EUROPEAN CENTRAL BANK
EUROSYSTEM

Technical data on the financial stability impact of the digital euro

The European Central Bank received a formal request from co-legislators for technical data on the potential financial stability effects of alternative digital euro holding limits. It was specified that the information should encompass a range of hypothetical holding limits – up to €3,000 per individual – and aimed to quantify the potential impacts of each limit. The co-legislators requested that the analysis focus on certain key areas, including changes in bank deposits (absolute change in sight deposits), core liquidity metrics (liquidity coverage ratio and net stable funding ratio), banking profitability indicators (return on equity and return on assets), and lending dynamics (loan book growth and loan-to-deposit ratio).

In response, the ECB has produced this technical analysis estimating the extent of these impacts across the specified hypothetical limits. The analysis examines changes in the level and composition of deposits, implications for banks' liquidity metrics, and the potential effects on their profitability indicators and lending dynamics, under the modelling and data frameworks that the ECB has constructed in the course of developing the holding limit methodology. This work builds on the most advanced models available, as well as data collected and refined by the ECB specifically for the development of the methodology, with the objective of responding to the request as fully as possible and delivering complete technical input. Nonetheless, not all the requests (for example, a breakdown of hypothetical holding limits in €250 intervals) could be fully addressed owing to data limitations or because fulfilling certain requests (for example, providing information on market share by asset size in the respective market) could lead to the identification of individual institutions.

This document and the numerical results presented should be read solely as a technical response to the specific request from the co-legislators, and not as the outcome of the ECB's full methodological process nor as the ECB's position on an appropriate level for holding limits. The estimates outlined in this document are illustrative and reflect an initial and partial application of the methodology currently being developed by the ECB[1], rather than an exhaustive

1 For more information about the methodology, including the foundational principles of the models and the description of the survey used in this analysis, see Preliminary methodology for calibrating holding limits and Annex to preliminary methodology for holding limit calibration.

assessment. The complete methodology encompasses three pillars[2] with additional aspects that extend beyond the scope of this document. Moreover, the hypothetical holding limits assessed in this analysis are based on the co-legislators' specific requests to test a defined range. Consequently, the results presented should not, under any circumstances, be interpreted as representing the official final position of the ECB on the appropriate level of holding limits.

This document describes the approach used to derive outflow scenarios, including the modelling assumptions and data sources employed. As requested, the core of the analysis examines implications under two distinct environments – a business-as-usual scenario and a flight-to-safety scenario. It discusses banks' balance sheet reactions under both scenarios, assessing the consequent effects on liquidity and funding metrics, as well as the implications for banks' profitability.

1 Deriving outflow scenarios

This analysis involves assessing potential digital euro demand and its consequences for deposit outflows and banks' balance sheets. The following paragraphs detail the interconnection of three key elements (digitalisation, outflows and banks' reactions) used to assess the possible impact of digital euro demand under two scenarios – business-as-usual and flight-to-safety.

The first element considered is the impact of payment digitalisation trend on demand for banknotes. It should be recalled that issuing a digital euro would be a response to the increasing digitalisation of payments and the diminishing use of central bank money in the form of banknotes. The gradual decline in the use of banknotes for payments due to digitalisation corresponds to an increased use of deposit-based instruments, which, all else being equal, leads to a commensurate increase in bank deposits. Based on data from the ECB's study on the payment attitudes of consumers in the euro area (SPACE)[3], hypothetical values of total payments (i.e., including point-of-sale, person-to-person and online) settled with

2 The calibration of the digital euro holding limit for natural persons involves balancing three critical objectives: (i) ensuring that the digital euro can be used as a convenient means of payment, which will imply that it can preserve the current role of central bank money for European residents, while (ii) maintaining financial stability and (iii) smooth monetary policy implementation and transmission. In line with the draft Regulation on the establishment of the digital euro and the principles enshrined in Article 15(1), the Eurosystem is examining in detail the implications of introducing the digital euro for the banking sector, monetary policy implementation and transmission, and users' ability to make seamless payments. These three objectives naturally lead to a trade-off: the holding limit should be set sufficiently high to avoid impairing users' ability to use the digital euro as a convenient means of payment and to preserve the role of central bank money in the future, yet not too high to jeopardise the stability of the financial system or smooth monetary policy implementation and transmission. In addressing all three objectives simultaneously, the methodology adheres to the principle of proportionality, as enshrined in Article 5(4) of the Treaty on European Union and explicitly referenced in Recital 32 of the draft Regulation on the establishment of the digital euro. Pursuant to this principle, restrictions in EU legislation on the "store of value" function of public money (one of the three key functions of money) should be necessary, appropriate and the least intrusive measure required to achieve the objectives of the Treaty, including maintaining financial stability and supporting the effectiveness of monetary policy. Similarly, limitations on individuals' freedom to hold significant amounts of digital euro (a freedom that is considered unrestricted for cash) should be proportionate to these objectives.

3 SPACE is a survey carried out by the ECB to investigate the payment behaviour of euro area consumers.

banknotes in 2024 are constructed. For the past, this entails combining the banknote share observed in historical SPACE waves with the value of total payments in 2024. For expected future developments, the banknote share is extrapolated based on different methods and data sources and used to derive hypothetical values for the value of banknotes used to settle transactions. The average scenario under this analysis shows a €127 billion inflow of deposits due to the ongoing digitalisation of payments until 2034, which is equal to 0.4% of total banking sector assets or 1.5% of total retail sight deposits.[4]

Second, digital euro holdings and deposit outflows are estimated under a business-as-usual and a flight-to-safety scenario. Under the business-as-usual scenario, demand is estimated using survey outputs, yielding a likely amount of holdings rather than the maximum amount. Alternatively, under the flight-to-safety scenario, people are conservatively assumed to fully demand digital euro up to the holding limit or up to their available sight deposits, whichever is smaller. These estimates are complemented by the analysis of consumer payment needs, which helps to further understand the amount of digital euro users may need or wish to hold. In addition to payment needs, users' preferences in terms of prefunding their digital euro accounts, the role of deposit remuneration and the evolution of cash demand play crucial roles in determining this amount.

Third, the reaction of banks' balance sheets under the business-as-usual and flight-to-safety scenarios is estimated. Using the estimated demand for digital euro under both scenarios, the analysis focuses on the effects of possible deposit outflows on banks' liquidity positions, testing a range of holding limits from €500 to €3,000 and drawing on granular ad hoc data collected by European banking supervision on the distribution of retail deposits (the DRDEPO data collection). This approach helps analyse the impact on the banking sector by progressively increasing the possible deposit outflows also under stress conditions, and assessing the potential reactions of banks, including how they re-compose their balance sheets and what the implications are for liquidity and profitability, in particular for net interest income.

4 First, we use SPACE data and extrapolate it using either a third-order polynomial or an exponential model. Alternatively, we assume that the cash share's trend from 2019 to 2024 will repeat in subsequent periods. In particular, we assume that the proportional decline of the remaining stock of banknotes remains constant, resulting in a slowdown of the declining trend in terms of absolute amounts. Second, we analyse payment surveys from countries that are leading in payment digitalisation, such as Norway. Instead of following the SPACE trend, we project future developments based on these countries' experiences from 2016/17 to 2022/23. Lastly, we calculate the average cash share across all methods, determining minimum and maximum values for a comprehensive view on the range of possible outcomes.

2 Digital euro holdings and deposit outflows under business-as-usual and flight-to-safety scenarios

2.1 Definition of the two scenarios

The business-as-usual scenario represents a scenario that is widely expected to prevail, in which users hold digital euro as a means of payment under normal conditions. Under this scenario, digital euro demand is estimated based on the digital euro holding limit survey commissioned by the ECB. In the survey, a representative sample of respondents across all euro area countries were asked if they would hold digital euro and how much, and if they would obtain digital euro by exchanging banknotes[5], deposits, or other assets.[6] The answers are used to calculate the country-level average digital euro demand per individual. It is assumed that only individuals likely to try out the digital euro will hold digital euro (66% of respondents on average). In addition, survey information on the source of the funds of digital euro was used to estimate the share of digital euro demand that stems from deposits and thus leads to deposit outflows from banks. Respondents declared that they would credit their digital euro wallets primarily using deposits, either sight or savings, but also other assets (23% of total, including 16% from cash; Chart 1). The other assets category is thus excluded from banks' outflows (Chart 2). Finally, the individual average outflow is translated into bank deposit outflows based on the country-level variation in the survey responses, as well as data on the number of sight deposit holders per bank who are eligible to hold digital euro, sourced from the DRDEPO data collection.

5 To derive the banknote share in digital euro funding, two assumptions are made. First, some respondents specify a desired digital euro amount but do not provide a funding source allocation. For these respondents, we assume that they allocate funds like the average citizen of their country. Second, when desired digital euro demand exceeds the holding limit under consideration, we adjust the funding source allocations proportionally. For example, if digital euro demand is €10,000 and funded with €3,000 in cash and €7,000 in deposits, but the holding limit is €1,000, we adjust the cash and deposit funding to €300 and €700, respectively. The substitution rates are calculated as an average over the declared funding choices of all respondents.

6 The resulting digital euro demand is similar, albeit slightly larger for higher holding limits, than the digital euro demand based on Lambert, Larkou, Pancaro, Pellicani, and Sintonen Working Paper (2024). The demand for digital euro, and therefore the deposit outflows and the described impact on the Eurosystem balance sheet, changes with the interest rate environment. The higher the interest rates earned on bank deposits, the lower the demand for zero-renumerated digital euro and the lower the impact on monetary policy implementation.

Chart 1
Sources of digital euro balances

(x-axis: funding source; y-axis: percentage of digital euro wallet)

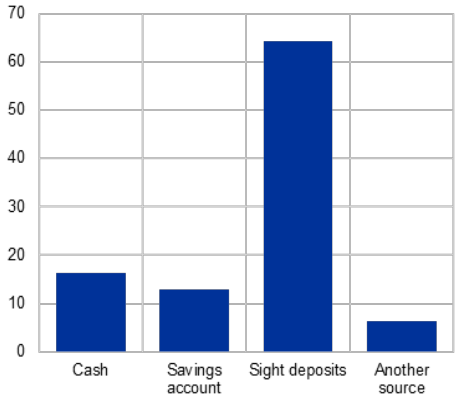
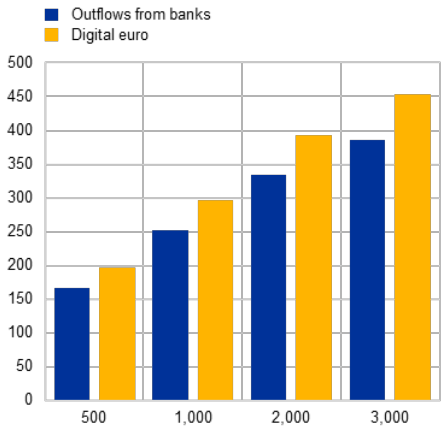


Chart 2
Digital euro demand and subsequent bank outflows by holding limit under the business-as-usual scenario

(x-axis: holding limits; y-axis: average per individual)



Source: Ad-hoc survey on users' behaviour and their money demand and ECB calculations.
Notes: Chart 2) to compute the outflows from banks the analysis only considers funding sources on bank balance sheets: "sight" and "saving" deposits, while "cash" and "another source" are excluded.

The flight-to-safety scenario represents a hypothetical and highly unlikely scenario in which, in crisis times, every individual in the euro area would hold the maximum amount of digital euro possible. Under this scenario, it is assumed that each depositor demands the maximum amount of digital euro allowed under the different holding limits, provided they have sufficient sight deposits. In this hypothetical case, the maximum possible outflow of retail sight deposits occurs rapidly and simultaneously for all banks. The resulting bank-level deposit outflows depend on the number of unique sight depositors a bank has and their actual deposit holdings.[7]

Such a scenario has never occurred in the 25 years of the euro; it thus assesses the theoretical potential consequences of an extreme tail event for the financial system, in the presence of the digital euro. Following the request by co-legislators, this highly conservative scenario is used to analyse what would happen if the banking sector experiences system-wide and substantial digital euro demand and related deposit outflows due to a loss of confidence in the banking system unrelated to the digital euro and under a no-policy-change from the central bank assumption. It is important to clarify that many of the effects estimated under such scenario would also materialise even in the absence of a digital euro. Specifically, these effects could arise from a combination of significant banknote withdrawals (given the amounts considered) or a shift towards emerging digital

7 These worst-case estimates may overestimate the maximum possible deposit outflows since they do not account for depositors with accounts at multiple banks and assume that all depositors open a digital euro account; or it may underestimate the maximum outflows since they assume that term and saving deposits are not withdrawn. Furthermore, this scenario does not consider potential adjustments to the ECB's monetary policy in response to such a situation. However, in accordance with its mandate, the ECB will need to consider potential actions, including the appropriate adjustment of its tools and measures, to effectively address a widespread bank run across the entire euro area.

assets, particularly stablecoins (most of which are denominated in non-euro currencies). Furthermore, it is important to highlight that under such a scenario, deposits other than sight deposits under €100,000 held by natural persons would be the most likely to flow out of the banking sector. Notably, 31% of overnight deposits are held by non-financial corporations, which are not covered by deposit insurance mechanisms, and more than one-third of eligible overnight household deposits are in accounts exceeding €100,000. These depositors would likely withdraw their funds amid the aforementioned loss of confidence in the banking system, which is unrelated to the introduction of the digital euro.

In the event of a systemic crisis of the type envisaged under the flight-to-safety scenario analysed, the impact on the ECB's monetary policy transmission mechanism would likely elicit a policy reaction, which is not factored into the analysis. Indeed, the ECB has a solid track record of decisive and effective policy responses to a series of crises to preserve the functioning of the monetary transmission mechanism and deliver on its primary mandate of price stability. Moreover, the ECB's operational framework for implementing monetary policy contains the necessary tools to preserve rate controllability and mitigate the liquidity impact on bank credit in the business as usual but also in a severe crisis scenario as the one analysed in this note.

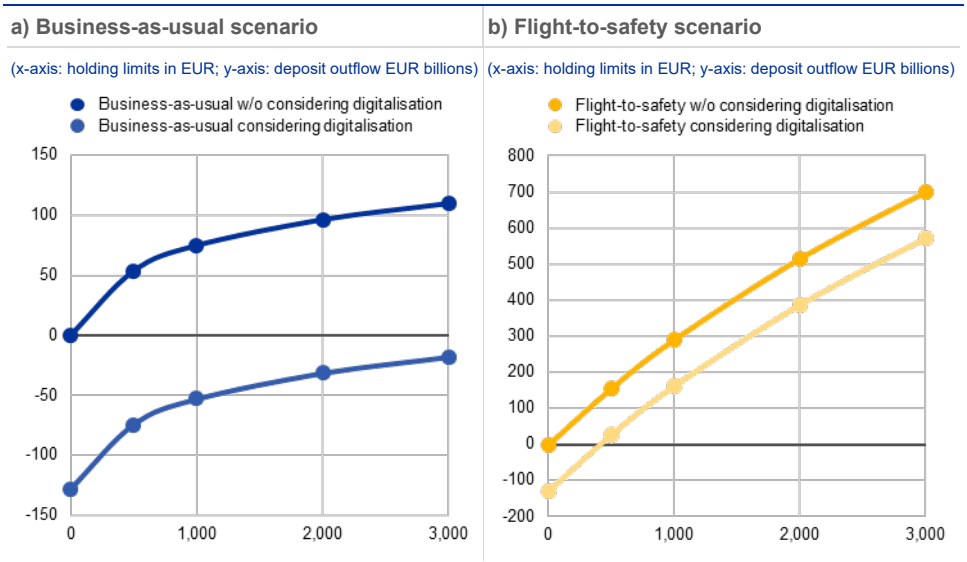
2.2 Impact of outflows under the two scenarios

The impacts on deposits are contained under the business-as-usual scenario and, as expected, more material under the flight-to-safety scenario. Under the business-as-usual scenario, the estimated impact of introducing a digital euro on bank deposits is contained for all assessed holding limit levels (Chart 3a). Under the flight-to-safety scenario, the estimated aggregate deposit outflow increases from €156 billion with a €500 holding limit (0.5% of total banking sector assets or 1.8% of total retail sight deposits) to €699 billion with a €3,000 holding limit (2.2% of total banking sector assets or 8.2% of total retail sight deposits) (Chart 3b).[8] An analysis of deposit outflows at the business model level reveals that small market lenders, retail lenders and diversified lenders are most affected compared with other business models under both the business-as-usual scenario (Chart 4a) and flight-to-safety scenario (Chart 4b). As explained by the integration of the digitalisation trend into the analysis (section 1), the charts show negative starting amount of deposit outflows for those scenarios considering digitalisation; this is a reflection of inflows of deposits resulting from the digitalisation trend of payments. For completeness, results are also shown without considering the digitalisation trend, with these outflows therefore starting from zero.

8 These aggregate deposit outflows can be compared with an outflow of 20.9% of retail deposits during the banking crisis in Cyprus in 2013, an outflow of 25.9% of retail deposits during the Greek debt crisis in 2015, and an outflow of 6.4% of retail deposits in Belgium when the government announced an attractive saving instrument for households.

Chart 3

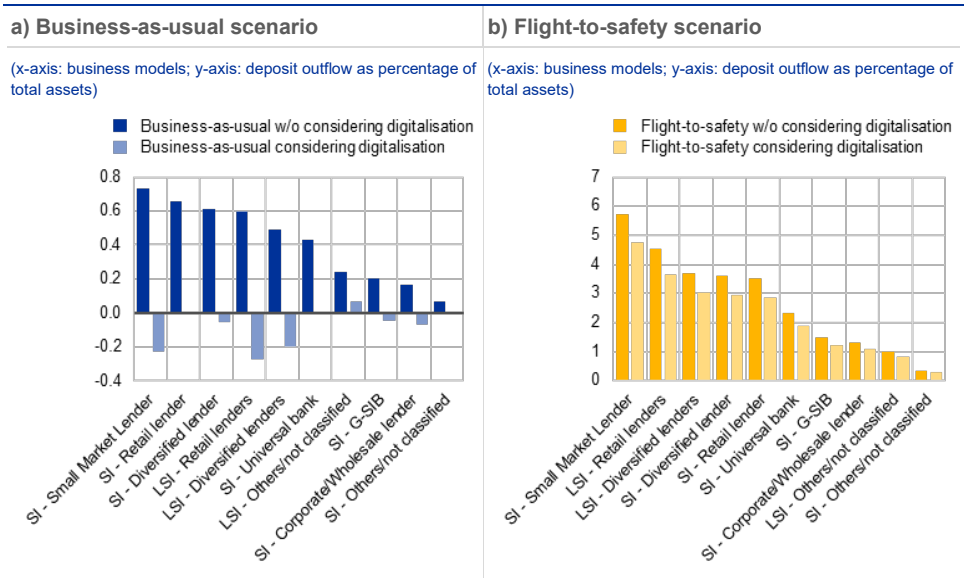
Estimated deposit outflows by holding limits



Source: ECB calculations based on supervisory reporting data from the first quarter of 2024 and DRDEPO data collection.
Notes: The sample includes 2,025 banks. Negative starting amounts result from inflows related to digitalisation considered in scenario.

Chart 4

Estimated deposit outflows by business model and scenario for €3,000 holding limit



Source: ECB calculations based on supervisory reporting data from the first quarter of 2024 and DRDEPO data collection..
Notes: The sample includes 2,025 banks. The "others/not classified" category includes banks without a specified business model, asset managers, consumer credit lenders, custodians, development lenders, and investment banks.

This impact on deposits is compared with the underlying assumptions in the liquidity coverage ratio (LCR) and ECB Banking Supervision liquidity stress test (LiST) scenarios from 2019 to get a sense of their relative magnitude. The 2019 sensitivity analysis of liquidity risk[9] was performed to assess banks' ability to withstand hypothetical idiosyncratic liquidity shocks. Chart 5 shows that under the

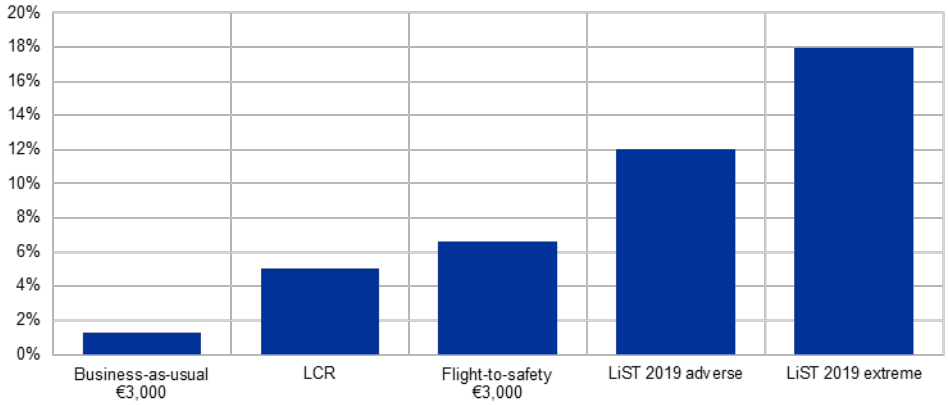
9 See ECB (2019), "Sensitivity Analysis of Liquidity Risk – Stress Test 2019".

business-as-usual scenario with a €3,000 holding limit, deposit outflow rates remain well below what banks would experience if 5% of their retail deposits were withdrawn, as assumed in the LCR Regulation (represented by the LCR bar).[10] Under the flight-to-safety scenario with a €3,000 holding limit, results are below both the LiST adverse and extreme scenario outflow rates. In addition, both LCR and LiST scenarios include further liquidity stress on other bank liabilities (e.g., drying-up of wholesale funding), which are not affected by the introduction of the digital euro. The analysis also shows that potential outflows into the digital euro are milder than the non-digital euro outflows assumed by ECB Banking Supervision in its regular assessments of liquidity risks (i.e., the standard tools used to assess whether banks can withstand hypothetical idiosyncratic liquidity shocks).

Chart 5

Stable retail deposits outflow rates under digital euro scenarios vs. LCR and supervisory stress scenarios (LiST)

(x-axis: digital euro, LCR, and LiST scenarios; y-axis: percentage of total retail sight deposits)



Source: ECB calculations, Sensitivity Analysis of Liquidity Risk – Stress Test 2019.

Bank deposits in the future will not only be affected by the possible introduction of a digital euro, but also by the ongoing trend of digitalisation of retail payments. Moreover, the gradual decline in the use of banknotes for payments due to digitalisation is expected to lead to an increase in bank deposits. For both the business-as-usual and the flight-to-safety scenarios, the implications of a digital euro with and without considering this digitalisation trend are analysed. Specifically, the average scenario shows a €127 billion inflow of deposits due to the ongoing digitalisation of payments until 2034, which is equal to 0.4% of total banking sector assets or 1.5% of total retail sight deposits. For holding limits up to and including €3,000, the estimated deposit inflow impact of digitalisation exceeds the estimated deposit outflows under the business-as-usual scenario on aggregate. Since it is uncertain which banks benefit most from this trend, it is assumed that the

10 The LCR is designed to ensure that banks maintain a sufficient buffer of high-quality liquid assets (HQLAs) to cover their expected net cash outflows over a 30-day stress period. In this standardised liquidity stress scenario, a 5% outflow rate is applied to retail deposits. It is thus assumed, for regulatory purposes, that 5% of retail deposits could be withdrawn within 30 days under stressed conditions.

inflow of deposits is distributed across banks proportionally to the estimated flight-to-safety deposit impact of the digital euro.

The analysis confirms that holding limits effectively restrict deposit outflows from the banking sector to levels that safeguard the stability of the financial system and support the correct formulation and implementation of monetary policy. This stands in stark contrast to the potential risks posed by other digital assets that could emerge as alternative destinations for deposit outflows in the absence of a digital euro. Such assets would not be subject to holding limits, allowing unrestricted withdrawals from the banking sector, especially under a flight-to-safety type scenario. This could result in far greater disruption to the financial system, underscoring the stabilising role of carefully-designed holding limits for the digital euro. These effects would be compounded by the fact that, for example, dollar stablecoins would make it easier for European households to acquire low-risk dollar assets, with negative macro-financial implications for the euro area in both business-as-usual and crisis times. While the likelihood of this scenario is hard to quantify, a growing prevalence of digital dollarisation would undermine monetary sovereignty by compromising the ability to control the unit of account within the euro area, significantly impairing the capacity of the central bank to implement effective monetary policy and, ultimately, maintain price stability.[11]

3 Reaction of banks' balance sheets under business-as-usual and flight-to-safety scenarios

3.1 Banks' balance sheet adjustment

When depositors demand digital euro and withdraw funds from, or deposit funds into, their bank accounts, banks have various options to adjust their balance sheets. The overall impact of digitalisation and the digital euro on banks' balance sheets depends on individual banks' choices. The analysis simulates how each bank re-optimises its balance sheet by applying an enhanced version of the constrained balance sheet optimisation model developed in Meller and Soons (2023).[12] In the model, banks respond in a profit-maximising manner, subject to constraints related to their liquidity risk preference, regulation, availability of reserves and eligible collateral, market liquidity and market access.[13]

11 Keynote speech by Mr Philip R Lane, Member of the Executive Board of the European Central Bank, at the University College Cork Economics Society Conference 2025, Cork, 20 March 2025.

12 The balance sheet optimisation model closely follows Meller and Soons (2025), which was previously published in the ECB Occasional Paper Series as Meller and Soons (2023).

13 More specifically, banks have three main adjustment options, each with distinct impacts on their constraints: 1) drawing down or increasing their central bank reserves or banknotes, 2) increasing central bank borrowing, 3) obtaining additional central bank reserves on the interbank market or by issuing bonds. Secured and unsecured funding options are available at various maturities and different costs. The relative costs of funding options are calibrated to observed market price and may change depending on the endogenous demand and supply for each funding option as well as the level of excess liquidity. Banks with net inflows are assumed to store these as excess reserves.

Banks' access to liquidity under the business-as-usual and flight-to-safety scenarios depends on interbank market conditions, the available monetary policy facilities, and their banking group structure. Under the business-as-usual scenario, a bank's ability to obtain funding on the interbank market in the model is determined by its own preferences and asset holdings as well as other banks' willingness to lend. This, in turn, is influenced by the extent of the deposit inflows and outflows, liquidity risk tolerance, and reserve holdings of all other banks, as well as the total quantity of reserves supplied by the central bank. Additionally, it is assumed that banks with no market access in the last three years remain without access after the introduction of a digital euro.[14] When a bank exhausts its available excess reserves and is unable to obtain additional market funding, the model assumes all banks could borrow from the central bank. A bank can do so through regular monetary policy operations if it has unencumbered eligible collateral, or – as a last resort to sustain its liquidity buffer – at a penalty rate by encumbering currently non-eligible collateral. The latter "residual central bank funding" option serves as a stress indicator by signalling which banks would be at risk of depleting their liquidity buffers beyond their assumed minimum buffers. Under the flight-to-safety scenario, the interbank market is impaired, leaving banks with two options in the model: use their excess reserves or borrow from the central bank. Under both scenarios, the analysis also accounts for the fact that many less significant institutions (LSIs) manage their liquidity jointly within their institutional protection scheme (IPS).[15]

Banks' reaction to deposit outflows depends on their liquidity preferences, i.e., the extent they are willing and allowed to deplete their available liquidity buffers. Under the business-as-usual scenario, it is assumed that banks are willing to preserve their liquidity buffers according to their internal targets. Under the flight-to-safety scenario, it is assumed that banks are willing to deplete their liquidity buffers to the 100% LCR level. In parallel, all banks continue to meet the minimum net stable funding ratio (NSFR) requirement of 100% as a minimum constraint. Under the flight-to-safety scenario, banks are thus assumed at all times to sustain a significant liquidity buffer after experiencing the maximum deposit outflows to digital euro. This conservative assumption is made so that banks remain able to use their remaining liquidity buffer to service outflows towards assets other than digital euro, which are not included in analysis. At the same time, it should be kept in mind that the Basel LCR standard and the EU LCR Regulation explicitly allow banks to operate with an LCR below 100% during periods of stress and both the Basel Committee and ECB Banking Supervision have confirmed during past stress events (such as in March 2020 following the outbreak of the COVID-2019 pandemic) that it would be entirely appropriate for banks to use their stock of HQLA during stress, thereby falling below a 100% LCR level. Hence, the results in this analysis should be

14 More specifically, banks are able to access markets if banks have issued debt securities at some point since 2021. We assume that banks who in the previous three years had no market access, remain inactive after the introduction of a digital euro. To note, in the flight-to-safety scenario the interbank market is closed for all banks.

15 The model assumes that banks that are part of an IPS can obtain funding from another IPS member with an excess liquidity buffer. IPS members with market access may raise funding on the interbank market on behalf of those without market access. The intra-IPS lending/borrowing comes at no additional economic or regulatory costs to the borrower or the lender.

interpreted carefully and would be less severe if banks were assumed to deplete their liquidity buffers below the 100% LCR level.

3.2 Impact on liquidity and funding metrics

This analysis evaluates the potential impact of the digital euro on banks' liquidity and funding metrics. While regulatory ratios such as the LCR and the NSFR are central to the assessment, the methodology also incorporates broader metrics used by ECB Banking Supervision to assess banks' liquidity and funding risks. These include the liquidity capacity period (LCP), the counterbalancing capacity (CBC), the loan-to-deposit ratio and other additional liquidity monitoring metrics (ALMM).[16] By going beyond regulatory compliance (100% LCR and NSFR level), this approach provides a more comprehensive view of funding sustainability and offers a second layer of comfort regarding banks' resilience under both normal and stressed conditions. The model output includes the impact of changes to banks' deposit funding and subsequent balance sheet adjustments on these key liquidity metrics. The analysis was performed using supervisory data for a sample of 2,025 banks, including both significant institutions (SIs) and LSIs.

Under the business-as-usual scenario the introduction of the digital euro is projected to have an extremely contained impact on banks' liquidity and funding metrics. When including the digitalisation trend, no aggregate outflows would be recorded at all under holding limits of €3,000 or less. Model results indicate that only a few banks would lack excess reserves that could be depleted while sustaining their preferred liquidity buffers. Among these, most banks would borrow from the interbank market, while those without market access would be able to resort to borrowing from the central bank as they retain sufficient unencumbered collateral.

Even without considering any compensating digitalisation trend, the various balance sheet indicators would only be marginally affected on aggregate. For instance, in case of a €3,000 holding limit, the LCR on aggregate decreases only slightly from 166% to 163% (Chart 7). The NSFR declines from 128% to 127%, while the wholesale funding ratio (WSF ratio) increases marginally from 52.4% to 52.6%. Finally, the central bank funding ratio (CBF ratio) remains constant at 2.1%. These results indicate that the banking sector would be well positioned to absorb moderate

16 The LCR assesses short-term liquidity by comparing the stock of liquid assets to the net cash outflows over a 30-day period. The net stable funding ratio (NSFR) compares a bank's stable funding sources to the liquidity characteristics and residual maturities of its assets and the contingent liquidity risk arising from its off-balance sheet exposures. The liquidity capacity period (LCP) measures the quality and quantity of the Liquidity Buffer based on the contractual maturity profile of balance sheet positions. It considers a 12-month horizon and indicates how long a bank can cover contractual cash outflows by monetizing its counterbalancing capacity (CBC). CBC refers to the stock of unencumbered assets or other funding sources that are legally and practically available at the reporting date and can be converted into cash to cover contractual or funding gaps. Other additional liquidity monitoring metrics (ALMM) include: the loan-to-deposit ratio, indicating the share of loans which need to be financed by other liabilities than deposits; the wholesale funding ratio (WSF ratio), defined as the share of wholesale (non-retail, market-based) funding in total funding; and the central bank funding ratio (CBF ratio), defined as the share of funding obtained through central bank operations in total funding. See the EBA implementing standards on supervisory reporting amendments with regards to ALMM.

deposit outflows caused by the digital euro under the business-as-usual scenario without any constraints to liquidity management or funding sustainability.

Chart 6
Aggregate bank balance sheet adjustment without considering the digitalisation trend

(x-axis: holding limit in EUR; y-axis: EUR billions)

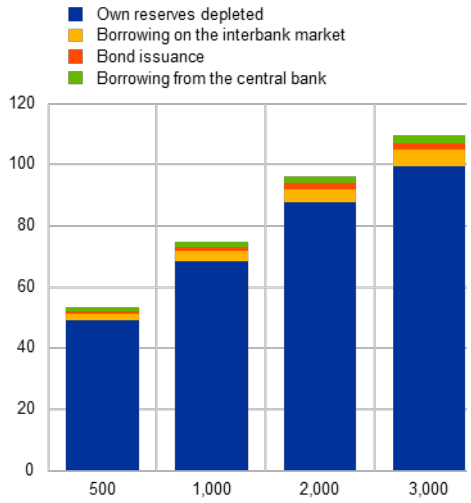
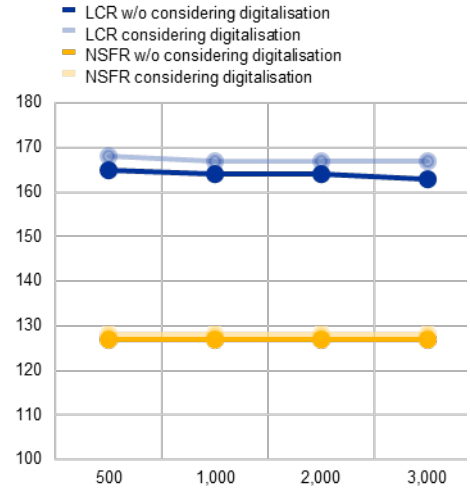


Chart 7
Digital euro demand and subsequent bank outflows by holding limit under the business-as-usual scenario

(x-axis: holding limit in EUR; y-axis: ratio)



Source: ECB calculations.
Notes: Calculations based on balance sheet optimisation model using supervisory reporting data from the first quarter of 2024 and DRDEPO data collection. The sample includes 2,025 banks. Chart 7) The aggregate ratio is calculated by summing the numerator and denominator for all banks.

Under the flight-to-safety scenario, the impact on liquidity metrics is more pronounced but remains manageable. This scenario assumes a system-wide crisis resulting in deposit outflows and it is conservatively assumed that all banks maintain an LCR and NSFR of at least 100% (even if the Basel LCR standard and the EU LCR Regulation explicitly allow banks to operate with an LCR below 100% during periods of stress) and without any intervention from the Eurosystem. Banks would thus primarily meet the deposit outflows by utilising their own reserves and borrowing short-term from the central bank through regular monetary policy operations.

Even under this stressed scenario and when conservatively not considering the digitalisation trend, regulatory liquidity metrics on aggregate remain well above 100% (Chart 8). On the individual bank-level, with a €3,000 holding limit, only 13 banks representing 0.3% of total banking sector assets would reach the 100% LCR level and only nine of those banks representing 0.1% of total banking sector assets would be at risk of depleting their liquidity buffers below the 100% LCR level as they do not retain enough unencumbered eligible non-HQLA collateral to borrow from the central bank through standard monetary policy operations (Chart 9).

Chart 8

Aggregate liquidity metrics under the flight-to-safety scenario

(x-axis: holding limit in EUR; y-axis: ratio)

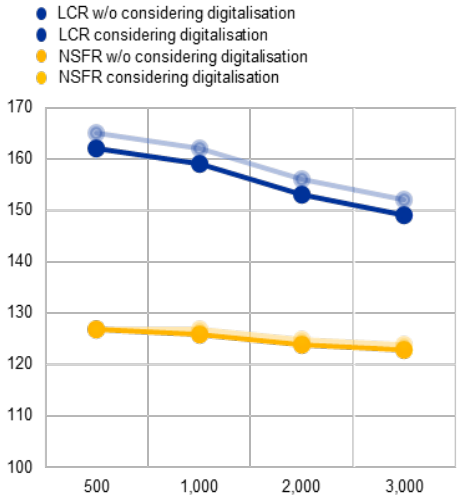
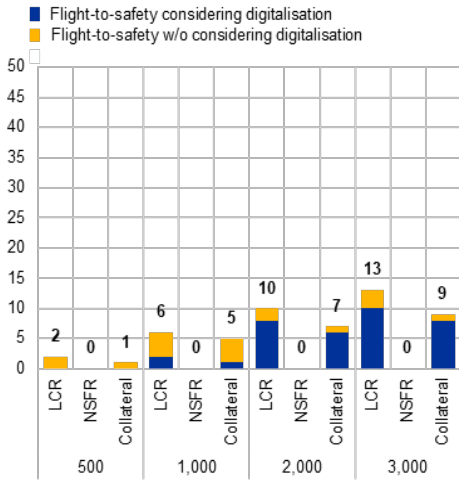


Chart 9

Number of banks that reach the 100% LCR and NSFR level and those that are at risk of going below the 100% level under the flight-to-safety scenario

(x-axis: holding limit in EUR; y-axis: number of banks)



Source: ECB calculations.
Notes: Calculations based on balance sheet optimisation model using supervisory reporting data from the first quarter of 2024 and DRDEPO data collection. The sample includes 2,025 banks. The aggregate ratio is calculated by summing the numerator and denominator for all banks. "Collateral" is short for the banks that are at risk of depleting their liquidity buffers below the 100% level due to their lack of unencumbered eligible non-HQLA collateral.

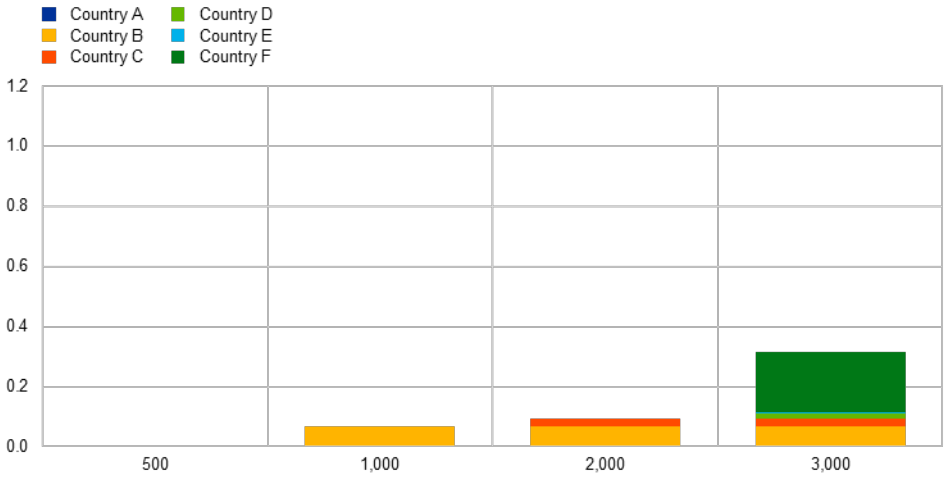
The analysis also examines the distribution of liquidity impacts across different business models and geographies. Banks are assessed at the highest level of consolidation, with the country of origin determined by the ultimate parent institution's location.[17] Chart 10 indicates the size and country of origin of those banks that reach the 100% LCR level. With a €3,000 holding limit, banks from six countries representing 0.3% of total banking sector assets would reach the 100% LCR level. Additionally, banks with retail lender business models are most likely to come closer to the 100% LCR level, as these institutions typically have smaller liquidity buffers relative to possible maximum outflows.

17 This approach aligns with the supervisory practices of Joint Supervisory Teams (JST) in the SSM and has been applied consistently throughout the analysis. However, it should be noted that in few euro area countries, less than half of the total banking assets are domestically incorporated.

Chart 10

Share of total banking sector assets of banks that reach the 100% LCR level under the flight-to-safety scenario without considering digitalisation, by country

(x-axis: holding limit in EUR; y-axis: share of total banking sector assets in %)



Source: ECB calculations.
Notes: Calculations based on balance sheet optimisation model using supervisory reporting data from the first quarter of 2024 and DRDEPO data collection. The sample includes 2,025 banks.

A review of broader liquidity metrics for SIs indicates that banks are unlikely to experience any significant impact under the different scenarios analysed. The LCP, which measures banks' survival period under liquidity stress, remains stable for most business models: under a €3,000 holding limit, all business models experience little to no decline, with no business model seeing a reduction approaching one month (Chart 11a). The impacts on the CBC ratio align with those for regulatory metrics (Chart 11b). Examining the loan-to-deposit ratio[18] (which provides a proxy of the share of loans[19] being funded by deposits), reveals that this ratio remains largely stable, with only minor variations across business models. Small market lenders experience a modest increase of 2 percentage points under a €3,000 limit (Chart 11c). Furthermore, a combined scenario of outflows to digital euro and LiST extreme assumptions (as per reverse liquidity stress-test methodology) shows that the survival periods are not materially impacted by outflows to digital euro (Chart 11d).

18 This ratio gives an indication of how banks finance their lending strategy. A higher ratio implies a potential need for external funding sources.

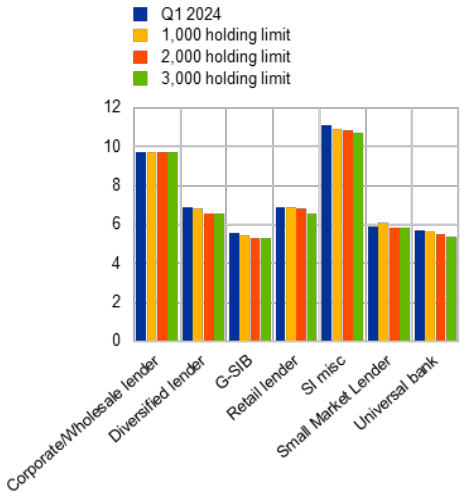
19 Loan supply impacts are derived from changes in funding costs and profitability under the two scenarios, translated using various econometric models typically used for policy analysis.

Chart 11

Estimated impact of digital euro on other liquidity and funding metrics for SIs

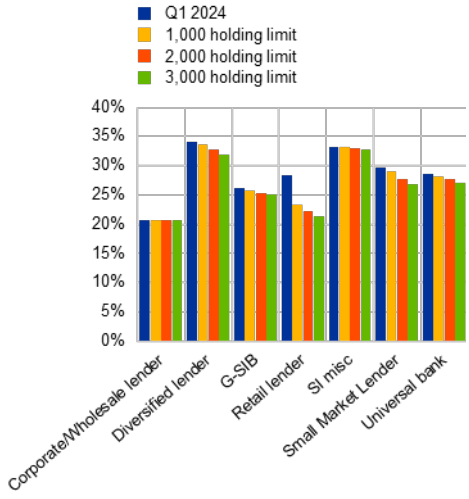
a) Liquidity capacity period under flight-to-safety scenario considering digitalisation

(x-axis: business models; y-axis: LCP in months)



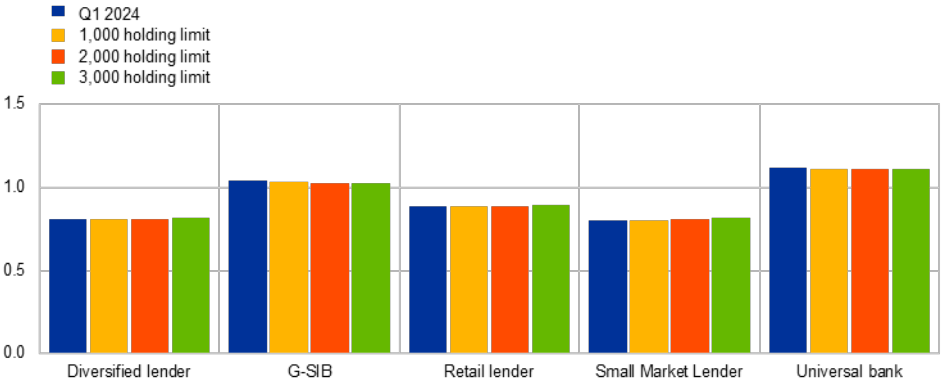
b) Counterbalancing capacity under flight-to-safety scenario considering digitalisation

(x-axis: business models; y-axis: CBC as percentage of total assets)



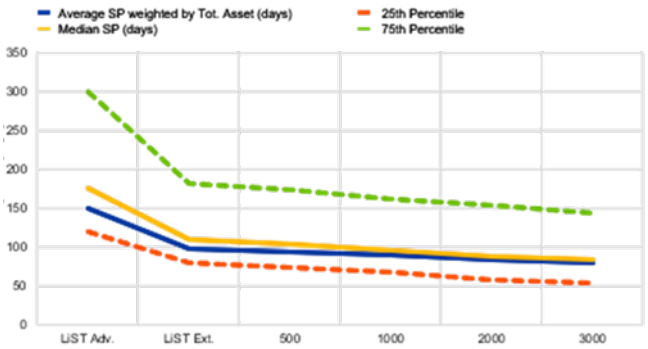
c) Loan-to-deposit ratio under flight-to-safety scenario considering digitalisation

(x-axis: business models; y-axis: loan-to-deposit ratio)



d) Impact of outflows to digital euro in addition to LiST stress scenario (survival period, in days)

(x-axis: business models; y-axis: loan-to-deposit ratio)



Source: ECB calculations

Notes: Based on balance sheet optimisation model outputs, liquidity stress test, supervisory reporting data from the first quarter of 2024, and DRDEPO data collection. "SI misc" includes SIs without specified business model and others. Loan-to-deposit ratio is not computed for corporate/wholesale lenders since this indicator is not relevant for this type of banks.

3.3 Impact on profitability

This analysis assesses the potential impact on banks' profits, focusing on net interest income (NII).[20] More specifically, the assessed effect on NII captures the possible changes in interest income and expense mainly due to changes in banks' balance sheets in response to deposit outflows towards the digital euro. The considered effect on banks' NII in this analysis stems from changes in volumes as well as price adjustments considered in the balance sheet optimisation model.[21] It is important to recall that the optimisation model does not consider that banks could increase deposit remuneration to limit possible deposit outflows.

The analysis also does not consider possible changes in consumer behaviour following the introduction of the digital euro. It also does not consider possible profitability gains from the provision of new added-value services related to the digital euro; but even more importantly this analysis does not take into account the revenues associated with transactions processed via digital euro that bring revenues to both acquiring and issuing banks and do not require scheme fees; nor does this analysis take into consideration the cost reduction achieved by banks in cash management. All these elements may well have a positive impact on profitability. Key legislative provisions and design features in that regard are (i) envisaged compensation similar to fees earned from comparable means of payment; (ii) the absence of scheme and settlement fees, such as those international card schemes levy on issuing banks; and (iii) the possibility for private solutions, owned by European banks, to leverage digital euro acceptance standards to increase both use case and geographical scope.

In this profitability analysis, the focus is on the business-as-usual scenario, as it reflects the long-term, stable demand for the digital euro, rendering the assessment of the impact in this context particularly important. Profitability results under the flight-to-safety scenario are considered less relevant because this scenario represents a system-wide stress event affecting all banks simultaneously that is expected to be short-lived and where temporarily reduced profitability would not be the primary concern.

The impact of the digital euro introduction on banks' NII is assessed by considering the changes in interest income and interest expense due to deposit outflows. More specifically, changes in interest income and expenses are determined by considering changes in the volumes of the various banks' balance sheet items. These changes are an outcome of the balance sheet optimisation model and are multiplied by the corresponding interest rates. Interest rates for each

20 NII is the difference between interest earned on assets (such as loans and investments) and interest paid on liabilities (such as deposits and borrowings).

21 These adjustments concern the €STR based on its relationship with excess liquidity and market rates that adjust proportionally to the €STR. Thus, it should be noted that the computation does not consider an additional change in funding costs, for instance due to a wider loss of confidence. In addition, deposit rates are assumed not to change consistently with the analysis presented previously.

balance sheet item are calibrated using observed prices at the bank level adjusted to capture the evolution of excess liquidity.

Under the business-as-usual scenario, results show that the change in banks' NII remains very contained for all holding limits. For holding limits between €500 and €3,000, the decline in NII ranges from 9 basis points to 18 basis points without considering the digitalisation trend (Chart 12). When considering the digitalisation trend, the analysis finds an increase in NII for holding limits where deposit inflows due to digitalisation outweigh outflows (i.e., up to a €3,000 limit) (Chart 12). These reductions are small compared with the historical volatility of banks' return on equity (RoE), approximately representing a maximum of 1.2% of the historical standard deviation of the RoE.[22] Impacts vary across different business models, with retail lenders, small market lenders, and universal banks experiencing more pronounced changes in RoE, consistent with the higher outflows over equity ratios observed for these business models. At the country-level, RoE contraction does not exceed 40 basis points across all holding limits except for one outlier (whose results are mainly due to a high concentration of depositors with small balances and thus a high outflow to total deposits ratio) (Chart 13).

22 The standard deviation (sd) of the RoE is calculated as the weighted average of bank-level quarterly standard deviations computed using available FINREP data, spanning from 2018 to 2024. The average sd is 363 basis points.

Chart 12
RoE impact under the business-as-usual scenario

(x-axis: holding limit in EUR; y-axis: RoE variation in basis points)

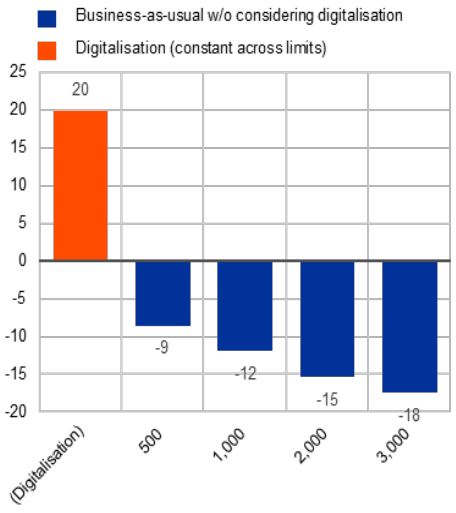
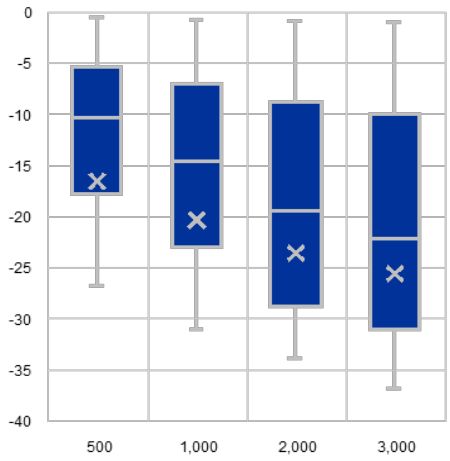


Chart 13
Distribution of RoE impact at country level under the business-as-usual scenario

(x-axis: holding limit in EUR; y-axis: RoE variation in basis points)



Sources: Supervisory reporting data, DRDEPO data collection, Iboxx, MMSR, iMIR.
Notes: The sample includes 2,002 banks. Data is from first quarter of 2024. Weighted averages by total assets. Chart 12) The analysis assumes that current levels of excess liquidity are fully available to be drawn down. "Digitalisation" isolates the effect of inflows from digitalisation constant for all holding limits and scenarios; this can be added to impacts without digitalisation to get impact with digitalisation. Chart 13) The box shows the 25th and 75th percentile (interquartile range, IQR), with the line inside marking the median. Whiskers extend to 1.5×IQR. The digitalisation trend is not considered.

The individual results for SIs were also reviewed from a supervisory perspective. Supervisory checks were conducted to assess whether banks experiencing a greater negative impact in terms of reduced RoE also exhibited business model or profitability concerns that would justify further action by the supervisors. These checks included, among other things: (i) the materiality of NII for the total operating income (i.e., checking whether a bank's profitability is heavily dependent on this factor), (ii) the reliance of the funding structure on households' deposits (i.e., assessing how much of a bank's funding comes from deposits made by households), and (iii) key risk indicators and SREP scores[23] for business models (i.e., assessing the impact on a bank's ability to generate profits or sustain its operations in the long term). The results of the analysis are in line with the conclusions outlined above, indicating that the change in banks' NII remains minimal across all holding limits and does not justify any supervisory intervention or corrective actions.

Sensitivity analyses reveal that the interest rate environment impacts profitability dynamics. To assess the impact of the interest rate environment on banks' profitability following the digital euro introduction, a sensitivity analysis was

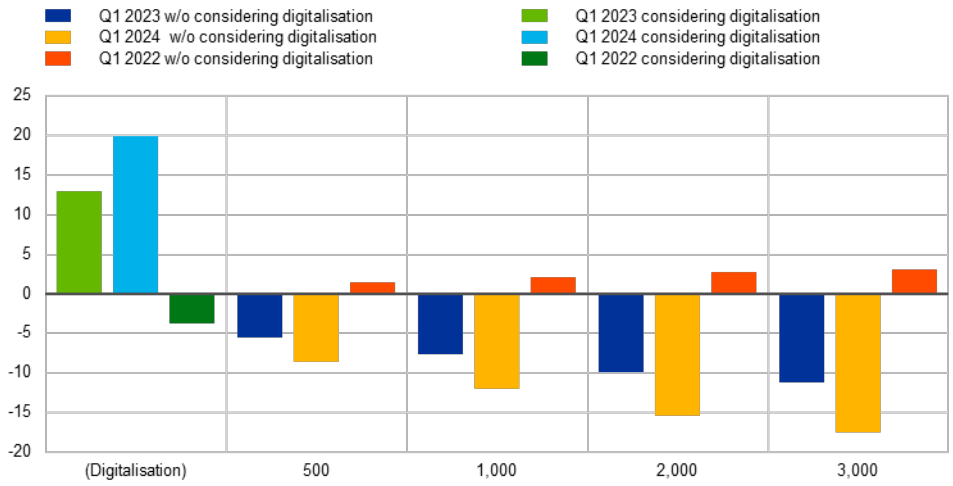
23 The Supervisory Review and Evaluation Process (SREP) scores are assessments made by ECB Banking Supervision to evaluate a bank's overall health and risk profile. Specifically, the score for the business model reflects how sustainable and viable the bank's business strategy is, taking into account profitability, competitive positioning and adaptability to changing conditions.

conducted using interest rate data from the first quarter of 2023 and the first quarter of 2022, while keeping all other elements constant. The analysis shows that the interest rate environment plays a crucial role as the spread paid for each unit of outflow, which closely aligns with the spread between deposit remuneration and the deposit facility rate (DFR), typically widens with monetary policy tightening (Chart 14).[24]

Chart 14

RoE impact for different interest rates under the business-as-usual scenario

(x-axis: holding limit in EUR; y-axis: RoE variation in basis points)



Sources: Supervisory reporting data, DRDEPO data collection, Iboxx, MMSR, iMIR.
Notes: The sample includes 2,002 banks. Averages weighted by total assets. Output of balance sheet optimisation model using first quarter of 2024 data for different environment rates. "Digitalisation" isolates the effect of inflows from digitalisation constant for all holding limits but varying the interest rate environment; this can be added to impacts without digitalisation to get impact with digitalisation.

24 Banks face a reduction of funding that they remunerate at the deposit rate and compensate either by reserve remunerated at the DFR or by additional funding (wholesale or CB) with remuneration above, but within a narrow corridor, of the DFR, explaining the key role of the spread between the remuneration on deposits and the DFR.

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

For specific terminology please refer to the ECB glossary (available in English only).