A quantitative analysis of the holding limit for a digital euro

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Disclaimer:
This paper represents the authors‘ personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or the Eurosystem.

Motivation and key question

What is an appropriate holding limit for the digital euro?

Balancing user demand and digital euro appeal vs. mitigation of undesired side-effects for monetary policy implementation.

Why is Monetary Policy Implementation interested in the holding limit?

- A digital euro increases demand for liquidity and monetary policy counterpartys are directly involved.
- MPI takes into account an aggregate view and the bank individual perspective.
- Heterogeneity of banks and households in the euro area is relevant for a smooth implementation of monetary policy.
- Many analysis abstract from different monetary policy environments, potential digital euro demand or a country break-down.

Overview on model outcome

What indications are given on the holding limit?

- **The lower** the defined holding limit is, **the less impact** it has for monetary policy implementation.
- Our analysis finds that **low holding limits (up to EUR 1,000) are no issue** when taking into account banking groups.
- Depending on household wealth and overall demand, **higher limits (i.e. EUR 3,000) could work as well** as overall liquidity supply currently is very high.
- Individual institutions may seek for unsecured long-term funding in order to cater for deposit outflows in reaction to high holding limits.

Data and variables

Qualitative Model Parameters	
Parameter	**Variable**
Institute Name	I
Country	C
Business Model (*Household Bank vs. Others*)	B
Banking Group	α
Bank Size (*Small, Medium, Large*)	β
Indirect Reserve Holder (*Yes, No*)	κ
Money Market Access (*Yes, No*)	ω

Table: Values in Tables are aggregate values for the whole sample across the Euro Area (i.e. for total assets) in EUR bn.

Data and variables

Quantitative Model Parameters			
Parameter	**Variable**	**2021**	**2023**
Total Assets	A	24,889	28,227
OVN Deposits	D	3,583	4,003
Collateral Pool	P	2,460	1,712
Unencumbered collateral	U	937	1,271
Central Bank Refinancing	R	1,730	404
Liquidity	L	3,563	2,927
Minimum Reserve	M	125	144
Household Number	H	0.254	0.277
Excess Liquidity	E	3,564	2,783
Funding Capacity	ψ	5,233	5,362
Available Funding Capacity	λ	5,109	5,223
Monetary Policy Excess Liquidity	θ	125	140

Sample and characterization of banks 2023

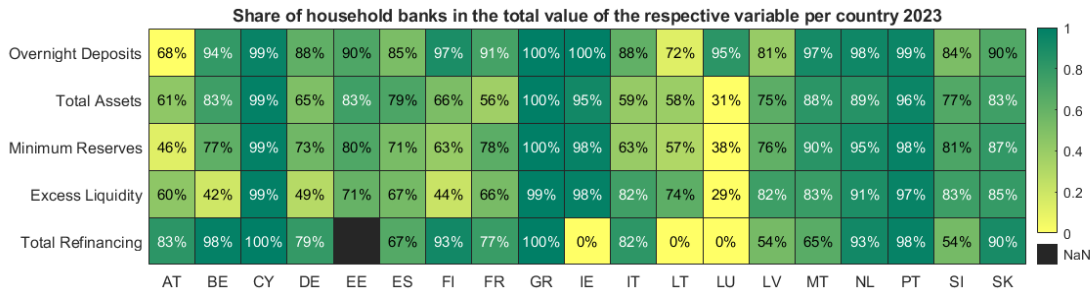
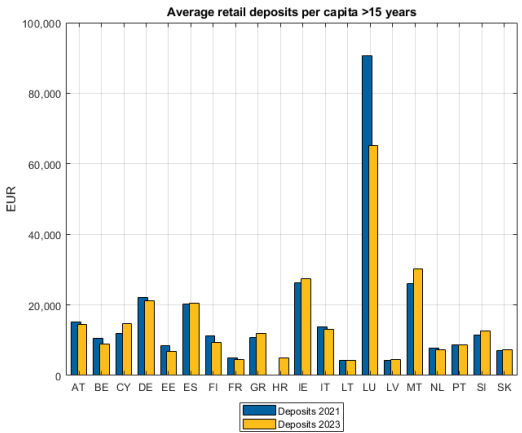


Figure: Share of household banks in the total value of the variable for each country in 2023. We show percentage of total overnight deposits, total assets, minimum reserves, excess liquidity and total refinancing.

Characterization of households



Household deposits per capita...

... are distributed heterogeneously.

... seem relatively stable over time.

... cannot be attributed to individual banks.

$$H_i = \frac{D_i}{D_c} H_c \tag{1}$$

Table: Average retail deposits per capita for households older than 15 years. Data include overnight deposit statistics and population data provided by the World Bank.

Overview on applied scenarios

Scenario 1: Fully utilised holding limit of EUR 3,000

$$\Omega_{i,b=1,\kappa=0} = H_i * 3,000 \tag{2}$$

$$\chi_i = \begin{cases} 1 \\ 0 \end{cases} \quad \text{if} \quad \lambda_{i,b=1;\kappa=0} - \Omega_{i,b=1,\kappa=0} < 0 \quad \text{with} \quad \chi_{b=1,\kappa=0} = \sum_{i=1}^{I} \chi_i \tag{3}$$

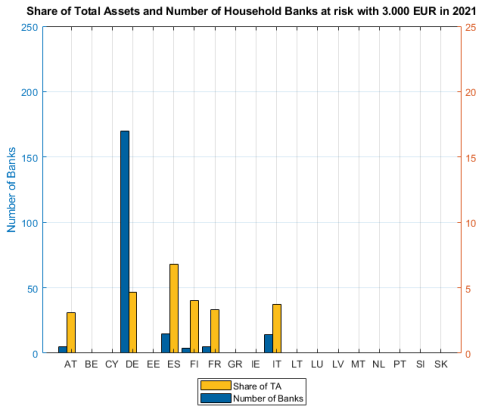
Scenario 2: Demand adjusted holding limit of EUR 3,000

$$\Omega_{i,b=1,\kappa=0} = H_i * 3,000 * 0.5 * 0.8 \quad \text{with} \quad \chi_i = \textit{see above} \tag{4}$$

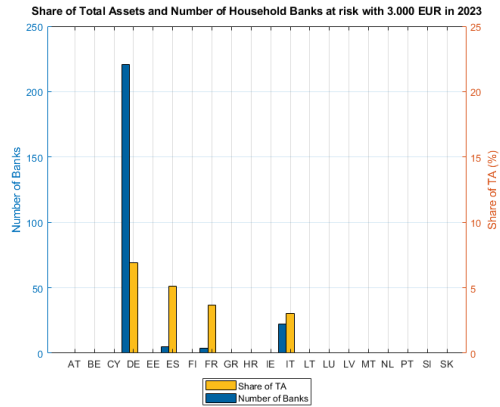
Scenario 3: Individual Maximum Holding Limit

$$\begin{aligned} \max \quad & \Omega_{i,b=1,\kappa=0} = H_i * \Omega_{i,h,b=1,\kappa=0} && \text{s.t.} \\ & \lambda_{i,b=1,\kappa=0} - \Omega_{i,b=1,\kappa=0} \leq 0 \\ & \chi_{i,b=1,\kappa=0} = 0 \end{aligned} \tag{5}$$

Scenario 1: Effects on individual banks



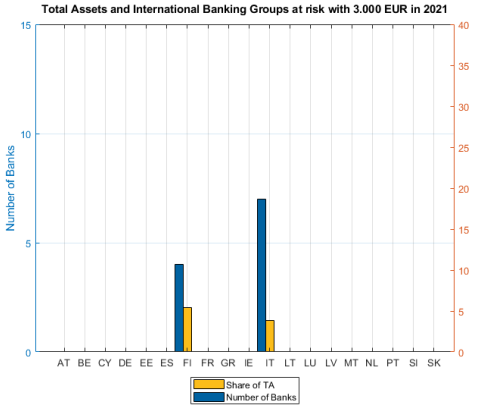
(a) Individual Household Banks in 2021



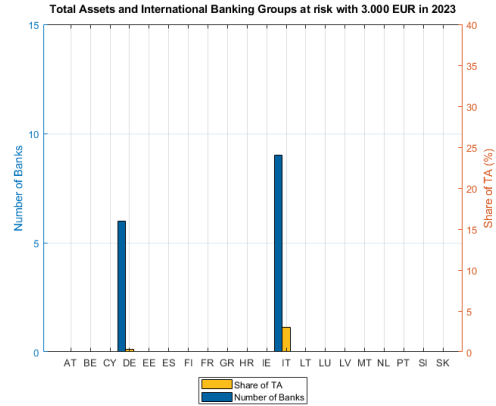
(b) Individual Household Banks in 2023

Figure: We only consider countries with at least 3 observations and no substantial share in order to keep confidentiality.

Scenario 1: Effects on international banking groups



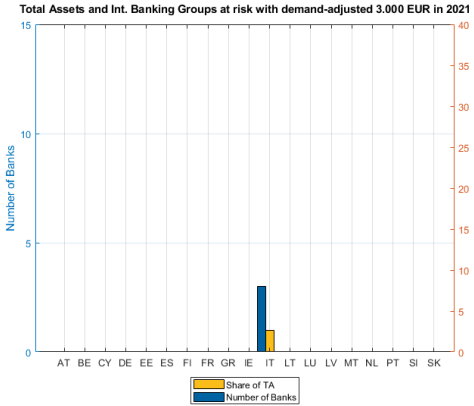
(a) International Banking Groups in 2021



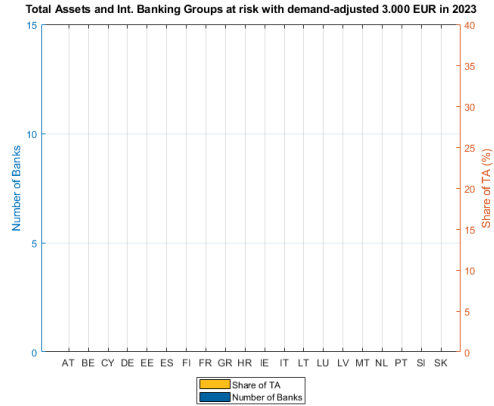
(b) International Banking Groups in 2023

Figure: We only consider countries with at least 3 observations and no substantial share in order to keep confidentiality.

Scenario 2: EUR 3,000 demand adjusted utilization



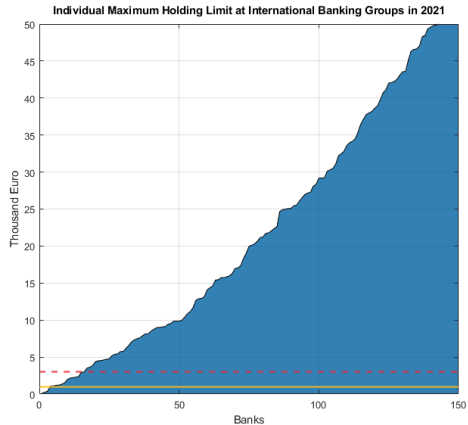
(a) International Banking Groups in 2021



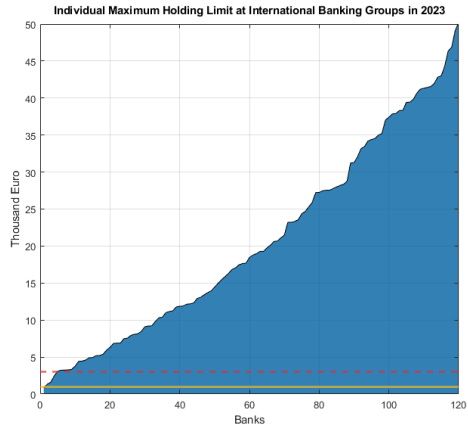
(b) International Banking Groups in 2023

Figure: We only consider countries with at least 3 observations and no substantial share in order to keep confidentiality.

Scenario 3: Individual Holding Limit for international banking groups



(a) International Banking Groups in 2021



(b) International Banking Groups in 2023

Potential Policy Implications

- Building Block 2 seems highly relevant as Monetary Policy counterparties are directly involved via liquidity, collateral and refinancing implications.
- Taking into account banking groups and assuming liquidity transfers between associated banks notably changes the model outcome.
- Bank individual data reveal pronounced heterogeneity between institutions, countries, business models and households.

Potential consideration: Defining a harmonised minimum amount for a D€?

- Each institution provides households with a **limit of at least i.e. EUR 1,000.**
- **Higher limits** are allowed but not mandatory and **could be defined by the bank**.
- **Allowing for heterogeneity** and a minimum degree of harmony.
- Uniform minimum limit as a standard with contained risks as individual and aggregate limits could be supervised.

Summary and future amendments

- A Digital Euro will **likely increase demand for central bank reserves** provided by the Eurosystem.
- Thus, a **future operational framework needs to take the effects into account**.
- MPI core variables such as available excess liquidity, the design of structural operations, collateral availability etc. are key for a Digital Euro supply.
- Our analysis finds that the **impact of low holding limits (up to EUR 1,000) is contained** when taking into account banking groups.
- Depending on household wealth and demand, **higher limits (i.e. EUR 3,000) could work as well** as overall liquidity supply is comfortable.
- Future amendments may include accurate data on potential deposit outflows and household behaviour.

Thanks for your attention!

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Literature Overview

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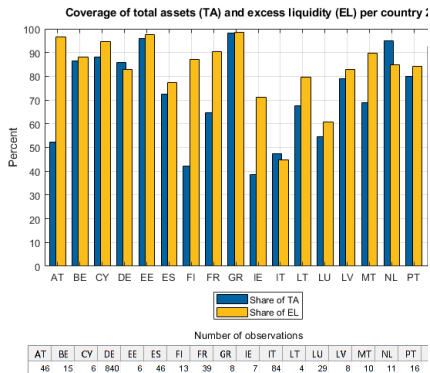
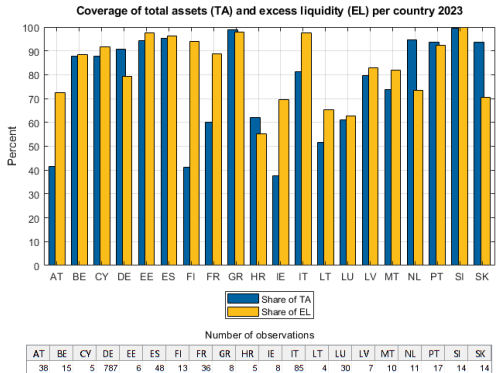
Sample and Coverage



(a) Model coverage in 2021



(b) Model coverage in 2023

Figure: Coverage of total assets and excess liquidity in the euro area.

Refinancing and excess liquidity per country

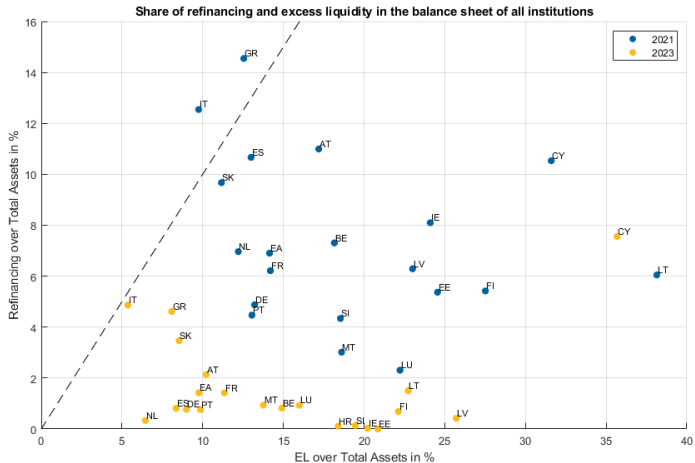


Figure: Share of refinancing and excess liquidity over total assets per country for 2021 and 2023

Sample and characterization of banks 2021

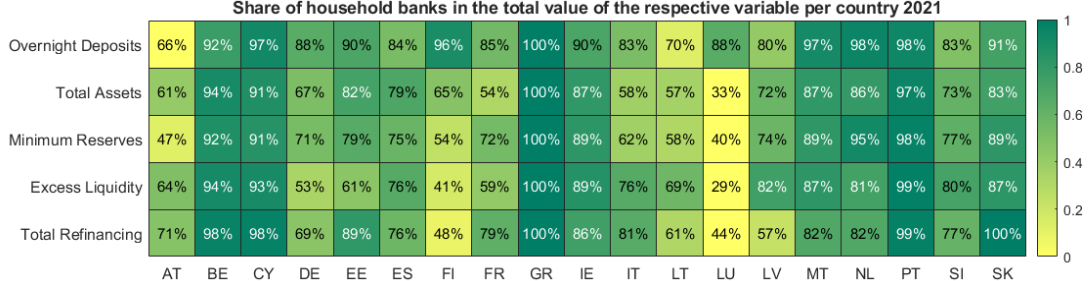


Figure: Share of household banks in the total value of the variable for each country in 2021. We show percentage of total overnight deposits, total assets, minimum reserves, excess liquidity and total refinancing.

Characterization of national banking systems

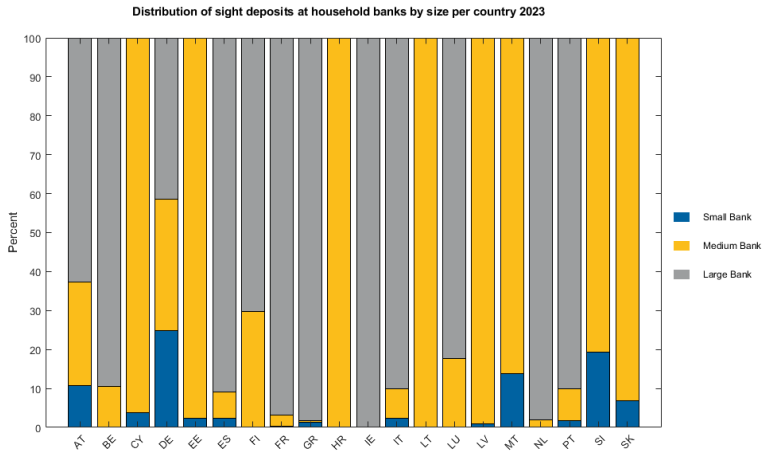


Figure: Distribution of sight deposits per country at household banks taking into account the bank's size.