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Bank profitability and central bank digital currency

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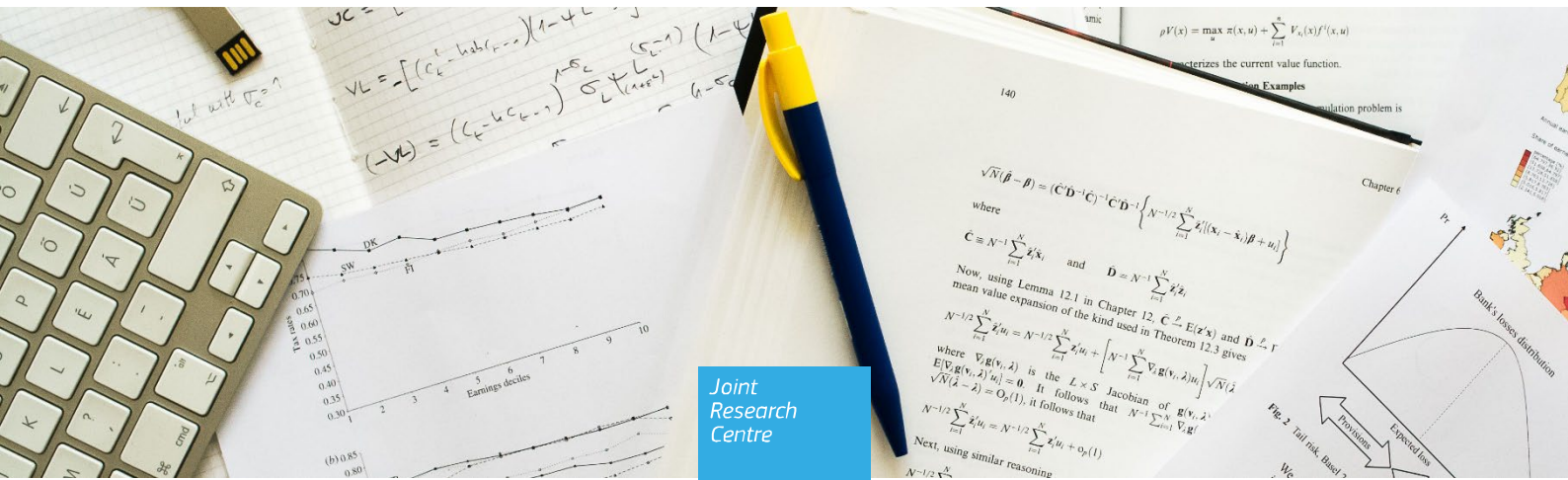

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Executive summary

With the rise of private initiatives and their potential disruptive effects on the financial system, central bank digital currency (CBDC) has become a topic of great importance. Essentially, CBDC represents an official currency that functions just like cash, but in digital form. The reasons why central banks worldwide are focusing on this topic are numerous. One of the key reasons is to provide access to central bank money, which can function as a backup to electronic payment methods. Additionally, CBDC can help to increase payment diversity and facilitate cross-border payments, which would ultimately boost financial inclusion.

Despite the advantages of CBDC, there are also several challenges to consider in terms of monetary policy and financial stability risks. One of the major concerns is the potential disintermediation of commercial banks. Banks play a crucial role in the transmission of monetary policy by providing liquidity and lending long-term to businesses and households while collecting short-term deposits. If depositors shift their liquidity from a bank deposit to a digital euro wallet, there would be a deposit outflow from the banking sector. This disintermediation could negatively affect the lending channel, reducing credit availability and shrinking banks' profitability.

To investigate the potential effects of CBDC on banks' profitability, we analysed the main determinants of banks' profitability, including bank-specific, cyclical, and structural determinants.

Policy context

In Europe, the Eurosystem decided to launch a two-year investigation exercise in mid-2020, in order to examine the design, features, advantages, and potential consequences of issuing a digital euro. The first report, published in October of the same year, analyses, from a policy perspective, the essential elements and the core principles of a digital euro, along with a first preliminary assessment of technical, economic, and financial issues. One of the identified undesirable effects is the potential disintermediation of commercial banks. A way to mitigate such consequences is to introduce some limits on CBDC holdings. However, estimating the rate of adoption by households and eventually corporations is quite difficult, although we observe a constant reduction in the use of cash for day-to-day payments, partially boosted by COVID-19. For that reason, in the initial investigation part, the ECB focuses on a retail CBDC, being used by the public and excludes the wholesale market (i.e., regulated financial institutions) in the first phase.

Main findings and key conclusions

The research replicates three demand scenarios from a paper by the ECB (2022) and assesses the reaction of profitability indicators, such as return on assets (ROA) and return on equity (ROE), to these changes. The results indicate that the moderate take-up scenario has a limited effect on the ROE of the panel of Eurozone banks. The 3,000 EUR capped scenario results in a slight decrease in the ROE from 4.3% to 4.1% for a representative large bank. However, under the large take-up scenario, the average ROE decreases substantially, down to 2.7% for large banks and 2.4% for small banks.

These findings suggest that banks' profitability is not significantly impacted by low take-up of CBDC (i.e., the maximum amount that can be held by an individual). However, larger take-up may pose potential challenges for banks' remuneration, particularly for small banks that rely heavily on deposits as a source of funding. Therefore, a "capped" scenario could be a good compromise, preserving the stock of deposits and the inherited profitability that comes from banks' cheaper funding. A thoughtful implementation strategy is necessary to ensure a smooth transition to the CBDC.

CBDC has the potential to provide several benefits, but its implementation requires careful consideration to ensure financial stability. The study's results suggest that a "capped" scenario may be the best approach, balancing the advantages of CBDC with the need to maintain banks' profitability.

Bank profitability and central bank digital currency

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Abstract

This paper analyzes the potential effect of a European Central Bank Digital Currency (CBDC) on banks' profitability. We use a large sample of EU banks that span the period from 2007 to 2021 to assess the sensitivity of banks' profits to the deposits. Using quantile regression, we estimate the conditional profit distribution of a representative bank. We then introduce a shock on the amount of deposits that would be replaced by the CBDC. Our results show that, for a large take-up of CBDC, there might be substantial challenges for the profitability of banks, especially for small banks, that mostly rely on deposits as a source of funding.

Keywords: Central Bank Digital Currency, CBDC, ECB, Bank Deposits.

JEL Classification: G18, G28, G32.

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1 Introduction

The interest in digital assets and digital currencies has substantially increased over the last decade. Starting from the seminal paper of Nakamoto (2008), which introduced the idea of a "peer-to-peer version of electronic cash": the Bitcoin, the crypto-assets environment has been growing exponentially. Because of the increase in the number of private initiatives[1] and their potentially disruptive effects on the financial system, the idea of a central bank digital currency (CBDC) started to gain importance. The Bank for International Settlements (BIS) defines a CBDC as "a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank" (Bank for International Settlements, 2020). CBDC thus represents an official currency, just like cash, but in digital form. There are several reasons why central banks worldwide are intensifying their research on this topic: access to central bank money, its function as a backup to electronic payment methods, increase payment diversity and cross-border payments and increase financial inclusion (Bank for International Settlements, 2020). However, there are several challenges in terms of monetary policy and financial stability risks depending on the CBDC design.

In Europe, the Eurosystem decided to launch a two-year investigation exercise in mid-2020, in order to examine the design, features, advantages, and potential consequences of issuing a digital euro. The first report, published in October of the same year (European Central Bank, 2020), analyses, from a policy perspective, the essential elements and the core principles of a digital euro, along with a first preliminary assessment of technical, economic, and financial issues. One of the identified undesirable effects is the potential disintermediation of commercial banks. Banks play a central role in the transmission of monetary policy. As liquidity suppliers and through maturity transformation, they lend in the long term to businesses and households while collecting short-term deposits. If depositors are induced to move some of their liquidity from a bank deposit to a digital euro wallet, there would be a deposit outflow from the banking sector. This disintermediation might affect the lending channel, reducing the availability of credit, and shrinking the

[1] For instance, many stablecoins initiatives, and the potential introduction of Libra.

profitability of banks. Indeed, deposits are the cheapest alternative to wholesale funding or capital markets. Thus, relying more on wholesale funding would reduce profitability. A way to mitigate such consequences is to introduce some limits on CBDC holdings. However, estimating the rate of adoption by households and eventually corporations is quite difficult, although we observe a constant reduction in the use of cash for day-to-day payments, partially boosted by COVID-19.[2] For that reason, in the initial investigation part, the ECB focuses on a retail CBDC, being used by the general public and excludes the wholesale market (i.e., regulated financial institutions) in the first phase. Note that this strategy is quite different from the US Federal Reserve's one, which is investigating the feasibility of a network of digital central banks' liabilities and commercial bank money using distributed ledger technology, letting the commercial banks issue the digital currencies used in retail.[3] The aim of this paper is to analyze the potential effect of a European CBDC on banks' profitability.

Some research effort has been made in investigating the implications of the introduction of a CBDC on the banking sector, particularly on bank disintermediation. Infante et al. (2022) provide an important literature review on the potential macroeconomic implications of CBDC, and they introduce a convenient framework to analyze its likely effects on the banking sector. They identified four main factors: 1) the competitiveness of the banking sector; 2) the CBDC remuneration; 3) the wholesale funding; and 4) the CBDC account limits. What emerges from the review is that it all depends on the assumptions made. For instance, Andolfatto (2021) shows that, in the case of a monopoly bank, an interest-bearing CBDC might actually increase the deposit base and also the lending, via an increase in competition. On the one hand, when considering a competitive banking sector, Keister and Sanches (2022) find that there is a high degree of bank disintermediation and a decrease in lending if the digital currency is deposit-like. On the other hand, there should be no effect if the digital currency is cash-like since it is merely a substitution of one form of money for another. The models presented above

[2]See for details the keynote speech by Fabio Panetta, available at https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210615~05b32c4e55.en.html.

[3]See https://www.newyorkfed.org/aboutthefed/nyic/facilitating-wholesale-digital-asset-settlement.

only assume deposit-backed lending and ignore the wholesale market. The latter is discussed in Whited et al. (2022), where they introduce the realistic assumption that loan origination is not limited by the creation of the deposit since banks can use wholesale funding. Due to several frictions and imperfect competition between banks, the authors show that a CBDC might lead to a decrease in banks' deposits, especially if the CBDC is remunerated, but with a limited effect on lending if banks can replace the deposits with wholesale market funding. Chiu et al. (2022) find that introducing a CBDC might have limited effects on disintermediation, depending on the remuneration of the CBDC. If the CBDC rate is higher than the deposit rate, there might be a reduction in loans and deposits. The earlier contribution by Brunnermeier and Niepelt (2019) shows that there are some potential policies that could reduce or neutralise the impact of a CBDC on banks, including a strong commitment by the central bank to act as a lender of last resort. These contributions are all theoretical and show that there is no consensus on the potential effect of disintermediation due to the CBDC.

More closely related to our study, Burlon et al. (2022) provide some empirical evidence on the potential impact of digital euro news on bank stock prices and lending behaviour, subsequently calibrating a DSGE model. Regarding bank profitability, they find that there is a substantial heterogeneity when considering the business model of the banks. Larger drops in stock market valuation (around -2%) are experienced when banks are more deposit-funded, and vice versa for banks where the deposit ratio is lower. All in all, the order of magnitude of these empirical findings is similar to the one obtained in our study, although with a different sample and a different methodology. Adalid et al. (2022) provide an initial assessment of the introduction of a digital euro on bank disintermediation, using some stylized illustrative scenarios with different levels of take-up and without considering in detail the complete design of the CBDC. In their assumptions, they envisage several safeguards, including holding limits and a potential tiered remuneration. We build on some of their scenarios, particularly those regarding the different holding limits, to evaluate the potential amount of bank deposit substitutions with CBDC.

In this study, we begin by investigating the main determinants of banks' profitabil-

ity. We follow Elekdag et al. (2020) analysis which includes bank-specific, cyclical and structural determinants. Our variable of interest is the deposit-to-total asset ratio. With respect to the four factors identified in Infante et al. (2022), we exclude CBDC remuneration because its consequences are uncertain, as discussed in Keister and Sanches (2022) and Chiu et al. (2022). The remaining factors are relevant to our work: we measure the competitiveness of the banking sector with market concentration, consider wholesale funding as an alternative to deposits but assume it to be constant, and use CBDC account limits to shock the levels of deposits. Next, we estimate and model the conditional profitability distribution of a representative bank using quantile regressions. It allows us to assess how the profitability distribution changes when we shock the level of deposits. We consider different levels of take-up, as in Adalid et al. (2022). Focusing on a large sample of Euro Area (EA19) banks that are part of the Single Supervisory Mechanism (SSM), we show that banks' profitability is unharmed with low take-up, while larger take-up may pose potential challenges for banks' remuneration, particularly for small banks that rely heavily on deposits as a source of funding.

The paper is organized as follows. In Section 2, we describe the methodology used to estimate the potential effect of introducing a CBDC in the European context. In Section 3, we provide an overview of the dataset. In Section 4, we report the empirical evidence, and finally, Section 5 concludes.

2 Methodology

In this section, we detail the methodology used to model the conditional distribution of the profitability of a representative bank. We begin our analysis with a standard panel regression, with fixed effects, to prove the relevance of the selected explanatory variables. The regression can be represented as follows:

$$Y_{i,c,t} = \alpha + \beta_1 X_{i,c,t-1} + \beta_2 GDP_{c,t-1} + \mu_i + \nu_t + \epsilon_{i,c,t} \tag{1}$$

where $Y_{i,c,t}$ represents different profitability measures used in the analysis for bank i,

in country c and for year t, $X_{i,c,t-1}$ represents a set of bank-specific components lagged by one period (excluding size and concentration), GDP_c represents the real GDP growth from the previous year for the country c, μ_i and ν_t are banks and year fixed effects. The explanatory variables in $X_{i,c,t-1}$ are those used in Elekdag et al. (2020) analysis and include bank-specific structural determinants with in particular the deposit-to-total asset ratio which is our variable of interest.[4]

Second, we estimate the quantile distribution of the banks' profitability by panel data quantile regression. The resulting quantile distribution of the banks' profitability is an estimate of the distribution of the profitability of a synthetic bank which is representative of the banks in the sample. Thus by selecting the banks entering the regressions, the representative bank can represent small, medium or large banks or banks from a country. Following Elekdag et al. (2020) and extending our previous panel regression, we estimate the quantile function[5] of the profitability of a representative bank by panel quantile regressions. Let us denote with $X_{i,c,t}$ the set of explanatory variables (bank-specific and country-specific components as before, and including the real GDP growth for compactness), μ_i and ν_t banks and year fixed effects, we estimate for each quantile Q and for each measure of profitability Y the following model:

$$Y^Q_{i,c,t} = \alpha_i + \beta^Q X_{i,c,t-1} + \mu^Q_i + \nu^Q_t + \epsilon^Q_{i,c,t} \tag{2}$$

Following Wooldridge (2019), the quantile regressions are estimated by including the time averages of the covariates, time dummies and time averages (Correlated random effects models, or CRE, in the spirit of Abrevaya and Dahl, 2008) to account for unobserved heterogeneity for each unit in the sample (fixed-effects).[6] The regressions are estimated for quantiles Q that go from 5% to 95% included, and they provide estimates of the quantile function.

Third, we fit the quantile distribution with a parametric distribution to get a fully

[4]See Section B for a description of the variables

[5]i.e., the inverse cumulative distribution function

[6]One alternative method to estimate the quantile panel regression is provided by Machado and Silva (2019). However, as pointed out in their paper, for short samples the estimator might suffer from the incidental parameter problem, thus it has no advantage with respect to different approaches.

described distribution of a representative bank's profitability, as in Adrian et al. (2019). [7] Practically, the distribution is fitted against the skewed t-distributions developped by Azzalini and Capitanio (2003) which is chosen for its flexibility and its parsimony. It is as follows:

$$f(y;\rho,\sigma,\gamma,\upsilon) = \frac{2}{\sigma} t\left(\frac{y-\rho}{\sigma};\upsilon\right) T\left(\gamma\frac{y-\rho}{\sigma}\sqrt{\frac{\upsilon+1}{\upsilon+\left(\frac{y-\rho}{\sigma}\right)^2}};\upsilon+1\right) \tag{3}$$

where t(·) represents the PDF and T(·) the CDF of the Student's t distribution, and the parameters $\{\rho,\sigma,\gamma,\upsilon\}$ represent the location, the scale, the slant, and the degrees of freedom, respectively. As the skewness parameter γ and the degrees of freedom υ vary, this distribution can accommodate both skewness and heavy tails. The fit is obtained by choosing the four parameters which minimize the squared distance between the quantile function estimated in Equation (2) and the quantile function of the skewed t-distribution to match the 5, 25, 75, and 95 percent quantiles.

Finally, a shock is applied to the deposit-to-asset ratio to mimic the effect of the introduction of the CBDC. The resulting quantile distribution shows its potential impact on the profitability of the representative bank.

3 Data and descriptive statistics

We included a representative cross-section of banks in our sample, covering the period from 2007 to 2021. The data source is Orbis Bankfocus, which provides good coverage of all balance sheet data at different levels of consolidation. Our analysis focuses on banks located in the Euro Area (EA19), matching the Orbis database with the list of significant entities supervised by the European Central Bank (ECB) and less significant institutions provided by the Single Supervisory Mechanism (SSM), using the Legal Entity Identifier (LEI) code. The coverage increases with the years (due also to survivor bias), particularly starting from 2014. The unbalanced dataset includes 398 banks with different

[7] The fitting presented in Adrian et al. (2019) is applied marginally also in Elekdag et al. (2020).

levels of consolidation. When available, we use the highest level of consolidation and exclude the subsidiaries to avoid double-counting. For standalone banks, we use the level of consolidation available. We end up with around 60% of banks with a consolidated balance sheet and around 40% of unconsolidated (standalone) balance sheet data.

We categorize banks as small, medium, and large, applying a simple approach using EBA thresholds based on total assets (TA). If the average TA is more than EUR 30 bn, we flag the bank as large. If the TA is less than EUR 3 bn, we flag the bank as small. Banks that are neither large nor small are flagged as medium. For small banks, which are the large majority in the original sample, we include the following specializations from the Orbis Bankfocus database: commercial bank, cooperative bank, and savings bank. We exclude the bank holding company category, as it may encompass big banking groups. However, we include these banks by looking at the balance sheet of the immediate subsidiary that is doing banking business as a core activity. As an additional check, we exclude entities that are flagged as banks but are not doing banking activities *stricto sensu* (for instance, financial companies owned by carmakers that are providing loans for cars or the Credits Municipaux in France, which provide loans based on some collateral, like a pawnshop), by looking at the NACE sector of the Global Ultimate Owner (GUO) and the ratio between loans to customers over (customer deposits plus wholesale funding). If the ratio is above 1, the bank is excluded from the sample. We exclude very small banks with less than 100 employees from the sample. Due to the peculiarity of the German banking system, we selected only a subset of the very large number of cooperative and savings banks to have a more balanced representation across Member States.[8]

Table 1 provides a breakdown by Member State of the number of banks and their respective total assets (in EUR trillion). The final database includes 90 significant entities (out of 115 as of January 2021) and 308 less significant institutions. In terms of total assets, the large group covers approximately 92.5% of the sample, the medium group 6.3%, and the small group around 1.2%. In terms of EA coverage, the sample represents around 70% of the total EA assets.

[8]Appendix A describes in detail the choices in terms of exclusion and the German banking system.

Table 1: Sample of banks. The table shows the sample of banks (for the year 2020) included in the analysis, divided into small, medium and large entities based on total assets, in EUR M. The coverage in terms of total assets is around 70% (ECB reports for the EURO area in 2020 around 35 EUR tn).

	Small		Medium		Large	
MS	**Entities**	**Total Asset**	**Entities**	**Total Asset**	**Entities**	**Total Asset**
AT	1	3.4	20	244.2	4	545.1
BE	2	4.2	5	74.9	3	623.1
BG	5	4.1	2	17.5	0	0.0
CY	3	4.2	2	20.7	0	0.0
DE	73	191.6	46	459.2	18	3,890.8
EE	2	1.4	2	22.4	0	0.0
ES	14	34.4	9	113.6	12	3,596.1
FI	1	1.7	3	24.2	1	552.2
FR	1	0.7	5	39.1	7	7,829.7
GR	0	0.0	1	3.6	4	286.8
HR	11	6.7	0	0.0	0	0.0
IE	0	0.0	1	21.5	5	317.4
IT	13	22.8	20	213.2	11	2,797.4
LT	2	3.4	2	24.2	0	0.0
LU	0	0.0	2	11.8	2	80.8
LV	2	1.6	3	16.6	0	0.0
MT	3	4.5	2	19.6	0	0.0
NL	0	0.0	11	171.4	5	2,193.1
PT	7	4.2	4	41.5	2	177.2
SI	2	4.7	1	19.6	0	0.0
SK	2	5.2	1	4.5	0	0.0
Total	144	298.8	142	1,563.3	74	22,889.7
% of assets		1.2%		6.3%		92.5%

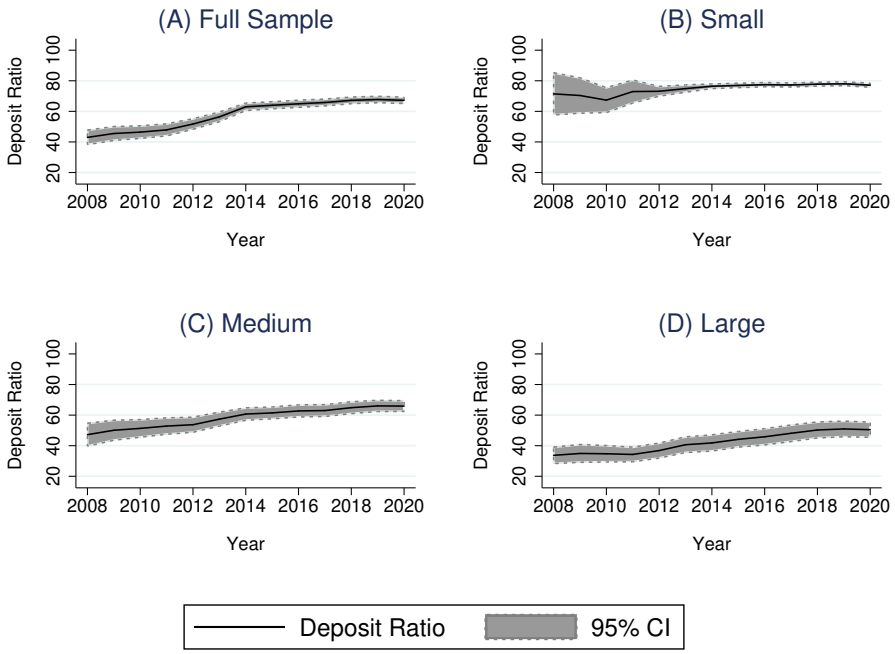
Following Elekdag et al. (2020), we include several explanatory variables that capture bank-specific factors that influence profitability and since there is an intrinsic procyclicality in the profits,[9] we include also the change in the real GDP for each Member State. Table 2 provides an overview of these variables, for the sample period 2006-2021.[10] The average ROA in the sample is around 0.28%, slightly smaller for large banks, and higher for medium and small banks. When looking at the ROE, medium banks appear to be much more profitable than the other groups of banks: their return on equity is around 5%, with respect to a 3.7% for large and 3.5% for small banks. Another remarkable difference is related to the equity over the total assets, where large banks display an average value of approximately6.5% w.r.t small and medium banks, around 9%. Cost to income ratio, measured as operating expenses over the operating income, gives a clear idea of the efficiency and productivity of the bank. The lower the ratio, the higher the productivity.

[9] i.e., the profit decreases when there is an economic downturn, and increases when there is an expansion.

[10] The description of the variables is provided in Appendix B. Due to the presence of large outliers, all profitability variables, are winsorized at the 5^{th} and 95^{th} percentile.

Regarding the deposit ratio, it has been increasing over time for the banks in our sample, especially for medium and large banks. Small banks, on the other hand, have had a relatively stable deposit ratio over time, ranging between 70% and 80%. Figure 1 shows the time evolution of the deposit ratio. Large banks show a much lower deposit ratio across the sample, as their business model is more diversified and relies on additional sources of funding, such as wholesale funding. Figure 2 shows that many large banks rely on this market, while small banks rely mostly on deposits and only marginally on this source of funding.

Figure 1: Time series of the deposit ratios. The figure displays the average deposit ratio (average customer deposits over total assets in %) for the entire sample (Panel A) and for different sizes of the banks (Panel B, C, and D), together with 95% confidence intervals. Data come from Orbis Bankfocus and refer to the time period 2007-2021.



Regarding the deposit ratio (Customer deposits over total assets), which is one of our variables of interest in relation to the introduction of a CBDC, Figure 3 shows the density distribution of the deposit ratio, which is mostly concentrated between 60% and 80% for small and medium banks. For large banks, there is a quite large dispersion. Based on these figures, we can conclude that small and medium banks rely more heavily

Figure 2: Deposit ratio versus wholesale funding ratio The figure displays the scatter plot between the deposit ratio and the wholesale funding ratio, for small and large banks. Data come from Orbis Bankfocus and refers to the year 2020.

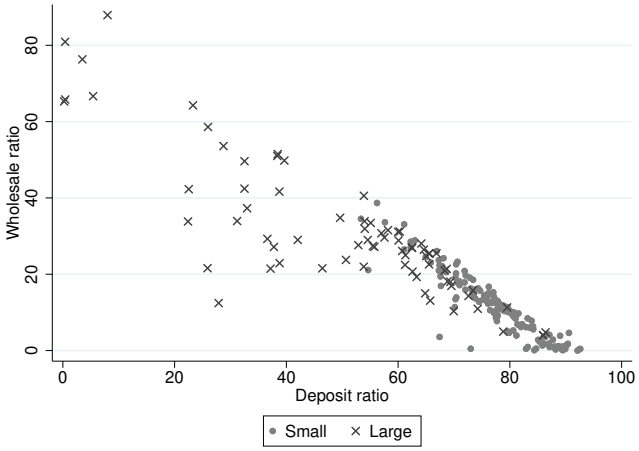
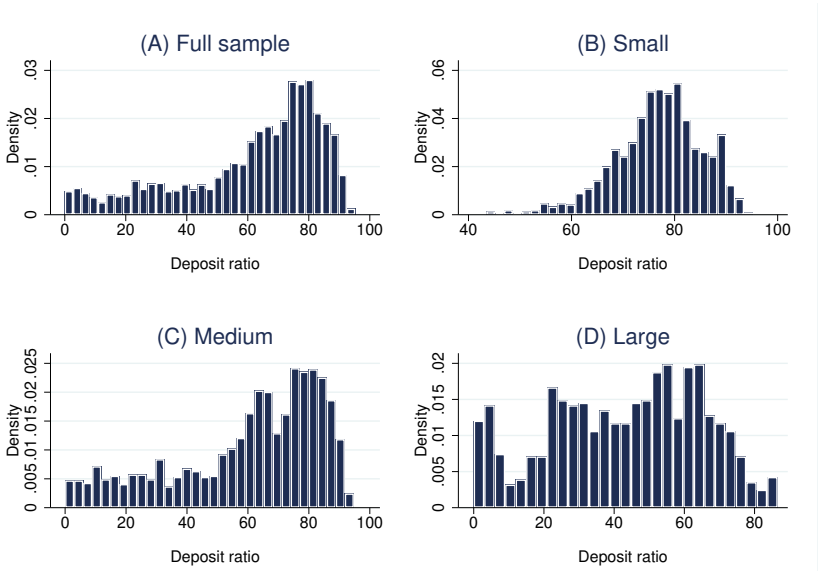


Table 2: Descriptive statistics. The table reports the descriptive statistics for the main profitability measures, and the explanatory variables included in the analysis. The source of data is Orbis Banfocus (for bank-specific data) and Eurostat (for the GDP). The sample period is 2007-2021 for EURO area banks.

	All sample				Small		Medium		Large	
Variable	**Obs.**	**Median**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
ROA	3814	0.284	0.366	0.499	0.351	0.444	0.444	0.529	0.248	0.489
ROE	3814	4.048	4.296	6.145	3.708	5.108	5.076	5.991	3.694	7.369
Net Income to TA	3808	1.476	1.511	0.668	1.825	0.521	1.429	0.688	1.250	0.646
LLP to TA	3737	0.136	0.293	0.430	0.264	0.420	0.265	0.412	0.380	0.462
Non Interest Income to TA	3813	0.961	1.096	0.719	1.061	0.582	1.221	0.840	0.923	0.598
Size	3814	8.719	9.090	1.947	7.185	0.833	8.947	0.696	11.798	1.223
Equity to TA	3808	7.891	8.277	4.104	9.250	2.878	8.584	4.526	6.486	4.122
Real GDP Growth	3814	1.492	1.035	3.429	1.227	3.371	1.005	3.263	0.841	3.759
NPL ratio	3612	3.151	6.366	9.045	7.225	10.046	5.538	8.425	6.714	8.653
Cost to income ratio	3808	66.974	66.253	291.788	70.251	29.397	72.836	286.476	49.621	446.364
Loans to TA	3810	61.587	58.852	18.187	63.040	12.242	57.302	20.837	56.146	18.721
Deposits to TA	3814	68.332	61.239	23.570	76.824	8.570	60.100	24.288	43.107	21.771
Non Interest Income to Revenue	3813	38.067	40.633	117.829	35.053	14.404	41.591	99.803	46.168	195.820
Concentration	3814	0.450	0.507	0.245	0.442	0.249	0.516	0.219	0.576	0.260

on deposits as a source of funding compared to large banks. Large banks, on the other hand, may rely on different sources in some cases. In fact, Figure 2 shows that large banks rely substantially also on wholesale funding. One potential consequence of a reduction in bank deposits is that banks may need to seek alternative sources of funding to maintain their current level of lending to the economy.

Figure 3: Distributions of the deposit ratio This figure displays the density distribution of the deposit ratio (customer deposits over total assets in %) for the entire sample (Panel A) and for different sizes of the banks (Panel B, C, and D). Data come from Orbis Bankfocus and refer to the time period 2007-2021.



4 Results

4.1 Baseline panel regression analysis

As pointed out in Section 2, we provide an initial assessment using panel OLS regression settings with bank/year fixed effects. These initial estimations set the ground for additional analysis with quantile regressions. For each measure of profitability (ROE, ROA, and its components: Net Income to TA, Loans Loss Provisions to TA, and No Interest Income to TA), we estimate Equation 1 for the entire sample. Table 3 reports the baseline results for all measures. At first glance, we notice that the selected variables are significant for at least one measure of profitability, thus it appears appropriate to include all of them in subsequent analysis.

Regarding ROE, consistent with the analysis of Elekdag et al. (2020), we find that both real GDP growth and the NPL ratio substantially affect the return on equity. More interestingly, the customer deposits ratio is also related to profitability measured with ROE and ROA, where the sign is positive and statistically significant. The economic

magnitude of the potentially large reduction of deposits might be significant. Ceteris paribus, a one percent decrease in the deposit ratio would decrease ROE by 5.9 basis points and ROA by 0.4 basis points. For comparison, the average ROE in the sample is about 4.3%, and the average ROA is about 37 basis points. A larger take-up, for instance, a one standard deviation decrease in the deposit ratio (around 23.5%), would reduce ROA by 9.4 basis points and ROE by around 1.4%. All in all, in relation to the amount of deposits, there are still channels where the use of deposits as the main source of funding (and its potential reduction) might harm the profitability of these banks.

Table 3: Profitability Panel regression. The table reports the estimation of a panel regression where the dependent variables are the Return on Equity (ROE), the Return on Assets (ROA), and its components (Net Income over TA, Loans Loss Provisions (LLP) over TA, and Non-Interest Income over TA), against a set of explanatory variables. Models are estimated with bank and year fixed effects. Robust standard errors, clustered at bank and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(A)	(B)	(C)	(D)	(E)
	ROE	**ROA**	**Net Income / TA**	**LLP / TA**	**Non Int Income / TA**
Size(-1)	1.482**	0.091**	-0.252***	0.064**	-0.099**
	(0.596)	(0.040)	(0.043)	(0.026)	(0.045)
Real GDP Growth	0.470***	0.036***	0.002	-0.031***	-0.000
	(0.086)	(0.007)	(0.003)	(0.004)	(0.005)
Equity to TA (-1)	-0.041	0.023***	0.014**	-0.006	0.014**
	(0.079)	(0.004)	(0.006)	(0.005)	(0.006)
NPL Ratio (-1)	-0.108***	-0.010***	-0.003	0.010***	-0.000
	(0.036)	(0.003)	(0.002)	(0.002)	(0.002)
Cost to income (-1)	-0.033***	-0.003***	-0.003***	-0.000	0.003***
	(0.012)	(0.001)	(0.001)	(0.000)	(0.001)
Loans to TA (-1)	0.007	-0.001	0.006***	0.005***	0.000
	(0.020)	(0.001)	(0.001)	(0.001)	(0.001)
Deposits to TA (-1)	0.059***	0.004***	0.005***	-0.003***	-0.001
	(0.021)	(0.001)	(0.001)	(0.001)	(0.002)
Non interest income to rev (-1)	-0.023**	-0.002***	-0.007***	0.000	0.007***
	(0.009)	(0.001)	(0.001)	(0.001)	(0.001)
Concentration (-1)	-1.073	-0.073	0.348***	-0.141**	-0.146**
	(1.090)	(0.080)	(0.072)	(0.062)	(0.070)
Constant	-8.939	-0.502	3.386***	-0.283	1.516***
	(6.430)	(0.412)	(0.438)	(0.269)	(0.425)
Observations	3814	3814	3808	3737	3813
Adj R^2	0.459	0.574	0.873	0.642	0.807
Fixed effects			Bank-Year		

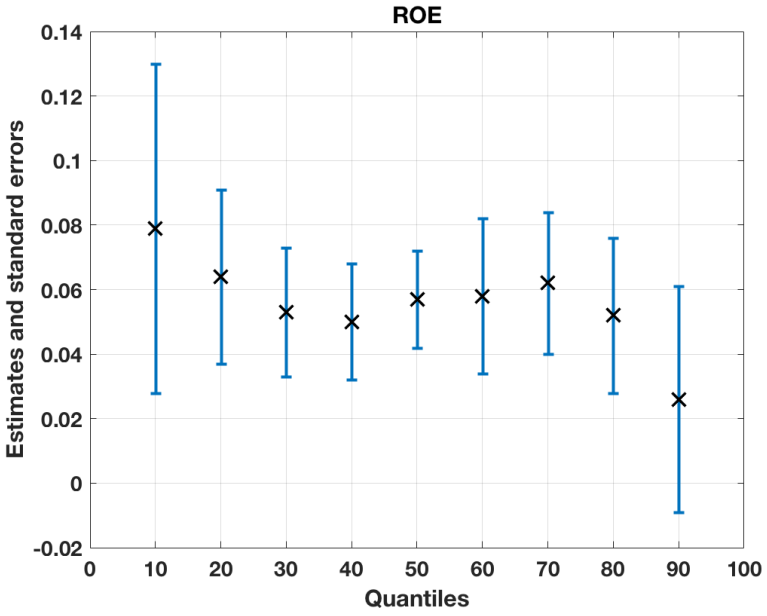
Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

4.2 Quantile regressions

Quantile regressions serve in our framework as a bridge between the bank-by-bank data and the estimation of the final shocked distribution. We start our analysis by focusing on the ROE for the entire sample of banks. Table 4 reports the result for quantiles considered in the analysis (from the 10^{th} to the 90^{th}). As shown in previous studies, the (lagged) coefficients for real GDP growth are monotonically decreasing across quantiles, together with the NPL ratio. Both are highly statistically significant in almost all quantiles.

Coming to the deposit ratio, the estimation shows that the variable is positive and either decreasing or stable across quantiles, see Figure 4. Thus, deposits are expected to have a stronger impact on the left part of the distribution of ROE, where lies the least profitable banks.

Figure 4: Deposit ratio coefficient estimates and standard errors. The figure represents estimates and standard errors of the deposit ratio coefficient for the quantile regression on ROE.



One additional variable which appears to be quite significant across quantiles is the Cost to income ratio measuring the efficiency and productivity of the bank. It is negative and significant in almost all quantiles.

The quantile regressions using ROA (Table 6) provide similar results, albeit the mag-

Table 4: Quantile regression on ROE. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quantiles	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Size (-1)	0.748	0.288	0.839	0.805	0.783	1.123**	1.480**	1.963***	1.798*
	(1.056)	(0.858)	(0.858)	(0.638)	(0.663)	(0.566)	(0.650)	(0.624)	(0.962)
Real GDP Growth	0.548**	0.685***	0.556***	0.469***	0.382***	0.385***	0.382***	0.329***	0.321***
	(0.237)	(0.125)	(0.111)	(0.102)	(0.061)	(0.066)	(0.075)	(0.079)	(0.104)
Equity to TA (-1)	0.235***	0.049	0.000	-0.031	-0.114	-0.161*	-0.192**	-0.171	-0.300*
	(0.090)	(0.081)	(0.060)	(0.065)	(0.081)	(0.094)	(0.082)	(0.181)	(0.167)
NPL Ratio (-1)	-0.291***	-0.209***	-0.137***	-0.113**	-0.113***	-0.118**	-0.066	-0.054	-0.056**
	(0.060)	(0.045)	(0.038)	(0.046)	(0.044)	(0.049)	(0.047)	(0.069)	(0.028)
Cost to income (-1)	-0.026*	-0.045	-0.046***	-0.050***	-0.052***	-0.049***	-0.050***	-0.053***	-0.057***
	(0.015)	(0.031)	(0.017)	(0.018)	(0.012)	(0.011)	(0.008)	(0.008)	(0.011)
Loans to TA (-1)	0.020	-0.014	-0.007	-0.008	-0.011	-0.010	-0.001	-0.001	-0.036
	(0.030)	(0.019)	(0.019)	(0.019)	(0.022)	(0.022)	(0.022)	(0.024)	(0.029)
Deposits to TA (-1)	0.079	0.064**	0.053***	0.050***	0.057***	0.058**	0.062***	0.052**	0.026
	(0.051)	(0.027)	(0.020)	(0.018)	(0.015)	(0.024)	(0.022)	(0.024)	(0.035)
Non interest income to rev (-1)	-0.017	-0.018	-0.014	-0.013	-0.024***	-0.024***	-0.019***	-0.023*	-0.009
	(0.012)	(0.013)	(0.014)	(0.012)	(0.008)	(0.009)	(0.007)	(0.012)	(0.011)
Concentration (-1)	-0.532	0.189	1.149	0.923	0.542	-0.145	-0.297	-0.881	-0.384
	(1.753)	(1.631)	(1.805)	(1.114)	(1.119)	(1.090)	(1.253)	(1.401)	(0.808)
Observations	3814								
Fixed effects	Bank-Year								

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

nitude of the coefficients is clearly much smaller.

We report in Tables 5 and 7 an overview of the estimates of the quantile regressions on ROE and ROA by bank size.[11] With the sample of small banks, the deposit ratio coefficient estimate is significant for the 30%, 70% and 90% quantiles and close to being significant[12] for 4 other quantiles. For the samples of medium and large banks, the coefficients are nearly always significant except at the extremes quantiles, i.e. quantiles below 15% and above 70%. We observe that on average the coefficients of the deposit ratio are decreasing with the size of the banks in the sample. For the samples of large, medium and small banks, the estimates' averages are 0.0726, 0.0656 and 0.0503 with average standard errors of 0.0477, 0.0385 and 0.404 respectively. While the standard

[11] See Section C for the complete estimations
[12] i.e. their p-value is less than 15.3%

Table 5: Quantile regression on ROE - Bank size. The table reports the estimation of a set of panel quantile regressions where the dependent variable is the return on equity (ROE), against a set of explanatory variables, for different bank sizes. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Size		**Large**			**Medium**			**Small**	
Quantiles	**25**	**50**	**75**	**25**	**50**	**75**	**25**	**50**	**75**
Size (-1)	-0.222	1.729	1.640**	1.461	1.959**	2.217	-0.311	1.169	1.059
	(1.124)	(1.431)	(0.778)	(1.308)	(0.896)	(1.682)	(1.022)	(0.948)	(0.831)
Real GDP Growth	0.213	0.516***	0.221*	0.539**	0.370***	0.389**	0.498***	0.421***	0.271***
	(0.257)	(0.199)	(0.118)	(0.233)	(0.128)	(0.155)	(0.130)	(0.099)	(0.085)
Equity to TA (-1)	0.199	0.233	-0.024	-0.068	-0.107	-0.265	-0.275*	-0.299**	-0.290**
	(0.141)	(0.299)	(0.131)	(0.171)	(0.086)	(0.231)	(0.146)	(0.129)	(0.127)
NPL Ratio (-1)	-0.278***	-0.189***	-0.132***	-0.120*	0.011	0.018	-0.190**	-0.156**	-0.228***
	(0.073)	(0.070)	(0.041)	(0.068)	(0.023)	(0.032)	(0.095)	(0.064)	(0.049)
Cost to income (-1)	0.006	-0.006	-0.025	-0.050**	-0.053***	-0.056**	-0.061**	-0.047**	-0.040***
	(0.013)	(0.024)	(0.017)	(0.024)	(0.019)	(0.023)	(0.028)	(0.019)	(0.013)
Loans to TA (-1)	-0.022	-0.019	-0.034	0.002	0.029	0.021	-0.037	0.008	-0.005
	(0.060)	(0.042)	(0.046)	(0.030)	(0.030)	(0.043)	(0.050)	(0.042)	(0.035)
Deposits to TA (-1)	0.091**	0.103**	0.083**	0.089***	0.071***	0.053	0.066	0.021	0.036
	(0.044)	(0.049)	(0.039)	(0.025)	(0.024)	(0.057)	(0.052)	(0.033)	(0.030)
Non interest income to rev (-1)	0.011	-0.007	-0.009	-0.017	-0.022	-0.020	-0.039	-0.028	-0.050**
	(0.018)	(0.024)	(0.017)	(0.016)	(0.015)	(0.021)	(0.024)	(0.027)	(0.019)
Concentration (-1)	-2.480	-2.954	-4.190**	-0.034	0.742	0.251	3.463	3.436*	1.908
	(4.877)	(2.430)	(2.072)	(2.093)	(1.743)	(4.219)	(2.709)	(1.816)	(1.871)
Observations		945			1649			1220	
Fixed effects		Bank-Year			Bank-Year			Bank-Year	

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

errors are rather similar, the decrease in the estimates makes the latest partly non-significant. Because of the structural decrease of the deposit ratio estimate with the banks' size and because these estimates are often close to being significant for small banks, we proceed with the small banks' sample as we do for the medium and large banks samples.

Table 6: Quantile regression on ROA. The table reports the estimation of a set of panel quantile regressions where the dependent variable is the return on assets (ROA), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROA	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quantiles	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Size (-1)	0.058	0.004	0.013	0.021	0.033	0.040	0.056	0.106**	0.076
	(0.104)	(0.060)	(0.063)	(0.058)	(0.064)	(0.049)	(0.035)	(0.052)	(0.084)
Real GDP Growth	0.045***	0.056***	0.041***	0.043***	0.036***	0.033***	0.029***	0.025***	0.033***
	(0.013)	(0.011)	(0.009)	(0.009)	(0.005)	(0.006)	(0.008)	(0.007)	(0.009)
Equity to TA (-1)	0.024***	0.023***	0.021***	0.023***	0.024***	0.022***	0.024***	0.023***	0.020*
	(0.007)	(0.003)	(0.005)	(0.008)	(0.007)	(0.006)	(0.008)	(0.007)	(0.011)
NPL Ratio (-1)	-0.020***	-0.018***	-0.015***	-0.013***	-0.012***	-0.014***	-0.009**	-0.004*	-0.004**
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)
Cost to income (-1)	-0.001	-0.003**	-0.004***	-0.004***	-0.003***	-0.003***	-0.003***	-0.004***	-0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Loans to TA (-1)	0.001	-0.002	-0.001	-0.001	-0.000	-0.001	-0.000	0.001	-0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Deposits to TA (-1)	0.002	0.002**	0.003**	0.004***	0.005***	0.005***	0.004**	0.004**	0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Non interest income to rev (-1)	-0.001	-0.002*	-0.002**	-0.002***	-0.002**	-0.002***	-0.002***	-0.002*	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Concentration (-1)	-0.079	-0.079	0.014	0.011	0.042	0.008	-0.023	-0.057	-0.055
	(0.095)	(0.160)	(0.097)	(0.089)	(0.072)	(0.096)	(0.112)	(0.121)	(0.066)
Observations	3814								
Fixed effects	Bank-Year								

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 7: Quantile regression on ROA - Bank size. The table reports the estimation of a set of panel quantile regressions where the dependent variable is the return on assets (ROA), against a set of explanatory variables, for different bank sizes. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROA	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Size		**Large**			**Medium**			**Small**	
Quantiles	**25**	**50**	**75**	**25**	**50**	**75**	**25**	**50**	**75**
Size (-1)	0.137*	0.108	0.058	0.024	0.072	0.112	-0.027	0.046	-0.002
	(0.073)	(0.114)	(0.054)	(0.089)	(0.082)	(0.098)	(0.099)	(0.076)	(0.079)
Real GDP Growth	0.010	0.033**	0.030**	0.042***	0.028**	0.023**	0.037***	0.034**	0.028***
	(0.021)	(0.016)	(0.014)	(0.015)	(0.012)	(0.011)	(0.011)	(0.015)	(0.008)
Equity to TA (-1)	0.037***	0.042	0.038	0.022***	0.027***	0.025**	-0.007	0.000	0.012
	(0.005)	(0.030)	(0.023)	(0.008)	(0.007)	(0.010)	(0.020)	(0.014)	(0.009)
NPL Ratio (-1)	-0.023***	-0.019***	-0.018***	-0.011**	-0.003	0.000	-0.008	-0.011	-0.018***
	(0.006)	(0.007)	(0.003)	(0.005)	(0.007)	(0.002)	(0.008)	(0.007)	(0.004)
Cost to income (-1)	-0.000	-0.000	-0.000	-0.004**	-0.004***	-0.004***	-0.005**	-0.005**	-0.005***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Loans to TA (-1)	-0.000	-0.003	-0.003	0.000	0.002	0.001	-0.000	-0.001	-0.000
	(0.003)	(0.004)	(0.005)	(0.001)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)
Deposits to TA (-1)	0.002	0.004	0.005**	0.003	0.004**	0.005**	0.005	0.003	0.003
	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Non interest income to rev (-1)	-0.000	-0.001	0.000	-0.001	-0.002*	-0.002**	-0.003	-0.003	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Concentration (-1)	-0.042	-0.171	-0.269**	0.027	0.037	0.077	0.458***	0.341*	0.253
	(0.196)	(0.190)	(0.121)	(0.131)	(0.174)	(0.096)	(0.163)	(0.204)	(0.218)
Observations		945			1649			1220	
Fixed effects		Bank-Year			Bank-Year			Bank-Year	

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

4.3 Calibration of CBDC take-up

The ECB occasional paper by Adalid et al. (2022) provides interesting insights about the potential features that a European CBDC might have, including potential assumptions about the demand and corresponding limitations on the uptake. In particular, they envisage three scenarios:

A "Moderate demand" for retail payments only.

B "Large demand", resulting from the digital euro being intensively used as a means of payment and store of value.

C "Capped take-up" scenario, with different limits on the maximum amount per household.

Petracco Giudici and Di Girolamo (2022) translated the ECB scenarios into demand scenarios for each Member State, based on the number of households, the share of households with deposits, and the average number of people per household from ESTAT, as well as data on deposits from households and NFCs from the ECB, and on cash holdings from ESTAT. The first two ECB scenarios imply a maximum take-up of EUR 1.5k (for the moderate demand scenario) and EUR 14k (for the large demand scenario). The last scenario is calibrated according to a limit of EUR 3,000 for every resident, which implies a maximum total demand of EUR 1.15tn. Other intermediate scenarios are also evaluated, specifically for EUR 2k, EUR 4k, EUR 5k, and EUR 10k. Since the subsequent analysis, and specifically, the shock on the deposit ratio, will be carried out by aggregating the entire system or considering only a subset of banks based on size, we calculate a weighted average shock for each subsample, using the amount of deposits at the Member State level as the weight (Table 9). The shock to the deposit ratio is presented in Table 8 for the entire sample and for different banks' sizes, with several take-ups considered in the calibration. The shocks to deposits range from around 0.5% (for a EUR 1k take-up) up to more than 40% (for a large take-up for small banks). In addition, the size of the shock depends on the bank size. As we have seen in Table 2, small banks have a larger

deposit-to-total assets ratio than large banks, which also impacts the calculation of the weighted average shock.

Table 8: Calibration of the Deposit to Asset shock. The table reports the shock in percentage of the deposit ratio for the entire sample and for different banks' sizes. Several take-ups are considered in the calibration.

Scenario	Full Sample	Large Banks	Medium Banks	Small Banks
1k Take-Up	0.53%	0.52%	0.63%	0.56%
2k Take-Up	2.13%	2.14%	2.14%	1.94%
3k Take-Up	4.55%	4.48%	5.06%	5.30%
5k Take-Up	9.38%	9.17%	10.90%	12.02%
10k Take-Up	21.44%	20.89%	25.26%	28.56%
Moderate Take-Up	1.22%	1.21%	1.24%	1.17%
Large Take-Up	30.94%	30.26%	35.36%	40.56%

A simple comparison of the percentages presented in Table 8 with the statistics on deposits shown in Table 9 reveals that a reduction of 22% of customer deposits for LT is more than five times its standard deviation in the sample. In the "Large demand" scenario depicted by Adalid et al. (2022), deposits could be completely substituted by the CBDC in many member states. However, these scenarios appear to be quite unrealistic since it assumes that across the EU, the take-up of 3K EUR would be filled, even though the median wealth in a bank deposit is less than 1K EUR. Furthermore, the median amount of deposit per household varies substantially across Europe, from more than 20K EUR for Luxembourg to less than 300 EUR for Latvia. Second, the percentage of households with a bank account with deposits ranges from 100% for Finland to 80% for Cyprus (data from ESTAT). These two facts together could clearly affect the banking system differently.

4.4 Shock on deposits and conditional distributions

Having described the main tools available to us, in this section we discuss the potential vulnerabilities in terms of lower profits that banks might face when introducing a CBDC. Before going into the details of the results, it is important to consider some caveats. First, the results of the quantile regressions span a time period where there has been at least two important crisis (the Great Financial Crisis of 2009, and the COVID crisis of 2020 whose effects might not be yet incorporated in the balance sheet of banks). Second, this

Table 9: Customer deposit descriptive statistics. The table reports descriptive statistics of the customer deposits at the member state level. The source of data is Orbis Banfocus. Data refer to the year 2020.

MS	Total Customer Deposits (EUR bn)	Average Deposit ratio(%)	SD Deposit ratio(%)
AT	434.66	45.02	20.12
BE	353.92	66.86	24.73
BG	18.21	83.55	6.88
CY	20.12	76.62	12.56
DE	1,941.45	70.70	17.22
EE	17.03	77.15	6.85
ES	2,074.84	69.63	9.39
FI	198.32	58.82	20.44
FR	2,437.66	33.23	25.45
GR	192.42	68.62	5.65
HR	5.37	79.72	8.79
IE	244.33	76.45	7.56
IT	1,496.67	61.65	18.37
LT	23.51	84.16	4.16
LU	63.91	73.38	6.95
LV	14.23	79.40	4.54
MT	20.39	84.56	3.48
NL	1,362.88	57.37	21.65
PT	167.61	77.94	12.55
SI	20.47	87.11	3.83
SK	7.82	80.72	0.76
Total	11,115.83	67.21	19.87

analysis should be considered as a static assessment of what might happen when banks face a reduction in the amount of deposits due to migration to CBDC. While here the banks do not react, a number of reactions can be thought of: they might reduce cash and reserves, keeping the same amount of present and future lending; they might substitute their funding going in the wholesale market without affecting the amount of lending, but most likely the costs for lenders would increase; banks might reduce loans to customers for the amount of deposits that are no longer available. This latter effect would be the most detrimental to the real economy. Assessing the banks' reactions is particularly challenging, as it may involve a combination of the aforementioned effects. Third, we are not considering any intervention by the ECB to match the reduction in bank deposits, in the form of liquidity injection or collateral posted to obtain additional (cheaper) funding from the ECB. We are also not considering potential future financial crises or the increases in the reference interest rates in response to a rise in inflation. The assessment of the conditional distribution is aimed to show what might be the consequences in terms of

profitability when a certain amount of deposits outflow would materialize due to the introduction of a CBDC.[13]

In the following analysis, we focus only on two main measures of profitability, namely the ROE and the ROA, which are widely used and easily comparable with other works in this field. Starting with the ROE, Figure 5 shows the illustrative distribution conditioned on the variables included in the quantile regressions of Section 4.2, evaluated at sample means. In other words, we assume that the "representative bank" has all characteristics set at the average in the sample. We fit the skewed t-distribution to the estimated quantile regressions, as described in Section 2. The distribution for the full sample has an average of 4.3% and a standard deviation of 6.26% (the sample values are 4% and 6.1% respectively, see Table 2). Panel A shows the results of applying shocks to the deposit ratio that match the moderate demand and large demand scenarios of the ECB, which implies a maximum take-up per household of 1.5K EUR (moderate demand scenario) and 14K EUR (large demand scenario). The moderate scenario leaves the ROE distribution substantially unaffected while, as expected, the large demand scenario has a considerable impact on both the shape of the distribution and the mean. Table 10 provides an overview of the parameters for the fitted distributions under the three scenarios selected by the ECB. Under the large demand scenario, the new average value for the ROE is 3.31% which implies a reduction of around 0.96% of profits for the representative bank. The distribution of the ROE is pushed to the left, the standard deviation is slightly increased and there is more mass of probability in the left part, where the lower and negative profit lies. Figure 5 and Table 10 also present results for different bank sizes. The distribution for large banks appears to be the least impacted by the shocks. Banks categorized as small in our sample appear to be the most penalized according to our estimations. Their ROE in the large demand scenario would turn to a lower average value for the conditioned distribution of around 2.3%. Table 10 also shows that for the moderate and the capped scenario, the reduction in the profitability is marginal, and ranges from -0.04% to -0.19%.

Panel B of Figure 5 presents the profitability distribution of the representative banks

[13]Some of these adjustments have been extensively described in Adalid et al. (2022).

Table 10: Conditional ROE distribution statistics. The table reports descriptive statistics for the fitted distributions using quantile regressions. The column *Diff* refers to the simple difference between the baseline of the representative bank and the value in the scenario. Values are in percentage.

ROE	Representative bank		Moderate demand			Capped scenario 3k			Large demand		
	Mean	Std	Mean	Std	Diff (%)	Mean	Std	Diff (%)	Mean	Std	Diff (%)
All sample	4.28%	6.26%	4.24%	6.26%	-0.04%	4.13%	6.28%	-0.14%	3.31%	6.43%	-0.96%
Large	3.65%	5.55%	3.61%	5.56%	-0.04%	3.51%	5.56%	-0.13%	2.75%	5.61%	-0.90%
Medium	5.10%	6.10%	5.06%	6.11%	-0.05%	4.92%	6.13%	-0.19%	3.78%	5.66%	-1.33%
Small	3.70%	3.28%	3.66%	3.31%	-0.04%	3.52%	3.44%	-0.17%	2.39%	4.72%	-1.30%

for several intermediate scenarios of take-up, ranging from 1k to 10k EUR. We observe that the 3k EUR value set by Adalid et al. (2022) in the "capped" scenario is relatively close to the baseline for both the overall sample and subsamples, especially for large banks. Beyond this value, particularly starting from 5k EUR, the distributions shift to the left. The "capped" scenario seems to strike a reasonable balance between maintaining the stock of deposits and the inherent profitability that results from cheaper bank funding. However, it is important to note that the banking industry's overall profitability (as measured by ROE) is quite low, and this could be further reduced in the future if fintech companies gain more prominence, leading to fee compression due to increased competition.

Table 11 provides additional quantitative information based on the final fitted distributions. Using a 4% ROE threshold, we calculate the probability of banks achieving an ROE above or below the threshold for the baseline and various CBDC take-up scenarios. We observe that a take-up of 3k would result in a symmetric distribution for the entire sample, but higher take-up amounts would significantly decrease the probability of banks achieving an ROE above 4%. In the large demand scenario, there is only a 40% probability of banks having an ROE above the threshold. This vulnerability appears to be more pronounced for small "representative" banks, with the probability of achieving an ROE above 4% dropping to 30% at 10k take-up and 28% in the large demand scenario. These results, combined with those presented in Table 10, highlight the potential vulnerability of small banks, which could be severely affected by large CBDC take-up.

Very similar results hold for the ROA. Figure 6 shows the conditional distributions for the representative banks for the entire sample and the breakdown of banks by size.

Table 11: Conditional ROE distribution statistics. The table reports the probability of ROE being above or below the 4% threshold, for different samples of banks and different take-ups of CBDC.

	All sample		Large		Medium		Small	
ROE threshold	<4%	>4%	<4%	>4%	<4%	>4%	<4%	>4%
Baseline	47%	53%	51%	49%	41%	59%	58%	42%
1k	48%	52%	51%	49%	42%	58%	59%	41%
2k	48%	52%	52%	48%	42%	58%	59%	41%
3k	49%	51%	53%	47%	44%	56%	61%	39%
5k	51%	49%	54%	46%	46%	54%	64%	36%
10k	56%	44%	58%	42%	53%	47%	70%	30%
Large Demand	60%	40%	61%	39%	57%	43%	72%	28%

Panel A shows that only the large demand scenario would have a significant impact on the distribution of bank profitability, notably for small and medium-sized banks. When looking at Panel B, as in the previous analysis, take-up from 10K EUR per household seems to have a stronger effect, while below 10K, the distributions are very close to the baseline. Overall, small and medium-sized banks appear to be more affected, at least considering our representative bank and its distribution. Just to mention, the ROA of the banks in our sample is quite low, around 0.3% for the entire sample and slightly higher for large banks. Tables 12 and 13 report the comparative statistics and the probabilities of being above and below the 0.3% ROA threshold. In particular, Table 13 shows that also in the case of ROE, considering large amounts of take-up would result in a deterioration of profits, especially for small and large banks.

Figure 5: Shock on Deposits and ROE. The figure represents the conditional distribution of ROE for the baseline of a representative bank (grey area) and after applying a shock to the deposit ratio, consistent with a moderate demand, a large demand, and a capped take-up of EUR 3K of CBDC, as described in Adalid et al. (2022) (Panel A), and with different levels of take-up per household (Panel B), for the entire sample and for different bank sizes (small, medium, and large). The X-axis represents the ROE values (in percentage).

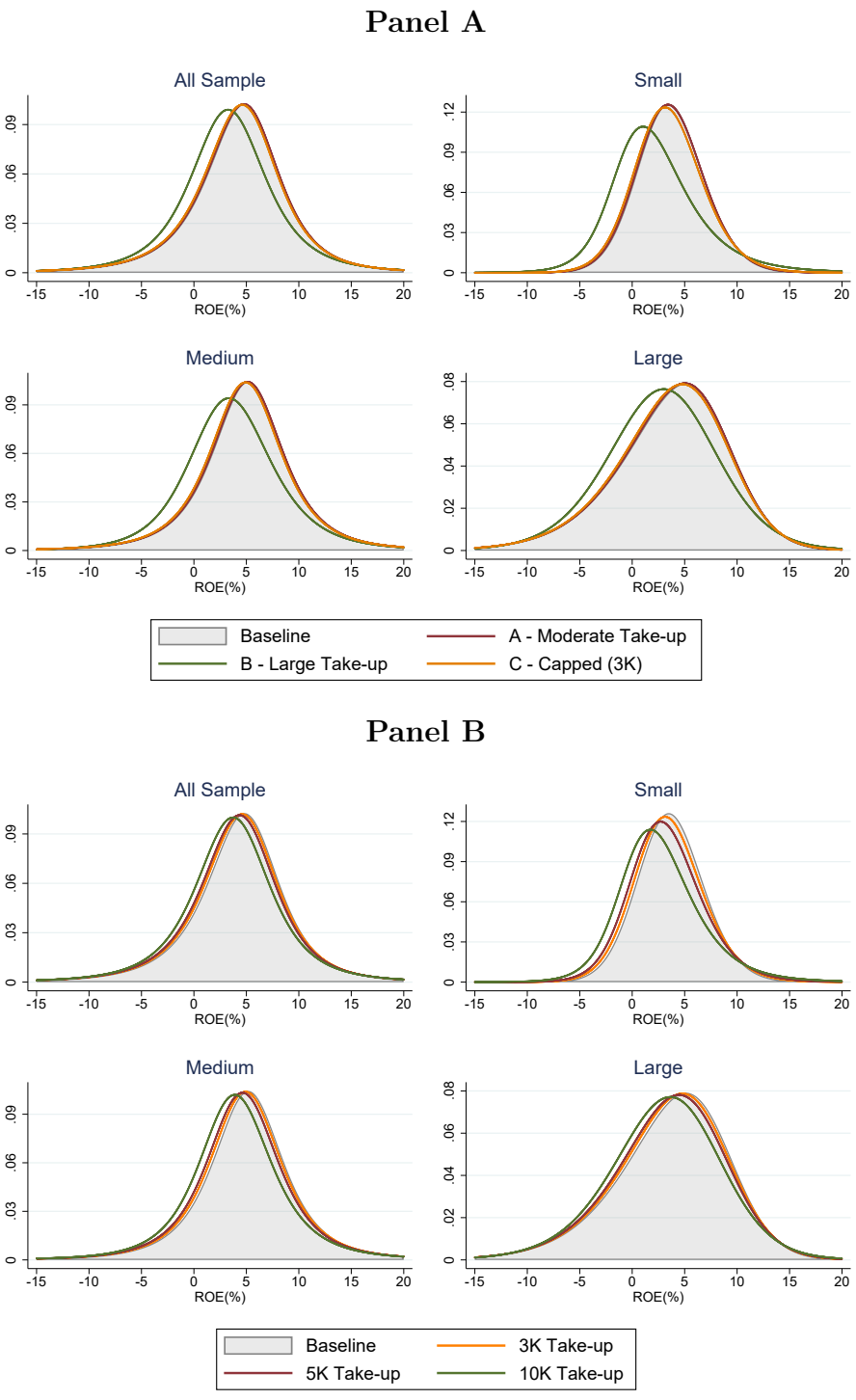


Figure 6: Shock on Deposits and ROA. The figure represents the conditional ROA distribution for the baseline of a representative bank (grey area) and after applying a shock to the deposit ratio, consistent with a moderate demand, a large demand and a capped take-up of EUR 3K of CBDC as described in Adalid et al. (2022) (Panel A) and with different levels of take-up per household (Panel B), for the entire sample and for different banks' sizes (small, medium, and large). The X-axis represents the ROA values (in percentage)..

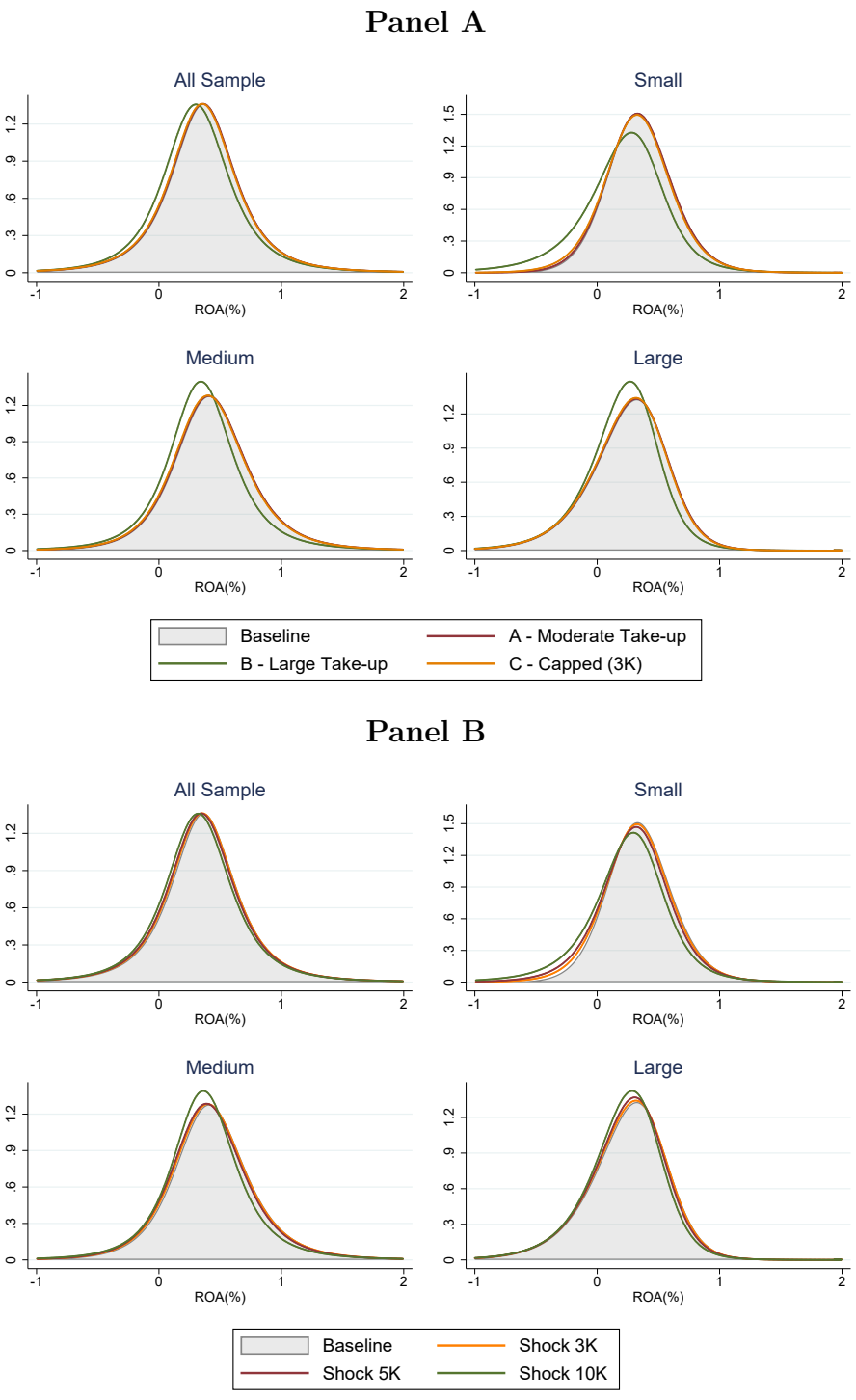


Table 12: Conditional ROA distribution statistics. The table reports descriptive statistics for the fitted distributions using quantile regressions. The column *Diff* refers to the simple difference between the baseline of the representative bank and the value in the scenario.

ROA	Representative bank		Moderate demand			Capped scenario 3k			Large demand		
	Mean	Std	Mean	Std	Diff (%)	Mean	Std	Diff (%)	Mean	Std	Diff (%)
All sample	0.366%	0.218%	0.364%	0.218%	-0.002%	0.358%	0.218%	-0.008%	0.312%	0.220%	-0.054%
Large	0.244%	0.119%	0.242%	0.119%	-0.002%	0.236%	0.118%	-0.007%	0.195%	0.116%	-0.049%
Medium	0.445%	0.174%	0.442%	0.173%	-0.003%	0.433%	0.173%	-0.012%	0.359%	0.208%	-0.086%
Small	0.349%	0.080%	0.345%	0.082%	-0.004%	0.330%	0.089%	-0.019%	0.198%	0.170%	-0.151%

Table 13: Conditional ROA distribution - 4% threshold. The table reports the probability of ROE being above or below the 4% threshold, for different samples of banks and different take-ups of CBDC.

	All sample		Large		Medium		Small	
ROA threshold	<0.3%	>0.3%	<0.3%	>0.3%	<0.3%	>0.3%	<0.3%	>0.3%
Baseline	51%	49%	63%	37%	43%	57%	54%	46%
1k	51%	49%	63%	37%	43%	57%	54%	46%
2k	51%	49%	63%	37%	43%	57%	55%	45%
3k	52%	48%	64%	36%	44%	56%	56%	44%
5k	53%	47%	65%	35%	46%	54%	59%	41%
10k	56%	44%	68%	32%	50%	50%	64%	36%
Large Demand	59%	41%	71%	29%	53%	47%	67%	33%

5 Conclusion

The study shows that the implementation of a digital euro could pose substantial challenges to the profitability of banks, especially for smaller financial institutions that heavily rely on deposit funds. The study examines the relationship between the adoption of the digital euro and bank profitability, by evaluating the extent to which banks depend on deposit profits. To determine the impact of a decrease in deposit funds on bank profitability, the study uses quantile panel regressions with fixed effects.

The research replicates three demand scenarios from a paper by Adalid et al. (2022) and assesses the reaction of profitability indicators, such as return on assets (ROA) and return on equity (ROE), to these changes. The results indicate that the moderate take-up scenario has a limited effect on the ROE of the panel of Eurozone banks. The 3,000 EUR capped scenario results in a slight decrease in the ROE from 4.3% to 4.1% for a representative large bank. However, under the large take-up scenario, the average ROE decreases substantially, down to 2.7% for large banks and 2.4% for small banks.

It's important to note that this analysis is a static evaluation of the potential impact of the digital euro on bank deposits and profitability. It doesn't consider the banks' possible responses to the introduction of the digital euro, such as adjusting their business models or finding alternative funding sources. Additionally, the study only assesses the impact of a reduction in deposit funds and doesn't take into account the possible benefits of the digital euro, such as increased efficiency, reduced transaction costs, and improved financial inclusion.

The findings of the study suggest that the "capped" scenario could be a good compromise, preserving to some extent the stock of deposits and the inherited profitability that comes from the banks' cheaper funding. A thoughtful implementation strategy is necessary to ensure a smooth transition to the CBDC. Further research is needed to fully understand the complex interplay between the digital euro and the banking sector.

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Appendices

A Small Banks' selection and the German banking system

The following appendix outlines the criteria used to select banks, as described in Section 3. As previously mentioned, our analysis focuses on "traditional" banks, since the list of significant entities supervised by the ECB includes also other financial institutions that are not fully doing banking activities (i.e., both collecting deposits and lending). Clearing and custody institutions such as Banque Centrale de Compensation SA, Clearstream Banking SA, EUREX Clearing AG, Euroclear Bank SA, and Euroclear SA/NV, are excluded from the sample as they are unaffected by a decrease in deposits. We also exclude Credits Municipaux in France, which provides loans based on collateral such as a pawnshop. Specifically, we exclude the Credits Municipaux of Bordeaux, Lyon, Nancy, Nice, Nimes, and Toulouse. Additionally, we control for the sector of the Global Ultimate Owner (GUO) for each financial institution. When considering the GUO sector "manufacturing," we identify and exclude banks such as Airbus Bank, Banque PSA Finance, BMW Bank, Mercedes-Benz Bank, and Toyota KreditBank, among others. When controlling for the GUO sector "Mining and quarrying," we find and exclude Banque ENI SA and Sofax Banque SA.

We also consider the ratio between loans and deposits, which is calculated using Equation 4, where $LDR_{i,t}$ represents the loans-to-deposits and wholesale funding ratio for bank i in year t. Banks with an LDR ratio above 1 grant loans that are not adequately covered by deposits and/or wholesale funding. We exclude banks with an LDR ratio above the median value of 1.1. This excludes other institutions such as Porsche Bank AG and Hewlett Packard International Bank, among others. The original LDR ratio has an average median value of 0.7, and its 99th percentile is 1.001. The exclusion of these banks slightly decreases the average to 0.66. Finally, we exclude an additional 229 very small banks with less than 100 employees, which represents only 0.3% of the total assets

for the year 2020.

$$LDR_{i,t} = \frac{\text{Gross Loans}_{i,t}}{\text{Customer Deposits}_{i,t} + \text{Wholesale}_{i,t}} \tag{4}$$

A.1 The German banking system

The German banking system is quite peculiar compared to other EU Member States, mainly due to historical reasons. For detailed information on these peculiarities, see Behr and Schmidt (2015). In Germany, banks are categorized according to the so-called "three-pillar system," which consists of three groups of banks. The first pillar includes large private commercial banks, including the "big banks" (Deutsche Bank, Commerzbank, and Dresdner Bank, among others) and several other specialized private banks. They are profit-oriented and privately owned. According to Behr and Schmidt (2015), their total assets account for around 40% of the German banking system.

The second pillar includes the savings bank group, which consists of local savings banks and regional banks called *Landesbanken*. Some of these banks have government participation, and a considerable number of them are small and regional. The size of pillar two banks is roughly comparable to that of pillar one (about 40

The third pillar includes cooperative banks, a large number of independent institutions with a relatively simple business model (collecting deposits and lending to local SMEs and households). Each local bank is independent, and the members of the cooperative bank provide equity. Many additional considerations and historical motivations exist for why the German banking system is still divided into three pillars, but they are beyond the scope of this brief introduction (see Behr and Schmidt, 2015 for more information).

For our analysis, we provide some statistics that help explain why we decided to exclude some small German banks. Our initial dataset includes 1656 unique banks for the EU, of which 1149 are based in Germany (about 70% of the entire sample). We identified the regional banks by looking at the name of the institution and isolating the following types, which have the largest number of single entities (in parentheses is the number of institutions):

- **Pillar two - savings banks:** *Sparkasse* (369), *Landesbank* (4).
- **Pillar three - cooperative banks:** *Raiffeisen* (284), *Volksbank* (313), VR bank (95), *Sparda Bank* (11), *PSD Bank*(13).

These banks (1089), categorized as medium or small, alone account for 95% of the total number of banks in Germany. As pointed out in the main sections, our aim is to have an overall holistic picture of the potential effects across the European Union of the introduction of a CBDC, taking into account Member States' peculiarities. Although we control for banks' and time-fixed effects, we still want to have a balanced representation of the European banking system in our sample. Therefore, we rank all the savings and cooperative banks described above by the average total asset in the sample and keep at least the top fifteen banks for the medium size and the top fifteen for the small size (top fifteen medium Sparkasse, top fifteen small Sparkasse, and so on). This leads to the final number of banks for Germany decreasing from 1149 to 137 (See Table 1).

As a robustness check, we show the result of the quantile regressions for the ROE when including all banks in Germany in Table A.1. The results are qualitatively similar to Table 4 in terms of significance, albeit the coefficients for the explanatory variables are slightly lower.

Table A.1: Quantile regressions on ROE including all cooperative and saving banks. The table reports the estimation of a set of panel quantile regressions where the dependent variable is the return on equity (ROE), against a set of explanatory variables, including all cooperative and saving banks located in Germany. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quantiles	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Size (-1)	0.103	0.079	0.152	0.158	0.302	0.361	0.656**	0.943	0.928**
	(0.245)	(0.314)	(0.289)	(0.336)	(0.200)	(0.386)	(0.325)	(0.584)	(0.392)
Real GDP Growth	0.172**	0.284***	0.369***	0.404***	0.410***	0.443***	0.415***	0.348***	0.237***
	(0.086)	(0.076)	(0.058)	(0.078)	(0.058)	(0.072)	(0.077)	(0.056)	(0.060)
Equity to TA (-1)	0.013	0.016	-0.023	-0.058	-0.090	-0.139***	-0.147**	-0.127	-0.113
	(0.043)	(0.031)	(0.047)	(0.050)	(0.061)	(0.047)	(0.058)	(0.099)	(0.095)
NPL Ratio (-1)	-0.055***	-0.054***	-0.074***	-0.077***	-0.080**	-0.077**	-0.079**	-0.042***	-0.052***
	(0.015)	(0.014)	(0.019)	(0.025)	(0.032)	(0.036)	(0.033)	(0.015)	(0.008)
Cost to income (-1)	-0.003	-0.010***	-0.013***	-0.013***	-0.013***	-0.014***	-0.017***	-0.017***	-0.018***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.006)
Loans to TA (-1)	0.008	0.008	0.003	-0.001	-0.002	0.000	-0.001	-0.000	0.008
	(0.010)	(0.009)	(0.009)	(0.011)	(0.010)	(0.010)	(0.017)	(0.019)	(0.023)
Deposits to TA (-1)	0.025	0.025***	0.027***	0.031***	0.030***	0.039***	0.036**	0.034*	0.018
	(0.016)	(0.008)	(0.010)	(0.012)	(0.011)	(0.013)	(0.018)	(0.020)	(0.020)
Non interest income to rev (-1)	-0.007	0.001	-0.004	-0.003	-0.007	-0.015**	-0.017**	-0.010	-0.023**
	(0.006)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.008)	(0.014)	(0.011)
Concentration (-1)	1.047	1.609	1.957	1.906	1.336	0.939	1.341	0.711	1.195
	(1.453)	(1.388)	(1.342)	(1.320)	(0.949)	(0.855)	(1.206)	(1.498)	(0.872)
Observations	7388								
Fixed effects	Bank-Year								

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

B Variables description

Table B.1: Variables Description

Variable	Description
ROA	Return on average assets
ROE	Return on average equity
Net Income to TA	Net Income to total assets
LLP to TA	Loans Loss Provision to total assets
Non Interest Income to TA	Non Interest Income to total assets
Size	Log of total assets
Equity to TA	Equity to total assets
Real GDP Growth	Real GDP Growth
NPL ratio	Non performing loans over total loans
Cost to income ratio	Overhead costs to operating income
Loans to TA	Gross loans over total assets
Deposits to TA	Customers deposits over total assets
Wholesale to TA	Wholesale funding over total assets
Non Interest Income to Revenue	Non interest income to operative income
Concentration	Share of five largest banks over total asset at MS level

Table B.2: Conditional ROE and ROA distribution statistics and take-ups. The table reports descriptive statistics for the fitted distributions using quantile regressions. The columns from 1k to 10k represent the average of the conditional distributions based on different take-up levels.

ROE	Representative bank						
	Mean	Std	1k	2k	3k	5k	10k
All sample	4.28%	6.26%	4.26%	4.21%	4.13%	3.98%	3.61%
Large	3.65%	5.55%	3.63%	3.58%	3.51%	3.37%	3.02%
Medium	5.10%	6.10%	5.08%	5.02%	4.92%	4.70%	4.16%
Small	3.70%	3.28%	3.68%	3.63%	3.52%	3.30%	2.78%

ROA	Representative bank						
	Mean	Std	1k	2k	3k	5k	10k
All sample	0.366%	0.218%	0.365%	0.362%	0.358%	0.349%	0.328%
Large	0.244%	0.119%	0.243%	0.240%	0.236%	0.229%	0.210%
Medium	0.445%	0.174%	0.444%	0.440%	0.433%	0.419%	0.384%
Small	0.349%	0.080%	0.347%	0.342%	0.330%	0.305%	0.243%

C Quantile regression estimation by size

Table C.1: Quantile regression on ROE - Small banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	2.482*	0.760	0.559	0.475	-0.311	-0.294	-0.419	0.038	0.375	1.169	1.200	0.959	0.657	1.044	1.059	0.960	0.786	1.311	1.303
	(1.376)	(1.416)	(0.987)	(0.864)	(1.022)	(0.894)	(0.872)	(1.062)	(1.003)	(0.948)	(0.881)	(1.228)	(1.164)	(0.835)	(0.831)	(1.232)	(1.196)	(1.471)	(1.376)
Real GDP growth	0.780**	0.430	0.478***	0.517***	0.498***	0.481***	0.400***	0.375***	0.384***	0.421***	0.377***	0.413***	0.364**	0.301***	0.271***	0.323***	0.333***	0.347***	0.180*
	(0.325)	(0.313)	(0.168)	(0.099)	(0.130)	(0.108)	(0.111)	(0.142)	(0.116)	(0.099)	(0.115)	(0.119)	(0.183)	(0.073)	(0.085)	(0.089)	(0.110)	(0.095)	(0.104)
Equity to TA (-1)	-0.000	-0.082	-0.144	-0.230	-0.275*	-0.263	-0.274	-0.336**	-0.363**	-0.299**	-0.291*	-0.313**	-0.235	-0.306***	-0.290**	-0.233**	-0.355***	-0.311**	-0.423**
	(0.111)	(0.153)	(0.119)	(0.142)	(0.146)	(0.190)	(0.172)	(0.156)	(0.170)	(0.129)	(0.154)	(0.150)	(0.197)	(0.114)	(0.127)	(0.094)	(0.106)	(0.147)	(0.182)
NPL Ratio (-1)	-0.103	-0.120	-0.092	-0.136	-0.190**	-0.155**	-0.102*	-0.153***	-0.150***	-0.156**	-0.176***	-0.171**	-0.180**	-0.191***	-0.228***	-0.196**	-0.149*	-0.021	-0.036
	(0.070)	(0.090)	(0.076)	(0.094)	(0.095)	(0.065)	(0.055)	(0.042)	(0.052)	(0.064)	(0.059)	(0.080)	(0.077)	(0.043)	(0.049)	(0.079)	(0.079)	(0.085)	(0.051)
Cost to income (-1)	-0.072***	-0.059*	-0.049**	-0.047*	-0.061**	-0.064**	-0.066***	-0.069***	-0.059**	-0.047**	-0.041*	-0.046*	-0.052*	-0.050**	-0.040***	-0.039***	-0.044**	-0.046**	-0.052***
	(0.026)	(0.035)	(0.024)	(0.025)	(0.028)	(0.027)	(0.025)	(0.024)	(0.030)	(0.019)	(0.024)	(0.027)	(0.031)	(0.020)	(0.013)	(0.013)	(0.019)	(0.021)	(0.014)
Loans to TA (-1)	-0.023	-0.037	-0.031	-0.029	-0.037	-0.013	-0.002	-0.019	-0.008	0.008	0.008	0.005	-0.002	0.000	-0.005	-0.015	0.027	0.036	0.035
	(0.059)	(0.050)	(0.040)	(0.038)	(0.050)	(0.034)	(0.035)	(0.037)	(0.042)	(0.042)	(0.044)	(0.051)	(0.053)	(0.040)	(0.035)	(0.046)	(0.044)	(0.057)	(0.086)
Deposits to TA (-1)	0.076	0.074	0.082	0.065	0.066	0.074**	0.061	0.055	0.043	0.021	0.037	0.036	0.036	0.046*	0.036	0.044	0.052	0.096**	-0.044
	(0.060)	(0.054)	(0.055)	(0.045)	(0.052)	(0.035)	(0.042)	(0.039)	(0.042)	(0.033)	(0.033)	(0.032)	(0.031)	(0.028)	(0.030)	(0.034)	(0.039)	(0.038)	(0.045)
Non interest income to rev (-1)	-0.065	-0.021	-0.033	-0.047	-0.039	-0.031	-0.019	-0.024	-0.025	-0.028	-0.024	-0.024	-0.036	-0.048	-0.050**	-0.060**	-0.056*	-0.055	-0.084***
	(0.064)	(0.030)	(0.026)	(0.031)	(0.024)	(0.028)	(0.018)	(0.022)	(0.023)	(0.027)	(0.027)	(0.028)	(0.030)	(0.031)	(0.019)	(0.024)	(0.030)	(0.047)	(0.025)
Concentration (-1)	0.250	4.394	4.149	3.727	3.463	3.610**	3.900**	3.599	3.535*	3.436*	3.546*	3.633	3.351	3.453*	1.908	2.049	2.315	1.283	0.934
	(6.002)	(4.757)	(3.240)	(2.609)	(2.709)	(1.799)	(1.525)	(2.207)	(1.960)	(1.816)	(2.152)	(2.208)	(3.658)	(2.095)	(1.871)	(3.178)	(3.508)	(2.918)	(1.999)
Observations	1220																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table C.2: Quantile regression on ROE - Medium banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	0.161	0.969	0.805	0.898	1.461	1.191	0.827	1.351	1.537	1.959**	1.818	1.648	1.715	2.003	2.217	2.504*	2.779*	2.103	1.746**
	(1.934)	(1.467)	(1.489)	(1.245)	(1.308)	(1.362)	(1.035)	(0.953)	(0.990)	(0.896)	(1.248)	(1.430)	(1.291)	(1.260)	(1.682)	(1.422)	(1.515)	(1.456)	(0.877)
Real GDP growth	0.568**	0.736**	0.618*	0.572**	0.539**	0.516***	0.494***	0.449***	0.382*	0.370***	0.362**	0.439***	0.468***	0.372***	0.389**	0.263	0.134	0.079	-0.103
	(0.233)	(0.323)	(0.322)	(0.256)	(0.233)	(0.186)	(0.159)	(0.122)	(0.200)	(0.128)	(0.149)	(0.162)	(0.100)	(0.116)	(0.155)	(0.184)	(0.166)	(0.180)	(0.117)
Equity to TA (-1)	-0.057	-0.005	-0.030	-0.085	-0.068	-0.079	-0.099	-0.097	-0.076	-0.107	-0.102	-0.133	-0.161	-0.183	-0.265	-0.269	-0.333**	-0.207	0.115
	(0.199)	(0.166)	(0.230)	(0.156)	(0.171)	(0.168)	(0.193)	(0.105)	(0.094)	(0.086)	(0.122)	(0.125)	(0.127)	(0.156)	(0.231)	(0.291)	(0.157)	(0.198)	(0.255)
NPL Ratio (-1)	-0.225	-0.230**	-0.222***	-0.154*	-0.120*	-0.103	-0.062	-0.058	-0.015	0.011	0.003	0.008	0.012	0.010	0.018	0.018	0.032	-0.015	-0.047
	(0.159)	(0.095)	(0.061)	(0.092)	(0.068)	(0.072)	(0.068)	(0.050)	(0.130)	(0.023)	(0.030)	(0.030)	(0.023)	(0.025)	(0.032)	(0.045)	(0.033)	(0.062)	(0.031)
Cost to income (-1)	-0.041**	-0.050	-0.061***	-0.059***	-0.050**	-0.045***	-0.052***	-0.049***	-0.053***	-0.053***	-0.045***	-0.047***	-0.048***	-0.049***	-0.056**	-0.061***	-0.058***	-0.049**	-0.023
	(0.021)	(0.032)	(0.017)	(0.016)	(0.024)	(0.017)	(0.018)	(0.016)	(0.021)	(0.019)	(0.017)	(0.016)	(0.015)	(0.018)	(0.023)	(0.019)	(0.013)	(0.022)	(0.021)
Loans to TA (-1)	0.080*	0.045	0.007	-0.003	0.002	0.010	0.014	0.023	0.028	0.029	0.013	0.016	0.018	0.018	0.021	-0.015	-0.031	-0.013	0.008
	(0.044)	(0.045)	(0.032)	(0.035)	(0.030)	(0.030)	(0.025)	(0.025)	(0.030)	(0.030)	(0.025)	(0.024)	(0.020)	(0.030)	(0.043)	(0.049)	(0.032)	(0.048)	(0.025)
Deposits to TA (-1)	0.054	0.068	0.078*	0.087***	0.089***	0.082***	0.080***	0.080***	0.072***	0.071***	0.064***	0.071*	0.072**	0.069	0.053	0.029	0.051	0.040	0.036
	(0.067)	(0.064)	(0.040)	(0.033)	(0.025)	(0.024)	(0.021)	(0.024)	(0.024)	(0.024)	(0.024)	(0.039)	(0.034)	(0.043)	(0.057)	(0.051)	(0.055)	(0.057)	(0.025)
Non interest income to rev (-1)	-0.048	-0.017	-0.015	-0.021*	-0.017	-0.019	-0.020	-0.018	-0.023	-0.022	-0.023*	-0.022	-0.025*	-0.020	-0.020	-0.032	-0.021	-0.029	-0.013
	(0.046)	(0.051)	(0.017)	(0.011)	(0.016)	(0.016)	(0.014)	(0.015)	(0.024)	(0.015)	(0.012)	(0.014)	(0.013)	(0.021)	(0.021)	(0.025)	(0.028)	(0.023)	(0.012)
Concentration (-1)	-1.335	-2.237	-0.327	-0.186	-0.034	-0.278	-0.665	0.051	0.307	0.742	0.718	0.773	0.723	0.312	0.251	-0.214	-1.334	-0.825	-3.503*
	(2.247)	(3.011)	(2.363)	(2.099)	(2.093)	(1.914)	(1.795)	(2.145)	(2.059)	(1.743)	(1.834)	(1.821)	(1.629)	(2.091)	(4.219)	(2.165)	(1.954)	(1.435)	(1.875)
Observations	1649																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table C.3: Quantile regression on ROE - Large banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	-0.257	-1.426	-0.472	-0.930	-0.222	-0.032	1.200	1.721	1.882	1.729	1.434	0.603	1.054	1.584**	1.640**	0.523	0.170	0.009	-1.128**
	(1.500)	(0.895)	(1.013)	(1.436)	(1.124)	(1.457)	(2.749)	(1.446)	(1.520)	(1.431)	(1.174)	(1.474)	(1.920)	(0.727)	(0.778)	(1.088)	(0.944)	(1.022)	(0.498)
Real GDP growth	0.262	0.325	0.256	0.146	0.213	0.254	0.285	0.297	0.417	0.516***	0.470***	0.430***	0.346*	0.306**	0.221*	0.267**	0.196	0.139	-0.221**
	(0.261)	(0.310)	(0.270)	(0.232)	(0.257)	(0.269)	(0.232)	(0.226)	(0.260)	(0.199)	(0.167)	(0.158)	(0.184)	(0.152)	(0.118)	(0.134)	(0.145)	(0.165)	(0.111)
Equity to TA (-1)	0.162	0.257***	0.228**	0.195*	0.199	0.193*	0.254	0.239	0.232	0.233	0.181	0.106	0.076	0.020	-0.024	-0.081	-0.242	-0.507***	-0.621***
	(0.226)	(0.096)	(0.090)	(0.106)	(0.141)	(0.103)	(0.409)	(0.314)	(0.309)	(0.299)	(0.178)	(0.185)	(0.218)	(0.116)	(0.131)	(0.181)	(0.289)	(0.193)	(0.082)
NPL Ratio (-1)	-0.379***	-0.415***	-0.394***	-0.318***	-0.278***	-0.256**	-0.202**	-0.177***	-0.181***	-0.189***	-0.143	-0.109	-0.133**	-0.137***	-0.132***	-0.127***	-0.072	-0.074*	-0.048
	(0.121)	(0.095)	(0.118)	(0.093)	(0.073)	(0.100)	(0.089)	(0.067)	(0.057)	(0.070)	(0.087)	(0.067)	(0.052)	(0.045)	(0.041)	(0.046)	(0.045)	(0.042)	(0.034)
Cost to income (-1)	-0.004	-0.007	0.004	0.005	0.006	0.000	-0.006	-0.009	-0.008	-0.006	-0.007	-0.024	-0.021	-0.026**	-0.025	-0.024**	-0.025*	-0.020**	-0.028
	(0.013)	(0.011)	(0.008)	(0.011)	(0.013)	(0.012)	(0.014)	(0.012)	(0.022)	(0.024)	(0.020)	(0.068)	(0.046)	(0.011)	(0.017)	(0.012)	(0.013)	(0.009)	(0.032)
Loans to TA (-1)	-0.057	-0.045	-0.045	-0.031	-0.022	-0.021	-0.028	-0.014	-0.013	-0.019	-0.026	-0.033	-0.039	-0.046	-0.034	-0.035	-0.053	-0.099*	-0.098**
	(0.058)	(0.061)	(0.048)	(0.061)	(0.060)	(0.046)	(0.037)	(0.041)	(0.041)	(0.042)	(0.042)	(0.043)	(0.059)	(0.045)	(0.046)	(0.048)	(0.059)	(0.056)	(0.042)
Deposits to TA (-1)	0.026	0.055	0.033	0.068	0.091**	0.088**	0.101**	0.114**	0.110***	0.103**	0.100*	0.072	0.087	0.098**	0.083**	0.052	0.048	0.047	0.004
	(0.088)	(0.073)	(0.053)	(0.045)	(0.044)	(0.037)	(0.046)	(0.047)	(0.041)	(0.049)	(0.051)	(0.044)	(0.059)	(0.040)	(0.039)	(0.043)	(0.045)	(0.032)	(0.030)
Non interest income to rev (-1)	-0.032	-0.016	0.002	0.011	0.011	0.011	0.006	0.006	0.007	-0.007	-0.012	-0.022	-0.012	-0.004	-0.009	-0.014	-0.017	-0.017	-0.022**
	(0.021)	(0.017)	(0.014)	(0.017)	(0.018)	(0.022)	(0.026)	(0.021)	(0.028)	(0.024)	(0.019)	(0.023)	(0.022)	(0.014)	(0.017)	(0.016)	(0.013)	(0.011)	(0.011)
Concentration (-1)	2.133	-6.557	-2.011	-0.290	-2.480	-2.895	-3.063	-1.257	-1.888	-2.954	-2.851	-2.305	-3.260	-3.825**	-4.190**	-2.632	-3.193	-5.286***	-4.045***
	(8.992)	(5.237)	(3.892)	(4.327)	(4.877)	(3.272)	(3.675)	(2.288)	(2.785)	(2.430)	(1.991)	(1.920)	(2.115)	(1.736)	(2.072)	(1.912)	(2.216)	(1.285)	(1.216)
Observations	945																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table C.4: Quantile regression on ROA - Small banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	0.228*	0.144*	0.040	-0.013	-0.027	-0.041	-0.028	0.016	0.030	0.046	0.043	0.064	0.047	0.011	-0.002	0.016	-0.011	-0.016	-0.012
	(0.116)	(0.075)	(0.146)	(0.094)	(0.099)	(0.085)	(0.077)	(0.082)	(0.093)	(0.076)	(0.095)	(0.078)	(0.085)	(0.075)	(0.079)	(0.086)	(0.069)	(0.104)	(0.071)
Real GDP growth	0.045***	0.066***	0.048***	0.042***	0.037***	0.039***	0.040***	0.036***	0.038***	0.034**	0.033***	0.027***	0.029***	0.030***	0.028***	0.029***	0.025**	0.023**	0.031**
	(0.014)	(0.022)	(0.017)	(0.013)	(0.011)	(0.010)	(0.009)	(0.010)	(0.010)	(0.015)	(0.010)	(0.010)	(0.009)	(0.007)	(0.008)	(0.008)	(0.011)	(0.011)	(0.013)
Equity to TA (-1)	0.012	0.008	-0.014	-0.011	-0.007	-0.009	-0.006	-0.005	-0.005	0.000	0.003	0.009	0.016	0.013*	0.012	0.013	0.010	0.005	0.009
	(0.011)	(0.018)	(0.017)	(0.018)	(0.020)	(0.011)	(0.013)	(0.013)	(0.014)	(0.014)	(0.016)	(0.016)	(0.049)	(0.008)	(0.009)	(0.010)	(0.017)	(0.012)	(0.011)
NPL Ratio (-1)	-0.008*	-0.011	-0.004	-0.007	-0.008	-0.013***	-0.011**	-0.012*	-0.012**	-0.011	-0.014**	-0.014***	-0.016**	-0.017***	-0.018***	-0.017***	-0.010	-0.005	-0.001
	(0.004)	(0.007)	(0.006)	(0.005)	(0.008)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.006)	(0.005)	(0.006)	(0.003)	(0.004)	(0.005)	(0.011)	(0.012)	(0.004)
Cost to income (-1)	-0.003	-0.005**	-0.004**	-0.005*	-0.005**	-0.006***	-0.006***	-0.006***	-0.006***	-0.005**	-0.004*	-0.005**	-0.005***	-0.005***	-0.005***	-0.004***	-0.004***	-0.004***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Loans to TA (-1)	-0.003	-0.001	-0.001	-0.001	-0.000	-0.001	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.001	0.001	0.002	0.000
	(0.006)	(0.006)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.007)
Deposits to TA (-1)	0.012**	0.007*	0.007	0.006*	0.005	0.004	0.004	0.003	0.004	0.003	0.003	0.002	0.002	0.003	0.003	0.004	0.005	0.003	0.002
	(0.005)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)
Non interest income to rev (-1)	-0.007	-0.004	-0.004	-0.004*	-0.003	-0.002	-0.001	-0.003	-0.003	-0.003	-0.003	-0.003	-0.005*	-0.004**	-0.005***	-0.006***	-0.007***	-0.007**	-0.007***
	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Concentration (-1)	0.389	0.258	0.244	0.331	0.458***	0.456***	0.464***	0.448***	0.380**	0.341*	0.361	0.412*	0.261	0.284	0.253	0.192	0.083	0.058	-0.099
	(0.455)	(0.552)	(0.413)	(0.371)	(0.163)	(0.167)	(0.166)	(0.160)	(0.177)	(0.204)	(0.227)	(0.246)	(0.315)	(0.175)	(0.218)	(0.145)	(0.191)	(0.200)	(0.064)
Observations	1220																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table C.5: Quantile regression on ROA - Medium banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	-0.017	0.042	0.000	-0.014	0.024	0.038	0.046	0.033	0.040	0.072	0.086	0.103	0.068	0.065	0.112	0.181**	0.155	0.134	0.067
	(0.128)	(0.103)	(0.088)	(0.089)	(0.089)	(0.063)	(0.065)	(0.066)	(0.091)	(0.082)	(0.099)	(0.086)	(0.072)	(0.065)	(0.098)	(0.085)	(0.120)	(0.108)	(0.066)
Real GDP growth	0.055***	0.058**	0.053**	0.041**	0.042***	0.042***	0.040***	0.034*	0.025**	0.028**	0.028***	0.027**	0.023**	0.025***	0.023**	0.017	0.017	0.007	0.014
	(0.019)	(0.024)	(0.022)	(0.016)	(0.015)	(0.011)	(0.012)	(0.018)	(0.011)	(0.012)	(0.011)	(0.011)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.015)	(0.011)
Equity to TA (-1)	0.007	0.019	0.019*	0.021**	0.022***	0.022***	0.024***	0.021***	0.023**	0.027***	0.027***	0.028***	0.024***	0.025***	0.025**	0.027*	0.024	0.021*	0.018***
	(0.009)	(0.012)	(0.010)	(0.009)	(0.008)	(0.006)	(0.005)	(0.005)	(0.011)	(0.007)	(0.007)	(0.008)	(0.009)	(0.006)	(0.010)	(0.014)	(0.022)	(0.013)	(0.002)
NPL Ratio (-1)	-0.014***	-0.018***	-0.017***	-0.015**	-0.011**	-0.010**	-0.007	-0.006	-0.005	-0.003	-0.002	-0.002	-0.001	0.001	0.000	-0.001	-0.000	-0.003	-0.004**
	(0.005)	(0.005)	(0.006)	(0.007)	(0.005)	(0.005)	(0.008)	(0.006)	(0.005)	(0.007)	(0.006)	(0.012)	(0.003)	(0.002)	(0.002)	(0.003)	(0.006)	(0.018)	(0.002)
Cost to income (-1)	-0.004**	-0.004*	-0.004**	-0.004***	-0.004**	-0.003***	-0.003***	-0.003***	-0.004***	-0.004***	-0.003**	-0.003*	-0.003**	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.003
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Loans to TA (-1)	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)
Deposits to TA (-1)	0.004	0.004*	0.004*	0.003*	0.003	0.004***	0.004***	0.004***	0.004*	0.004**	0.004*	0.004	0.003	0.003*	0.005**	0.002	0.003	0.003	0.005*
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)	(0.003)	(0.003)
Non interest income to rev (-1)	-0.003	-0.002	-0.002	-0.001	-0.001	-0.002**	-0.002*	-0.001	-0.002*	-0.002*	-0.002	-0.002**	-0.002*	-0.002**	-0.002**	-0.002	-0.002	-0.000	-0.002
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Concentration (-1)	-0.236	-0.228	-0.104	0.037	0.027	-0.008	0.001	0.061	0.073	0.037	0.030	0.037	0.056	0.036	0.077	0.025	-0.041	-0.154	-0.284***
	(0.279)	(0.352)	(0.234)	(0.165)	(0.131)	(0.110)	(0.110)	(0.138)	(0.139)	(0.174)	(0.125)	(0.126)	(0.105)	(0.077)	(0.096)	(0.123)	(0.141)	(0.171)	(0.103)
Observations	1649																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table C.6: Quantile regression on ROA - Large banks. The table reports the estimation of a panel quantile regression where the dependent variable is the return on equity (ROE), against a set of explanatory variables. Quantile regressions are estimated including time averages of the covariates and time dummies (CRE model) to account for fixed effects (see Equation 2). Robust standard errors, clustered at bank, country, and year levels, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ROE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Quantiles	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
Size (-1)	0.057	0.058	0.072	0.075	0.137*	0.169***	0.175***	0.143*	0.109	0.108	0.077	0.040	0.031	0.081	0.058	0.052	-0.012	-0.036	-0.075
	(0.060)	(0.073)	(0.064)	(0.090)	(0.073)	(0.047)	(0.035)	(0.073)	(0.105)	(0.114)	(0.113)	(0.092)	(0.079)	(0.071)	(0.054)	(0.060)	(0.072)	(0.058)	(0.064)
Real GDP growth	0.006	0.022	0.021	0.005	0.010	0.016	0.024	0.022	0.031*	0.033**	0.034***	0.035***	0.031**	0.027**	0.030**	0.027**	0.029*	0.023**	0.038***
	(0.013)	(0.017)	(0.024)	(0.012)	(0.021)	(0.015)	(0.014)	(0.016)	(0.016)	(0.016)	(0.013)	(0.012)	(0.013)	(0.012)	(0.014)	(0.013)	(0.016)	(0.009)	(0.011)
Equity to TA (-1)	0.028***	0.029***	0.037***	0.039***	0.037***	0.038***	0.037***	0.036***	0.036***	0.042	0.048*	0.049***	0.046***	0.046***	0.038	0.035**	0.024*	0.008	-0.002
	(0.009)	(0.007)	(0.006)	(0.009)	(0.005)	(0.005)	(0.005)	(0.011)	(0.012)	(0.030)	(0.024)	(0.011)	(0.009)	(0.012)	(0.023)	(0.014)	(0.013)	(0.013)	(0.011)
NPL Ratio (-1)	-0.023***	-0.026***	-0.026***	-0.023***	-0.023***	-0.022***	-0.022***	-0.019***	-0.021***	-0.019***	-0.016***	-0.016***	-0.016***	-0.016***	-0.018***	-0.015***	-0.014***	-0.009***	-0.011***
	(0.005)	(0.005)	(0.007)	(0.005)	(0.006)	(0.005)	(0.008)	(0.004)	(0.005)	(0.007)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)
Cost to income (-1)	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000	-0.001	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Loans to TA (-1)	0.000	0.001	-0.001	-0.001	-0.000	0.001	0.000	-0.001	-0.001	-0.003	-0.004	-0.003	-0.004	-0.004	-0.003	-0.004	-0.004	-0.007**	-0.006*
	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)	(0.005)	(0.006)	(0.004)	(0.003)	(0.004)
Deposits to TA (-1)	0.002	0.002	0.001	0.001	0.002	0.003	0.004*	0.003	0.004	0.004	0.004	0.005*	0.005**	0.005*	0.005**	0.005*	0.004	0.007***	0.006***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)
Non interest income to rev (-1)	-0.002	-0.001	-0.001	-0.001	-0.000	0.000	0.000	-0.000	-0.001	-0.001	-0.001	-0.000	-0.001	-0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Concentration (-1)	0.102	0.053	0.053	0.117	-0.042	-0.169	-0.240	-0.171	-0.171	-0.171	-0.149	-0.145	-0.191	-0.259*	-0.269**	-0.351**	-0.409***	-0.429***	-0.381***
	(0.270)	(0.220)	(0.262)	(0.180)	(0.196)	(0.215)	(0.170)	(0.148)	(0.148)	(0.190)	(0.148)	(0.156)	(0.135)	(0.144)	(0.121)	(0.168)	(0.114)	(0.094)	(0.112)
Observations	945																		
Fixed effects	Bank-Year																		

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

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