How Does the NSFR Regulatory Constraint Affect Profitability and Lending? Evidence From EU Banks

European Financial Management

WILEY

EUROPEAN FINANCIAL MANAGEMENT

ORIGINAL ARTICLE OPEN ACCESS

How Does the NSFR Regulatory Constraint Affect Profitability and Lending? Evidence From EU Banks

Paolo Agnese[1] | Andrea Delle Foglie[2] | Pasqualina Porretta[3] | Fabrizio Santoboni[3]

[1]Faculty of Economics and Law, International Telematic University UNINETTUNO, Rome, Italy | [2]Department of Economics, John Cabot University, Rome, Italy | [3]Management Department, Faculty of Economics, Sapienza University of Rome, Rome, Italy

Correspondence: Pasqualina Porretta (pasqualina.porretta@uniroma1.it)

Received: 5 June 2025 | **Revised:** 15 September 2025 | **Accepted:** 15 October 2025

Keywords: banks | lending activity | liquidity risk | NSFR | profitability

ABSTRACT

This paper analyzes the relationship between long-term liquidity regulatory constraints, profitability, and lending activities in the EU banking sector. In particular, we examine how Net Stable Funding Ratio (*NSFR*) liquidity requirements impact the profitability and the core banking activities of 187 banks. Our findings reveal that higher *NSFR* levels improve profitability and asset quality over time rather than immediately. Additionally, *NSFR* supports loan growth, highlighting the duality of the Basel III liquidity requirement as a prudential constraint and a performance driver. This study highlights that well-calibrated liquidity regulations can strengthen the financial system while ensuring a stable credit supply.

JEL Classification: G21, G28

1 | Introduction

The 2008 crisis, which began as a subprime crisis, quickly transformed into a global illiquidity crisis in the interbank markets. This undermining of the reputation of banking intermediaries on the markets consequently altered their ability to find funding sources, particularly wholesale ones. From this perspective, liquidity risk has been identified as one of the major factors that contributed to the collapse of several banks worldwide during the crisis period (Chen et al. 2020; King 2013). The global financial crisis reminded policymakers and practitioners that banks' liquidity positions, regulatory requirements, and performance are closely interdependent (Ashraf et al. 2016; Veeramoothoo and Hammoudeh 2022).

After the crisis, the liquidity risk was introduced into the prudential supervisory framework by defining two main liquidity ratios: the Liquidity Coverage Ratio (LCR) (relating to the short-term resilience of the liquidity risk profile of banks, Basel Committee on Banking Supervision [BCBS] 2013) and the Net Stable Funding Ratio (*NSFR*) (relating to reduce funding risk over a longer time horizon by requiring banks to fund their activities with sufficiently stable sources of funding, BCBS 2014). The *NSFR* is a key liquidity standard under Basel III reforms designed to promote the long-term resilience of banks' funding profiles and enhance financial stability.

The *NSFR* is defined as the ratio of *Available Stable Funding (ASF)* to *Required Stable Funding (RSF)*, with a ratio of at least 100% required, meaning the bank has sufficient stable funding to cover its funding needs on an ongoing basis. Previous studies on the impact of *NSFR* have largely depended on artificially constructed measures, considering that the requirement became mandatory with CRR2 Regulation (e.g., Ashraf et al. 2016; DeYoung and Jang 2016; Dietrich et al. 2014; Grundke and Kühn 2020; King 2013; Nguyen and Nguyen 2022; Papadamou et al. 2021a, 2021b; Veeramoothoo and Hammoudeh 2022). Most of these approaches were used before or around the initial implementation of the *NSFR* requirement, thus failing to incorporate the officially reported regulatory indicators that banks disclose in their Pillar III reports. To address this gap, our study uses the *NSFR* as it is accurately calculated and disclosed by banks according to the official Basel regulatory formula. By utilizing this direct regulatory measure, our analysis provides a more accurate and suitable evaluation of the *NSFR*'s impact.

Furthermore, our study examines a large sample of banks within the EU banking system, enabling us to comprehensively investigate the interdependencies among liquidity requirements expressed by the *NSFR*, profitability, and core banking activities, particularly lending. This approach provides valuable insights into the real-world effectiveness of liquidity regulation, considering that the Basel III standards were developed to enhance the stability and resilience of the EU banking sector.

With reference to banks' regulatory liquidity requirements, we focus on the *NSFR*. The EU *NSFR* framework was issued in June 2019 by means of Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019 (Capital Requirements Regulation II—CRR2 Regulation). It applies to all credit institutions and systemic investment firms in the EU. This integration ensures that capital not only serves as a buffer against losses but also underpins banks' long-term funding stability, reinforcing the overall resilience of the banking sector. As underlined above, the *NSFR* requires banks to have a ratio of ASF to RSF of at least 100%. In other words, the *NSFR* aims to calculate the share of ASF through equities and certain liabilities related to the RSF. In particular, the *NSFR* mandates that ASF (long-term liabilities and equity) covers RSF (illiquid assets and off-balance exposures) and promotes a more stable funding structure. This reduces reliance on short-term wholesale funding but may limit high-yield asset investments (BCBS 2014). The *NSFR* became a binding 100% minimum requirement in June 2021 under Basel III, with phased implementation beginning in 2018. Early adoption phases (pre-2021) enabled banks to adjust their long-term financing formula gradually, thereby mitigating short-term profitability shocks. Banks then need to ensure they have sufficient "stable funding" to match their funding-weighted assets.

The *NSFR* could be too restrictive a regulatory constraint, potentially undermining the traditional role of banks in transforming liquidity and maturities, as well as the autonomy of management in determining the qualitative and quantitative composition of balance sheet assets and liabilities. In summary, adhering to the *NSFR* restricts banks' autonomy in determining their long-term financing formula frameworks, which affects their funding costs and, consequently, their income statement and economic results through various drivers outlined below, based on our interpretation and study of liquidity and other management balances.

The *NSFR* ratio promotes maintaining a higher proportion of stable, long-term funding, which can be more expensive than short-term funding, thereby increasing the average funding cost. It can affect a bank's ability to make profits by reducing the asset-liability maturity mismatch. Banks may need to adjust their asset portfolios to align with the longer-term funding requirements, potentially impacting their net interest margins. Moreover, the *NSFR* ratio increases banks' survival probability by reducing maturity mismatches. Still, it may lower ex post profitability due to constraints on risk-taking and higher funding costs for short-term liabilities. Additionally, the *NSFR* ratio impacts profitability by altering the spread between interest income and interest expenses. The corollary of what has been established above allows us to affirm that: longer-term loans (e.g., mortgages) become more expensive to fund, potentially reducing credit availability or increasing borrower costs; the increase in lending activity produces a demand for stable funding, capital requirements mandatory for credit risk (Capital Requirements Regulation [CRR] 2013), and so economic consequences.

In this perspective, this paper aims to explore the impact and the dynamics of the *NSFR*, exploring the following research questions:

1. *How does the NSFR affect bank profitability immediately and over time?*
2. *To what extent does compliance with the NSFR regulatory constraint influence banks' lending activity?*

This paper is structured as follows: Section 2 provides a summary of the existing literature on the topic and develops the research hypothesis. In Section 3, we outline the data and methodology used in the research. Section 4 presents the empirical findings along with various robustness checks. Finally, Section 5 offers conclusions and further recommendations.

2 | Literature Review and Hypothesis Development

The broad topic of bank liquidity management has been widely discussed in the prior and relevant literature (e.g., Berger and Bouwman 2009; Cornett et al. 2011; DeYoung and Jang 2016). The study by Berger and Bouwman (2009) highlighted a lack of comprehensive measures for liquidity creation, which obstructs the understanding of how banks' liquidity creation functions impact the economy. Cornett et al. (2011) examined liquidity risk management and credit supply during the 2007–2009 financial crisis, finding that banks' actions to manage the liquidity crisis led to a decrease in credit supply. The research by DeYoung and Jang (2016) examines how banks may react to a liquidity standard similar to the *NSFR*. It specifically examines how US commercial banks managed their loans-to-core deposits ratios from 1992 to 2012. The authors conclude that analyzing bank liquidity management based on the pre-Basel III capital rules may not effectively predict banks' liquidity behaviours under the stricter capital requirements established by Basel III.

A part of the literature focused on the relationship between bank liquidity, systemic risk, and financial stability. Husodo et al. (2024) find that the LCR significantly reduces bank systemic risk, while the *NSFR* is not statistically significant. However, Ly et al. (2017) show that banks typically adopt an immediate trading equilibrium in response to the Basel III reform on the *NSFR*, thus reducing systemic risk. On the same wave, Li et al. (2025) demonstrate that banks' higher *NSFR* target levels enhance their stability, reducing systemic risk. Furthermore, Ashraf et al. (2016) argue that the *NSFR* (modified to consider the Islamic banking industry's unique aspects) positively impacts the financial stability of Islamic banks.

Other authors show that bank liquidity conditions can impact the likelihood of default. Bologna (2015) highlights how structural funding positions significantly explain the probability of bank defaults. Similarly, Grundke and Kühn (2020) demonstrate that the introduction of LCR and *NSFR* helps reduce default risk. However, Hong et al. (2014) find that both the *NSFR* and the LCR have limited effects on bank failures.

Another area of research examines the relationship between liquidity requirements and bank lending. Banerjee and Mio (2018) demonstrate that tighter liquidity regulation in the UK has not led banks to reduce the amount of lending to the nonfinancial sector. Similarly, Papadamou et al. (2021a), using data from the EU banking sector, demonstrate that low *NSFR* banks reduce loan supply in response to higher interest rates and suggest that compliance with the Basel III liquidity requirements is likely to have a positive impact on policies aimed at increasing bank lending. Other authors focus on African banks. Adesina (2019) finds that both the *NSFR* and the LCR have a significantly positive effect on African bank loan growth rates. However, Mutarindwa et al. (2020) demonstrate that African banks that comply with the *NSFR* threshold lend less than their peers. The study of Roberts et al. (2023), instead, analyzes the US banking system and focuses on the LCR. The authors find that LCR banks tighten lending standards.

On the basis of the above literature, we formulate the following hypothesis.

Hypothesis 1. *The liquidity requirements expressed by the* NSFR *are positively associated with EU bank lending.*

Furthermore, a strand of literature has explored the association between bank liquidity and performance, as expressed by profitability. King (2013) considers the *NSFR* for banks in 15 countries. The author demonstrates a reduction in net interest margins of 70–88 basis points on average, or approximately 40% of their year-end 2009 values, suggesting that banks below the ratio need to increase stable sources of funding and reduce assets that require funding. More recently, Pak (2020) utilizes annual data from banks headquartered in the three founding states of the Eurasian Economic Union (Russia, Kazakhstan, and Belarus) for the period 2008–2017 and finds that compliance with the minimum level of the *NSFR* significantly reduces the net interest margin. The author suggests that banks could be engaged in noninterest-generating activities to support profitability. However, a large part of this literature highlights the existence of a statistically significant and positive relationship between liquidity and bank profitability. Concerning the US banking sector, Le et al. (2020) show that a moderate increase in liquidity reduces bank profit inefficiency (i.e., improves efficiency), but excessive liquidity expansion may increase inefficiency. Nguyen and Nguyen (2022) analyze the effects of different measures of liquidity on interest margins of a sample of US commercial banks from 2001 to 2018 and demonstrate that the *NSFR* and LCR exercise a positive influence on bank margins, stressing the costs associated with complying with regulatory liquidity standards in the sense that increased costs associated with strict liquidity requirements are likely to be passed on to banks' customers in the form of higher interest margins. Similarly, Veeramoothoo and Hammoudeh (2022) analyzed data from US commercial banks from the first quarter of 2010 through the third quarter of 2017. They find a positive and significant relationship between the LCR, the *NSFR*, and profitability. Focusing on company size, the authors demonstrate that small banks are more vulnerable to LCR. In contrast, big banks are more susceptible to *NSFR*, suggesting that liquidity requirements should be tailored based on bank size and relative bank profitability.

Additionally, other authors have focused on European banks. Dietrich et al. (2014) analyze a sample of 921 Western European banks between 1996 and 2010 and demonstrate that lower *NSFR* negatively influences profitability measures such as the return on assets (*ROAA*), the return on equity (*ROAE*), and the net interest margin, even though the funding costs for banks with a lower *NSFR* are significantly lower. More recently, Grundke and Kühn (2020) investigated different types of German banks and analyzed the impact of the Basel III liquidity ratios, finding that the introduction of LCR and *NSFR* has no unambiguous impact on banks' equity returns and balance sheet growth. Papadamou et al. (2021b) focus on *NSFR*, utilizing a unique data set that includes all EU banks from 2000 to 2014. They find that the *NSFR* improves banks' performance and, more importantly, promotes the stability of the banking sector. To calculate banks' performance, the authors used the *ROAA*, the risk-adjusted *ROAA*, and the return on risk-adjusted capital.

On the basis of the above literature, we formulate the following hypothesis:

Hypothesis 2. *The liquidity requirements expressed by the* NSFR *are positively associated with EU bank profitability.*

3 | Data and Methodology

This section presents the sample of EU banks included in our analysis and the methodological strategy employed to identify the relationship between *NSFR* trends and banks' profitability and lending activity.

3.1 | Sample Selection

Our empirical analysis considers 187 banks headquartered in the European Union (see Table A1 for details on the sample selected). The data set comprises an unbalanced panel of yearly observations from 2019 to 2023, sourced from the Moody's Analytics BankFocus and Eurostat databases. The research focuses on EU banks, considering that Basel III standards are part of the EU Capital Regulatory framework. The analysis starts in 2019, when the *NSFR* requirement became mandatory for EU banks following the implementation of the CRR2 Regulation. Our study extends until 2023, encompassing the latest available data.

3.2 | Variables

Our methodological framework explores whether the *NSFR* is a key determinant of banks' profitability while defining the regulatory formula and its impact on lending activity. Thus, according to the liquidity formula, the main independent variable used in the model specification is the *NSFR*, directly disclosed by the banks in the Basel Pillar III requirements. The regulatory formula defines

$$NSFR = \frac{Available\ amount\ of\ stable\ funding\ (AFS)}{Required\ amount\ of\ stable\ funding\ (RFS)} \times 100 \geq 100,$$

where *AFS* refers to the portion of capital and liabilities that are expected to remain stable over a 1-year time horizon, and the *RFS* is a function of the liquidity characteristics and remaining maturities of the various assets held by the bank, as well as those of its off-balance sheet exposures. According to the regulatory requirements, the value of the *AFS* on the *RFS* is multiplied by 100. The value of the *NSFR* should be equal to or greater than 100 on an ongoing basis to be compliant with the Regulatory framework. Considering our main explanatory variables, we first include the *ROAE* and the *ROAA*, as these are the most commonly used ratios for a bank's or firm's profitability. They measure the net income as a percentage of average total equity and as a percentage of average total assets, respectively. The ratios are expressed as a percentage. Then, to explore the lending activity, we consider the commonly used *Annual growth of Net Loans* (*ΔLoans*) in percentage year-to-year. Moreover, to deepen our understanding, we also consider the *Impaired Loans Ratio* (*ILR*) as a proxy for the credit risk of a loan's portfolio. Considering our research hypotheses, we investigate the acceptance or rejection of the null hypothesis concerning the inexistence of the relationship between the *NSFR* and the explanatory variables, since our hypotheses are consistent with the idea that *good long-term liquidity management contributes to increasing bank profitability in the long run through lending activity*.

Indeed, more stable long-term funding could directly support lending activity/expansion in terms of its magnitude (loan growth) and asset quality (*ILR*), with a lower risk of loan defaults.

We control for differences in the bank size by taking the natural logarithm of total assets (*Size*) at the end of the year and the Total Capital Ratio (*TCR*), in percentage, as reported according to the Basel requirements that are largely used in the research (Li et al. 2025; Mutarindwa et al. 2020) because it measures a bank's capital adequacy by comparing its eligible capital (Tier 1 + Tier 2) to total risk-weighted assets (*RWA*) exposures, which include credit risk, operational risk, and market risk. As is known, *Credit Risk RWAs* are by far the largest component of *RWA* for most banks, as their main business is lending activity. Credit risk typically constitutes 60%–80% of total *RWA* in banks' *TCR*, making it the dominant component, although this percentage varies depending on a bank's business focus (e.g., retail lending vs. investment banking). Then, to control the level of coverage of the portfolio expected credit risk, we take the ratio of Loan Loss Reserves to Gross Loans. The *Loan-to-Deposit* (*LtD*) ratio and the *Leverage* ratio are added to control the bank's liquidity risk and debt level. We also use the bank's funding cost because it is a consequence of the long-term funding formula adopted by banks, and therefore, of the *NSFR* value. This is a critical factor influencing a bank's profitability. The difference between the funding cost and the interest rate charged on loans (known as the net interest income) is a major source of profit for banks. Funding costs in a bank refer to the expenses financial institutions incur to acquire funds for lending or other business activities. This cost is typically expressed as the interest rate paid on borrowed funds, such as deposits, interbank loans, or capital market issuances. Our methodological framework is a proxy for the bank's long-term funding cost, obtained by taking the natural logarithm of the ratio of *Total Interest Expenses* to *Wholesale funding*. Finally, the annual rate of inflation, measured as the percentage change in the consumer price index (*INF_rate*), is used as a macroeconomic and country-level control.

3.3 | Empirical Model

To investigate our main hypothesis concerning the extent to which the *NSFR* influences the profitability and the lending activities of banks, we set our empirical strategy first running a high-dimensional fixed-effect Ordinary Least Squares (OLS) regression (Bonfim and Soares 2018; Hou and Lu 2024; P. Wang and Yang 2024) and then controlling the endogeneity, simultaneity, and reverse causality between the dependent variables and the independent variables, running a high-dimensional fixed-effect instrumental variable (IV) two-stage least square (2SLS) (Bednarek et al. 2021; Dinger et al. 2022; Polidoro et al. 2022). This combined approach, which utilizes two different methods for model estimation, is widely employed in the finance literature and provides robustness to the methodology, leveraging the strengths and potential of both (Williams 2012). For the OLS regression, we employ the following empirical model, adopting the algorithm proposed by Correia (2017):

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta_j NSFR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t},$$

where $Y_{i,t}$ denotes the dependent variable of bank i at time t, represented by two profitability measures and two explanatory variables of the bank's lending activity, along with their lagged values at time $t-1$. Notably, profitability is measured by the *ROAE* and the *ROAA*. The lending activity is measured by the bank's annual loan growth rate (*ΔLoans*) and the *ILR*, which also represents the expected credit loss on loans. Therefore, the $\beta_{i,t,t-1}$ is the coefficient of the most interesting variable for our research hypothesis: the Basel III *NSFR* reported by bank i at times t and $t-1$. $X_{i,t}^{j}$ is the vector of our bank-level controls listed in Table A2. At the same time, $\gamma_{i,t}$ and δ_t represent the unobserved time-invariant and bank-specific fixed effects, respectively, and the $\varepsilon_{i,t}$ term estimates heteroscedasticity-consistent standard errors (Stock and Watson 2008). Considering the two different model explications, it is possible to define the following equations:

$$ROAE_{i,t} = \alpha ROAE_{i,t-1} + \beta_j NSFR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t}, \quad (1)$$

$$ROAA_{i,t} = \alpha ROAA_{i,t-1} + \beta_j NSFR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t}, \quad (2)$$

$$Loans_{i,t} = \alpha Loans_{i,t-1} + \beta_j NSFR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t}, \quad (3)$$

$$ILR_{i,t} = \alpha ILR_{i,t-1} + \beta_j NSFR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t}. \tag{4}$$

Therefore, for the 2SLS model, we still operate the Correia (2018) estimator. In the first stage, we predict $NSFR_{i,t,t-1}$ using its progressively expanding moving average from t to $t+4$ as an instrument and the remaining second-stage variables:

$$NSFR_{i,t,t-1} = \alpha Y_{i,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \lambda_j (instrument) + \gamma_{i,t} + \delta_t + \varepsilon_{i,t},$$

$$Y_{i,t} = \alpha Y_{i,t-1} + \lambda_j N\tilde{S}FR_{i,t,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{j} + \gamma_{i,t} + \delta_t + \varepsilon_{i,t}.$$

The estimators used in this strategy allow the simultaneous incorporation of multilevel fixed effects in linear regression (i.e., *bank* and *time* fixed effects). This method also extends traditional IV regression, which typically does not include absorbed fixed effects or provide additional standard errors that account for conditional heteroskedasticity of regression disturbances and serial correlation of instruments and regression disturbances (Correia 2017, 2018).

4 | Empirical Findings

4.1 | Descriptive Statistics and Univariate Analysis

This section provides summary statistics of the research variables used in the empirical analysis throughout the period (2019–2023). All variables are winsorized at the 1st and 99th percentiles to mitigate the effect of outliers. Table 1 reports descriptive statistics.

The Basel III *NSFR*, as directly disclosed by the bank, averages 144.37%, with a minimum value of 104.60% and a maximum of 270%. The value of the *NSFR* is not the result of our calculations, but is directly disclosed by banks in the Pillar III reports (using the official regulatory formula). Notably, all the observed values of *NSFR* are above the 100% regulatory threshold, indicating that EU banks are fully compliant with liquidity requirements, even though the standard deviation (29.47%) suggests a moderate level of dispersion. Therefore, considering our main explanatory variables, the average *ROAE* of 7.41% and *ROAA* of 0.59% generally reflect a moderate level of profitability among EU banks. However, high heterogeneity is observed, with *ROAE* ranging from a minimum of −12.48% to a maximum of 41.5% and *ROAA* from −0.97% to 2.35%, showing more stability. The standard deviation and the interquartile range confirm a moderate but dispersed profitability. The average annual loan growth rate (*ΔLoans*) stands at approximately 6%, with a moderate variation reflected by a standard deviation of 14.44%, spanning a range from −27.83% to 86.62%. The *ILR* averages 4.28%, but with a broad dispersion, suggesting varying credit risk across banks, despite a limited magnitude (minimum 0.04% and maximum 42.43%). Among control variables, bank size (measured by the natural logarithm of the banks' total assets) and the regulatory capital adequacy (*TCR*) also exhibit considerable variation across the sample. The average amount (21.78%) of *TCR* confirms that the EU banks are strongly capitalized, with a good resilience perspective. The *LtD* ratio, which captures funding structure risk, averages 88.69%, but with considerable variability (45.55%), ranging from 13.91% to 241.20%. The leverage ratio (*leverage*) has a mean of 13.60% (5.59%), with values ranging from 0.31% to 36.73%, reflecting varying levels of exposure and capital strength.

The level of Loan Loss Reserves over Gross Loans (*LLR_GLoans*), used as a proxy for credit quality and the level of coverage, has a mean of 2.43%, but with substantial dispersion (2.81%; with a range of 0%–17.46%), broadly in line with the *ILR*. *Funding Cost* averages 0.93%, ranging from 0% to 4.94%, with a relatively tight interquartile range (0.27%–1.18%), indicating generally low but heterogeneous funding conditions. Finally, the Inflation rate (INF rate) in each bank's country of operation averages 3.82%, with a standard deviation of 3.54% and a wide range from −1.30% to 19.40%, capturing the diversity of macroeconomic environments across the sample. Table 2 provides the pairwise correlations among variables, showing expected significant positive correlations between profitability indicators (*ROAE* and *ROAA*) and negative correlations between profitability measures and *ILR*. Interestingly, the *NSFR* has a positive correlation with profitability and a negative

TABLE 1 | Summary statistics.

Variables	*N*	Mean	Minimum	Maximum	Median	p25	p75	Std. Dev.
ROAE	935	7.412	−12.476	41.5	6.369	3.4	10.019	7.789
ROAA	932	0.588	−0.973	2.347	0.497	0.25	0.867	0.577
ΔLoans	932	6.017	−27.827	83.621	4.479	−0.124	9.304	14.437
ILR	882	4.278	0.043	42.248	2.699	1.613	4.477	6.025
NSFR	935	144.365	104.600	270	138	125	156.6	29.466
Size	935	23.528	20.945	27.37	23.423	22.229	24.744	1.602
TCR	923	21.783	11.900	97.6	19.3	16.73	22.4	10.983
LtD	934	88.691	13.914	241.202	79.032	64.714	93.947	45.548
Leverage	935	13.596	3.010	36.734	12.644	9.745	16.54	5.857
LLR_GLoans	935	2.433	0.000	17.463	1.768	0.634	3.047	2.811
Funding Cost	932	0.928	0.030	4.939	0.592	0.27	1.178	0.975
INF_rate	935	3.815	−1.300	19.4	2.8	1.1	5.9	3.536

TABLE 2 | Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) *ROAE*	1.000											
(2) *ROAA*	0.843*	1.000										
(3) Δ*Loans*	0.137*	0.086*	1.000									
(4) *ILR*	−0.137*	−0.128*	−0.005	1.000								
(5) *NSFR*	0.135*	0.119*	0.035	−0.017	1.000							
(6) *Size*	−0.059	−0.153*	−0.099*	−0.229*	−0.170*	1.000						
(7) *TCR*	−0.043	−0.006	−0.073*	−0.196*	0.173*	0.092*	1.000					
(8) *LtD*	−0.084*	−0.060	−0.063	−0.186*	−0.401*	0.201*	0.320*	1.000				
(9) *Leverage*	0.001	−0.277*	0.131*	−0.091*	−0.071*	0.285*	0.214*	0.330*	1.000			
(10) *LLR_GLoans*	−0.090*	−0.026	−0.017	0.883*	0.068*	−0.232*	−0.173*	−0.235*	−0.231*	1.000		
(11) *Funding Cost*	0.047	0.047	−0.097*	−0.032	−0.131*	0.198*	0.168*	0.248*	0.024	−0.066*	1.000	
(12) *INF_rate*	0.234*	0.197*	−0.085*	−0.111*	0.077*	0.018	0.005	−0.006	−0.028	−0.081*	0.253*	1.000

Note: This table reports the correlation matrix for the dependent, explanatory, and bank-level control variables employed in the panel regressions. Variable descriptions are available in Table A2.
***Statistically significant at the 1% level, **statistically significant at the 5% level, and * statistically significant at the 10% level.

correlation with funding costs, which supports the hypothesis that stable funding enhances economic outcomes. The high correlation (0.883) between *ILR* and loan loss reserves (*LLR_GLoans*) highlights that provisions closely track asset quality deterioration.

In addition to the correlation coefficients presented in Table 2, which are used to assess multicollinearity, we also examine the tolerance and variance inflation factors shown in Table 3. Reviewing both Tables 2 and 3, it becomes clear that our preliminary analyses eliminate the possibility of a multicollinearity issue.

These univariate results provide initial evidence supporting our hypotheses, indicating significant relationships among liquidity regulation, bank profitability, and lending activities, which will be further examined in multivariate regressions.

TABLE 3 | Diagnostics of multicollinearity.

Variable	VIF	Tolerance
NSFR	1.40	0.72
Size	1.19	0.84
TCR	1.31	0.76
LtD	1.63	0.61
Leverage	1.23	0.81
LLR_GLoans	1.14	0.88
Funding Cost	1.21	0.83
INF_rate	1.10	0.91
Mean VIF	1.27	

Note: This table reports variance inflation factors (VIF) and tolerance tests of multicollinearity for the explanatory variables and bank-level controls. The values of VIF in the table are less than 10, and the values of Tolerance in the table are also greater than 0, signifying no multicollinearity.

4.2 | Baseline Results and Robustness

We present baseline results from estimates of Equations (1)–(4) in Table 4. In Panel A, we present the results of the high-dimensional fixed-effects OLS model, using our main dependent variables: *ROAE*, *ROAA*, Δ*Loans*, and *ILR*. We control for bank and time-fixed effects to account for unobserved time-invariant and bank-specific characteristics simultaneously. In Panel B, we further control the impact of the leading independent variable lagged by one period.

With these estimations, we focus on the magnitude, sign, and significance of the *NSFR* coefficients to confirm or reject our hypothesis related to the extent to which *NSFR* influences banks' profitability, by the way of the lending activity, such as the core activity of banks, while controlling for bank-specific and country-level variables, including macroeconomic conditions and bank and time unobserved fixed effects.

First, the results of the first estimation in Panel A show a positive and significant relationship between the $NSFR_{i,t}$ and the equity profitability (at 5% level), while a positive but marginally significant (at 10% level) relationship with the asset profitability. Thus, the effect of the funding structure on the banks' profitability is not statistically strong if we consider the *ROAA*, probably due to the difference in the ratios' construction and/or the potential endogeneity of the explanatory variable. These preliminary results are consistent with the previous literature, which did not find a clear causality between the level of funding and the banks' profitability (Dietrich et al. 2014; King 2013; X. Wang 2023; Wei et al. 2017) and in contrast with Pak (2020) and Mergaerts and Vander Vennet (2016) showing there is no significant effect of the funding structure on the *ROAA*.

Regarding the lending activity, in the Panel A estimations, there is no significant relationship between the bank's $NSFR_{i,t}$ and credit intermediation, as represented by the annual loan growth rate, meaning that we cannot conclude that funding stability directly affects lending expansion. This supports our hypothesis

TABLE 4 | Ordinary least squares estimations of the *NSFR* on the banks' profitability and lending activity.

	Panel A				Panel B			
Variables	**(1) *ROAE***	**(2) *ROAA***	**(3) *Lending***	**(4) *ILR***	**(5) *ROAE***	**(6) *ROAA***	**(7) *Lending***	**(8) *ILR***
$ROAE_{i,t-1}$	−0.127				−0.127			
	(0.092)				(0.092)			
$ROAA_{i,t-1}$		−0.107				−0.108		
		(0.084)				(0.083)		
$\Delta Loans_{i,t-1}$			−0.160**				−0.170***	
			(0.065)				(0.064)	
$ILR_{i,t-1}$				0.163***				0.156***
				(0.037)				(0.003)
$NSFR_{i,t}$	0.034**	0.002*	0.071	−0.012***				
	(0.015)	(0.001)	(0.046)	(0.004)				
$NSFR_{i,t-1}$					0.032**	0.003***	0.086*	−0.008***
					(0.014)	(0.001)	(0.046)	(0.003)
$Size_{i,t}$	6.102***	0.409**	7.739	0.927	6.871***	0.469**	9.585	0.666
	(2.193)	(0.201)	(10.755)	(0.699)	(2.311)	(0.201)	(10.597)	(0.676)
$TCR_{i,t}$	−0.014	0.012	−0.712***	−0.025	0.014	0.013*	−0.665***	−0.044*
	(0.088)	(0.007)	(0.245)	(0.024)	(0.088)	(0.008)	(0.240)	(0.023)
$LtD_{i,t}$	−0.025	−0.001	0.157**	−0.002	−0.027	−0.001	0.156**	−0.001
	(0.017)	(0.001)	(0.079)	(0.005)	(0.018)	(0.002)	(0.076)	(0.006)
$Leverage_{i,t}$	−0.696***	−0.039***	0.279	−0.040	−0.709***	−0.041***	0.246	−0.041
	(0.263)	(0.014)	(0.451)	(0.025)	(0.265)	(0.014)	(0.459)	(0.026)
$LLR\_GLoans_{i,t}$	−1.311***	−0.098***	−1.063	1.267***	−1.372***	−0.105***	−1.228*	1.293***
	(0.374)	(0.033)	(0.741)	(0.096)	(0.373)	(0.033)	(0.708)	(0.099)
$FundingCost_{i,t}$	−0.675**	−0.067**	0.038	0.307***	−0.641**	−0.062**	0.151	0.305***
	(0.296)	(0.029)	(1.005)	(0.064)	(0.296)	(0.028)	(0.973)	(0.065)
INF_rate	0.149	0.015	−0.463	−0.017	0.126	0.013	−0.526*	−0.012
	(0.119)	(0.010)	(0.328)	(0.024)	(0.125)	(0.010)	(0.314)	(0.024)
Observations	738	735	738	692	735	735	735	692
Adjusted-R^2	0.746	0.666	0.746	0.983	0.669	0.489	0.492	0.983
Bank fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the estimations of the high-dimensional fixed-effects panel regression based on Equations (1)–(4), where the dependent variables are the return on equity (*ROAE*), the return on assets (*ROAA*), the annual loan growth rate (*ΔLoans*), and the impaired loans ratio (*ILR*). $NSFR_{i,t-1}$ is the one-period lag of the main explanatory variable. $ROAE_{i,t-1}$, $ROAA_{i,t-1}$, $\Delta Loans_{i,t-1}$, $ILR_{i,t-1}$ are the lags of the dependent variables. Other variable descriptions are available in Table A2. Robust standard errors are in parentheses.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

regarding the increase in loans and coverage ratio, indicating a stable rise in funding.

Therefore, there is a strong and significant negative relationship (at the 1% level) with the quality of lending, denoted by the *ILR*. This relationship highlights the importance and the need for stable funding in managing and reducing credit risk. This could be due to greater financial resilience or stricter credit standards. This perspective aligns with the broader regulatory rationale behind the *NSFR*, which aims to enhance the financial system's stability by encouraging banks to balance their assets and liabilities and to utilize more reliable, long-term funding sources for their structural assets.

Therefore, the results in Panel B present an alternative perspective when we examine the potential endogeneity of the $NSFR_{i,t}$ in relation to banks' profitability and lending measures, using a one-period lag. The results show a positive and highly significant relationship (at the 5% and 1% levels, respectively, for the two specifications in columns 5 and 6) between the $NSFR_{i,t-1}$, and the banks' profitability. Specifically, a higher *NSFR* indicates that banks maintain a stable funding structure over time, thereby mitigating the risk associated with sudden liquidity shocks and ensuring the resilience and stability of banks over a long-term horizon. The positive effect can be attributed to the fact that stable funding reduces the need for emergency liquidity measures, which lowers financing costs and may lead to improved profitability in the long run. These results support the idea that liquidity creation enhances bank profitability (Duan and Niu 2020; Papadamou et al. 2021b; Veeramoothoo and Hammoudeh 2022).

The results suggest that the relationship between *NSFR* and profitability is likely more influenced by the previous year's *NSFR* levels rather than an immediate effect. It is evident from the stronger and more significant coefficients when using a one-lag period of *NSFR*, indicating that the impact of liquidity regulation on bank profitability materializes over time rather than instantly, according to Le et al. (2020), who suggest lagged *NSFR* has a positive relationship with profit efficiency. This finding aligns with the idea that adjustments in liquidity management and funding structures take time to influence financial performance, reinforcing the importance of considering lagged effects in regulatory impact assessments. Banks with higher *NSFR* seem more cost-effective in mobilizing external funding over short periods. Therefore, banks with a higher *NSFR* are more efficient in their financial intermediation processes, as they are better at managing liquidity and maintaining a balanced composition of assets and liabilities compared to banks with a lower *NSFR* (Le et al. 2020). This also supports our hypothesis that the regulatory formula establishes the necessity for stable funding, which directly influences the bank's economic outcomes. However, our findings differ significantly from those of Dietrich et al. (2014), suggesting that the *NSFR* has no significant effect on accounting profitability, including *ROAA*, *ROAE*, and net interest margin.

Furthermore, looking at the model specification concerning the credit intermediation in Panel B (columns 7 and 8), the results highlight an improvement in the magnitude and the statistical significance of the coefficient for the lending growth (at the 10% level) and confirm the strong significance of the magnitude of the impaired loans coefficient (at 1% level). Consequently, banks with more stable funding structures in the past are more likely to increase lending activity in the present. This finding reinforces the notion that funding stability improves banks' capacity to provide credit over time. In addition, the lagged *NSFR* remains negatively and significantly associated with the ratio of impaired loans, confirming that greater funding stability contributes to a reduction in future expected credit risk (impairments) and improves asset quality, thereby decreasing the credit risk capital ratio. Overall, these findings underline the forward-looking benefits of maintaining a strong funding profile for both lending activities and risk management.

The results are consistent with those of Adesina (2019) and Papadamou et al. (2021a), who found that liquidity regulatory requirements have a significant positive impact on bank loan growth rates. Additionally, the results indicate that *NSFR* mitigates the adverse effects of poor loan portfolio performance on these growth rates.

As expected, among the control variables, in both Panels A and B, and the profitability model specifications (columns 1–2 and 5–6), we also find that the banks' profitability is positively and significantly associated with bank size. At the same time, the relationship with leverage, loan loss reserves, and the cost of funding is negative. This aspect confirms that increasing financial risk and credit provisions can diminish performance, and higher long-term funding costs reduce returns, emphasizing the necessity of effectively managing borrowing expenses for long-term funding. Considering the sign of the funding cost, it is consistent with the idea that *NSFR* requires banks to maintain stable funding, which can result in higher funding costs. Since assets and liabilities vary in their stability, banks may need to rely more on expensive funding sources, such as long-term deposits or senior unsecured debt, to comply with *NSFR* requirements. This shift can squeeze profit margins, particularly for banks with limited access to stable funding options. The interpretation of controls is quite different in columns (3)–(4) and (7)–(8). The coverage ratio (*LLR* to gross loans) is negatively associated with loan growth and strongly positively associated with impaired loans, indicating that higher credit risk provisions are linked to slower credit expansion and poorer asset quality. The *TCR* exhibits a negative and significant relationship with loan growth, possibly reflecting more conservative lending policies in macroeconomic contexts of stagnation that hinder lending activity expansion. Lastly, funding cost is positively associated with impaired loans, highlighting that more expensive funding may coincide with higher credit risk, while it has no meaningful impact on loan growth. Overall, these control variables capture important dimensions of bank behaviour and credit risk, even if their effects vary across outcomes.

The difference between the Panels A and B estimations suggests further addressing the potential risk of endogeneity and reverse causality of the $NSFR_{i,t,t-1}$ variable on banks' profitability, which should misrepresent the magnitude and the significance of the variable coefficient in the OLS estimations. According to Ashraf et al. (2016), OLS model estimation becomes inefficient and underestimates the error variance in such situations. This results in inflated t statistics, which may lead to the erroneous rejection of the null hypothesis.

In this regard, Table 5 addresses the potential endogeneity using a 2SLS estimation. The results in Panels C and D confirm the endogeneity hypothesis by showing a change in the magnitude, and sometimes in the significance, of the $NSFR_{i,t,t-1}$ coefficient, and confirming that OLS underestimated the true effect on the dependent variable, biasing the estimations.

By analyzing the estimations, we highlight the Kleibergen–Paap–Wald F statistic of the first-stage weak identification test (Kleibergen and Paap 2006; Kleibergen and Schaffer 2007). This statistic rejects the underidentification hypothesis and exceeds the Stock and Yogo (2005) critical value (16.38) for a maximum size distortion of 10%. This also ensures that the instrument is sufficiently strong. The Sanderson and Windmeijer (2016) test confirms the absence of underidentification and the use of a strong instrument within the model estimations.

The 2SLS estimations show that the explanatory variables now become strongly statistically significant in all the model explanations, increasing the magnitude of the coefficients. Specifically, when correcting for potential endogeneity, omitted variables, and reverse causality, the lending estimation in column (3) becomes statistically significant compared to the OLS, reinforcing all the

TABLE 5 | Two-stage least square estimations of the *NSFR* on the banks' profitability and lending activity.

	Panel C				Panel D			
Variables	**(1) *ROAE***	**(2) *ROAA***	**(3) *Lending***	**(4) *ILR***	**(5) *ROAE***	**(6) *ROAA***	**(7) *Lending***	**(8) *ILR***
$ROAE_{i,t-1}$	−0.128*				−0.129			
	(0.078)				(0.079)			
$ROAA_{i,t-1}$		−0.108				−0.110		
		(0.091)				(0.089)		
$\Delta Loans_{i,t}$			−0.153**				−0.176***	
			(0.065)				(0.065)	
$ILR_{i,t-1}$				0.162***				0.144***
				(0.033)				(0.035)
$NSFR_{i,t}$	0.052**	0.004***	0.177***	−0.016***				
	(0.023)	(0.002)	(0.052)	(0.005)				
$NSFR_{i,t-1}$					0.056**	0.005***	0.188***	−0.018***
					(0.026)	(0.002)	(0.054)	(0.006)
$Size_{i,t}$	5.894***	0.382**	6.537	1.003	7.177***	0.489**	10.825	0.569
	(2.037)	(0.194)	(10.972)	(0.736)	(2.304)	(0.195)	(10.540)	(0.653)
$TCR_{i,t}$	−0.034	0.009	−0.828***	−0.015	0.007	0.013*	−0.701***	−0.039*
	(0.090)	(0.007)	(0.246)	(0.025)	(0.090)	(0.008)	(0.245)	(0.023)
$LtD_{i,t}$	−0.023	−0.001	0.169*	−0.002	−0.025	−0.001	0.166**	−0.001
	(0.017)	(0.001)	(0.089)	(0.005)	(0.017)	(0.002)	(0.082)	(0.006)
$Leverage_{i,t}$	−0.704***	−0.040***	0.224	−0.037	−0.731***	−0.043***	0.164	−0.032
	(0.255)	(0.013)	(0.428)	(0.025)	(0.262)	(0.013)	(0.441)	(0.026)
$LLR\_GLoans_{i,t}$	−1.315***	−0.099***	−1.095	1.269***	−1.425***	−0.108***	−1.448*	1.333***
	(0.374)	(0.033)	(0.795)	(0.098)	(0.364)	(0.032)	(0.750)	(0.106)
$FundingCost_{i,t}$	−0.649**	−0.063**	0.196	0.299***	−0.578*	−0.057**	0.411	0.282***
	(0.289)	(0.028)	(1.010)	(0.065)	(0.295)	(0.027)	(1.071)	(0.069)
$INF\_rate_{i,t}$	0.143	0.014	−0.505	−0.016	0.100	0.011	−0.635*	−0.001
	(0.123)	(0.010)	(0.338)	(0.025)	(0.132)	(0.011)	(0.332)	(0.024)
Observations	738	735	738	692	735	735	735	692
KP	35.95***	35.87***	38.97***	34.18***	52.62***	52.59***	52.62***	47.95***
SW	282.83***	279.89***	277.41***	279.33***	146.98***	145.90***	147.37***	128.59
Bank fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the estimations of the high-dimensional fixed-effects panel regression based on Equations (1)–(4), where the dependent variables are the return on equity (*ROAE*), the return on assets (*ROAA*), the annual loan growth rate (*ΔLoans*), and the impaired loans ratio (*ILR*). $NSFR_{i,t-1}$ is the one-period lag of the main explanatory variable. $ROAE_{i,t-1}$, $ROAA_{i,t-1}$, $\Delta Loans_{i,t-1}$, $ILR_{i,t-1}$ are the lags of the dependent variables. *KP* is the chi-squared statistic of the Lagrange multiplier test for underidentification (Kleibergen and Paap 2006). *SW* is the *F* statistic of the Wald test for weak identification (Sanderson and Windmeijer 2016). Other variable descriptions are available in Table A2. Results of the first-stage regressions are not reported for brevity. Robust and heteroskedasticity–autocorrelation–consistent standard errors are in parentheses.
*$p < 0$; **$p < 0.05$; ***$p < 0.01$.

coefficients. The relationship between the *NSFR* and its one-period lag indicates that stronger and more persistent funding stability is positively associated with bank profitability. In particular, higher levels of *NSFR*, both currently and over time, are linked to significant improvements in *ROAE* and *ROAA*, suggesting that stable funding conditions translate into more efficient use of capital and resources. Moreover, when considering banks' lending dynamics, the evidence is even stronger: a more robust *NSFR* position today and in the previous period corresponds to a marked acceleration in loan growth, coupled with better asset quality. This supports the view that stable funding does not merely enhance profitability but also fosters lending expansion and healthier credit portfolios. The increase in the magnitude and significance of the coefficients suggests that the OLS results were likely due to endogeneity bias. On the other hand, we can still confirm across all specifications that the effect of *NSFR* (and its lag) on asset quality is consistently negative and statistically significant (at 1% level), indicating that higher *NSFR* leads to fewer impaired loans. The other bank-level controls persist in their effects, slightly improving the magnitude of all the coefficients.

5 | Conclusions and Further Remarks

This study examines the relationship between the banks' *NSFR* liquidity requirement and their performance in terms of profitability and lending activities, using a panel of 187 EU banks. On the basis of the Basel III requirements and the EU regulatory framework, we consider banks' financial information starting from 2019, when the *NSFR* requirement became mandatory for EU banks due to the implementation of the CRR2 Regulation.

We combined two approaches largely used in the finance literature to investigate our hypotheses concerning the extent to which the *NSFR* influences profitability and lending. Our empirical strategy involves running a high-dimensional fixed-effects OLS regression, controlling for endogeneity, simultaneity, and reverse causality between the dependent and independent variables, and then running a high-dimensional fixed-effects IV 2SLS. This approach provides robustness to the methodology by combining its strengths and potential.

Our findings provide robust empirical evidence that higher levels of *NSFR* are positively associated with bank profitability (particularly *ROAE*) and contribute to improved asset quality by reducing the impaired loan ratio. The effects become more pronounced and statistically significant when the *NSFR* is considered with a one-period lag, rather than having an immediate impact. This suggests that the benefits of a stable funding structure tend to emerge over time. It indicates that the liquidity structural ratio influences economic performance with a delay, as banks gradually adjust their balance sheets and calibrate the relation between assets and liabilities.

In contrast, the immediate effect of *NSFR* on loan growth appears to be limited under OLS estimation, but becomes significant and economically meaningful once potential endogeneity is addressed. The 2SLS results reveal that a one percentage point increase in *NSFR* (both current and lagged) is associated with a sizable increase in loan growth, suggesting that stable funding enhances banks' ability to expand credit supply. Moreover, consistent negative effects on impaired loans across specifications confirm that stronger funding profiles contribute to better credit risk mitigation and asset quality. It could be due to their greater financial resilience or stricter credit standards among well-funded banks.

These findings align with the broader regulatory rationale behind the *NSFR*, which aims to improve the financial system's stability by encouraging banks to maintain a balance between assets and liabilities and use more reliable, long-term funding sources for their structural assets.

Moreover, these results underline the dual role of the *NSFR*. While designed as a prudential regulatory tool, it also indirectly promotes profitability and credit stability by incentivizing longer-term funding strategies. Notably, the findings highlight the relevance of considering lagged effects in regulatory impact assessments, as liquidity adjustments do not translate into immediate performance outcomes.

In conclusion, this study confirms that the *NSFR* regulatory constraint, interpreted as a structural financial formula, affects both the profitability and the magnitude of banks' lending activity. These findings have significant policy implications: when well-calibrated, liquidity regulation can support the banking sector's resilience without compromising its lending function. From this perspective, the bank's liquidity risk management process can consider these results as a key driver to redefine the interaction between short-term and long-term liquidity profiles and other banks' functions/activities.

Our research is not without limitations. We analyze a sample of EU banks, considering that the *NSFR* requirement is mandatory for EU credit institutions. Moreover, our analysis includes a limited period that ranges from 2019 to 2023, as the *NSFR* requirement follows the implementation of the CRR2 Regulation.

Future studies, utilizing newer and more abundant data, can build upon and validate our findings, paving the way for additional empirical research on the relationship between long-term liquidity regulatory constraints, profitability, and lending activities in the banking sector. In addition, future research may explore the interaction between the *NSFR* and other regulatory tools/requirements (e.g., LCR, capital buffers) and/or another internal liquidity ratio (such as the cash capital position or structural liquidity ratio), as well as cross-country implementation and impact heterogeneity.

Author Contributions

Paolo Agnese: conceptualization, investigation, methodology, supervision, writing – original draft and review. **Andrea Delle Foglie:** conceptualization, data curation, investigation, methodology, software, writing – original draft and review. **Pasqualina Porretta:** conceptualization, investigation, writing – original draft and review. **Fabrizio Santoboni:** supervision, funding.

Acknowledgements

Open access publishing facilitated by Universita degli Studi di Roma La Sapienza, as part of the Wiley - CRUI-CARE agreement.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data that support the findings of this study are available from Moody's Analytics BankFocus, and the Eurostat database.

References

Adesina, K. S. 2019. "Basel III Liquidity Rules: The Implications for Bank Lending Growth in Africa." *Economic Systems* 43, no. 2: 100688.

Ashraf, D., M. S. Rizwan, and B. L'Huillier. 2016. "A Net Stable Funding Ratio for Islamic Banks and Its Impact on Financial Stability: An International Investigation." *Journal of Financial Stability* 25: 47–57.

Banerjee, R. N., and H. Mio. 2018. "The Impact of Liquidity Regulation on Banks." *Journal of Financial Intermediation* 35, no. part B: 30–44.

Basel Committee on Banking Supervision (BCBS). 2013. *Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring*. Bank for International Settlements, January 2013.

Basel Committee on Banking Supervision (BCBS). 2014. *Basel III: The Net Stable Funding Ratio*. Bank for International Settlements, October 2014.

Bednarek, P., V. Dinger, D. M. te Kaat, and N. von Westernhagen. 2021. "To Whom Do Banks Channel Central Bank Funds?" *Journal of Banking & Finance* 128: 106082.

Berger, A. N., and C. H. S. Bouwman. 2009. "Bank Liquidity Creation." *Review of Financial Studies* 22, no. 9: 3779–3837.

Bologna, P. 2015. "Structural Funding and Bank Failures. Does Basel 3 Net Stable Funding Ratio Target the Right Problem?" *Journal of Financial Services Research* 47: 81–113.

Bonfim, D., and C. Soares. 2018. "The Risk-Taking Channel of Monetary Policy: Exploring All Avenues." *Journal of Money, Credit and Banking* 50, no. 7: 1507–1541.

Capital Requirements Regulation (CRR). 2013. "Regulation (EU) No. 575/2013 of the European Parliament and of the Council of 26 June 2013 on Prudential Requirements for Credit Institutions and Investment Firms and Amending Regulation (EU) No. 648/2012." Official Journal of the European Union.

Chen, I. J., Y. Y. Lee, and Y. C. Liu. 2020. "Bank Liquidity, Macroeconomic Risk, and Bank Risk: Evidence From the Financial Services Modernization Act." *European Financial Management* 26: 143–175.

Cornett, M. M., J. J. McNutt, P. E. Strahan, and H. Tehranian. 2011. "Liquidity Risk Management and Credit Supply in the Financial Crisis." *Journal of Financial Economics* 101, no. 2: 297–312.

Correia, S. 2017. *REGHDFE: Stata Module for Linear and Instrumental-Variable/GMM Regression Absorbing Multiple Levels of Fixed Effects. Statistical Software Components S457874*. Boston College, Department of Economics.

Correia, S. 2018. *IVREGHDFE: Stata Module for Extended Instrumental Variable Regressions With Multiple Levels of Fixed Effects. Statistical Software Components S458530*. Boston College, Department of Economics.

DeYoung, R., and K. Y. Jang. 2016. "Do Banks Actively Manage Their Liquidity?" *Journal of Banking & Finance* 66: 143–161.

Dietrich, A., K. Hess, and G. Wanzenried. 2014. "The Good and Bad News About the New Liquidity Rules of Basel III in Western European Countries." *Journal of Banking & Finance* 44: 13–25.

Dinger, V., L. Erman, and D. M. te Kaat. 2022. "Bank Bailouts and Economic Growth: Evidence From Cross-Country, Cross-Industry Data." *Journal of Financial Stability* 60: 100984.

Duan, Y., and J. Niu. 2020. "Liquidity Creation and Bank Profitability." *North American Journal of Economics and Finance* 54: 101250.

Grundke, P., and A. Kühn. 2020. "The Impact of the Basel III Liquidity Ratios on Banks: Evidence From a Simulation Study." *Quarterly Review of Economics and Finance* 75: 167–190.

Hong, H., J. Z. Huang, and D. Wu. 2014. "The Information Content of Basel III Liquidity Risk Measures." *Journal of Financial Stability* 15: 91–111.

Hou, X., and X. Lu. 2024. "Debtholder Responses to Controlling Shareholders' Share Pledging." *Quarterly Review of Economics and Finance* 98: 101928.

Hoxha, I. 2013. "The Market Structure of the Banking Sector and the Financially Dependent Manufacturing Sectors." *International Review of Economics & Finance* 27: 432–444.

Husodo, Z. A., A. F. Raz, and D. N. Danarsari. 2024. "The Bind and the Slack of Basel III Liquidity Regulations: Evidence From Indonesia." *Journal of International Financial Markets, Institutions and Money* 96: 102046.

King, M. R. 2013. "The Basel III Net Stable Funding Ratio and Bank Net Interest Margins." *Journal of Banking & Finance* 37, no. 11: 4144–4156.

Kleibergen, F., and R. Paap. 2006. "Generalized Reduced Rank Tests Using the Singular Value Decomposition." *Journal of Econometrics* 133, no. 1: 97–126.

Kleibergen, F., and M. Schaffer. 2007. *Ranktest: Stata Module to Test the Rank of a Matrix Using the Kleibergen–Paap rk Statistic*. Boston College Department of Economics, Statistical Software Components S456865.

Le, M., V. N. Hoang, C. Wilson, and S. Managi. 2020. "Net Stable Funding Ratio and Profit Efficiency of Commercial Banks in the US." *Economic Analysis and Policy* 67: 55–66.

Li, M., K. Li, Y. Huang, and Z. Cao. 2025. "Commercial Bank NSFR Adjustment and Risk: Evidence From China." *Research in International Business and Finance* 73, no. part A: 102559.

Ly, K. C., Z. Chen, S. Wang, and Y. Jiang. 2017. "The Basel III Net Stable Funding Ratio Adjustment Speed and Systemic Risk." *Research in International Business and Finance* 39, no. part A: 169–182.

Mergaerts, F., and R. Vander Vennet. 2016. "Business Models and Bank Performance: A Long-Term Perspective." *Journal of Financial Stability* 22: 57–75.

Mutarindwa, S., D. Schäfer, and A. Stephan. 2020. "The Impact of Liquidity and Capital Requirements on Lending and Stability of African Banks." *Journal of International Financial Markets, Institutions and Money* 67: 101201.

Nguyen, T. V. H., and T. V. H. Nguyen. 2022. "How Do Banks Price Liquidity? The Role of Market Power." *Global Finance Journal* 53: 100736.

Pak, O. 2020. "Bank Profitability in the Eurasian Economic Union: Do Funding Liquidity and Systemic Importance Matter?" *North American Journal of Economics and Finance* 54: 101265.

Papadamou, S., D. Sogiakas, V. Sogiakas, and K. Syriopoulos. 2021a. "The Role of Net Stable Funding Ratio on the Bank Lending Channel: Evidence From European Union." *Journal of Banking Regulation* 22: 287–307.

Papadamou, S., D. Sogiakas, V. Sogiakas, and K. Toudas. 2021b. "The Prudential Role of Basel III Liquidity Provisions Towards Financial Stability." *Journal of forecasting* 40: 1133–1153.

Polidoro, Jr., F., C. M. Lampert, and M. Kim. 2022. "External Knowledge Sourcing, Knowledge Spillovers, and Internal Collaboration: The Effects of Intrafirm Linkages on Firm-University Co-Authorship Linkages." *Strategic Management Journal* 43: 2742–2776.

Roberts, D. T., A. Sarkar, and O. Shachar. 2023. "Liquidity Regulations, Bank Lending and Fire-Sale Risk." *Journal of Banking & Finance* 156: 107007.

Sanderson, E., and F. Windmeijer. 2016. "A Weak Instrument F-Test in Linear IV Models With Multiple Endogenous Variables." *Journal of Econometrics* 190, no. 2: 212–221.

Stock, J. H., and M. Yogo. 2005. "Testing for Weak Instruments in Linear IV Regression." In *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, edited by D. W. K. Andrews and J. H. Stock, 80–108. Cambridge University Press.

Stock, J. H., and M. W. Watson. 2008. "Heteroskedasticity-Robust Standard Errors for Fixed Effects Panel Data Regression." *Econometrica* 76, no. 1: 155–174.

Veeramoothoo, S., and S. Hammoudeh. 2022. "Impact of Basel III Liquidity Regulations on US Bank Performance in Different Conditional Profitability Spectrums." *North American Journal of Economics and Finance* 63: 101826.

Wang, P., and X. Yang. 2024. "Social Trust and Household Financial Decision-Making: An Empirical Study Based on the Usage of Household Financial Technology." *Finance Research Letters* 70: 106294.

Wang, X. 2023. "A Macro-Financial Perspective to Analyse Maturity Mismatch and Default." *Journal of Banking & Finance* 151: 106468.

Wei, X., Y. Gong, and H. M. Wu. 2017. "The Impacts of Net Stable Funding Ratio Requirement on Banks' Choices of Debt Maturity." *Journal of Banking & Finance* 82: 229–243.

Williams, J. 2012. "Efficiency and Market Power in Latin American Banking." *Journal of Financial Stability* 8, no. 4: 263–276.

Appendix

TABLE A1 | Sample selection.

Search step	Selection criteria	Step results
Country selection	European Union (27).	11,944
Bank specialization	Only institutions from Moody's Analytics BankFocus specialization groups: Commercial bank; Savings bank; Cooperative bank; Real estate and mortgage finance institution; Specialized governmental credit institution; Bank holding company.	9740
Size/significance	The total assets exceed USD 1 billion, or the institution is among the top 10 in terms of total assets in its respective country.	2109
Basel III net stable funding ratio (*NSFR*)	All entities with a known value of *NSFR* (as reported) starting from 2019 until 2023. This step ensures obtaining a strongly balanced panel without missing observations.	260
Consolidation code	All entities that provide consolidated statements when available, and otherwise the unconsolidated ones, to avoid double-counting (Hoxha 2013).	187

TABLE A2 | Definition of variables.

Variable	Definition	Source
Dependent variables		
ROAE	Return on Average Equity (%), obtained as the net income as a percent of average total equity.	Moody's Analytics BankFocus
ROAA	Return on Average Asset (%), obtained as the net income as a percent of average assets.	Moody's Analytics BankFocus
ΔLoans	Annual growth of Net Loans (%).	Moody's Analytics BankFocus
ILR	Impaired Loans Ratio (%), as reported by the bank.	Moody's Analytics BankFocus
Key independent variable		
NSFR	Basel III Net Stable Funding Ratio (%), as reported according to the Basel requirements.	Moody's Analytics BankFocus
Bank-level control variables		
Size	The bank size is measured by the natural logarithm of the total assets.	Moody's Analytics BankFocus
TCR	Total Capital adequacy ratio (%), as reported according to the Basel requirements.	Moody's Analytics BankFocus
LtD	Loan-to-Deposits ratio (%), calculated by the gross loans amount and advances to customers over customer deposits.	Moody's Analytics BankFocus
Leverage	Liabilities to Total Shareholders' Equity (%).	Moody's Analytics BankFocus
LLR_Impaired	Loan Loss Reserves/Impaired Loans (%)	Moody's Analytics BankFocus
Funding Cost	A proxy of the bank's long-term funding cost obtained by the natural logarithm of the ratio of Total Interest Expenses over the Wholesale funding.	Moody's Analytics BankFocus
Country-level and macroeconomic control		
INF_rate	The annual rate of inflation measured as the percentage change in the consumer price index.	Eurostat database