DOES CREDIT DIVERSIFICATION DRIVE BANKS' COST OF INTERMEDIATION? AN EMPIRICAL EXPLORATION

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Abstract

The disparity between the interest rates on loans and deposits is a widely used indicator of how expensive financial intermediation is for a community. The nations which reflect lower intermediation costs have higher levels of banking penetration and financial development (Gupta et al., 2021). This research examines the impact of credit diversification strategy on cost of intermediation of the Indian commercial banks. Additionally, our study shows the moderating role of bank ownership in this nexus. The static and dynamic estimation of panel data of the banks during the period 2014 to 2020 are carried out to analyse this relationship. Our baseline results refute the findings of Bustaman et al. (2016) and Huynh and Dang (2021) and indicate that the more diversified a bank's credit portfolio, the higher its cost of intermediation. Besides, the results reflect the effect of credit diversification in inflating the cost of intermediation is less severe for the banks with public ownership. Thus, this research emphasizes while promoting a diversified strategy, regulators and bank managers should carefully evaluate the positive impact of credit diversification on banks' cost of intermediation with a caution that the positive impact is more severe for private sector banks.

Keywords: Cost of Financial Intermediation, Credit Diversification, Bank Ownership, Commercial Banks, India

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1. INTRODUCTION

Bank as a financial intermediary is primarily involved in the traditional business of creating a link between the savers (depositors) and borrowers (investors) in the economy. In this process of financial intermediation, banks earn return in the form of interest charged from the borrowers and the banks provide interest for accepting deposits from the savers. The difference between this interest income and interest expense gives rise to the net interest income or interest spread of the banks. The net interest margin (NIM) of the banks is arrived at upon dividing net interest income by the earning assets of the banks, which is frequently used as a measure of the cost of intermediation or as a gauge of the efficiency of a bank's financial intermediation and reveals the strength and pricing

power of the banks (Almarzoqi & Ben Naceur, 2015; Barik & Raje, 2019). A higher level of NIM may prove to be a profitable state for the banks in the short run and can help to strengthen a bank's capital base through the reallocation of profits to the capital structure (Nassar et al., 2017). Nonetheless, a persistent growth in NIM hampers the banks' intermediation business and thereby economic growth in the long run since loans become dearer with high-interest rates charged from the borrowers while the savers receive lower returns in the form of low-interest rates. Poghosyan (2013) raised further concerns relating to a bank's high cost of intermediation which may be a sign of insufficient competitiveness in the banking market, presence of inefficiency resulting to higher cost of operations of the banks as well as the presence of numerous regulatory restrictions hindering smooth banking business. The critical work of Ho and Saunders (1981) highlights four well-researched factors influencing banks' net interest margin, namely: 1) the risk-averse nature of the bank managers, 2) the degree of competition in the banking market, 3) the average value of bank transaction and 4) interest rate risk. As an extension of this work, Allen (1988) included a bank's loan portfolio diversification by type and sector as one of the factors to show that diversification reduced a bank's interest margin considering the cross-elasticities between different products offered by the banks. However, corporate finance theory posits that diversification into newer regions by taking up new activities seems to alleviate banks' intermediation costs. McShane and Sharpe (1985) through their work offer support to the corporate finance theory.

In view of this, our research seeks to find the answer to the question:

RQ1: Does credit diversification influence banks' cost of intermediation?

In India, the central bank (the Reserve Bank of India [RBI]) of the country has set prudential exposure norms in order to capture the concentration risk and to encourage diversification of lending. This acts as a motivation to empirically assess whether banks operating within the Indian banking system diversify their credit portfolio and how this strategic decision influences their intermediation cost. Our paper makes a novel attempt to understand this relationship considering the dynamics of the Indian banking market. This theme of discussion directly affects the regulation of the financial market in this developing country since credit diversification or concentration strategy can be encouraged or restrained based on how they affect the intermediation costs of the banks. Further, our paper also enriches the existing literature on determinants of banks' cost of intermediation.

We structure the remaining part of the paper into the following sections. Section 2 presents a comprehensive review of the literature existing in the concerned field. Section 3 outlines the methodological aspects of the study mentioning about the data source, the study variables and empirical estimation techniques. Section 4 discusses the results from our empirical estimations and analysis. Finally, Section 5 highlights the conclusion and implication of our study.

2. LITERATURE REVIEW

A considerable amount of effort has been dedicated to establishing a linkage between bank diversification-concentration strategy and bank performance. Some of the seminal works of Markowitz (1952) and Diamond (1984) stress the significance of diversification to minimise risk and enhance a firm's performance. From the point of view of a bank, diversification plays a crucial role in risk management considering its nature as an intermediary in the financial market. One of the pioneering studies of Bebczuk and Galindo (2008) in Argentine banking systems shed light on the positive influence of bank credit diversification on bank profitability. Similarly, Aarflot and Arnegard (2017) for Norwegian banks, Mulwa (2018) for the four East African Community Countries (Kenya, Uganda, Rwanda, and Tanzania); Maheshwari et al. (2018) for two emerging economies and a developed economy, namely: India, China and Australia found that diversification is positively related to banks' performance. Interestingly, the Italian banking sector revealed a contrasting view to the findings of the above-mentioned studies. Acharya et al. (2016) conducted a study on Italian banks and concluded that diversification across different industries and sectors do not always hold well as well as do not prove beneficial for banking firms. Likewise, studies by Langrin and Roach (2009), Berger et al. (2010), Tabak et al. (2011), and Adzobu et al. (2017) show decreased return and increased risks for the banks and recommended concentration as a strategic option for the banks.

In majority of the studies in this domain, we find that bank profitability or performance is proxied by the traditional accounting measure return on asset and return on equity. Atahau and Cronge (2017), however, exclusively tried to see the association between banks' loan concentration and loan portfolio returns along with the traditional return measures and found that the concentration of loan portfolios improves banks' loan interest earnings. This unfolds a scope for interest margins of the banks to be considered as one of the performance indicators of the bank. García-Herrero et al. (2009), Cruz-García et al. (2020), and several other scholars mention about the net interest margin of the banks as one of the main components of bank profitability which also reflects the intermediation efficiency of the banks. While explaining the various drivers of banks' interest margins, McShane and Sharpe (1985) and Allen (1988) tested diversification as one of the determinants of NIM. In order to examine and advance the dealer model on the factors determining the interest margins of the banks McShane and Sharpe (1985) conducted an analysis on a sample of Australian private trading banks and the government-owned Commonwealth Trading Bank of Australia. The outcomes of their study are in line with what the hedging theory on the determination of bank interest margin which proposed a non-linearity in the linkage between interest margins of the banks and indicators of their market dominance, levels of risk aversion of the bank managers and unpredictability of interest rates. The authors discovered that the loan-deposit portfolio mix of the Australian trading banks varied significantly during their period of analysis with a distinct shift

from a business component to a personal component. The authors reported this transition of the loan and deposit activity from one sector to the other resulted in higher bank intermediation margins. Similarly, Allen (1988) instances two classes of loans to show that raising the discount for one class of loan will increase the demand for substitute financial products offered by the banks. Thus, when cross elasticities of demand between bank products and services are taken into account, pure interest spread may be lowered due to the portfolio effect brought on by the interdependence of needs across bank products and services. These two basic researches provided the necessary foundation for other studies in a similar line associating bank diversification as one of the ingredients of interest margin determination. Carbó Valverde and Rodríguez Fernández (2007) state that by diversifying their output to non-traditional areas, banks can increase their income and gain more market share. The reduced interest margin brought on by increased rivalry in traditional business may be partially offset by income from non-traditional business. Bustaman et al. (2016) observed a declining trend in the net interest income of four ASEAN countries, namely: Indonesia, Malaysia, Thailand and Philippines which is in harmony of the rising share of non-interest income in the income portfolio of the banks. They tried to examine if this decreasing trend in net interest income of the banks is associated with bank income diversification and credit diversification across sectors and by different types of credit offered to customers. In line with the findings of Carbó Valverde and Rodríguez Fernández (2007), they discovered that banks diversify into non-traditional to neutralize their declining revenue from traditional lending business. Additionally, the study reflected that banks specialising (less diversifying) in certain industrial sectors charge high interest rates leading to a high cost of intermediation. Omet (2019) discovered that the diverse income streams of the banks in the Jordanian banking sector impact their profitability positively; thus, the banks pass on this benefit to their clients by contracting their net interest margin, i.e., contracting their cost of intermediation. Sarwar et al. (2020) also came to a similar conclusion that an increase in income diversification narrows down bank margins in the Pakistani banking sector. However, they found asset diversification widens banks' intermediation margins. Huynh and Dang (2021) in recent years tried to establish a nexus between loan diversification, bank return, and business model and market power of Vietnamese commercial banks. The study considered net interest margin as one of the measures of bank profit to verify the claim that when banks diversify their loan in new economic sectors, they lower their lending rates in order to lure customers in the face of intense competition in those sectors (Jensen, 1996). The results revealed that loan diversification has a detrimental effect on the returns of the banks.

The literature on bank diversification has garnered less attention on the linkage between bank credit diversification and the cost of intermediation of the banks. While the issue of bank diversification versus concentration in improving banks performance is a much-debated topic, our analysis will enrich the existing literature taking the net interest margin of the banks as an important metric of bank performance. We explore this linkage using India as a test bed having a rich banking culture since decades.

3. DATA AND METHODOLOGY

3.1. Data sources

We conduct the empirical analysis based upon secondary data pertaining to sector-wise outstanding loans of public sector and private sector banks in India during the time period of seven years from 2013–2014 to 2019–2020. The bank-level information for each study variable has been extracted from the annual reports of each individual bank. Macroeconomic data have been extracted from the World Bank database. The starting period of our empirical analysis is 2013–2014 since the banks have started reporting their sector-wise loan exposure from 2013–2014 only. Finally, the study is conducted on an unbalanced panel data set consisting of 274 observations due to mergers and acquisitions of some banks during the study period.

3.2. Variables included in the study

3.2.1. Dependent variable

We use *net interest margin* (*NIM*), i.e., interest income minus interest expenses scaled by the total assets of the banks as the dependent variable in our study. *NIM* is widely used as a measure of the cost of intermediation of the banks (Poghosyan, 2013; Almarzoqi & Ben Naceur, 2015; Rahman et al., 2017). A higher *NIM* indicates a high cost of intermediation of the banks.

3.2.2. Independent variables

Credit portfolio diversification across economic sectors is employed as the main explanatory variable in our study. The *credit diversification index* (*CDI*) based on the *Hirschman-Herfindahl index* (*HHI*) is computed to capture banks' credit portfolio diversification following Raei et al. (2016) and Chen et al. (2013). *HHI* is popularly used in the literature to capture diversification in the banking industry. It is calculated "as the sum of the square of the share of credit exposure to each economic sector" (Belguith & Bellouma, 2018, p. 41).

For a bank b at time t, it is defined as,

$$HHI_{bt} = \sum_{k=1}^{N} \left(\frac{Q_{btk}}{T_{btk}}\right)^2 \quad (1)$$

where, HHI_{bt} is the Hirschman-Herfindahl index based on credit disbursed by the bank b at time t; Q_{btk} is the loan disbursed to k^{th} sector of the economy by the b^{th} bank at time t; T_{btk} is the total credit disbursed to the economic sectors by the b^{th} bank-group at time t; N is the total number of economic sectors to which the banks provide credit.

Thus, *credit diversification index* (*CDI*) is constructed by subtracting 1 from *HHI*:

$$CDI_{bt} = 1 - HHI_{bt} \quad (2)$$

CDI has a value between zero and one. When the CDI number is closer to zero, it suggests that there is no diversification of the credit portfolio, while a *CDI* value of (N-1)/N indicates complete diversification of bank credit portfolio.

3.2.3. Control variables

Bank-specific control variables

The bundle of other bank-specific control variables which determine *net interest margin*s of the banks used in the study is the natural logarithm of total assets of the banks, employed as the proxy of *bank size*. Angbazo (1997), Maudos and Fernandez de Guevara (2004), and Barik and Raje (2019) argue that there is a negative influence of *bank size* on *net interest margin* as there is a cost reduction on account of scale economies as banks grow bigger in size. *Bank liquidity* proxied by the *credit-to-deposit (CDR)* ratio of the banks is used as another control variable in the study. A lower *CDR* implies that a bank ploughs back funds in more liquid assets and in the form of cash holdings in order to meet the withdrawal requirements of its depositors. Banks with more liquidity offset the opportunity cost of retaining additional liquidity in the form of higher margins (Poghosyan, 2013). There is a mixed opinion on the *capital adequacy ratio* (*CAR*) of the banks which is used as one of the determinants of a bank's *net interest margin*. On one hand, a high *CAR* indicates solvency and safety of a bank which in turn allows banks to expend less on the savings of confident deposit holders, thereby elevating the interest margins of the banks (Sensarma & Ghosh, 2004; Barik & Raje, 2019). On the other hand, Poghosyan (2013) observes that a high *CAR* which indicates high risk aversion encourages the banks to invest their capital in lower-yielding activities with less risk, which would reduce bank margins. In accordance with Poghosyan (2013), Nassar et al. (2017), and Almarzoqi and Ben Naceur (2015) banks' credit risk proxied by the non-performing loans ratio of the banks is used as another control variable (Arifaj & Baruti, 2023). The variable credit risk can have both positive and negative influences on the *net interest margin.* On one hand, higher credit risk will require more provisioning on the part of the banks (Alnabulsi et al., 2023); thus, the banks pass on this extra cost to their customers by way of increased interest charges. On the contrary, higher provisioning to tackle bad loans of the banks may block bank's resources from investment in other high-yielding alternatives. *Net non-interest income* (*NNII*) of the banks which reflects income from non-traditional banking activities is expected to exert a negative influence on intermediation margins of the banks since banks may charge lower interest rates from their customers in order to remain competitive and neutralise the shortfall with higher fee-based incomes. *The operating efficiency ratio* (*OPER*) calculated by dividing operating expenses with the total assets of the banks is taken as another control variable. The existing literature justifies the positive relation between *the operating efficiency ratio* and the cost of intermediation of the banks with two arguments. A higher ratio indicates a less efficient bank which incurs huge operating costs and hence needs larger margins to cover up the costs Almarzoqi and Ben Naceur (2015) and Barik and Raje (2019). Again, the efficient banks having lower *OPER*, in order to gain more market share, might also offer a reduced cost of financial intermediation and transfer the cost savings to depositors and borrowers by allowing higher interest payments and charging lower interests on loans, respectively (Rahman et al., 2017).

Industry-level control variable

The *bank market concentration ratio* (*CR3*) is used as an industry-level control variable in our study as a measure of the market concentration of the banks. *CR3* is computed as the sum of the market share (based on total assets) of the top three banks in the banking industry. A *CR3* value closer to unity indicates high concentration and monopoly in the industry (Bikker & Haaf, 2002). The variable is predicted to have a positive influence on banks interest margins since with an increase in market concentration banks may have monopoly power in setting higher interest margins.

Macroeconomic control variables

Real per capita gross domestic product (*RGDP*) growth rate and *inflation rate* are incorporated as macroeconomic control variables in our analysis. During the period of economic booms when gross domestic product (GDP) is rising, banks are able to increase their lending rates due to increased positive business sentiments which in turn have a positive impact on intermediation margins of the banks. The real worth of money in financial assets is threatened by the inflationary situation in the economy (Merko & Habili, 2023). Thus, inflation flares up economic volatility and financial insecurity. At times of anticipated inflation, on one hand, the real value of the interest received by the savers goes down while on the other hand, banks charge high interest from the borrowers. Thus, the cost of intermediation goes up during inflation (Barik & Raje, 2019; Poghosyan, 2013).

Ownership dummy variables

We employ bank *ownership dummy* variable (Own_{bt}) which takes the value 1 for public sector banks and zero otherwise. The study also seeks to examine if the impact of bank credit portfolio diversification on cost of intermediation is different for different bank ownership. As such, interaction variable between loan diversification (DIV_{bt}) and ownership (Own_{bt}) is used in our regression model. Table 2 presents the definitions of all study variables, the sources of data and the hypothesised relationship with banks' *net interest margins*.

Table 1. Dependent and independent variables of the study

Dependent variable	*Proxy*	*Notation*	*Data source*
Cost of intermediation	*Net interest margin*	*NIM*	*RBI*
Independent variables	***Notation/Computation***	***Expected signs of β coefficient***	***Data source***
Credit diversification index	*CDI*	-	Self-computed using data from banks' annual report
Bank size	*Natural logarithm of total assets (SIZE)*	-	RBI
Bank liquidity	*Credit to deposit ratio (CDR)*	+	RBI
Bank solvency	*Capital adequacy ratio (CAR)*	+/-	RBI
Net non-interest income	*NNII*	-	RBI
Credit risk	*Non-performing loans ratio (NPLR)*	+/-	RBI
Operating efficiency ratio	*OPER*	+	RBI
Bank market concentration ratio	*CR3*	+	RBI
Real per capita gross domestic product	*RGDP*	+	World Bank Database
Rate of inflation	*INFL*	+	World Bank Database
Ownership dummy	*OWN*	+/-	RBI

Source: Authors' compilation.

3.3. Estimation of the empirical model

3.3.1. Impact of credit diversification on banks' cost of intermediation

We consider the following Model 1 as represented by Eq. (3) which regresses the net interest income (*NII*) of the banks on credit diversification measures in order to study the effect of credit diversification on banks' cost of intermediation.

$$NII_{bt} = a + \beta_1 CDI_{bt} + \beta_2 SIZE_{bt} + \beta_3 CDR_{bt} + \beta_4 CAR_{bt} + \beta_5 NNII_{bt} + \beta_6 NPL_{bt} + \beta_7 OPER_{bt} + \beta_8 CR3_{bt} + \beta_9 RGDP_{bt} + \beta_{10} INFL_{bt} + \beta_{11} OWN_{bt} + \mu_{bt} \quad (3)$$

where, *NII* is the net interest income, *b* refers to the cross-section units-banks, *t* refers to the time component of panel data, μ_{bt} is the composite error term.

3.3.2. Impact of credit diversification on banks' cost of intermediation in presence of bank-ownership effect

The kind of bank ownership is an important factor to be taken into consideration while framing the lending policy of a bank (Atahau & Cronje, 2017). Public sector banks in the Indian banking system dominate the nation's credit market. Private sector banks co-exist with the public sector banks to meet the country's banking demand sever since the deregulation and establishment of new private sector banks. As a result, the study also aims to determine if credit diversification has an effect on banks' cost of intermediation depending on the different types of bank ownership. By including the interaction variable between *credit diversification* (CDI_{bt}) and *ownership* (OWN_{bt}) in Eq. (3), we get the following Eq. (4).

$$NII_{bt} = a + \beta_1 CDI_{bt} + \beta_2 SIZE_{bt} + \beta_3 CDR_{bt} + \beta_4 CAR_{bt} + \beta_5 NNII_{bt} + \beta_6 NPL_{bt} + \beta_7 OPER_{bt} + \beta_8 CR3_{bt} + \beta_9 RGDP_{bt} + \beta_{10} INFL_{bt} + \beta_{11} OWN_{bt} + \beta_{12} OWN \times CDI_{bt} + \mu_{bt} \quad (4)$$

Since our data is in the nature of panel data, we apply panel data regression for estimation of the models. Static panel data estimation primarily consists of application of the best out of the three models viz., pooled ordinary least squares (OLS) model, fixed effects model and the random effects model. First, we conduct the poolability test (through F-statistics) to assess whether or not the pooled OLS model may be used. Secondly, the fixed and the random effects model allow controlling for the unobserved cross-sectional heterogeneity. The fixed effects model assumes that there is a correlation between the unobserved heterogeneity and the explanatory factors, whereas the random effects model does not assume this correlation. We apply the Hausman test to select the best out of the two alternatives.

Considering the persistent nature of banks' intermediation margin over time, we additionally apply dynamic panel data model as a robustness check. The present observations of interest margins may be dictated by their past observations. Carbó Valverde and Rodríguez Fernández (2007) and Angori et al. (2019) argue that banks must coordinate the demand for loans and supply of deposits that comes in a random fashion over time. Thus, incorporating the lag of the dependent variable as an explanatory variable will help us to model his behaviour appropriately. In addition, the problem of endogeneity that may result in biased estimates can be taken care of using fixed effects two stage least square (2LS) instrumental variables technique, which is however less efficient. Thus, we resort to two step difference generalized method of moments (GMM) estimators as advanced by Arellano and Bond (1991) which use instrumental variables geared to deal with the problem of endogeneity that may spur up on account of the correlation between the lagged dependent variable and the error term as well as take care of heteroskedasticity and autocorrelation in the error term (Ferreira et al., 2019). Further, we employ Sargan–Hansen test of over-identifying restrictions in order to appraise the instruments' validity. The dynamic model is as follows:

$$NIM_{bt} = \beta_0 + \beta_1 NIM_{bt-1} + \beta_2 CDI_{bt} + \sum_{l=1}^{L}\left(\beta_{3l} X_{bt}^{l} + \beta_4 CR3_{bt}\right) + \sum_{m=1}^{M}\left(\beta_{5m} Z_{bt}^{m}\right) + \varepsilon_{bt} \quad (5)$$

where, NIM_{bt} refers to *net interest margin* of bank b at time period t, *CDI* refers to bank credit diversification, X_{bt} with superscript l indicates the vectors of bank-specific control variables, Z_{bt} with superscript m indicates the vectors of macroeconomic control factors and ε reflects the disturbance term. The above Eq. (5) is expanded to include the interaction term. The coefficient β_5 of the ownership $\times$ *CDI* term demonstrates the differential effect of credit diversification on banks' cost of intermediation across bank ownership types.

$$NIM_{bt} = \beta_0 + \beta_1 NIM_{bt-1} + \beta_2 CDI_{bt} + \sum_{l=1}^{L}\left(\beta_{3l} X_{bt}^{l} + \beta_4 CR3_{bt}\right) + \sum_{m=1}^{M}\left(\beta_{5m} Z_{bt}^{m} + \beta_6 OWN \times CDI_{bt}\right) + \varepsilon_{bt} \quad (6)$$

4. RESULTS AND DISCUSSIONS

4.1. Descriptive statistics

This section provides the results of empirical estimation. First, the descriptive statistics of bank according to bank ownership type is presented in Table A.1 (Appendix A) for all the study variables. The table depicts that the average cost of intermediation (*NIM*) of the banks is 2.6% which commensurate with the *net interest margins* of some of the high income and middle-income countries around the world (Table A.2, Appendix A). However, among the middle-income countries, Brazil and Indonesia are an anomaly since their banks use notably high-interest margins. The standard deviation of *net interest margin* of all banks is, however, 0.11% signalling that the *net interest margins* of the banks have remained almost steady during the period of study which is also evident from Figure A.1 in Appendix A. The mean interest margin of private sector (3.35%) has remained higher than the public sector banks (2.27%) during the research period (Figure A.1, Appendix A). The average value of *bank market concentration ratio* (*CR3*) is 0.35 which is closer to zero than unity indicating a less degree of concentration of the top three largest banks in the Indian banking market. The mean operating efficiency of all banks is 1.90%. *The operating efficiency ratio* of private sector banks is greater than the public sector banks. The mean value of all other bank-specific control variables *SIZE*, *CDR*, *CAR*, *NNII,* and *NPLR* are 11.97%, 75.39%, 13.13%, 1.09%, and 3.86%, respectively and macro-economic variables *RGDP* and *INFL* are 5.51% and 4.86%, respectively.

The magnitude of credit diversification of public and private banks is depicted in Table 2. The mean value of *credit diversification index* (0.688 and 0.692) of both the categories of banks points out that Indian banks strategize diversification of their credit exposure across the economic sectors-agriculture & allied activities, Industry (micro & small, medium and large), services, personal loans and others.

This is due to the proximity of the mean values of diversification index to its maximum value, that is ($0.800 = \frac{(5-1)}{5}$). The maximum index value is given by $\frac{(n-1)}{n}$ where n is the number of sectors to which the banks provide credit. The yearly values of the index reflect that there is an increasing trend towards diversification of loan exposure for all public and private sector banks in India. It is also seen that private sector banks are more diversified as exhibited by the greater index value than their public counterparts. Interestingly, this difference in mean index value is not statistically significant as demonstrated by the p-value of the Man-Whitney U test statistics.

Table 2. Yearly average credit diversification index values of public banks and private banks in India during 2013–2014 to 2019–2020

Year	*Public sector banks*	*Private sector banks*	*All banks*
2013–2014	0.667	0.689	0.678
2014–2015	0.673	0.691	0.682
2015–2016	0.674	0.691	0.683
2016–2017	0.692	0.676	0.684
2017–2018	0.693	0.681	0.687
2018–2019	0.708	0.711	0.709
2019–2020	0.706	0.706	0.706
Mean	0.688	0.692	0.696
Standard deviation	0.017	0.012	0.008
Minimum	0.667	0.676	0.685
Maximum	0.708	0.711	0.713
Man-Whitney U test	U = 21.500 P-value = 0.701		

Note: All banks refers to total of public and private banks considered in our study.
Source: Authors' calculation using data from individual bank's annual reports.

Next, we have constructed a correlation matrix (Table B.1, Appendix B) to see the degree of association among the explanatory variables employed in our empirical estimations. We also diagnose whether multicollinearity exists among the variables through the variance inflation factor (VIF) test. The matrix reveals that there is no high degree of correlation and the VIF column shows the absence of multicollinearity among the explanatory variables. The only high correlation coefficient (-0.699) is observed between real per capita GDP growth rate and inflation rate. However,

this does not pose a question on reliability of regression estimates since the VIF value is less than 10 (Franke, 2010).

4.2. Results of panel regression models

Finally, we present the results of empirical estimations utilising both static and dynamic regression models. Table 3 outlines the results for analysis of the impact of credit diversification on banks' cost of intermediation in Model 1 and Model 2 using fixed effects estimation. The choice of fixed effects estimation is supported by the significant p-value of the Hausman test in Table 3. We also use robust standard errors to correct the heteroskedasticity problem present in our model. The *credit diversification index* (*CDI*) value is found positive which is also statistically significant in both the models indicating that increasing credit portfolio diversification results in higher *net interest margins* of the banks. This signifies that banks' cost of intermediation goes up as they diversify their credit portfolio across economic sectors. However, this positive relationship as exhibited by our analysis is contradictory to the findings of Bustaman et al. (2016), Carbó Valverde and Rodríguez Fernández (2007), and Huynh and Dang (2021) who also studied the effect of bank credit diversification on *net interest margin* of the banks. A possible explanation of this positive relationship is that diversification into new economic sectors demands an overload cost of monitoring new borrowers and projects (Cerasi & Daltung, 2000). The banks charge this cost hike to their customers modelled as higher interest rates on loans. Additionally, the bank ownership effect results in Model 2 reflect a significant negative coefficient of the interaction term implying that credit diversification does not increase cost of intermediation equally for both public and private banks. Banks with public ownership structure are the ones for which this positive relationship between banks' *net interest margin* and credit diversification is less powerful. That is, in case of public banks increasing diversification of credit exposures may lower their intermediation margins. Alternatively, this negative sign of the interaction variable also points to the fact that the public sector banks not being solely guided by profit motive, these banks try to keep their intermediation margins low even if diversified in order to ensure society's well-being.

Table 3. Static model: Impact of credit diversification on banks' cost of intermediation

Variables		*Model 1*		*Model 2*	
		β	***P-value***	***β***	***P-value***
CDI		0.011	0.038*	0.016	0.000*
SIZE		0.001	0.341	0.001	0.349
CDR		-0.003	0.000*	-0.003	0.000*
CAR		0.030	0.100**	0.034	0.061**
NNII		0.446	0.109	0.466	0.096**
NPLR		-0.057	0.000*	-0.057	0.000*
OPE		0.024	0.420	0.020	0.450
CR3		-0.030	0.487	-0.031	0.481
RGDP		-0.056	0.271	-0.064	0.219
INFL		-0.045	0.380	-0.052	0.308
Own_{pv}		-0.001	0.190	-0.013	0.086**
$CDI*Own_{pv}$		-	-	-0.020	0.067**
Constant		0.015	0.365	0.013	0.396
R-square:	Within	0.23		0.24	
	Between	0.46		0.47	
	overall	0.40		0.41	
Observations		274		274	
Hausman Test (p-value)		0.001		0.000	

*Note: Dependent variable: NII. * and ** represents significant at 5% level and 10% level, respectively. White's Heteroskedasticity corrected standard errors are used for controlling heteroskedasticity in the residuals. Hausman test p-value shows that fixed effect is the consistent estimator for both the models.*
Source: Authors' calculation.

In order to capture the persistence of *net interest margin* over time, we further estimate Eq. (5) and (6) using two-step difference GMM estimation. The p-value of Sargan-Hansen test (Table 4) reflects that our choice of instruments is jointly valid in the models. Further, the value of first-order autocorrelation AR (1) is positively significant while the value of second – order autocorrelation AR (2) is negative and insignificant which are the necessary conditions for GMM model. Thus, we proceed towards interpretation of regression results of Model 3 and 4 as depicted in Table B.1 (Appendix B). The coefficient of *CDI* is found positive as well significant at a 5% level in both the models which are in conformity to the results of the static model. Thus, we can infer that credit diversification increases banks' cost of intermediation for Indian public and private sector banks. The coefficient of lagged value of *net interest margin* (*NIM*) is highly significant and positive in both the dynamic models. This signifies those positive past values of interest margins positively influence their present values.

Along with the primary findings, the estimates of various control factors are noteworthy and consistent with previous studies. In Model 4, the variable *bank size* (*SIZE*) is found to exert a negative influence on *NIM*. Our findings, thus, proffer support to the claims made by Almarzoqi and Ben Naceur (2015) and Barik and Raje (2019) that due to economies of scale effect big sized banks with broader transaction can disperse their operating expenses over a broader base. This allows big-sized banks to lower their cost of intermediation. Interestingly, the variable *liquidity* (*CDR*) is observed negative and significant in our static estimation results. Although this outcome is inconsistent with the prior findings of (Nassar et al., 2017) but a bank with greater liquidity may imply

that the demand for deposits is higher relative to the demand for loans. In this case, the *net interest margin* shrinks when the banks' interest expense is more than its earnings. The other finding which is consistent with the prior research of Sensama and Ghosh (2004) and Barik and Raje (2019) is that *CAR* is positive and significant in all the models. Thus, we discover that banks with higher capital adequacy ratios, a sign of strong financial standing, are better able to control their interest costs when it comes to paying their secure depositors. We observe a negative relation between bank's *credit risk* and its intermediation margin. Increase in credit risk demands increase provisioning on the part of the banks.

Table 4. Dynamic model: Impact of credit diversification on banks' cost of intermediation

Variables	*Model 3*		*Model 4*	
	β	*P-value*	*β*	*P-value*
NIM(-1)	0.294	0.000*	0.268	0.000*
CDI	0.306	0.000*	0.302	0.000*
SIZE	-0.035	0.221	-0.067	0.024*
CDR	-0.163	0.220	0.026	0.898
CAR	0.268	0.010*	0.304	0.004*
NNII	0.038	0.285	0.033	0.415
NPLR	-0.070	0.004*	-0.054	0.028*
OPE	-0.111	0.000*	-0.156	0.000*
CR3	0.870	0.038*	0.771	0.143
RGDP	0.061	0.341	0.069	0.397
INFL	0.064	0.179	0.093	0.113
Own_{it}	-1.494	0.021*	-1.265	0.132
*CDI*D1*	-	-	0.105	0.010*
Constant	0.026	0.174	0.026	0.202
Observations	191		191	
Sargan and Hansen test: p-value	0.18		0.40	
AR (1)	0.048		0.053	
AR (2)	0.626		0.633	

*Note: Dependent variable: NII. * and ** represents significant at 5% level and 10% level respectively.*
Source: Authors' calculation in Stata.

In line with Chortareas et al. (2012), we argue that the funds earmarked for other possible investment avenues are reduced when provision for nonperforming loans rises, thus *NPLR* is inversely associated with the net intermediation margins of the banks. Another view is that a bank can reduce high credit risk by allocating resources in low-yielding government assets, thereby reducing their cost of intermediation (Almarzoqi & Ben Naceur, 2015). The coefficient of *operating efficiency ratio* (*OPER*) is significant and negative in Model 3 and 4 which is ubiquitous to the finding of popular studies (Almarzoqi & Ben Naceur, 2015; Barik & Raje, 2019). Our result indicates that more efficient banks displaying lower *OPER* can increase their financial intermediation cost by lowering their input costs, such as deposits and borrowed money, while increasing output prices such as loans (Rahman et al., 2017). Moreover, we find result contrary to the existing literatures that increase in *net non-interest income* (*NNII*) of the banks is associated with increase in banks' cost of intermediation (Poghosyan, 2013; Bustaman et al., 2016; Barik & Raje, 2019). *NNII* of the banks is difference between non-interest income and non-interest expenses as a proportion of total assets of the banks. We argue that when *net non-interest income* of the banks decreases as a result of increase in non-interest expenses, banks raise their intermediation margin on traditional interest generating business in order to meet those non-interest expenses. Further, our results suggest that banks in a concentrated banking market may utilise its monopoly power to set higher intermediation margins. As such, the variable *bank market concentration ratio* (*CR3*) is found significant and positively affecting the bank's *net interest margin*. As regards the *ownership dummy* variable (OWN_{bt}) our result is consistent with the prevailing scenario in Indian banking market (as seen in Figure A.1, Appendix A) that public banks have lower cost of intermediation than the private banks. Our findings do not show any significant impact of macroeconomic variables — *RGDP* and *INFL* on cost of intermediation of the banks.

5. CONCLUSION

In this research, we try to explore whether credit diversification drives banks' cost of intermediation. We use a sample of Indian public and private sector commercial banks to examine this relationship. First, we identified the degree of banks' credit diversification across economic sectors and find that credit portfolios of public as well as private sector banks are diversified across the sectors of the economy. As regards the cost of intermediation of the banks measured in terms of net interest margin of the banks, we discovered that India has bank intermediation margin which is comparable to other high- and middle-income nations. The private sector banks, however, have high intermediation cost as compared to the public sector banks in India. Using both static and dynamic estimation techniques, our findings show that diversification of credit across economic sectors escalates banks' cost of intermediation. Examining the conditioning role of bank ownership type, we show that the positive influence of credit diversification is not the same for both the public and the private sector banks. More specifically, for the public sector banks, this positive relationship between banks' credit diversification and net interest margin is impotent. That is, public sector banks may lower their intermediation cost through diversification of their credit portfolios across sectors. Apart from this, we find that banks' capital adequacy ratio and banking industry concentration positively influences banks' cost of intermediation; banks' credit risk and operating cost efficiency ratio exerts a negative pressure on banks net intermediation margin.

A high-cost financial intermediation of the banks impinges upon proper channelization of funds from savers to the investors of the economy. It also impedes financial inclusion in the economy. In the process of financial intermediation, banks are thus, expected to minimise their intermediation margins in order to uplift the community well-being. A plausible implication that follows from our study is that banks should be able to control the increased costs of monitoring associated with diversification of credit into different sectors in order to reap the advantages of credit portfolio diversification and the low cost of intermediation simultaneously. Apart from this, private sector banks should also bring their intermediation cost at par with the public sector banks.

Banks' net interest margin is an important metric to gauge their efficiency of intermediation and financial inclusion. Numerous studies have focussed on the impact of diversification on bank profitability. However, examining its impact on banks cost of intermediation provides a holistic view of this association. Nonetheless, our study being based upon a single country database is a limitation in itself and limits the generalizations of findings. This restriction, however, might serve as a motivational tool and researchers may choose to consider multi-country setting and worldwide database. Future studies may also be conducted employing other measures of bank cost of intermediation.

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APPENDIX A

Table A.1. Descriptive statistics of study variables

Variables	Mean			Minimum			Maximum			Standard deviation		
	Public banks	Private banks	All banks	Public banks	Private banks	All banks	Public banks	Private banks	All banks	Public banks	Private banks	All banks
NIM (%)	2.275	3.353	2.634	2.080	3.260	2.500	2.450	3.424	2.810	0.136	0.059	0.113
CDI	0.687	0.690	0.689	0.670	0.660	0.680	0.710	0.710	0.710	0.018	0.017	0.015
SIZE (%)	12.587	11.393	11.979	12.250	11.090	11.710	12.840	11.720	12.240	0.196	0.257	0.193
CDR (%)	68.981	84.639	75.388	64.067	77.690	73.398	74.400	103.072	76.599	4.478	8.822	1.103
CAR (%)	11.463	14.719	13.126	11.070	13.830	12.500	12.100	15.550	13.850	0.369	0.668	0.493
NNII (%)	0.962	1.361	1.088	0.808	1.231	0.482	1.153	1.569	1.377	0.152	0.133	0.296
NPL (%)	6.000	2.000	3.857	3.000	1.000	2.000	10.000	3.000	6.000	2.582	0.816	1.464
OPER (%)	1.643	2.162	1.909	1.402	2.002	1.694	1.897	2.440	2.177	1.643	2.162	1.909
CR3	0.346	0.346	0.346	0.325	0.325	0.325	0.369	0.369	0.369	0.015	0.015	0.015
RFDP (%)	5.510	5.510	5.510	1.300	1.300	1.300	2.950	2.950	2.950	6.920	6.920	6.920
INFL (%)	4.857	4.857	4.857	3.300	3.300	3.300	6.700	6.700	6.700	1.361	1.361	1.361

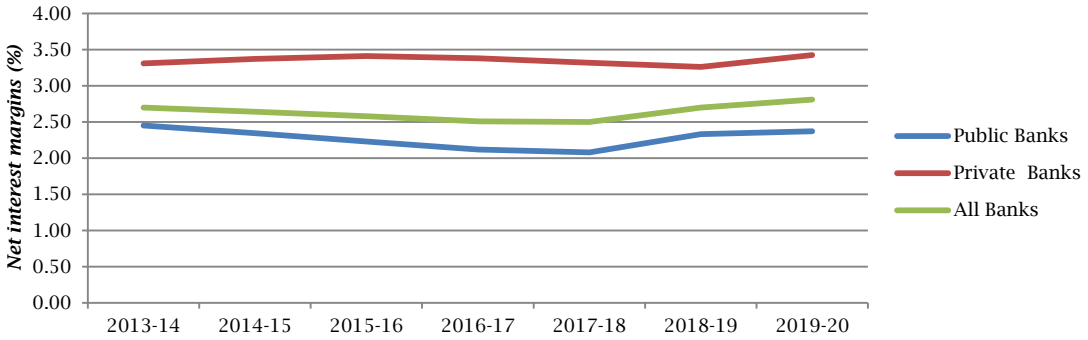
Note: All banks refers to total of public and private banks considered in our study.
Source: Authors' calculation using data from individual bank's annual reports.

Table A.2. Average net interest margin of select countries from 2014 to 2020

Countries	Net interest margin (%)
United States	3.352
United Kingdom	1.819
Germany	0.845
Canada	1.706
Brazil	5.107
China	2.411
India	2.950
Indonesia	5.663
Pakistan	3.737
South Africa	3.245

Source: Authors' compilation using data from The World Bank database.

Figure A.1. Yearly average net interest margins of public sector banks and private sector banks in India from 2014 to 2020



Source: Authors' construction using data from Reserve Bank of India database.

APPENDIX B

Table B.1. Bi-variate correlation matrix and VIF test

Variables	CDI	SIZE	CDR	CAR	NNII	NPL	OPE	CR3	RGDP	INFL	VIF
CDI	1	-0.136* (0.025)	-0.240** (0.000)	-0.177** (0.003)	-0.116 (0.055)	0.130* (0.032)	0.002 (0.970)	0.116 (0.055)	-0.103 (0.089)	0.014 (0.812)	1.14
SIZE	-0.136* (0.025)	1	0.003 (0.957)	-0.098 (0.102)	0.101 (0.093)	0.238** (0.000)	-0.209** (0.000)	0.127* (0.035)	-0.068 (0.261)	-0.024 (0.690)	1.20
CDR	-0.240** (0.000)	0.003 (0.957)	1	0.353** (0.000)	0.155** (0.010)	-0.242** (0.000)	-0.024 (0.691)	-0.040 (0.509)	0.031 (0.610)	0.031 (0.606)	1.21
CAR	-0.177** (0.003)	-0.098 (0.102)	0.353** (0.000)	1	0.393** (0.000)	-0.479** (0.000)	0.109 (0.070)	0.130* (0.029)	-0.072 (0.232)	-0.016 (0.790)	1.74
NNII	-0.116 (0.055)	0.101 (0.093)	0.155** (0.010)	0.393** (0.000)	1	-0.234** (0.000)	0.210** (0.000)	0.207** (0.000)	-0.111 (0.065)	-0.017 (0.781)	1.33
NPLR	-0.116 (0.055)	0.101 (0.093)	0.155** (0.010)	0.393** (0.000)	-0.234** (0.000)	1	0.210** (0.000)	0.207** (0.000)	-0.111 (0.065)	-0.017 (0.781)	1.75
OPER	0.002 (0.970)	-0.209** (0.000)	-0.024 (0.691)	0.109 (0.070)	0.210** (0.000)	-0.134* (0.025)	1	0.099 (0.101)	-0.053 (0.380)	-0.020 (0.744)	1.12
CR3	0.116 (0.055)	0.127* (0.035)	-0.040 (0.509)	0.130* (0.029)	0.207** (0.000)	0.238** (0.000)	0.099 (0.101)	1	-0.503** (0.000)	-0.182** (0.002)	5.56
RGDP	-0.103 (0.089)	-0.068 (0.261)	0.031 (0.610)	-0.072 (0.232)	-0.111 (0.065)	0.099 (0.100)	-0.053 (0.380)	-0.503** (0.000)	1	-0.699** (0.000)	7.69
INFL	0.014 (0.812)	-0.024 (0.690)	0.031 (0.606)	-0.016 (0.790)	-0.017 (0.781)	-0.288** (0.000)	-0.020 (0.744)	-0.182** (0.002)	-0.699** (0.000)	1	9.14

*Note: Figures in parenthesis represent the p-value. ** and * represent correlation is significant at the 1% level and 5% level, respectively.*
Source: Authors' calculation on the basis of secondary data collected from the Reserve Bank of India database.