceived as a safe haven asset and the confidence in the banking system is low. Lower transaction and holding costs are incurred when transferring deposits into D€ compared to cash withdrawals or transfers to parties outside the affected banking system. As a result, system-wide bank run scenarios could occur more quickly.[1]

We examine the impact of introducing a D€, as currently conceptualized in the proposal by the European Commission, on the liquidity situation of banks in Germany. The analyses are the basis for assessing the effects of a digital euro on banks' liquidity, as presented in the 11th Annual Report of the German Financial Stability Committee. This paper extensively addresses the technical details of the analyses and substantiates the robustness of the discussed findings.[2] Our analysis focuses on short-term effects. In this environment, deposits are swiftly withdrawn and converted into D€, leaving banks with limited opportunities to adapt. Various factors influence potential deposit outflows and the liquidity situation of banks upon the introduction of the D€. These include: (i) users' preferences to swap bank deposits for D€. (ii) The distribution of financial assets in the population, where sight deposit balances for a large portion of the population are below proposed holding limits. (iii) The level of coordination within the savings and cooperative bank sectors to provide interbank liquidity, in particular liquidity balancing between primary institutions and central institutions or among regional associations. For the analysis, we employ a unique dataset that combines banking supervisory data with payment transaction information.

[1] See BIS (2021).
[2] See German Financial Stability Committee (2024).

Our analysis reveals that the current liquidity status of the banking system remains sufficient even when fully utilizing currently discussed holding limits of €3,000. Setting holding limits, in particular during the introductory period, is sensible, as the initial demand for the D€ is very uncertain. Holding limits may also allow for sufficient time for banks to gradually adjust to a financial system featuring a D€. Our analysis proceeds as follows: Chapter 2 explains the methodology and assumptions of our analysis in detail and Chapter 3 describes the data set. In Chapter 4, we present and interpret the results. The paper concludes with a discussion on potential extensions of the analysis (Section 5).

2 Methodology

The starting point for the analysis is banks' excess liquidity, which is based on the Liquidity Coverage Ratio (LCR) and the Systemic Liquidity Buffer (SLB). The LCR excess liquidity is determined on the bank-individual level and equals high-quality liquid assets (HQLA) minus expected net outflows during a stress period of 30 calendar days. The LCR assigns regulatory haircuts to HQLA to reflect the potential decrease in market value during adverse market conditions. The SLB is similar to the LCR, but assigns price discounts to HQLA based on a model simulation. These discounts are more conservative than the LCR's regulatory haircuts to HQLA. They aim at describing price adjustments more realistically in a situation of simultaneous actions of a larger number of agents.[3] Consequently, the SLB excess liquidity is lower than the LCR excess liquidity. To measure systemic risks, we derive the liquidity shortfall from the excess liquidity as a complementary measure. It focusses on banks whose HQLA do not sufficiently capture expected outflows. In more technical terms, the liquidity shortfall is the maximum of no excess liquidity and the expected net outflows minus HQLA. In our analysis, we adjust the expected net outflows by factoring in the additional expected outflows related to the introduction of the D€.

We examine four scenarios, which differ in terms of the assumed scale of deposit withdrawals for alternative holding limits. The number of potential users of the D€ varies in these scenarios, as does the size of the deposits exchanged for digital euro. Very restrictive assumptions are deliberately selected for the analysis. First, users of the D€ exchange their deposits for the digital currency immediately after it is introduced and that individual banks have not made any advance adjustments to their liquidity management. Second, the Eurosystem does not take any accompanying measures to support the introduction. Scenario 1 further assumes that all retail banking customers of a bank use the D€ and max out their holding limit. Since there is no available data on the number of customers a bank has, we approximate the customer count using the number of accounts held by a bank. As a customer can have multiple accounts, we calculate a factor based on the size of the adult population (about 69 million) relative to the total number of retail sight deposit accounts (about 95 million) in the banking

[3] See Krüger, Roling, Silbermann und Wong (2023).

system. We estimate the number of customers a bank has by multiplying this factor by the number of accounts held by that bank.[4]

Scenario 2 and Scenario 3 consider risk-mitigating factors, where customers may not want or be able to fully utilize their holding limits. Scenario 2 assumes, initially, it will largely be technically literate users who use the D€ and substitute deposits for D€. We identify this group as customers who already have an online account and restrict deposit outflows linked to the D€ to this specific customer segment.[5] Scenario 3 considers that the distribution of account balances for sight deposits among the population is uneven. As shown in Figure 1, 50% of households would not be able to fully utilize a holding limit of €3,000. Based on the distribution, Figure 2 illustrates the estimated average maximum potential deposit withdrawal per customer for different holding limits. Assuming that the distribution of sight deposit balances within the population approximates well for each bank's customer base, one can calculate the average maximum potential deposit withdrawal per customer for alternative holding limits for each bank.[6]

Scenario 4 takes the special properties of the banking associations' liquidity management into account. Savings banks and cooperative banks are integrated in a central cash management (e.g. cash pooling) controlled by their respective central institutions. This refers to the surplus of deposits or excess liquidity of savings and cooperative banks, in particular. Should a savings or cooperative bank possess an excess of deposits or liquidity, this surplus can be redistributed to other institutions in the network that may require additional liquidity. The precise mechanism governing liquidity adjustment can vary between banking associations and may not always be publicly disclosed.[7] Depending on the level of coordination within the banking association, three sub-scenarios can be distinguished: In Scenario 4a, all savings banks and cooperative banks access their excess liquidity (claims minus liabilities) from central institutions, irrespective if they require additional liquidity. In Scenario 4b, liquidity within the banking association is redistributed based on the needs of individual member banks. In this context, savings banks (including state-owned banks or "Landesbanken") within their regional associations and cooperative banks (including the central institution) can each be considered collectively.[8] Scenario 4c aligns with Scenario 4b, with the added liquidity redistribution between regional associations within the savings bank sector, such as liquidity balancing between associations of Hesse-Thuringia and Bavaria. Here, all regional associations are aggregated into a single savings bank association. When considering scenarios 4a-4c we abstract from possi-

[4] This assumes that the number of accounts per customer is the same for all banks.

[5] For savings banks and cooperative banks, approximately 71% of retail accounts are online accounts; almost 86% of retail accounts are online accounts for credit banks (per Q4 2022). The above approach relies on additional assumptions. For example, the 29% of customers of savings banks and cooperative banks without an online account might have an online account with another (commercial) bank. This possibility is excluded by assumption.

[6] In reality, the distribution may vary between different regions and types of banks. For example, the sight deposit balances of large commercial banks are likely to be larger on average than the sight deposit balances of savings banks and cooperative banks. Against this background, the assumed deposit outflows for savings banks and cooperative banks are likely to be overestimated, while they are likely to be underestimated for large commercial banks.

[7] These are often internal processes and structures designed specifically for each network and its member banks.

[8] It is assumed that liquidity will initially be provided to affiliated institutions facing shortfalls that have larger balance sheets.

ble effects of liquid positions on banks' individual business models or internal control processes. We assume that HQLA can be easily transferred between individual member banks to compensate for the potential outflow caused by the introduction of the D€ and do not take into account long-term aspects of the choice of a particular asset and liability structure, such as income from certain positions or specific forms of cooperation within banking associations.[9]

3 Data

The analysis is based on data from the national balance sheet statistics (Bista), the statistics on payments and the European Common Reporting Framework (COREP). Data on the individual components of the LCR, i.e. the stock of HQLA-eligible securities, cash (equivalents) and expected net outflows are obtained from COREP. Savings banks and cooperative banks' excess liquidity is taken from Bista. To simulate deposit outflows from banks at different holding limits, the number of retail deposit accounts per bank is derived from the statistics on payments. As the holding limit will most likely be set per individual, the number of retail deposit accounts per bank is scaled (pro rata) to match the total number of adult residents in Germany (69.3 million).[10] To account for the wealth distribution of bank customers, the distribution of demand deposits per bank is approximated by that of the entire population using data from the Panel on Household Finances (PHF) published in April 2023. The reference date is September 30, 2023, except for the PHF, which is based on 2022 data, and statistics for payments, where the reference date is December 31, 2022.[11]

Generally, we use reporting information at the banking group level; for banks not part of a banking group, we use reporting information at the individual level. The implicit assumption is that liquidity can quickly be transferred within the same banking group. The assumption could be substantial in times of stress for large international banks, which conduct worldwide business operations across several jurisdictions[12]. Furthermore, for some scenarios, we aggregate data for the different banking associations, to consider the unique properties of their liquidity management. As the savings and cooperative banks are integrated into a central cash management controlled by their respective central institutions, it is not reasonable to model them as independently acting players. Thus, by aggregating data for banking associations, we assume that savings banks coordinate with their regional head bank (Landesbank), and cooperative banks coordinate with their respective central institute.

[9] There are additional risk-mitigating factors. For instance, banks can increase their Liquidity Coverage Ratio (LCR) through liquidity transformation, i.e. by obtaining liquidity from the central bank, collateralized by assets not qualifying as HQLA.

[10] To precisely determine deposit withdrawals at different threshold levels, it is necessary to have information on the number of customers and accounts per bank. Additionally, details about the relationship between customers and bank accounts are required to exclude potential double-counting of individuals who may be customers at multiple institutions. Due to a lack of data availability on the relationship between customers and bank accounts, the approach described above is applied to approximate the determination of deposit outflows.

[11] Given the assumption that the number of retail accounts does not change significantly in the short term, the temporal delay of a few quarters should have no material impact.

[12] See, for example, FSB (2018) on the ongoing regulatory discussion regarding complexities associated with liquidity in resolution for global systemically important banks.

4 Results

Savings banks and cooperative banks are particularly vulnerable to retail deposit outflows from exchanges into D€. As illustrated in Figure 3, the portion of banks facing liquidity shortfalls according to the LCR for alternative holding limits largely comprises affiliated institutions within the savings banks and cooperative sector. Taking into account that initially only tech-savvy users will adopt the D€ and that the unequal distribution of sight deposit balances in the population will limit the adoption (Scenario 2 and 3), the share of banks with a liquidity shortfall according to the LCR decrease by around one-third[13] compared to Scenario 1. Notably, the aggregate liquidity shortfall according to the LCR itself remains at a moderate level relative to the banking system's HQLAs (see Figure 4) in all scenarios. The liquidity shortfall stands at just over 2% with full utilization of a holding limit of €3,000. This may suggest that with enough lead time banks should be able to adjust their liquidity position and cope with the introductions of the D€ with currently discussed levels of holding limits.

Effective liquidity balancing within the banking associations is crucial to mitigate liquidity risks from retail deposit outflows. As shown in Figure 3 (lower panel) if liquidity within the banking association can be redistributed based on the needs of individual member banks, the portion of banks facing liquidity shortfalls according to the LCR is reduced by two-thirds compared to the results of Scenario 1. Similarly, as evident from Figure 4 (lower panel), in the case of an effective liquidity balancing within the banking associations (i.e. Scenario 4 b and c), the liquidity shortfall is negligibly small with a holding limit of €3,000 and only noticeably increases with considerably higher holding limits. Consequently, the level of coordination of the banking associations is a crucial factor for the resilience of the banking system as a whole against liquidity shocks. In fact, the results may suggest that in the presence of an effective liquidity balancing the banking system should be able to compensate outflows from deposits due to the introductions of the D€ with holding limits above the currently discussed €3,000.

The banking system could withstand additional deposit outflows even when price adjustments are more realistically modelled using the SLB model, given the liquidity balancing within banking networks is effective. Overall, the numerical effects for the liquidity situation of the banking system are larger when considering the SLB compared to the LCR (see Figure 5 and Figure 6). This larger impact follows from the SLB methodology because it describes price-drops in scenarios of simultaneous actions of agents, in this case retail depositors. Nevertheless, the two approaches show similar qualitative outcomes. Consequently, the effective liquidity balancing within the banking associations remains a crucial factor for the resilience of the banking system in times of a liquidity shortfall, as illustrated by Figure 5 and Figure 6 (lower panels). With a holding limit of €3,000, the systemic effects would be very small measured by the portion of banks facing liquidity shortfalls and the aggregate liquidity shortfall

[13] The share is measured in terms of the balance sheet of banks with a liquidity shortfall relative to the banking system's balance sheet.

according to the SLB if the degree of coordination within the banking associations is high (Scenario 4 b and c). For holding limits above €3,000, the systemic effects gradually increase.

5 Conclusion and Discussion

Our analysis shows that the banking system has enough liquidity to compensate outflows from deposits based on a holding limit of €3,000, even when it is fully utilized. One crucial factor is the level of coordination within the banking associations. If liquidity in the form of HQLA can be swiftly and smoothly redistributed within the banking associations based on the liquidity needs of the individual member banks, the resilience of the entire banking system to liquidity shocks increases significantly. Furthermore, it must be considered that a scenario where all depositors fully utilize their holding limit is unrealistic, as a significant portion of the population has account balances that are lower than €3,000.

6 Literature

BIS (2021): Central bank digital currencies: financial stability implications, Report No 4, September 2021.

Financial Stability Board, Funding strategy elements of an implementable resolution plan, FSB Policy Document, 2018.

German Financial Stability Committee (2024): Elfter Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, 11th Annual Report, 2024.

Krüger, U., Roling, C., Silbermann, S. and Wong L. H (2023): Banks' strategic interaction, adverse price dynamics and systemic liquidity risk, Journal of Banking Regulation (JBRE-D-23-00049R2), forthcoming.

7 Figures and Tables

Figure 1: Distribution of account balances for sight deposits among the population (Q1 2023).

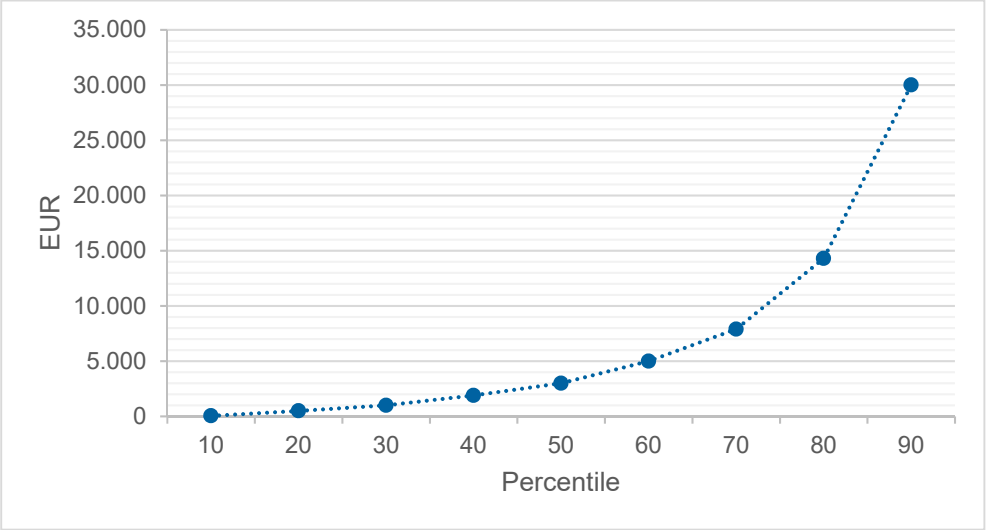
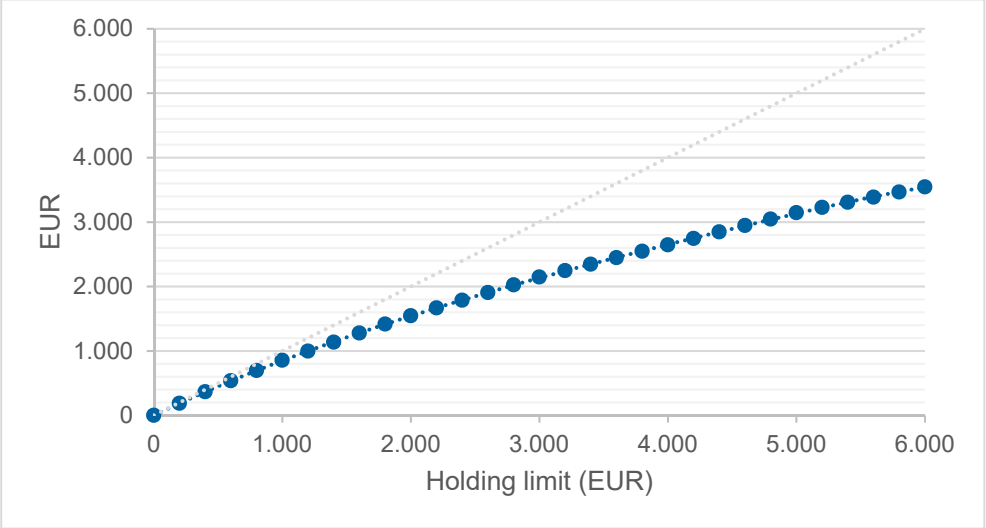


Figure 2: Estimated average maximum potential deposit withdrawal per customer.



Liquidity situation of the banking system according to the LCR for alternative holding limits (Q3 2023)

Figure 3: Total assets of banks with LCR liquidity shortfall as share of total assets in the banking system.

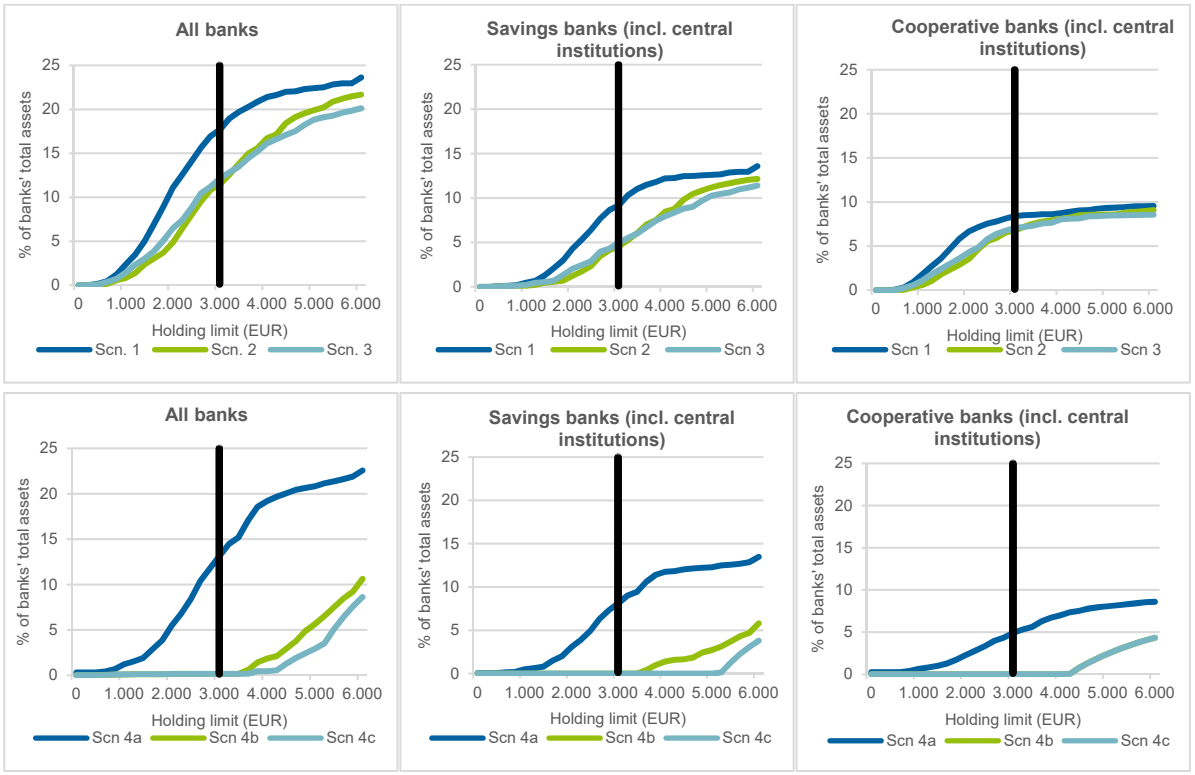
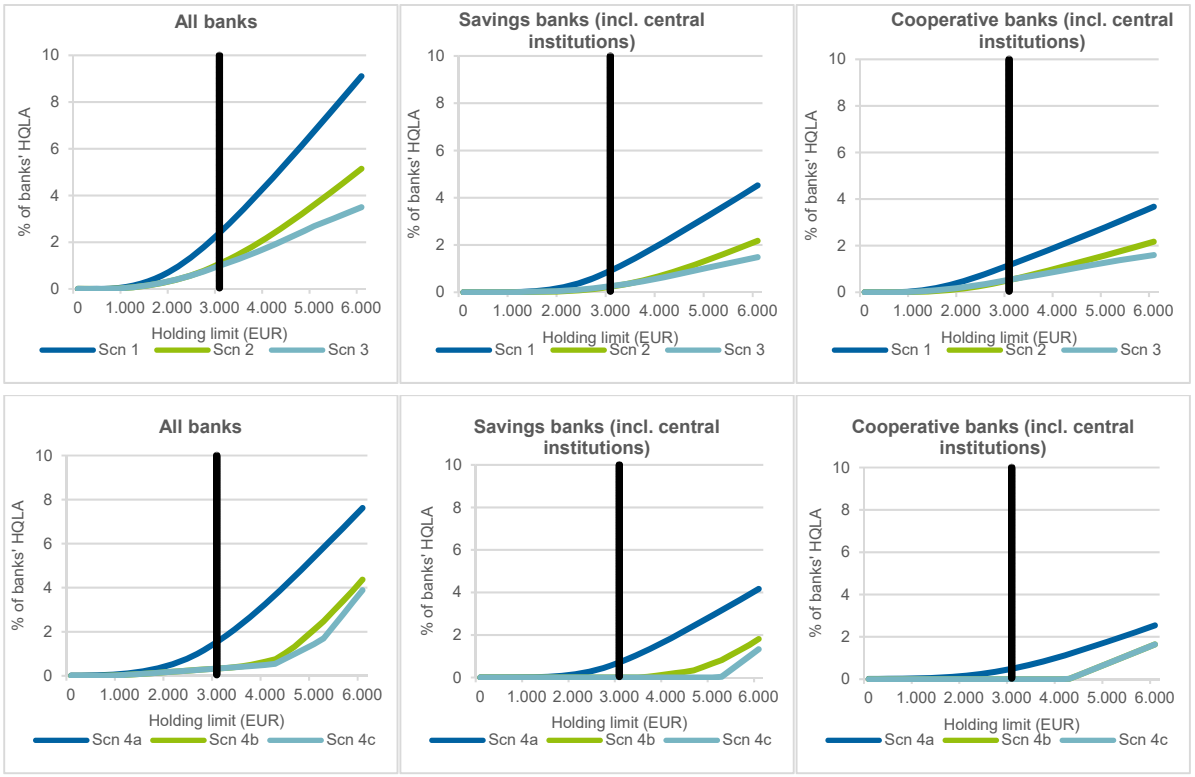


Figure 4: LCR liquidity shortfall as share of HQLA in the banking system.



Liquidity situation of the banking system according to the SLB for alternative holding limits (Q3 2023)

Figure 5: Total assets of banks with SLB liquidity shortfall as share of total assets in the banking system.

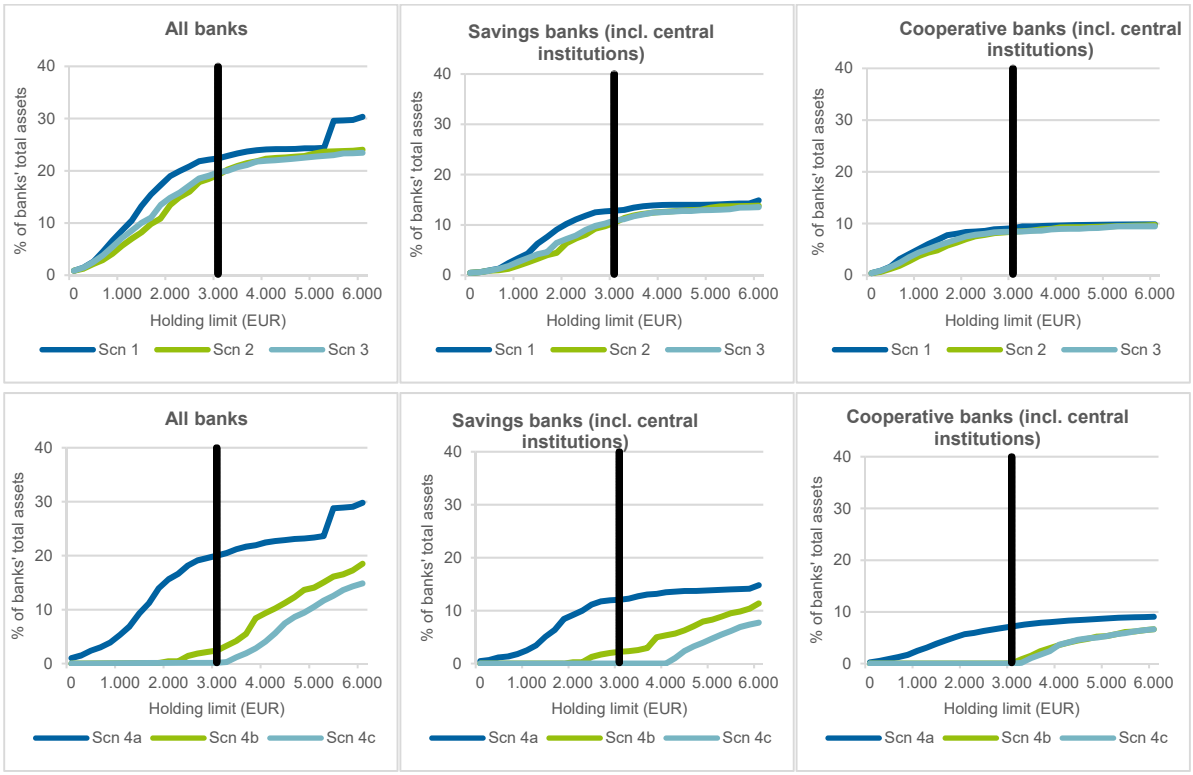


Figure 6: SLB liquidity shortfall as share of HQLA in the banking system