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Net Stable Funding Ratio (NSFR) and Bank Performance: A Study of the Indian Banks

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Abstract: The present study examines the impact of the Net Stable Funding Ratio (NSFR) on the performance of Indian commercial banks from 2010 to 2021. The study further investigates how the relationship between liquidity and performance varies under the influence of bank-specific factors such as ownership structure (Promoter vs. Institutional investors). Bank performance is evaluated using a two-fold approach—Profitability measures (NIMs and ROA) and NPA levels of banks. Using the Dynamic panel data regression technique, we find that the relationship between NSFR and NIMs is negative, implying that bank NIMs tend to decline as banks comply with NSFR regulation. Furthermore, the study demonstrates that the inverse relationship between NSFR and bank NIMs becomes more profound when promoters' stakes are high. Finally, the results highlight that for banks with higher institutional holdings, NPA levels witness an upward trend as the NSFR ratio increases. From a policy perspective, study results will help policymakers understand how changes in liquidity levels impact the wider banking sector and guide them on the overall direction in which to progress with the reforms.

Keywords: NSFR; NIMs; ROA; NPAs ownership structure; dynamic panel data analysis

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1. Introduction

The financial crisis of 2007–2008 raised key questions on the health and quality of banks' assets, liquidity being one of the topmost. The acute liquidity shortage did not only lead to economic collapse but also weakened the banks' self-correction abilities and drew regulators' attention to banks' funding/liquidity risk. To address these liquidity-related risks, the Basel Committee on Banking Supervision (2010) introduced a new liquidity framework comprising two quantitative liquidity ratios, the Liquidity coverage ratio (LCR) and the Net Stable Funding Ratio (NSFR). The LCR levies stricter controls on short-term liquidity flow and regulates the liquidity risk, while the NSFR manages the funding risk by persuading banks to recourse to more stable and safe funding sources.

The literature shreds evidence that the implementation of the new long-term liquidity ratio -NSFR requires banks to re-think their financial strategies, which can subsequently impact their performance. To comply with the NSFR, banks need to restructure their balance sheet by extending the maturity of wholesale funding and holding more high-quality liquid assets (King 2013). These changes would prevent bank failures and promote the stability and resilience of the financial sector, as evidenced in several studies (Example: Diamond and Kashyap 2016; Konovalova 2016; Rochet 2008). However, the trade-off here is impaired performance in normal times. On the one hand, holding high-quality assets will lower interest income, and on the other hand, funding assets through longer maturity liabilities will increase the interest expenses, adversely impacting banks' Net Interest Margins (NIMs). As a matter of fact, the concerns raised around the adverse impact of liquidity on the operations and profitability of banks were one of the primary reasons that led to the deferred deployment of the new liquidity framework.

Despite the critical nature of the new regulation, we find that very few studies examine its impact on the performance of the banking industry. Further, whatever studies exist, we find them insufficient for the following reasons. Firstly, most studies do not consider nonlinear relationships (Le et al. 2020). Secondly, empirical evidence indicates that bank performance is influenced by several intrinsic factors that are institution-specific, such as size, asset quality, and ownership. Thus, it can be stated that any study conducted on bank performance would remain incomplete until it analyzes the role of the aforementioned elements. However, the existing studies fail to explore this dimension. Thirdly, most of the studies pertain to the pre-implementation period of NSFR.

This paper attempts to fill in the above research gaps by applying a more holistic approach to examine how the NSFR influences banks' performance in India. The study goes a step further by investigating how this relationship varies with the introduction of bank-specific factors such as ownership concentration (Promoter vs. Institutional). The Indian banking sector is of particular interest in exploring the impact of the new liquidity regulations on bank performance. The comprehensive banking de-regulation reforms introduced in 1991 have strengthened the banking industry through improved productivity and performance. Additionally, liquidity requirements such as adequate maintenance of the Cash reserve ratio and Statutory Liquidity ratio enforced by the national regulators have added a tight noose to the already existing set of regulations. However, with the advent of the new stern global regulations, it is essential to re-assess the current state.

Moreover, as evident in the existing literature, banks may adopt different strategies to comply with the new NSFR regulation, leading to varied outcomes. Therefore, studies conducted on the topic in one geography/economy might not necessarily be a good representative for others. Thus, it is imperative to understand how these regulations impact an emerging economy such as India. As scarce studies are available on the subject for Indian banks, this study will help achieve this goal by analyzing how the performance of Indian banks changes under the impact of stricter liquidity rules introduced by the BASEL III framework.

The study contributes to the existing corpus of literature in several important aspects. First, the study adds to the literature on bank performance (as studied by Staub et al. 2010; Barth et al. 2013) by providing all-inclusive evidence on the relationship between NSFR and performance for a large sample of Indian banks.

Second, the study contributes to the growing literature on BASEL III Liquidity regulation (Example, King 2013; Banerjee and Mio 2018; Pak 2020; Papadamou et al. 2021) by examining the impact of NSFR not only on the profitability measures but also on the NPA levels of banks.

Third, the paper adds to the literature on the impact of new BASEL III regulations on the banking sector of emerging economies (Example, Abdel-Baki 2012; Manlagnit 2015) by conducting the study on India, one of the world's biggest developing economies. The results of the study, coupled with those from other relevant research, will help emerging countries decide upon how global regulations can be implemented to achieve the highest standards of performance. Further, the study's framework establishes a foundation for conducting akin research in other complex economies such as India.

From a policy perspective, given the recent implementation of NSFR in the country, it is imperative to know whether it has a positive or negative effect on the performance of banks. This study will help policymakers understand how changes in liquidity levels impact the wider banking sector and guide them on the overall direction in which to progress with the reforms.

The rest of the paper is structured as follows. Section 2 discusses the existing literature and formulates the hypothesis. Section 3 defines the data, the study's variables, and the research methodology. Section 4 discusses the empirical results. Lastly, Section 5 deliberates on the findings and their implications, and Section 6 provides the conclusion.

2. Literature Review and Hypothesis Formulation

2.1. NSFR and Bank Profitability

The existing literature that examines the impact of NSFR on bank performance brings forth different perspectives, which are discussed in the next section.

Dang (2021) studies the impact of NSFR on the performance of Vietnamese banks for the period of 2007–2018. The author finds that the higher NSFR levels not only have a favorable influence on the accounting ratios—Return on assets (ROA) and Return on equity (ROE) but also lead to an increase in the bank NIMs by reducing funding costs. The findings are consistent with those of Khan et al. (2015), who document an improvement in the NIMs of US commercial banks, as the fund providers favor the banks with sufficient liquidity. Additionally, Said (2014) confirms that compliance with the NSFR augments bank performance in response to the enlarged stock of stable and safe funding sources.

However, there is another strand of literature that suggests that this improvement in profitability on account of higher liquidity is not permanent. Beyond a point, as more liquidity is infused into the system, the higher cost associated with these relatively stable sources of funding start to outweigh their marginal benefits, thereby affecting the bank's performance (Le et al. 2020; Tran et al. 2016; Bordeleau and Graham 2010).

Furthering the discussion on the decline in profitability of banks due to advanced liquidity levels, Pak (2020) observes that the implementation of NSFR would lead to a decline in NIMs of the banks due to a narrower spread (loans) and maturity mismatch. The author's findings support that of Molyneux and Thornton (1992), who evidence that higher liquidity holdings (particularly those imposed by the authorities) have an adverse impact on profitability, as they represent a cost to the bank. Similarly, Muriithi and Waweru (2017), in their study conducted for Kenyan banks, find a decline in banks' profitability in response to NSFR implementation. They suggest that increased competition for stable sources of funding, such as retail deposits, capital, and debt instruments, leads to higher costs, resulting in deteriorated bank performance.

It can be summarized from the above discussion that the implementation of the new liquidity regime does affect bank profitability. To assess the impact further for Indian banks, we formulate the following hypothesis on the relationship between NSFR and the profitability of banks.

Hypothesis 1 (H1). *NSFR significantly affects the profitability of banks.*

2.2. NSFR and NPA Levels

The NSFR is designed to persuade banks to rely on a more stable and reliable source of funding and to hold high-quality liquid assets. Thus, the implementation of the new liquidity ratio is expected to have a significant bearing on the banks' Non-Performing assets.

Adesina and Mwamba (2021), while analyzing the impact of NSFR on the NPAs levels of African banks, report that banks tend to reduce their risk-taking behavior when being compliant with the long-term liquidity ratio and witness a decline in their NPAs. The results are not different from those of Paulet (2018) and Hoerova et al. (2018), who conclude that the higher liquidity requirements restrict banks' risk-taking, ensuing in a more thorough portfolio constitution. On the contrary, another set of literature suggests that the enhanced safety cushion provided by stable funding sources prompts banks to resort to riskier- lending activities leading to increased NPA levels (Distinguin et al. 2013; Schwerter 2011).

The above discussion highlights that though NSFR does impact banks' NPA levels, the direction of this relationship cannot be determined with certainty. Accordingly, we formulate the below hypothesis to test the relationship between NSFR and the NPA levels of Indian banks.

Hypothesis 2 (H2). *NSFR significantly impacts the NPA levels of banks.*

2.3. Ownership Structure and Bank Performance

Ownership structure has an important bearing on the performance of banks. Nevertheless, one of the glaring gaps identified in the existing literature related to ownership structure and performance is that most of the research focuses on issues of private vs. public (Figueira et al. 2009; Chen 1998) and domestic vs. foreign-owned (Lensink et al. 2008; Lin et al. 2016). However, we find that there is a dearth of studies that examine the different constituents of ownership (Promoters vs. Institutional investors) and their impact on bank performance. The current study would abridge this gap by studying how the different buckets of bank ownership govern the relationship between NSFR and bank performance.

There are minimal studies that evaluate the role of ownership class in altering the relationship between liquidity and performance. However, we do find evidence of how the bank's performance varies under the different ownership structures.

Barry et al. (2011) argue that banks with high promoters' stakes are risk-averse, which reduces the bank's default risk and, in the process, strengthens their resiliency. The results are consistent with the findings of Iannotta et al. (2007) for European banks. Iannotta et al. (2007) document that though the higher ownership concentration does not impact the profitability of banks, it lowers the insolvency risk of banks by encouraging them to hold a more sound asset base. However, Rastogi et al. (2021) demonstrate opposing results for India, where they find that promoters' holding does not influence banks' Non-Performing Assets (NPAs). However, it has a negative impact on the profitability of banks.

The discussion above highlights that promoter holdings impact the performance of banks in more than one way. Thus, the following hypothesis is formulated to assess promoters' stakes' influence on NSFR and bank performance.

Hypothesis 3 (H3). *Promoters' stake significantly impacts the association between NSFR and bank performance.*

Similar to studies on promoters' stakes, the evidence on the relationship between institutional investors' holdings and bank performance is also mixed. Saghi-Zedek (2016) argues that banks owned by institutional investors benefit from their additional skills and expertise and exhibit better performance. On the contrary, Barry et al. (2011) find that institutional investors tend to promote policies and strategies that are riskier in nature and can thus weaken the stability of banks. Similarly, Rastogi et al. (2021) find that banks have higher NPA levels, where institutional investors dominate the ownership structure.

Given the empirical evidence mentioned above, we find that bank performance is influenced by the level of holding that institutional investors have in banks' ownership structure and thus can impact their performance.

Hypothesis 4 (H4). *Institutional investor holdings significantly impact the relationship between NSFR and bank performance.*

3. Data and Methodology

3.1. Data and Variables

The study uses secondary data for a sample of 31 Indian banks constituting the majority share of the Indian banking sector. The banking system in India comprises 34 scheduled Indian commercial banks; due to the lack of availability of synchronized data for three banks, only 31 were finalized as the sample for reliable outcomes. The sample period of the study is from 2010 to 2021. We take the post-crisis period, 2010–2021 so that the impact of adverse economic disruption caused by the financial crisis would have a minimal effect on the data attributes considered for the study. CMIE Prowess and the official websites of respective banks are the primary sources utilized for retrieving the data.

The paper aims to analyze the impact of NSFR on the performance of banks and how this relationship varies under the influence of ownership structure. We apply a two-fold approach to assess the performance of the banks. First, we study the impact that NSFR has on banks' profitability and include two profitability measures—NIMs and ROA. Second,

we study how the NPA levels of banks change with the implementation of NSFR. The details of the variables used in this paper are provided in Table 1.

Table 1. List of variables.

SN	Variable	Type	Symbol	Definition	Citations
1	NSFR	EV	NSFR	NSFR is a liquidity ratio calculated by dividing the amount of available stable funding by the required stable funding for a one-year time horizon.	Bouzgarrou et al. (2018); Bertay et al. (2013); King (2013); García-Herrero et al. (2009)
2	NIM	DV	NIM	NIM is a performance measure calculated by deducting interest income earned from interest expenses paid.	DeYoung and Jang (2016); Mergaerts and Vennet (2016); Dietrich et al. (2014)
3	ROA	DV	ROA	ROA is a profitability measure calculated by dividing net income by assets at the end of the period.	Sujud and Hashem (2017); Al Nimer et al. (2015)
4	NPAs	DV	NPAs	NPAs refer to loans or advances for which the principal or interest payment has continued to stay overdue for a period of 90 days.	Kumari et al. (2017); Kiran and Jones (2016)
5	Promoters' ownership	MV	po	It shows the promoters' holdings in a bank.	Rastogi et al. (2021); Kanoujiya et al. (2021)
6	Institutional investors	MV	ii	It shows institutional investors' holdings in a bank.	Kanoujiya et al. (2021); Rastogi et al. (2021)
7	Assets	CV	lasset	It indicates the bank size. The higher value means a larger bank size. The natural log is taken for consistency.	Rastogi et al. (2021); Jayadev (2013)
8	Sales	CV	lsales	It shows the firm's value. The amount of sales is taken in INR. The natural log is taken for consistency.	Jayadev (2013); Dias (2013)
9	Lerner's Index	CV	Li	LI assesses the market power of the bank.	Lerner (1934); Coccorese (2014)

Note: CV, MV, EV, and DV represent the control variable, moderating variable, explanatory variable, and dependent variable, respectively.

3.2. Methodology

We apply the dynamic panel GMM technique in our study, as the interrelationship between liquidity and bank profitability poses potential endogeneity and serial correlation problems in dynamic panel models. As per Arellano and Honoré (2001), ordinary least squares (OLS), instrumental variables estimators, and panel data estimators such as least square dummy variables (LSDV) can be inadequate in addressing the problem of biased and inconsistent estimators.

Therefore, Arellano and Bond (1991) and Blundell and Bond (1998) recommend the dynamic panel GMM to conventional estimators due to the following advantages: First, the dynamic panel GMM technique corrects the possible endogeneity, heteroscedasticity and autocorrelation problems of the panel data. Second, using lagged values of the dependent variable and the exogenous variable as valid instruments to account for simultaneity eliminates the need for external instruments. Third, the GMM estimator captures potential correlations that might exist between any of the independent variables. Accordingly, we use the two-step system GMM dynamic panel estimators for our empirical estimates.

We apply the base and quadratic models to examine the existence of a linear or nonlinear association between NSFR and bank performance parameters. Additionally, the study also investigates the moderating association under ownership (Promoter vs. Institutional) using interaction models. The details of the models are as follows:

Base Models:
Model 1—$NIM_{it} = \beta_0 + \beta_1 NSFR_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 2—$ROA_{it} = \beta_0 + \beta_1 NSFR_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 3—$NPA_{it} = \beta_0 + \beta_1 NSFR_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Quadratic Models:
Model 4—$NIM_{it} = \beta_0 + \beta_1 NSFR^2_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 5—$ROA_{it} = \beta_0 + \beta_1 NSFR^2_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 6—$NPA_{it} = \beta_0 + \beta_1 NSFR^2_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Interaction Models:
Model 7—$NIM_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 po_{it} + \beta_3 i\_nsfr\_po_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 8—$ROA_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 po_{it} + \beta_3 i\_nsfr\_po_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 9—$NPA_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 po_{it} + \beta_3 i\_nsfr\_po_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 10—$NIM_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 ii_{it} + \beta_3 i\_nsfr\_ii_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 11—$ROA_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 ii_{it} + \beta_3 i\_nsfr\_ii_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$
Model 12—$NPA_{it} = \beta_0 + \beta_1 NSFR_{it} + \beta_2 ii_{it} + \beta_3 i\_nsfr\_ii_{it} + \gamma_1 lasset_{it} + \gamma_2 lsales_{it} + \gamma_3 li_{it} + u_{it}$

where NIM, ROA, and NPA are the dependent variables. NSFR is the explanatory variable. $NSFR^2$ is square_term (NSFR*NSFR) for nonlinear connection. Furthermore, the interaction terms (IT) (i_nsfr_po (nsfr*po) and i_nsfr_ii (nsfr*ii)) are also introduced to observe the interaction effect under moderating variable (MV) ownership concentration (promoter ownership (po) and institutional_investors (ii)). lassets, lsales, and li are taken as control variables for a good fit of models. Assets, sales, and li are included as control variables because they are deciding factors in evaluating banks' economic importance across segments/groups and thus can interfere with performance measurement. A detailed discussion on variables is reported in Table 1. u_{it} is error terms, and '*i*' is an entity (bank) at a time '*t*'. βj is the coefficient where β0 is constant. γ is the coefficient for control variables.

4. Empirical Results

4.1. Descriptive Statistics and Multicollinearity

Table 2 depicts the outcomes of the descriptive statistics. The mean of the NSFR ratio is around 1.4, implying that most banks comply with the new liquidity regulations. However, as the same is closer to its minimum of 0.8747669, it indicates that banks maintain just the bare minimum liquidity that would make them regulation compliant. The average scores of NIM and ROA are 2.669538 and 0.4941398, respectively; both are more inclined towards their minimum than maximum, highlighting that the overall profitability of Indian banks is on the lower side. The NPA levels of Indian banks seem to be well within the control, as represented by a lower mean score of around 3.

Table 2. Descriptive statistics.

Variables	Mean	SD	Min	Max
NSFR	1.378711	0.1419797	0.8747669	2.038707
NIM	2.669538	0.6323266	1.04	4.63
ROA	0.4941398	1.021761	−6.36	2.37
NPAs	3.188798	2.766785	0.01	16
Po	55.06828	32.19636	0	100
ii	25.97382	23.89833	0	98.6
lasset	11.98892	1.34218	8.080141	15.32721
lsales	9.059638	1.571435	3.912023	12.84691
li	−0.2152977	5.98978	−51.20252	1.875981

Note: SD is the standard deviation, and Min and Max are minimum and maximum, respectively.

Further, the mean value of po (promoters' holdings) is 55.0682 and slightly inclined towards the maximum. It shows that Indian banks have higher promoters' holdings banks on average. However, ii (institutional investors) shows a mean value of 25.97382, which is quite close to the minimum, demonstrating that institutional investors are less in bank holdings. The mean values of lasset and lsales are 11.98892 and 9.059638, respectively (both are slightly close to the maximum), demonstrating a sufficient level of bank size and sales. The average score of li is −0.2152977, implying that Indian banks operate in an environment of high competition. The lower standard deviation of all variables demonstrates that these determinants do not highly differ from one bank to another.

Correlation analysis is performed to measure the level of correlation among the study variables, and the same is presented in Table 3. The correlation between all study variables is lower than the value of 0.80. Hence, the multicollinearity issue in variables does not exist (Wooldridge 2015).

Table 3. Correlation matrix.

Variables	NSFR	NIM	ROA	NPAs	Po	ii	i_nsfr_po	i_nsfr_ii	lasset	lsales	li
NSFR	1										
NIM	−0.3419 *	1									
ROA	−0.0733 *	0.5563 *	1								
NPAs	0.1835 *	−0.5878 *	−0.6957 *	1							
Po	0.2476 *	−0.3838 *	−0.2575 *	0.2871 *	1						
ii	−0.1045 *	0.3173 *	0.1839 *	−0.2108 *	−0.7728 *	1					
i_nsfr_po	−0.0806 *	0.0060	−0.0232	−0.0218	−0.2275 *	0.0787 *	1				
i_nsfr_ii	0.1965 *	−0.0620 *	−0.0257	−0.0258	0.0624 *	−0.0755 *	−0.8227 *	1			
lasset	0.0668 *	−0.1213 *	−0.1108 *	0.2483 *	0.1569 *	−0.0555 *	0.3876 *	−0.4398 *	1		
lsales	−0.0623 *	0.0905 *	−0.0435 *	0.1266 *	−0.0083	0.0788 *	0.3785 *	−0.4343 *	0.8372 *	1	
li	−0.1568 *	−0.0433 *	−0.0409 *	0.1084 *	0.2185 *	−0.4130 *	0.3604 *	−0.4627 *	0.2877 *	0.2538 *	1

Note: * is for significance level at 0.05.

4.2. Outcome of Dynamic Panel Data Analysis (Base and Quadratic Models)

Table 4 elaborates on the results of base and quadratic models for the linear and nonlinear association resp. Models 1, 2, and 3 analyze the linear relationship between NSFR and dependent variables—NIMs, ROA, and NPAs, whereas Models 4 to 6 test for the existence of nonlinear relationships between the variables. The negative coefficient (−0.509) with the p-value < 0.05 signifies the existence of a negative relationship between the NSFR and NIMs of banks, implying that with an increase in the NSFR levels of banks, the NIMs tend to decrease and vice-versa. However, the insignificant p-values for models 2 and 3 highlight that NSFR has no impact on banks' ROA or NPA levels. Similarly, insignificant results for quadratic models 4 to 6 confirm that NSFR has no nonlinear relationship with either of the three performance parameters, i.e., NIM, ROA, and NPAs.

Table 4. Base and quadratic models results (dynamic panel data analysis).

DV	Model 1 NIM	Model 2 ROA	Model 3 NPA	Model 4 NIM	Model 5 ROA	Model 6 NPA
nsfr	−0.509 ** (0.243)	1.085 (0.778)	0.400 (2.431)	-	-	-
nsfr^2	-	-	-	0.0187 (1.201)	−2.592 (7.043)	−18.61 (14.80)
lassets	0.0165 (0.0342)	0.319 ** (0.150)	−0.556 (0.461)		0.344 * (0.181)	−0.378 (0.479)
lsales	−0.0312 (0.0250)	−0.425 *** (0.111)	0.705 ** (0.303)	−0.0310 (0.0326)	−0.447 *** (0.150)	0.548 * (0.297)
li	−0.00227 (0.0113)	0.0188 (0.0576)	0.0249 (0.112)	−0.00226 (0.0113)	0.0163 (0.0527)	0.00667 (0.124)
Constant	1.084 * (0.610)	−4.598 ** (2.330)	11.63 (7.919)	1.126 (2.984)	−10.44 (16.43)	−30.30 (34.52)
AR1	−2.33 *	−2.54 *	−2.37 *	−2.42 *	−2.90 *	−2.17
AR2	0.83	0.72	1.29	0.83	0.97	1.21
Hansen test of overid. restrictions	29.23	29.76	28.45	28.19	28.07	27.91
Difference-in-Hansen tests of Exogeneity	−0.59	−0.23	0.38	−0.06	0.72	−0.16

Note: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0$. AR1 denotes autocorrelation at the first order, and AR2 denotes autocorrelation at the second order.

Thus, the hypothesis that NSFR has a significant relationship with bank NPAs is rejected. However, the hypothesis regarding the impact of NSFR on bank profitability is partially accepted, as though NSFR has no impact on ROA, it does have a significant negative relationship with NIMs.

4.3. Outcome of Dynamic Panel Data Analysis (Interaction Models)

Table 5 presents the results for interaction models. The Interaction models (Model 7 to Model 9) examine the impact of NSFR on NIM, ROA, and NPA resp. under po (promoters' ownership). Additionally, interaction models (Model 10 to Model 12) examine the impact of NSFR on NIM, ROA, and NPA resp. under ii (institutional investors). The insignificant results for models 8 and 9 demonstrate that the promoter's stake does not impact the relationship of NSFR with the banks' ROA and NPA levels. However, the negative and significant coefficient (−0.0223) for the interaction term i_nsfr_po in Model 7 demonstrates that promoters' stake has a negative impact on the relationship between NSFR and NIMs. It implies that an increase in NSFR leads to a corresponding decline in the NIMs for banks with high promoter holdings. The interaction Figure 1 below explains how NSFR reduces banks' NIMs when promoters have a higher stake in the ownership structure and vice versa.

Table 5. Interaction model results (dynamic panel data analysis).

DV	Model 7 NIM	Model 8 ROA	Model 9 NPA	Model 10 NIM	Model 11 ROA	Model 12 NPA
nsfr	−0.498 (0.308)	1.059 (0.879)	0.380 (2.401)	−0.538** (0.266)	1.391 (0.981)	−2.529 (3.555)
i_nsfr_po	−0.0223 * (0.0124)	−0.0420 (0.0884)	−0.267 (0.179)	-	-	-
po	−0.0039 *** (0.0013)	0.0000131 (0.00729)	−0.0230 * (0.0138)	-	-	-
i_nsfr_ii	-	-	-	0.00420 (0.0190)	−0.0502 (0.0875)	0.548 ** (0.222)
ii	-	-	-	0.00217 (0.00187)	−0.0165 ** (0.0875)	0.0735 ** (0.0292)
lassets	0.116 * (0.0657)	0.396 (0.280)	0.279 (0.647)	0.0481 (0.0700)	0.0514 (0.246)	1.142 (0.765)
lsales	−0.0824 * (0.0457)	−0.464 ** (0.204)	0.277 (0.323)	−0.0539 (0.0428)	−0.248 (0.156)	−0.158 (0.368)
li	−0.00194 (0.0137)	0.0296 (0.0687)	0.0617 (0.123)	−0.00183 (0.0126)	0.0121 (0.0724)	0.113 (0.151)
Constant	0.670 (0.827)	−5.415 * (2.859)	6.550 (9.827)	0.948 (0.801)	−3.274 (2.981)	0.449 (11.32)
AR1	−2.50 *	−2.69 *	−2.08	−2.73 *	2.22 *	−2.05 *
AR2	1.17	0.94	−0.17	0.89	−0.52	−1.39
Hansen test of overid. restrictions	26.88	28.40	27.38	26.30	24.70	25.77
Difference-in-Hansen tests of Exogeneity	0.43	3.32	1.01	29.01	1.67	4.07 *

Note: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. AR1 denotes autocorrelation at the first order, and AR2 denotes autocorrelation at the second order.

For institutional investors, we observe that the results of Models 10 and 11 are insignificant, highlighting that the relationship between NSFR and profitability is not governed by the level of a bank's institutional holdings. However, significant results for Model 12 indicate that institutional investors significantly influence the relationship between NSFR and NPAs. The positive and significant coefficient (0.548) for i_nsfr_ii suggests that for banks with higher institutional investors, an increase in the NSFR ratio also leads to an increase in the bank's NPA levels. This is also explained below with the help of the interaction graph (Figure 2), it is demonstrated that NSFR has a more profound impact on the NPA levels of banks when the institutional holdings are relatively low. Individually, NPA has an insignificant relationship with NSFR, whereas ii has a positive and significant relationship with NPA, confirming that NPA levels of banks tend to increase when institutional holdings are high.
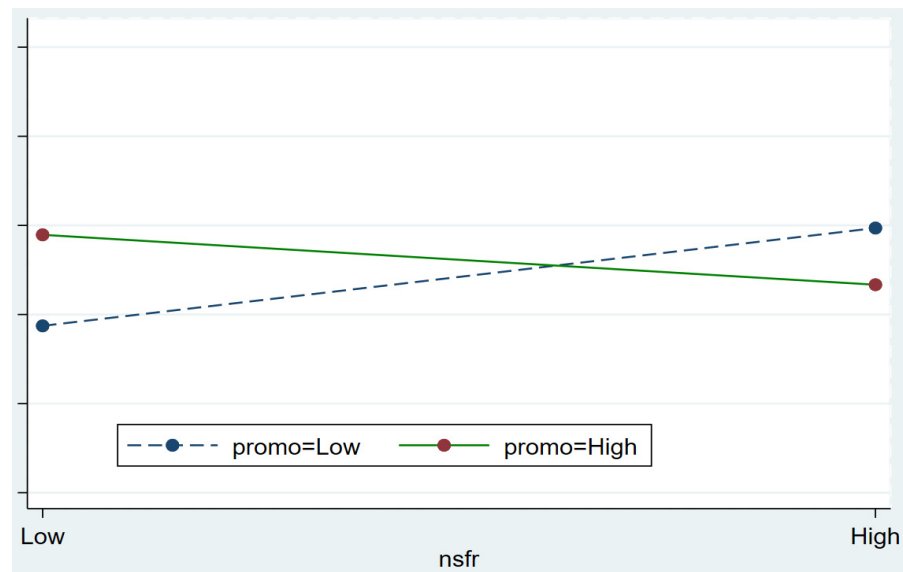
Figure 1. Impact of Promoters' stake on the relationship between NSFR and NIMs.
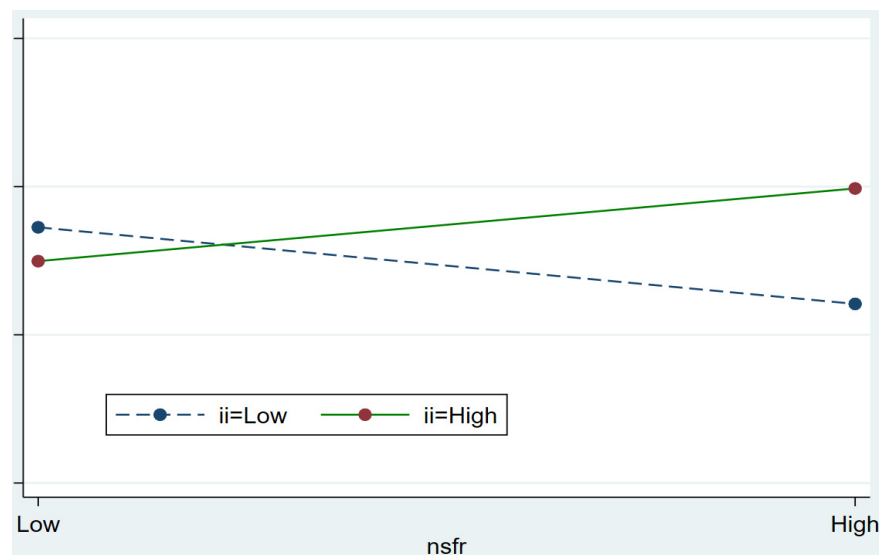

Figure 2. Impact of Institutional holdings on the relationship between NSFR and bank NPAs.

4.4. Endogeneity

The problem of endogeneity arises because of three primary reasons—measurement errors in variables, reverse causality, and omitted variables (Wooldridge 2015). The endogeneity issue is inherent to our study due to the interrelationship between liquidity creation and profitability. The same is well documented in the existing studies by Pak (2020) and Tran et al. (2016). In order to minimize the impact of endogeneity, we have applied the dynamic panel GMM technique for our empirical estimates.

5. Discussion and Implication of Results

The paper has two-fold objectives. First, to examine the impact of NSFR on the performance of banks. Second, to analyze how this relationship behaves while interacting with other bank variables such as ownership structure (Promoter vs. Institutional holdings).

The results for the first objective confirm that NSFR has no significant relationship with either ROA or NPA levels of banks. However, while analyzing the association of NSFR with NIMs, the authors document an inverse relationship between the two variables. The findings are consistent with those of Mergaerts and Vennet (2016), who, in their study

of European banks, reveal that though NSFR has no impact on the ROA, it does have an adverse effect on NIMs. We explain the negative relationship between NSFR and NIMs, below.

Compliance with the new NSFR regulation requires banks to adjust their balance sheet in a manner that helps them to increase the available amount of stable funding (AASF) and reduce the required amount of stable funding (RASF). In order to increase the AASF, banks can lengthen the maturity of their wholesale funding, expand their stable deposits, and recourse to the issuance of long-term debt and equity capital. However, longer-term liabilities, enhanced competition for stable deposits, and expensive equity capital lead to increased interest expenses and a higher weighted cost of funds, lowering the bank's profitability. Similarly, to decrease the RASF, banks would have to slim their long-term loan portfolios and re-align their investments in favor of assets that require less weight per the NSFR norms. The swap of higher-yield long-term assets with lower-yield short-term investments shrinks the bank's interest income and, consequently, its profitability. Our findings thus highlight that the economic benefits of creating more liquidity to strengthen financial stability are offset by the deteriorated bank performance.

When examining how the relationship between NSFR and bank performance varies with the ownership structure of banks, we find that the relationship of NSFR with ROA remains unstirred by both promoters and institutional holdings.

However, the findings reveal that the promoters' stake negatively influences the association between NSFR and NIMs. This implies that an increase in NSFR leads to a decline in the NIMs of banks where promoter holdings are high. Though there is a dearth of studies exploring the effect of promoters' stakes on the connection between NSFR and NIM, empirical evidence suggests that the profitability of Indian banks, in general, tends to suffer when promoters' stakes are high (Rastogi et al. 2021). This explains why the adverse impact of NSFR on bank NIMs becomes more profound when the promoter's holdings are high. Further, the study finds that institutional holdings do not affect the relationship between NSFR and NIMs.

For NPAs, we find that promoter stakes do not influence the affiliation between the NSFR and the bank's NPA levels. However, for banks with high institutional holdings, the NPA levels increase, as banks comply with the NSFR regulation. The plausible explanation for this finding is discussed below.

Banks with high institutional investors are known to assume higher risks as they try to enhance their returns (Barry et al. 2011). Therefore, the extended liquidity cushion under the new liquidity regime further incentivizes them to invest in riskier assets, thereby increasing the levels of the bank's non-performing loans.

Our results bring forth necessary implications for the current liquidity framework. The first implication regards the negative relationship between NSFR and NIMs. The persistent decline in profitability can adversely impact the banking industry's long-term stability through constrained growth in capitalization and lending. Therefore, it is essential to identify the possible reasons contributing to this negative relationship between liquidity and NIMs so that the same can be factored in while making further policy changes.

The second implication relates to the observed no relationship between NSFR and NPAs, which is an unexpected finding. The fundamental construct of the NSFR ratio promotes the holding of safer and more stable assets, which should ideally lead to a reduction in the NPA levels of banks. Thus, it would be prudent that the Indian regulators/policymakers should also cover the inside-out perspective and consider factors (investment strategies, concentration of own funds, and demographic conditions) that would influence long-term liquidity goals and reduce NPAs in the long term.

The third and last implication is for the ownership structure. The negative impact of the promoters' stake on the relationship between NSFR and NIMs is concerning and calls for further investigation. Similarly, the rise in NPA levels in response to increased NSFR for banks with high institutional holdings is rather alarming. Considering the study results, the authors propose to have a more diversified ownership structure with optimum

re-presentation of promoters and institutional investors. This would enable the banks to achieve a more balanced and positive effect of liquidity regime on bank performance by leveraging the effective risk management practices followed by promoters and the specific skill and expertise brought in by the institutional investors.

Furthermore, the authors find another study conducted by Sidhu et al. (2022) for the Indian banking industry that analyzes the impact of liquidity on the performance of banks and thus consider it worthwhile to add a discussion to compare the present paper with the same. We find that both studies attempt to understand the impact of the new liquidity regulation on banks' NIMs, ROA, and NPA levels using the dynamic model data analysis. However, it is essential to note that the studies consider different measures of liquidity; the current study aims to understand the impact of the long-term liquidity ratio—NSFR, which addresses the funding risk faced by banks, and the previous study analyses the impact of the short-term liquidity ratio—LCR, which addresses the liquidity risk of banks. Additionally, the current study goes a step further by analyzing how the association between the NSFR and performance variables varies under the influence of other bank-specific factors such as ownership structure. Moreover, the time-frame for the current study is 2010 to 2021, whereas the same is 2010 to 2019 for the previous study. The results of the two studies indicate that both LCR and NSFR have a significant negative relationship with NIMs of banks. However, for NPAs, we find that NPA levels of banks increase with a corresponding increase in the LCR, though NSFR has been found to have no impact on the NPAs. Further, the current paper also discusses the findings about the impact of ownership structure on the performance of banks, which is missing in the existing study.

6. Conclusions

The paper investigates the impact of NSFR on the performance of Indian banks from 2010 to 2021, using dynamic panel data analysis. When studying profitability, we find that though NSFR has no impact on banks' ROA, it does affect the NIMs of banks. Results demonstrate that as liquidity/NSFR increases, the NIMs of banks start declining, which is in line with the findings of King (2013) and Pak (2020). Further, NSFR has been found to have no impact on the NPA levels of banks. Additionally, when analyzing how ownership structure alters the interaction of NSFR and bank performance, the results suggest that neither the promoters' stake nor institutional holdings affect the association of NSFR with ROA. However, higher promoter holdings have been found to adversely influence the relationship between the NSFR and NIM. The increase in NSFR leads to a decline in the NIMs of banks with higher promoters' stakes. Moreover, findings suggest that an increase in NSFR leads to a rise in the NPA levels of banks when institutional holdings are high.

The statistical findings of this paper indicate that the observed impact of NSFR on Indian banks somewhere lacks in comparison with the regulation's objective of enhancing the resiliency and stability of the financial industry. Therefore, we recommend contextualizing the NSFR regulation in India, considering its specific micro and macroeconomic conditions.

The authors note that due to the intrinsic nature of the study, external market variables and the macroeconomic variables that might affect the internal liquidity constitution are not entirely explored. This is a limitation at this point in time and needs further analysis. Another limitation is that the study's time frame, 2010–2021, includes the COVID-19 period, which has been treated as under normal conditions for the analysis. As a future scope, the mix of internal factors along with market factors can be explored to assess the holistic impact of liquidity on banks' performance. Further studies would be needed to cover these key factors.

Author Contributions: All the respected authors have significantly contributed to the current paper's formulation. A.V.S. has handled the responsibility of writing the introduction, discussion, implications of the study, and the conclusion section of the paper. S.R. and R.G. have effectively handled the analysis section. A.R. and B.A. handled the literature review and the paper's formatting. All authors have read and agreed to the published version of the manuscript.

Abbreviations

BCBS	Basel Committee on Banking Supervision
NSFR	Net Stable Funding Ratio
LCR	Liquidity Coverage Ratio
NIM	Net Interest Margin
ROA	Return on Assets
NPAs	Non- Performing Assets

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