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Do Systematically Important Banks Pursue Low-Cost Deposits: Insights from a Difference-in-Differences Estimation

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Abstract

This study examines the impact of the classification of Domestic Systematically Important banks (DSIBs) and their approach to deposits. The research was conducted within the Indian context using a dataset of Indian banks from 2006 to 2022, with a pretreatment period of 2006-2015 and a post-treatment period of 2020-2022. The main hypothesis centers on the plausibility of DSIBs increasing their demand deposits to compensate for the constraints induced by the additional capital requirements imposed on them. A difference-in-differences (DID) estimation was performed to assess the impact of the change in classification on the deposit structure. The Breusch-Pagan test was used to assess heteroskedasticity, and a cluster-robust standard errors-based DID method was adopted to account for heteroskedasticity in the data. DID assessment was performed after controlling for total assets, which was used as a proxy for bank size. The parallel trends assumption was tested using a parallel trend test, and robustness was further checked using a Granger causality test. We find that the volume of demand deposits increased after the classification of these banks as being systematically important banks. We also find evidence that, on a comparable scale, the change in interbank deposits for DSIBs is much greater than the change in retail deposits from other sources.

Keywords

DSIB, Difference-in-Differences, Systematically Important, Bank, Deposit

1. Background

The economic crisis of 2007 led to the erosion of public trust in large financial institutions, which was worsened by bailouts done at the expense of the taxpay-

er. The crisis led to a reassessment of the approach towards financial institutions of systemic importance and resulted in the Basel accords that set guidelines for the identification of systematically important banks. Financial institutions that have a significant impact on the economy are considered systematically important (Bulatova & Ipatova, 2020). And banks are the main purveyors of credit and liquidity in the economy.

The Basel Committee on Banking Supervision also put in place guidelines to ensure the financial integrity of these systematically important institutions. These guidelines imposed a higher capital limit on these banks, besides subjecting them to closer scrutiny. Studies have shown that these regulatory guidelines have a beneficial impact on the resilience of Global Systematically Important Banks (GSIBs) (Acosta-Smith et al., 2020; Behn & Schramm, 2021).

The Basel Committee also developed a set of principles for national authorities to identify banks of systemic importance (BIS, 2018). In keeping with these recommendations, most central banks devised their own scoring method to identify domestic systematically important banks (DSIBs). In the Indian context, the Reserve Bank of India (RBI) had devised a systemic importance score to identify DSIBs. Based on the systemic score, the RBI initially identified ICICI Bank and State Bank of India (SBI) as DSIBs in 2015, and HDFC bank was included in the list in 2017. RBI guidelines mandate that these DSIBs maintain a higher common equity tier 1 (RBI, 2019).

Studies on GSIBs indicate that these changes affect investors' perceptions on these institutions (Lutz, 2016). Banks also adjust their balance sheets after being classified as GSIBs (Goel et al., 2019). Studies also indicate that this classification has impacted the approach of GSIBs towards corporate lending (Degryse et al., 2023). An assessment of the literature indicates that very few studies have covered the approach of these GSIBs towards the deposit function. An important study in this regard is that of (Violon et al., 2020), who found that a change in classification had an impact on the cost of deposits. In this regard, there is a lacuna in terms of studies conducted on DSIBs and their approach towards deposits. This takes on salience in the banking context, as the core function of banks is to intermediate between depositors and borrowers (Diamond & Dybvig, 1983).

Relevance of the Study

GSIBs are not only saddled with higher capital requirements but are also subject to heightened supervision. Degryse et al. (2023) find that the impact of supervision is greater than that of the additional capital that GSIBs are mandated to maintain. GSIBs respond to these constraints by reducing their balance-sheet size (Violon et al., 2020). From the perspective of stock markets, the announcement of the classification of these banks as systematically important leads to exaggerated responses from the investing community, but the market eventually tends to stabilize itself (Lutz, 2016). The focal question of

our research is how these systematically important banks tend to strategize around their deposits. To examine this, we study the changes in the volume of deposits, particularly demand deposits, before and after identifying these banks as DSIBs.

The Diamond-Dybvig model contends that a mismatch between the maturities of deposits and borrowings can cause issues if demand deposits are matched against long-term assets (Diamond & Dybvig, 1983). The essence of the idea is that the maturity profiles of the deposits are material to systemic stability; nevertheless, this aspect does not seem to have been given due importance in the literature on studies relating to systematically important banks. Of recent vintage is the study by Khan & Dewan (2014) which stresses on the importance of deposit insurance being material to the stability of the banking system. Studies conducted on banks in Sub-Saharan Africa point to the interlinkages between stability and profitability (Shani et al., 2023). Therefore, this study is relevant in this context, and we propose to study the impact of the classification on a bank's deposit structure and, in particular, the impact on demand deposits garnered by banks.

The approach adopted in this study is to use a difference-in-differences estimation to examine whether the designation has had an impact on the volume of deposits particularly demand deposits. It has been contended that the classification of banks as being systematically important has implications beyond the effects of enhanced capital requirements (Violon et al., 2020). The main research question of interest is how the designation of DSIBs tends to impact the volume of deposits of these DSIBs and this question attains relevance in the context of the Diamond-Dybvig model, which explains how bank runs are related to the level of demand deposits (Diamond & Dybvig, 1983).

An assessment of the literature shows that studies have been conducted on the lending function (Behn & Schramm, 2021; Degryse et al., 2023), but there is a clear gap in the literature when it comes to assessing the impact of the designation of banks as DSIBs on their attitudes towards deposits. Considering the criticality of this gap, we structure our study on the impact of the classification of banks of DSIBs and their approach towards deposits. The main contribution of this study is that it provides empirical evidence that the bank approach towards garnering deposits has changed after they have been classified as DSIBs. Violon et al. (2020) conducted a study on GSIBs; however, that study was primarily related to the cost of deposits. However, our study focuses on the impact of the DSIB classification on the volume of deposits and, in particular, on how banks center their strategy around low-cost deposits. The Diamond-Dybvig model indicates that there are inherent risks when banks have a larger proportion of their deposits in demand deposits (Diamond & Dybvig, 1983). Taking into account the importance of the deposit structure we seek to assess whether the identification of a bank as a DSIB has an impact on the volume of deposits. We examine the academic literature on the subject before delving into the analysis.

2. Literature Review and Formulation of Hypothesis

It is pertinent to state that prior to BASEL III, systematically important banks were treated at par with other banks, as far as regulatory controls were concerned. Slovik (2012) indicates that the regulatory requirement of capital, which is based on the proportion of risk-weighted assets, incentivizes banks to explore options outside their core functions. Regulatory guidelines demand that DSIBs maintain a higher amount of capital, which constrains banks' ability to lend. Research conducted in the context of banks under the European Banking Authority finds that banks respond to the additional capital requirement by decreasing their risk-weighted assets (Gropp et al., 2019). Investors and other stakeholders expect banks to be profitable, and profitability and risk are intricately intertwined (Martynova et al., 2020). It follows from this finding that banks must find alternative ways to stay profitable within the set of constraints imposed by the added capital requirements.

As capital requirements are structured around risk-weighted assets, it would not be prudent for a bank to take on loans with higher risks. Studies on global systematically important banks indicate that the DSIB designation leads to a reduction in bank lending, particularly to risky ventures (Degryse et al., 2023). Banks are also constrained in terms of managing their interest rates, because they are a function of competition and can only move within the bounds dictated by monetary policy. Research on the impact of regulatory capital on banks' return on equity in Gulf Cooperation Council (GCC) countries indicates that regulatory capital has a negative impact on banks' return on equity (Farooq et al., 2023).

Banks seek to enhance profitability by adjusting the maturity buckets of their deposits and loans (Ho & Saunders, 1981). Competition dynamics propel interest rates to a higher level for deposits with longer maturities, whereas interest rates on loans are generally a function of the borrower's riskiness (Merton, 1974). Since demand deposits are payable on demand, they are generally priced low, and are therefore an avenue for reducing the cost of funds and increasing net interest income. In their seminal paper on bank deposits (Diamond & Dybvig, 1983) argue that, although demand deposits are beneficial when depositors trust their banks, they can be counterproductive when depositors lose faith. This argument on the potential of demand deposits to be counterproductive is the key motivator for propelling this study on the impact of the classification of DSIBs and their approach towards deposits. This is particularly relevant, as the literature on the subject does not cover the impact of the classification on demand deposits, and this study seeks to cover this gap.

$NII = Interest\ income - Interest\ expense$

The incentive for banks to enhance the volume of deposits is that it increases net interest income, which is the difference between earnings from interest-generating assets and outflows of interest-bearing liabilities. Net interest income is the difference between the interest received on loans and that paid on

deposits.

Net interest income (NII) is an important source of income for banks (Busch & Memmel, 2017). Most studies consider the Net Interest Margin as the ideal yardstick to compare banks, but we eschew this approach in favour of the NII as the net interest margin (NIM) is based on earning assets and the logical concomitant to this is that using NIM may confound the findings on account of the intervening variable, NPA, which is not under consideration in this study. Studies on the Net Interest Margin in the Indian context indicate that the capital to risk-weighted asset levels, operating cost, size of the loan book, and proportion of low-cost deposits to all deposits are key determining factors of NIM (Barik & Raje, 2019). We first examine whether net interest income is impacted when a bank is identified as a DSIB, and we hypothesize the following:

H1: The identification of banks as DSIBs has a positive effect on net interest income.

Banks can increase their net interest income by expanding the volume of high-interest loans or increasing low-cost deposits. Increasing high-interest loans is fraught with risk, as it also increases risk-weighted assets and, by implication, the capital buffer.

An increase in the NII can be effected by increasing the loan portfolio of high yield loans but this increase would manifest itself in a higher proportion of risk-weighted assets (Bikker & Vervliet, 2018) which would again impact the capital requirement. Since banks that have been designated as DSIBs have to keep a higher capital buffer but are constrained in terms of assets, we conjecture that this would lead to an accumulation of low-cost deposits, as this is the only plausible way to enhance net interest income. We posit that the volume of deposits increases in response to an increase in capital requirements.

$$V_{it} = \alpha - \beta rd_{it} + \varepsilon_{it}$$

where α is a constant, V_{it} is the volume of deposits of bank i at time t, and rd_{it} is the interest rate on deposits of bank i at time t. β captures the movement of deposit volumes to movements in interest rates. It is realistic to assume that β will be positive and that banks will therefore find it prudent to increase the share of deposits, particularly low-cost deposits. This leads us to hypothesize as follows:

H2: The identification of banks as DSIBs has a positive impact on the total deposits.

Bank deposits can be classified into demand deposits and term deposits. These deposits can be obtained from banks or from the public. Term deposits refer to deposits received for a fixed period, which can be withdrawn only after the contracted period (RBI, 2009). We assess whether the designation of banks as DSIBs positively affects their term deposits.

H3: The identification of banks as DSIBs has a positive impact on the term deposits.

As banks' main goal is to enhance profitability, our main contention is that

banks are likely to focus more on obtaining demand deposits as these are low-cost deposits. We examine this from the perspective of demand deposits obtained from banks and demand deposits obtained from the public.

H4: The identification of banks as DSIBs has a positive impact on the volume of demand deposits.

Public deposits are insured with the Deposit Insurance and Credit Guarantee Corporation (DICGC) India, and this incentivises depositors to invest their funds in a bank. We examine this from the perspective of demand deposits obtained from banks and demand deposits obtained from the public. Therefore, we consider the approach taken by banks based on their impact on deposits sourced from the public and deposits sourced from banks. Study by Dinger & von Hagen (2009) pointed out that long-term exposure to interbank deposits can reduce the risk of borrowing banks. Given that banks have to focus on low-cost deposits and given that banks have to reduce risk, it follows that banks will try to enhance the level of interbank deposits.

H5: The designation of banks as DSIB has a positive impact on demand deposits sourced from banks.

While deposits from banks are attractive because of their lower risk, they cannot be their mainstay because banks need to diversify their deposit base (Chernykh & Cole, 2011) and find that deposit insurance increases in financial institutions that have insured their deposits. Retail deposits of banks in India are insured by the Deposit Insurance and the Credit Guarantee Corporation to a certain extent. Banks also benefit by cross-selling products to their depositors (Puri & Rocholl, 2008). Therefore, enhancing their deposit base also has implications for cross-selling other products, which also enhances non-interest income. Considering the importance of public demand deposits, we propose the following hypothesis:

H6: The designation of banks as DSIB has a positive impact on demand deposits sourced from the public.

The methodology of identifying DSIBs in India is similar to the methodology proposed by the Basel Committee to classify GSIBs, but there are differences based on country-specific considerations (Iwanicz-Drozdowska & Schab, 2013). The theoretical framework is based on the difference-in-differences estimation methodology of (Donald & Lang, 2007) with cluster robust standard errors.

3. Research Design

The objective of this research is to examine whether the change in classification and the corresponding changes in capital impacted the structure of bank deposits. Since the changes have been phased in by the RBI to be fully effective from 2019 onwards, we considered this year as the cut-off year for the purposes of the study. We propose to study this by examining the volume of deposits before and after the cutoff date, and the difference-in-differences (DID) approach is particularly adapted to this type of assessment.

The DID model compares DSIB banks by comparing their performance to a set of banks that have not been treated, and this will help isolate the effect of the classification. The DID approach requires that the treatment and control groups be relatively similar. As we have an assorted panel of banks with different asset sizes, we follow the method adopted by Vittorio et al. (2018) and combine the financials of banks affected by mergers. We use the exact match method to create a balanced panel of banks, consisting only of banks with an asset value of more than 10,000,000 million rupees. The State Bank of India, HDFC Bank, and ICICI Bank have been classified as DSIBs and therefore constitute the treatment variable, and banks that have not been subjected to the added capital buffer as specified for DSIBs constitute the control group. Punjab National Bank, Canara Bank, Bank of Baroda, and AXIS Bank were used as banks for comparison purposes.

Bias can inadvertently occur despite the panel being balanced as there is an obvious difference between the banks in terms of asset size and this may introduce bias. A commonly used approach is to use weights in order to the weed-out bias. This can be achieved using a proper weighting method, such as propensity scores. However, Freedman & Berk (2008) argue that weighting may be good in certain studies, but it can increase random error in the estimates and recommends that it is better not to use weights if the causal model is good. Therefore, we do not take propensity scores and adopt exact matching to carry out the study, and use total assets as a proxy for size. Size is a material consideration when evaluating banks, as studies indicate that size influences profitability. The use of total assets as an indicator of bank size is supported in the literature. Floreani et al. (2023) examined the impact of capital regulations on bank risk taking and find evidence that banks have reduced their risk exposure as a consequence of policy specifications on their capital. A larger asset size has a positive impact on revenue and profit and enables banks to use their capital more efficiently (Ngoc Nguyen, 2019). The reasoning behind this approach is that systematically important banks are generally larger in size on account of the fact that a substantial portion of the systemic importance score provides a higher weight for bank size.

3.1. Choice of Statistical Model

There are multiple ways to conduct a difference-in-differences estimation, and the appropriate method should match the type of data used as also the purpose of the study. To arrive at the correct method of estimation, we examine whether the data are heteroskedastic, as the assumption in an ordinary least squares regression is that the variables are not correlated, but this violation may be violated in the case of panel data, as the observations relating to the same group of banks may be correlated. We begin the analysis by first examining whether the data are heteroskedastic, as this can impact the efficiency of the regression estimator and lead to bias in the estimates of the standard error. All assessments in this study were conducted using Stata 17 (StataCorp, 2021). Since we con-

sider NII as a key variable, along with deposits and total assets, we employ the Breusch-Pagan test to assess heteroskedasticity (Breusch & Pagan, 1979).

The Breusch-Pagan test results (**Figure 1**) indicate the presence of heteroskedasticity in the data. Because the data are heteroskedastic, we adopt a difference-in-differences estimation based on cluster robust standard errors, as it will allow for intragroup correlation while assuming that the groups are independent (Donald & Lang, 2007).

3.2. Characteristics of the Sample

The Reserve Bank of India (RBI) identified the State Bank of India (SBI) and ICICI Bank as systematically important banks in 2015, and higher capital requirements were made applicable from April 1, 2016, onwards (RBI, 2019). HDFC Bank was brought under the ambit of D-SIB from September 4, 2017. The additional capital requirement was staggered and fully effective on April 1, 2019. The additional tier 1 requirement for each of these banks with an effect from 2019 is as follows (RBI, 2019) (**Table 1**).

We consider the years 2020 to 2022 as the post-treatment period for difference-in-differences estimation. We chose 2006-2015 as the pre-treatment period.

```
Fixed-effects (within) regression               Number of obs      =        91
Group variable: bankcode                        Number of groups   =         7

R-squared:                                      Obs per group:
     Within  = 0.9694                                         min =        13
     Between = 0.9088                                         avg =      13.0
     Overall = 0.9466                                         max =        13

                                                F(2,82)            =   1298.49
corr(u_i, Xb) = -0.1889                         Prob > F           =    0.0000
```

lnnii	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
lndeposits	.0045423	.2717591	0.02	0.987	-.5360731	.5451577
lntotass	1.017433	.2712394	3.75	0.000	.4778512	1.557015
_cons	-3.947779	.2710163	-14.57	0.000	-4.486916	-3.408641
sigma_u	.18360206					
sigma_e	.13689542					
rho	.64270104	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(6, 82) = 21.56                     Prob > F = 0.0000

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (7)  =      204.20
Prob>chi2 =      0.0000
```

Figure 1. Breusch-Pagan test.

Table 1. Additional Common Equity Tier 1 requirement for DSIBs.

Bank	Additional common equity tier 1 requirement (applicable from April 1, 2019)
State Bank of India	0.60%
HDFC bank, ICICI Bank	0.20%

Source: Reserve Bank of India (RBI, 2019).

The rationale behind the choice of the pre-treatment period is that the RBI had phased in the higher capital requirements for the DSIBs from 2016 onwards (RBI, 2019).

3.3. The Model

The main objective of this study is to examine the impact of classifying banks as DSIBs and, in particular, their impact on the volume of demand deposits. We consider the State Bank of India, HDFC Bank, and ICICI Bank as the set of treated banks. A study of the DSIB classification in the Chinese context indicates that it is better to study DSIBs as a group rather than as individual entities (Chen et al., 2014).

The estimation is done by examining whether the treated banks performed differently on demand deposits after the implementation of the additional common equity tier 1 requirement. We adopt the difference-in-differences approach as we can control for covariates. More specifically, we adopt the difference-in-differences method proposed by Donald & Lang (2007), whereby the data are aggregated, and the estimation is carried out with cluster-robust standard errors.

Therefore, we estimated the following equation:

$$LogV_{ibt} = \gamma_t + \gamma_b + \beta Z_{ibt} + Treated_b \times \delta Post_t + \varepsilon_{ibt}$$

where:

$LogV_{ibt}$ represents the outcome of interest.

γ_t represents the fixed effects for time with the pre-treatment period coded 0 and post treatment period coded 1.

γ_b represents the bank fixed effects.

Z_{ibt} represents the vector of control variables and i represents the individual observation of bank b at time t.

"*Treated*" refers to whether banks are in the control or treatment group (coded 1 for banks in the treatment group and 0 for banks in the control group).

"*Post*" is a binary variable which indicates time and is 0 if the period is between 2006 to 2015 and 1 if it is above 2019.

δ is the coefficient of the interaction term.

One of the key distinguishing parameters on which DSIBs are segregated is their size, which contributes to almost 40% of the systemic score (RBI, 2014).

Systematically important banks are generally large banks and size is a key dif-

ferentiating factor therefore we control for size by proxying 'total assets' as a covariate in the difference-in-differences estimation.

4. Results and Discussion

The key outcome variables in this study were net interest income, total deposits, term deposits, and demand deposits. We examine demand deposits in detail, as this is a critical aspect of the study. Therefore, we assess demand deposits from banks and demand deposits obtained from the public. Since the key variable of interest is demand deposit, we examine the impact on demand deposits from banks and the public separately. We include total assets as covariates to control for size. The descriptive statistics of the key variables for the observation period and banks are given in Table 2, which covers the sum, mean, standard deviation, minimum, and values of the observations.

Table 3 presents the estimation results of the difference-in-differences test. The variable "timetreat" is the interaction variable. The values of the coefficients are presented in the first row. This coefficient is the average treatment effect on the treated variables. The second row indicates the *p*-value and the third row indicates the standard error of the estimate. The results of the parallel trend test are presented in Table 4, and those of the Granger causality test are presented in Table 5.

H1: The designation of banks as domestic systematically important banks has a positive impact on the net interest income.

We take the logged values of the net interest income and estimate the following difference-in-differences equation:

$$LogNII_{ibt} = \gamma_t + \gamma_b + \beta Z_{ibt} + Treated_b \times \delta Post_t + \varepsilon_{ibt}$$

$LogNII_{ibt}$ represents the logged values of net interest income for banks and i stands for the specific observation of bank b at time t. We test this hypothesis by taking the logged values of net interest income and using total assets as a covariate. The difference-in-differences estimation was performed after controlling for total assets, which was used as a proxy for bank size.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
nii	91	22,198.319	22,868.309	1078	120,708
total as sets	91	847,637.03	869,503.93	49,731	4,987,598
deposits	91	672,158.96	705,665.31	40,114	4,051,534
termdeposit	91	403,674.6	396,077.16	24,078	2,247,954
demand deposits	91	67,087.758	59,759.099	7970	286,697
demand eposit banks	91	3166.89	3334.388	200	15,390
demand eposit public	91	63,920.901	57,604.097	7531	280,882

The output (Table 3) suggests that there is no difference between the pre- and post-treatment periods; therefore, the designation of banks as DSIB has no impact on net interest income. This finding is in keeping with the findings of (Lee & Hsieh, 2013), who conducted their analysis on Asian banking and found that the Net Interest margin does not impact profitability. However, this finding contrasts with the findings of (Behn & Schramm, 2021), who find that the NII to total assets is lower in the case of GSIBs. The results of the estimation do not indicate a relationship between the increased capital requirement and NII but it is possible that this could have been occasioned by the fact that NII is impacted by a wide array of factors.

H2: The designation of banks as DSIBs has a positive impact on the total deposits of the Bank.

Total deposits consist of term deposits and demand deposits, and we estimate the impact of identifying banks as DSIBs on total bank deposits. The logged value of the total deposits indicated by LogDepibt was used as the outcome variable.

$$LogDep_{ibt} = \gamma_t + \gamma_b + \beta Z_{ibt} + Treated_b \times \delta Post_t + \varepsilon_{ibt}$$

We estimate the above equation after controlling for the total assets. The estimation was performed using total assets as a covariate, controlling for bank size. With reference to deposits, the importance of bank size finds support in the literature and, in particular, the study conducted by (Erülgen et al., 2020), which states that the deposit ratio is positively associated with the size of the bank. The results of the difference-in-differences test (Table 3) indicate no relationship between deposits and the identification of the bank as a DSIB.

H3: The designation of banks as DSIBs has a positive impact on Term deposits.

Although the results indicate that the designation has no impact on term deposits, it is possible that this is because the largest proportion of deposits could be demand deposits.

$$LogTD_{ibt} = \gamma_t + \gamma_b + \beta Z_{ibt} + Treated_b \times \delta Post_t + \varepsilon_{ibt}$$

$LogTD_{ibt}$ refers to the logged values of the term deposit.

The output (Table 3) indicates that DSIBs do not differ from other banks in their approach to term deposits. This finding is not at variance with the main research question related to low-cost deposits, as term deposits are not essentially low-cost deposits as their pricing is higher because of the tenor of the deposit.

H4: The designation of banks as DSIBs has a positive impact on demand deposits.

This hypothesis is central to this study because our main research proposition is that low-cost deposits are the best option for DSIB designation banks. The output (Table 3) indicates that there is a clear difference in demand deposits between the pre- and post-treatment periods, with an average treatment effect on the treated (ATET) of 76%. This finding corresponds with the findings of (Bond, 1971), who noted that demand deposits are a profitable avenue for banks.

Table 3. Difference-in-differences estimation of the impact of classification of DSIB.

	lnnii		lndeposits		lntd		lndemdeposits		lnddbank		lnddpublic	
timetreat												
(1 vs 0)	0.517		0.404		0.375		0.761	*	1.475	**	0.718	*
	0.21		0.34		0.47		0.04		0.00		0.05	
	(0.37)		(0.39)		(0.49)		(0.29)		(0.28)		(0.29)	
totalassets	−0.000		−0.000		0.000		−0.000	*	−0.000	**	−0.000	
	0.25		0.80		0.98		0.04		0.00		0.06	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
year												
2007	0.170	*	0.262	**	0.287	**	0.237	**	0.286		0.232	**
	0.01		0.00		0.00		0.00		0.13		0.00	
	(0.05)		(0.03)		(0.02)		(0.04)		(0.16)		(0.03)	
2008	0.354	*	0.486	**	0.508	**	0.502	**	0.479	*	0.499	**
	0.04		0.00		0.00		0.00		0.01		0.00	
	(0.14)		(0.07)		(0.07)		(0.10)		(0.13)		(0.10)	
2009	0.603	**	0.667	**	0.725	**	0.571	**	0.643	*	0.567	**
	0.01		0.00		0.00		0.01		0.01		0.01	
	(0.15)		(0.12)		(0.15)		(0.14)		(0.18)		(0.14)	
2010	0.768	**	0.799	**	0.781	*	0.817	**	0.987	**	0.812	**
	0.01		0.00		0.01		0.00		0.00		0.00	
	(0.18)		(0.17)		(0.21)		(0.14)		(0.16)		(0.14)	
2011	1.011	**	0.933	**	0.912	*	0.927	**	1.036	**	0.922	**
	0.00		0.00		0.01		0.00		0.00		0.00	
	(0.21)		(0.21)		(0.27)		(0.17)		(0.19)		(0.17)	
2012	1.190	**	1.092	**	1.106	**	0.934	**	1.008	*	0.924	**
	0.00		0.00		0.01		0.00		0.01		0.00	
	(0.22)		(0.23)		(0.29)		(0.17)		(0.28)		(0.17)	
2013	1.391	**	1.288	**	1.294	**	1.146	**	1.375	**	1.127	**
	0.00		0.00		0.01		0.00		0.00		0.00	
	(0.23)		(0.25)		(0.32)		(0.20)		(0.26)		(0.21)	
2014	1.535	**	1.442	**	1.448	**	1.293	**	1.791	**	1.265	**
	0.00		0.00		0.01		0.00		0.00		0.00	
	(0.26)		(0.27)		(0.36)		(0.21)		(0.18)		(0.21)	
2015	1.661	**	1.565	**	1.564	**	1.448	**	2.066	**	1.413	**
	0.00		0.00		0.01		0.00		0.00		0.00	

Continued

	(0.29)		(0.30)		(0.40)		(0.22)		(0.19)		(0.23)	
2020	1.996	**	1.910	**	1.841	**	1.713	**	2.174	**	1.685	**
	0.00		0.00		0.00		0.00		0.00		0.00	
	(0.42)		(0.35)		(0.41)		(0.33)		(0.32)		(0.33)	
2021	2.162	**	2.021	**	1.895	**	1.973	**	2.332	**	1.941	**
	0.00		0.00		0.00		0.00		0.00		0.00	
	(0.44)		(0.37)		(0.43)		(0.36)		(0.47)		(0.36)	
2022	2.293	**	2.136	**	1.979	**	2.133	**	2.625	**	2.095	**
	0.00		0.00		0.01		0.00		0.00		0.00	
	(0.47)		(0.41)		(0.49)		(0.38)		(0.49)		(0.38)	
Intercept	8.539	**	11.889	**	11.363	**	9.977	**	7.087	**	9.910	**
	0.00		0.00		0.00		0.00		0.00		0.00	
	(0.16)		(0.12)		(0.14)		(0.13)		(0.12)		(0.13)	
N	91		91		91		91		91		91	

**$p < 0.01$, *$p < 0.05$. Note: Difference-in-differences estimation of the impact of classification of DSIB. The interaction term is "timetreat", and constitutes 1 for banks in the treated group and 0 for banks in the control group. The time variable is 0 if the year is between 2006 and 2015, and 1 if it is 2020 and above. In this table, the coefficient is followed by the significance level (α), standard error is indicated within parentheses.

We assessed parallel trends by examining trends before and after treatment. A visual inspection (**Figure 2**) indicates that the trend is mostly parallel for the pre-treatment period, and the difference emanates only during the post-treatment phase. The statistical test provides further confirmation that the linear trends are parallel (**Table 4**).

H5: The identification of banks as DSIBs has a positive impact on the volume of deposits obtained from banks.

The assessment of banks indicates that demand deposits for banks have increased post-treatment compared to the control banks (**Table 3**), which is highly significant. The parallel trends test (**Table 4**), read with the Granger causality test (**Table 5**), provides grounds for being sufficiently confident about this finding.

H6: The identification of banks as DSIBs has a positive impact on the volume of deposits obtained from the public

We hypothesized that DSIBs would pursue demand deposits from the public, and found evidence that this finding is significant. In sum, we find evidence for the core hypothesis that demand deposits of banks will increase as a reaction to the classification of banks as DSIB. Studies have indicated that there are risks posed by augmenting demand deposits (Adam et al., 2022). Central banks should monitor the deposit position, as there are inherent risks when bank

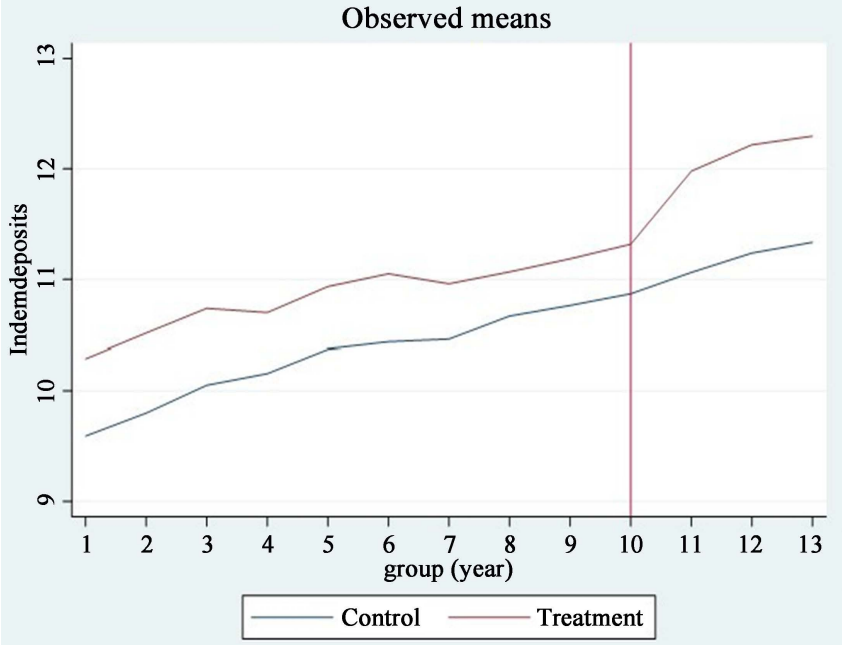

Figure 2. Parallel trends on demand deposits.

Table 4. Parallel trends test.

Variable	F statistics	*p*-value
Indemand deposit	0.5	0.5043
Inddbank	0.22	0.6576
Inddpublic	0.42	0.5422

Note: Parallel trend test with the null hypothesis that linear trends are parallel Robustness checks.

Table 5. Granger causality test.

Variable	F statistics	*p*-value
Indemand deposit	6.61	0.0185
Inddbank	300.77	0.0000
Inddpublic	10.43	0.0059

demand deposits increase substantially as maturity mismatches can result in issues in terms of the Diamond-Dybvig model. The results indicate that the impact of the classification is the highest on interbank deposits, which is an interesting finding that is relevant to policymakers.

4.1. Robustness Checks

The robustness of the above findings has been assessed by examining whether it fits the assumptions of the Difference-in-Differences estimation and in particular the assumption on parallel trends. Parallel trends is a necessary and sufficient

condition for the fixed effect estimation and this is particularly true when we hold the treatment effect be heterogenous across time and groups (Roth et al., 2023). The parallel trends associated with demand deposits are clearly justified in all three instances. The Granger causality test is seen to hold in all three instances and thereby confirms the robustness of the findings.

4.2. Granger Causality Test

The primary question revolves around the causal impact of the new policy and therefore we deem a Granger causality test as a further confirmation of the robustness of the finding. We test the null hypothesis that there is no effect in anticipation of treatment. The null hypothesis is rejected, and this finding, when read along with earlier diagnostics, indicates confidence in the DID analysis.

5. Concluding Remarks

In this study, we examined whether the identification of banks as DSIBs affects their approach to deposits. A selected set of seven banks has been included in the panel primarily on the basis of size, and of these banks, four are in the set of banks that have not been impacted by the DSIB capital requirements and therefore serve as control banks. The time bifurcation between the pre- and post-treatment periods is selected to rule out the impact of the capital buffer. The study began by examining the impact of the classification on NII and noted that the designation did not appear to have an impact on the NII. The study also noted that this finding did not hold true for deposits or term deposits. This finding was robust for demand deposits and supported the contention that low-cost deposits are the mainstay of banks when constrained by regulatory limits. This study examines this aspect more deeply and finds that deposits from banks have increased more than deposits from the public, highlighting the fact that banks are keen to increase their source of risk-free funds. This study is the first to assess the impact of the classification of banks as DSIBs and their impact on deposits, which has critical implications for regulatory authorities. It is important to closely monitor this aspect, as there are potential risks with an increase in the level of demand deposits in terms of the Diamond-Dybvig model (Diamond & Dybvig, 1983).

The limitation of this study is that it comprises of a smaller panel of banks. There is scope for studying a larger set of banks using alternate approaches such as matching methods in a difference-in-differences analysis. Future research can assess whether this finding holds for other countries, as the modality of selection of DSIBs is decided by the respective countries' central banks. This can also be explored within the context of GSIBs as these findings have systemic implications. Deposits are not the only source of funds for banks; therefore, there is scope to assess the interrelationship between DSIBs, borrowings, and deposits.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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