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Net Interest Margin, Financial Crisis and Bank Behavior: Experience of Indian Banks

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Tushar B. Das¹

Abstract

The global financial crisis that jeopardized the advanced economies is perceived to have had a limited impact on Indian banking system. However, the effect was so severe that the advanced economies are still struggling to achieve stability. In this paper, we attempted to analyze the impact of the financial crisis on the Net Interest Margin (NIM) of Indian banks. Variables considered for the analysis were of three different types: bank specific, those representing the banking industry, and a third category consisting of macro-economic variables. We used a wide range of bank-wise panel data for the period 1992 through 2010. In this paper, we examined the impact of the financial crisis on the variables, considered under the monetary transmission literature, such as size, capital and liquidity. When analyzed from the ownership angle, it has been observed that the public sector banks were affected significantly during the crisis. We find that, during the second half of the crisis, the margin of banks with low capital and poor liquidity was impaired significantly when compared with banks that had sufficient capital and liquidity support.

Keywords: Indian Banking Industry, Net Interest Margin, Financial Crisis, Bank Ownership

JEL Classification: G01, G21, G28

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1. Introduction

The global financial crisis that began in mid-2007 engulfed the Euro-Zone into a debt crisis and brought down the confidence level of the banking industries in advanced economies. The structural and regulatory fragilities persisting in the financial system of advanced economies has adversely affected emerging market economies also (Tan, 2012). Accordingly, central banks in both advanced and emerging economies resorted to a wide variety of measures – both conventional and unconventional – to put their systems back on an even keel. Using a combination of monetary and regulatory measures and support from national governments, authorities were able to gradually nurture their economic systems back to health. In this context, how the crisis impacted domestic banking profitability and its interaction with banking ownership remains a moot question.

The net interest margin (NIM) is considered to be an important measure of efficiency of financial sector. NIM is measured as the excess of interest income over interest expense scaled by total asset. This indicates as to how effectively the banks deploy their funds to generate income from credit and investment operations. Lower the ratio, the more efficient is the banking system. But when analyzed at bank level, the bank with high NIM is considered more efficient as compared to a bank with low NIM, since high NIM can raise profitability. Without loss of generality, banks in developed economies typically operate on smaller margin as compared to developing and emerging economies (Mohan, R. 2006, Demirgüç-Kunt *et al.* 1999).

In this backdrop, the paper investigates the NIM of Indian banks using available data during the period 1992 to 2010. Employing disaggregated bank-level data across different ownership categories, the following issues have been examined: (a) what factors influence banks' margins? (b) does ownership exert any perceptible influence on banks' margin? (c) what role did the crisis play in impacting bank margins? and finally (d) do margins differ across bank size, liquidity and capitalization? The final issue, in part, draws from the monetary transmission literature which observes that the other three characteristics play an important role in influencing the transmission process. These are interesting questions since a thorough and comprehensive study of domestic banks could provide useful leads to policy makers in their quest for a safe, sound and robust banking system.

India provides a compelling case among emerging markets to examine the said issues in some details. India has a long history of banks dating from the early 1700s. Beginning with the process of financial sector reforms, as part of overall economic reforms in 1991, the system has been liberalized gradually, allowing the free play of market forces in their economic decision-making. Second, the system has a wide gamut of banks spanning across diverse ownership categories, with differences in history and governance structures. Third, although India was relatively less impacted by the crisis as compared to comparable developing and emerging economies, the impact of the crisis was felt much later. More specifically, the domino effect of the crisis afflicted Indian banks through three distinct channels - the financial channel, the trade channel and the confidence channel. Our focus in the present paper is on the financial channel and more specifically, the ramifications of the financial channel on domestic banks.

The paper, examines the importance of interest margins for the banking sector of one of the leading emerging economies, namely, India. Specifically, the paper focuses on the impact of the global financial crisis on Indian banks' margins. Following the monetary transmission literature, the paper also investigates the impact of the major bank characteristics, such as size, liquidity and capitalization on the banks' margins during the crisis.

Most importantly, being part of the wider literature that examines the evolution of banking system in India, the present study supplements the extant evidence by focusing on NIMs of the Indian banks during the reform era period encompassing the global financial crisis.

The paper finds that the interest margins of banks operating in India differ markedly across ownership categories - domestic or foreign. While the margins of the public sector banks (PSBs) were significantly impaired during the crisis, the effect on foreign banks and new private banks was relatively muted. At the bank level, factors like capital strength, asset quality and operating cost were important drivers of banks' margin during 1992-2010.

The rest of the paper is organised as follows. Section 2 encapsulates some of the relevant literature. Section 3 highlights the origination of Indian banking industry and the movements of interest rate in India. The data, variable description, methodology and data model framework are described in Section 4. Section 5 lists out major findings and initiates some relevant discussions, followed by the concluding remarks in Section 6.

2. Literature review

There are opinions on the role of the banking industry in recovering the economy through financial intermediation. The cost of intermediation is considered to be a major part of total financial cost. There is a strong connection among cost, degree of financial intermediation and economic growth (Kasman *et al.*, 2010; Maudos *et al.*, 2004 and Domicic *et al.*, 2012). The cost of funding affects the investment potential and capital allocation of the banks. The increasing cost of intermediation negatively affects the growth potential of the economy. The increasing financial intermediation cost affects banks' profitability and thus, being a reason for decreasing efficiency of the banking sector as a whole (Garcia-Herrero *et al.*, 2009). High interest margin is also considered 'negatively' as it leads to 'disintermediation' (Brock *et al.*, 2000).

There is, by now a considerable volume of research on the determinants of banks' margin. Without loss of generality, the variables utilized in prior studies can be divided into three categories. The first category comprises of variables which are specifically related to individual banks and they focus more on how banks' margins are altered owing to plausible changes. These include, among others, bank size, asset share, operating cost and Non-Performing Assets (NPAs), to mention a few. The second category includes variables related to the banking industry environment. Salient among these are concentration ratios and presence of foreign banks (FBs). The third category is more generic and attempts to take on board the overall macroeconomic conditions. Several studies have considered these variables, either jointly or in isolation, with distinctly different results.

However, the studies on finding determinants of banks' efficiency, profitability or intermediation costs are mostly based on the initial empirical research done by Ho and Saunders (1981). They modeled the banks as dealers doing banking business and used a two-stage approach in estimating the model using bank level data for the US banks. In the first stage, they estimated a regression model for the bank spread considering a set of bank specific variables. In the second step, they used the volatility of the interest rate as a function of the interest spread, considering different maturity profiles. Banking sector specific variables were considered in the second phase while the bank specific variables were used in the first phase.

Studies on factors affecting banks profitability in developed economies were conducted by many researchers. Allen (1988) adopted Ho and Saunders' model for a set of loans with interdependent demands. Angbazo (1997) introduced credit risk, interest rate risk and their interaction effect in the model for the US banks. Later on Saunders *et al.* (2000) used two-stage regression technique on the interest spread

considering banks in the US and six European countries. Claeys *et al.* (2008) considered single stage estimation procedure to model banks' margin from 36 European (CEE²) countries. They concluded that concentration, operational efficiency, capital adequacy and risk behavior were the important determinants of the interest margin. Maudos *et al.* (2004), while modeling NIM for European Union using single stage regression technique, found operating cost significantly affecting the NIM. They concluded that reduction in NIM was compatible with a relaxation of the competitive market condition, which was getting countered by lowering interest rate risk, credit risk and operating cost. Schwaiger *et al.* (2008) observed limited impact of interest rate risk on NIM. Kasman *et al.* (2010) observed merger and acquisition improved banks' efficiency while size and managerial efficiency were negatively related to NIM. Brock *et al.* (2000) modeled the interest spread for Latin American banks using the same technique. They found that banks' operating cost and level of NPAs were positively affecting the interest spread while macroeconomic condition caused negative impact on margin. Entrop *et al.* (2012) extended this model to find the extent to which interest risk exposure was affecting the banks' margin considering banks from German banking system. They extended the model to capture the interest rate risk and expected returns from maturity transformation. Männasoo (2012) considered a set of dummies as control parameters while modeling interest spread following a two-stage regression technique for banks in Estonia. The outcome of the analysis suggested that the level of risk aversion and market structure were the primary ingredients for interest spread, while the effect of interest rate volatility was modest.

Impact of financial crisis on banks' margin was tested by Dietrich *et al.* (2011) by considering the commercial banks of Switzerland over a period of 1999-2009. After employing two sub-groups, viz., a) 1999-2006 and b) 2007-2009, they concluded that during pre-crisis era, ownership did not impact banks' profitability. But post crisis period, public sector banks became more efficient in comparison to the private banks. Market structure seemed important during pre-crisis period and turned out insignificant post crisis.

Besides the developed economies, a sizeable body of literature exists for the banks in emerging and developing economies as well. Khan *et al.* (2010) used a panel data set up to model NIM for the Pakistani banks and found operating cost and cost of funding were the main determinants for banking spread in Pakistan. Marginal influence of macroeconomic variables and market condition on NIM was reported by them.

² CEE is the Central and Eastern Europe countries

Country specific analysis was also carried out by Saad *et al.* (2010) for Lebanon, Ascarya *et al.* (2010) for Indonesia, Al-Jarrah (2010) for Jordan, Tan (2012) for Philippines, Maudos *et al.* (2009) for Mexico and Siddiqui (2012) for Pakistan.

As far as the margin of the Indian banks is concerned, Sarkar *et al.* (1998) studied the relationship between ownership pattern and Indian banks' performance. They have considered NIM as the performance parameter for banks. With limited number of banks' specific variables, they found that ownership was significantly affecting the banks' performance. Kannan *et al.* (2001) examined the relationship between NIM and the variables representing the health of the banks and the nature of their operations in the post liberalization period. They concluded that the fee income and NPA significantly affected the movement of NIM, but not size. Sensarma *et al.* (2004) considered a panel data set up and found similar results as observed by Kannan *et al.* (2001). But they found that the size affected the NIM significantly. Negative relation between NIM with investments in government securities and NPA were reported by them, while total loan and regulatory requirement exhibited positive impact. The increasing NPAs posed major challenges for the Indian banks to maintain their margin. Banks changing focus towards long term assets could be a possible reason for decline in asset quality (Mohanty, 2013). A recent study by Sharma *et al.* (2012) indicated that the banks' interest income was affected by the economic and financial cycles.

3. Indian banking industry and interest rate scenario

The origin of modern Indian banking dates back to 1921, when all presidency banks were amalgamated to form the Imperial Bank of India which carried out commercial banking business except dealing in foreign exchange. The establishment of the Imperial Bank was a major milestone as it was also entrusted with certain central banking activities prior to the establishment of Reserve Bank of India (RBI) in 1934.

RBI was established in 1934 as an apex body to regulate the banks in India. It was nationalized in 1949 under the RBI Act, 1934. In the same year, Banking Regulation Act was enacted providing powers to RBI to regulate, control and inspect the banks. In 1955, RBI acquired ownership of Imperial Bank of India and it was renamed as State Bank of India. State Bank of India nationalised its seven subsidiaries in 1959. To increase the resilience and robustness of the banking industry, Government of India nationalised 14 banks in 1969 and subsequently, eight more banks in 1980. The banks with full Government ownership increased the confidence of the public regarding their long term sustainability and started acting as catalytic agents for economic growth.

However, there was not much control on banking business and the banking industry was in a closed set up. The building up of NPAs was a real concern for the Government. In 1992, Narasimham Committee recommended wide range of reforms in line with the international banking practices. The amendments of Banking Regulation Act in 1993 witnessed major changes in the Indian banking system with lot many reforms, including entry of new private sector banks.

The Indian banking industry now primarily consists of a) commercial banks and b) co-operative banks. The structure of commercial banks is diversified with a number of public sector banks, in addition to old private, new private (established after the initiation of reforms) and foreign banks (which operate as branches) competing in the financial market. The co-operative banks cater to the need of small finances in rural and urban areas³.

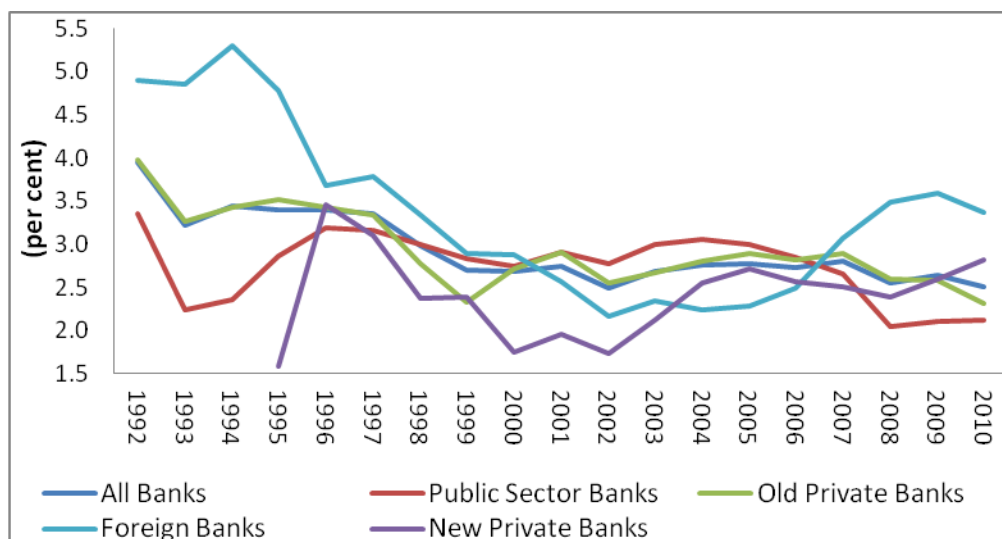
The banking industry witnessed several reforms during the past two decades. There were reforms relating to interest rate deregulation, easing of banks' licensing policy, functional autonomy to the public sector banks, strengthening the capital structure for ensuring stability etc. Banks responded to these measures and adequately contributed to the growth potential of the country.

Around the onset of the reform process in 1992, the NIM of Indian banks was around 3.9 per cent. This was mainly contributed by the foreign banks, having NIM over 5.0 per cent during that period due to their ability in mobilizing low cost deposit. The dominance of foreign banks in Indian banking was also discussed by Casu *et al.* (2012). Owing to the policy of deregulation and introduction of several easing norms by the regulator to promote domestic banks with more operational ease, NIM started declining substantially from 1994. It came down below 3% after 1997. In 2010, NIM for the Indian banks was 2.5 per cent. Even then, the foreign banks could operate with higher margin as compared to other categories of banks. They could manage to operate with NIM as high as 3 per cent. Considering the entire period of 1992 to 2010, the average NIM of all banks stood at 2.9 per cent (Table: A2). The lowest average was for the public sector banks (PSBs). Hence, it was unambiguous that the competition was spearheaded by the PSBs. In general, the average NIM for most of the developed countries and few other emerging economies stood below 2 per cent. It was therefore argued that there was still scope for reduction of NIM to further increase the competition as compared to

³ As at end March 2012, total finances extended by the co-operative banks was Rs.4700 billion, around 5 per cent of aggregate loans and advances of all scheduled commercial banks (*Ref. Report on Trend and Progress of Banking in India 2011-12*).

international benchmark (Mohan, 2006). The following Chart 1 shows the NIM movement of the banking industry since 1992.

Chart 1: Net Interest Margin for Indian Banks based on ownership



Source: Statistical Tables relating to banks in India – various issues

4. Empirical Analysis

Not much work has been done to check the impact of financial crisis on the Indian banks' margin. In this paper, we have studied the impact of the financial crisis on interest margin of Indian banks. Besides analyzing the determinants of banks margin during the entire period of 1992 to 2010, the paper also focused on major factors affecting Indian banks' interest margin during financial crisis.

4.1 Data and Sources

Our data comprise of an unbalanced panel of over 60 banks spanning across public sector, private sector (both old and new) and foreign banks from the period 1992, coinciding with the inception of financial reforms, through 2010. It needs to be recognized that the new private banks became operational only since 1994/95 onwards. Additionally, the banking industry also witnessed mergers and consolidations, both domestic and international. As a result, the number of reporting banks varied from year to year, with a minimum of 58 banks (as in 1992) to a maximum of 64 banks (as in 1996). With an average of 15 years of observation per bank, we have a total of 948 bank-years. The final set comprises of 28 public sector banks (PSBs), 15 old private

banks (OPBs), 6 new private banks and 16 foreign banks. These banks account for, on an average, over 90 per cent of banking sector assets for the sample period.

The data are sourced from three major publications. The bank-wise balance sheet and profit and loss information are extracted from various issues of '*Statistical Tables relating to banks in India*', a yearly publication by RBI. The set of prudential and financial ratios is culled out from the '*Report on Trend and Progress of Banking in India*', a statutory annual publication of RBI. Finally, the macroeconomic variables are sourced from '*Handbook of Statistics on Indian Economy*', another annual publication of RBI that provides time-series data on macro economic and monetary variables.

4.2 Variable description

Our major dependent variable of interest is *NIM*, defined as interest income less interest expense scaled by total asset. This measure of NIM has been commonly employed in the earlier research studies (Dumicic *et al.*, 2012; Entrop *et al.*, 2012; Kannan *et al.*, 2001 and Sensarma *et al.*, 2004).

The set of independent variables comprises of *bank specific, industry specific and macroeconomic variables*. Under the first set, the paper considers variables such as *bank size* (to account for scale economies), *asset share* (capturing banks' market power), *NPAs* (accounting for banks' ability to manage credit risk), *capital cushion* (which considers the banks' equity position and strength), and *liquidity* and *cost-income ratio* (which captures the banks' operational efficiency). The industry specific variables include *deposit concentration* (to capture banks' ability to deposit mobilization) and *foreign banks' asset share* (influence of foreign banks in domestic banking sector). In most of the cases, the signs of these variables are not evident, *a priori*. For example, higher share of foreign bank assets (indirectly implying greater competition) could impel banks to lower their margins or alternately, in case of price wars, raise margins. Finally, we control demand-side factors and the overall stance of monetary policy by including *real GDP growth rate* and *inflation* as additional variables in the regressions. The sign of these two variables cannot be judged, *a priori*.

Besides the above variables, we consider a set of dummy variables to account for the effect of ownership, merger and financial crisis. Separate dummies are employed for public sector, new private sector and foreign banks (old private banks being the control category). Likewise, we used a merger dummy which equals one for the acquirer bank in the year of merger. Finally, we include dummies to account for the effect of the financial crisis. In order to segregate the year-wise impact of the crisis, we include two

dummies, one for 2008 and another for 2009. The details of the variables used including their sources are given in Annex (Table -A1).

4.3 Methodology

Prior to our empirical model, in this section, the paper examines the anatomy of bank spreads. To do this, we employ the basic accounting identity of banks, from which profits are derived as the difference between interest income and income expense, net of provisions. Re-arranging this identity to highlight the relevance of NIM provides us with the following expressions as described below.

$$\begin{aligned} Profit(\pi) &= Income(I) - Expenditure(E) - Provision(P) \\ &= \{interest\ income(II) + non_interest\ income(NII)\} \\ &\quad - \{interest\ expense(IE) + non_interest\ expense(NIE)\} - Provision(P) \end{aligned}$$

$$so, \quad \pi = (II - IE) + (NII - NIE) - P \dots \dots \dots (1)$$

Dividing both sides of (1) by total asset (A) we get,

$$RoA = \frac{\pi}{A} = \left(\frac{II-IE}{A}\right) + \left(\frac{NII-NIE}{A}\right) - \frac{P}{A} = NIM + Burden - Provision$$

$$Hence, \quad NIM = RoA - Burden + Provision + Error \dots \dots \dots (2)$$

In other words, (2) means that NIM is derived as banks' Return on Assets (RoA) plus provisions netted for burden, with a residual error term.

Extending the identity in (2) further, we can write for a time point t,

$$\frac{d}{dt}(NIM_t) = \frac{d}{dt}(RoA_t) - \frac{d}{dt}(Burden_t) + \frac{d}{dt}(Provision_t) \dots \dots \dots (3)$$

Assume that the banks' maintain the level of profitability over time. Then, we put $\frac{d}{dt}(RoA_t) = 0$ in (3),

$$\frac{d}{dt}(NIM_t) = \frac{d}{dt}(Provision_t) - \frac{d}{dt}(Burden_t)$$

Or,

$$\frac{d}{dt}(NIM_t) = \frac{d}{dt}(Provision_t) + \frac{d}{dt}(NIE_t) - \frac{d}{dt}(NII_t) \dots \dots \dots (4)$$

It is, therefore, evident that to maintain the profitability level, the banks should adjust interest margin. Furthermore, equation(4) suggests that change in interest margin actually depends on changing level of provisions and burden. The reduction in burden

helps the margin to improve. Equation (4) also hints on the possible impact of variables affecting banks' non-interest income/expense in adjusting banks' margin, at a given level of provisioning.

Using data for the period 1992-2010, we examined the evolution of NIM within the framework of this relationship. The results are set out in the following Table (Table 1).

Table 1: Net Interest Margin Evolution

Year	NIM	Profit	Burden	Provision	Error
1992	0.039	0.0078	-0.0120	0.0197	-0.0000056
1993	0.032	-0.0044	-0.0137	0.0230	-0.0000001
1994	0.034	0.0008	-0.0106	0.0231	-0.0000006
1995	0.034	0.0089	-0.0106	0.0145	0.0000014
1996	0.033	0.0063	-0.0113	0.0164	0.0000001
1997	0.033	0.0086	-0.0106	0.0144	-0.0000003
1998	0.029	0.0037	-0.0081	0.0181	-0.0000012
1999	0.026	0.0041	-0.0148	0.0081	-0.0000006
2000	0.026	0.0060	-0.0090	0.0119	0.0000008
2001	0.027	0.0058	-0.0091	0.0125	0.0000000
2002	0.024	0.0079	-0.0024	0.0146	-0.0000007
2003	0.026	0.0106	-0.0005	0.0158	0.0000002
2004	0.027	0.0127	0.0006	0.0154	0.0000000
2005	0.027	0.0065	-0.0060	0.0153	0.0000000
2006	0.027	0.0095	-0.0065	0.0112	0.0000000
2007	0.028	0.0108	-0.0063	0.0109	0.0000001
2008	0.025	0.0130	-0.0037	0.0088	0.0000130
2009	0.026	0.0104	-0.0024	0.0135	0.0000133
2010	0.025	0.0090	-0.0040	0.0121	-0.0000004

Clearly, it is seen from the above table that banks used 45-50 per cent of their margin for provisioning and the trend continued to be similar over the entire consideration period of 1992 to 2010. But, over the years, the profit portion in the banks' margin increased from 19-20 per cent in 1992 to around 35-40 per cent by 2010.

As a starting point, we analyzed the pair-wise correlation coefficients of NIM with major independent variables as detailed in Table 2 below:

Table 2: Correlation matrix of variables

	<i>NIM</i>	<i>Size</i>	<i>Asset share</i>	<i>NPA</i>	<i>Cap cushion</i>	<i>CIR</i>	<i>Liquidity</i>	<i>Dep. concen</i>	<i>FB Asset</i>	<i>Inflation</i>	<i>GDP growth</i>
<i>NIM</i>	1.00										
<i>Size</i>	-0.23	1.00									
<i>Asset share</i>	-0.08	0.54	1.00								
<i>NPA</i>	-0.28	-0.32	-0.03	1.00							
<i>Cap cushion</i>	0.18	-0.31	-0.09	-0.04	1.00						
<i>CIR</i>	-0.16	-0.05	-0.01	0.27	-0.01	1.00					
<i>Liquidity</i>	0.02	-0.15	0.02	0.30	0.01	0.06	1.00				
<i>Dep concen</i>	0.25	-0.49	-0.02	0.36	-0.16	0.02	0.41	1.00			
<i>FB Asset</i>	-0.16	0.33	0.04	-0.27	0.11	-0.01	-0.31	-0.71	1.00		
<i>Inflation</i>	0.26	-0.29	0.01	-0.10	0.03	-0.02	0.19	0.50	-0.18	1.00	
<i>GDP growth</i>	-0.15	0.32	0.00	-0.26	0.10	-0.05	-0.31	-0.71	0.34	-0.41	1.00

In the above correlation matrix, NIM is negatively related with some of the bank specific variables like size, asset share, NPA, CIR and FB asset⁴. Negative relation between size and NIM was supported by scale efficiency theory. NPA and CIR measured the banks' operational (in) efficiency and negative correlation with NIM was justified as margin reduces with increasing inefficiency. On the other hand, capital cushion, liquidity and deposit concentration earmarked the banks' positive movement and thus helped banks to become more profitable. A positive correlation with these variables was thus expected. The negative correlation between NIM and GDP growth indicated the reduction of loan defaults which happened from 2004 onwards for all bank-groups.

4.4 Uni-variate framework

We further extended our analysis by conducting univariate test to examine the differences in margins. More specifically, we explored whether bank margins differ across ownership and therefore, analyzed the proximate causes of such differences. The results are provided in Table 3.

It is observed that margins, on an average, were typically the highest for foreign banks whereas the lowest for new private banks (NPBs). To illustrate, the average margins of foreign banks during the entire period was 3.4 per cent, roughly 40 per cent higher as compared to NPBs margins. Since NPBs entered the market only after reforms (1994-95), they needed to resort to aggressive pricing strategies in order to garner market shares. On the other hand, public sector and old private banks appeared

⁴ For detailed list of abbreviations please refer Annexed Table A1.

to have similar margins, but were lower as compared to their foreign counterparts. The univariate tests suggested that in all the cases, the differences in margins were statistically significant at conventional levels.

Some interesting phenomena were observed during the financial crisis, where tests revealed that the public sector banks were affected significantly by the financial crisis. Driven, among others, by lackluster loan demand (financial channel), their margins shrunk by around 25 per cent. A lower decline in margin was also evident for old private banks. In contrast however, margins of new private and foreign banks remained at levels prevailing prior to the crisis and in fact, improved. One way of looking at these outcomes would lead us to suggest that foreign and new private banks typically relied on “hard” information to extend credit, many of which were quite inelastic. Public sector banks, on the contrary, could be lending, among others, to SMEs, whose demand for credit appeared to have shrunk, in turn, impacting their margins (See, for instance, Berger *et al.* 2008).

Table 3: Univariate tests results

Ownership	NIM			
	Total period (1992-2010)		Crisis period (2008-2009)	
	Mean	SD	Mean	SD
PSB	0.028	0.007	0.021	0.005
OPB	0.029	0.009	0.026	0.006
NPB	0.024	0.009	0.025	0.009
FB	0.034	0.017	0.035	0.016
	T tests		T tests	
PSB vs. OPB	-2.96 ^{***5}		-4.15 ^{***}	
PSB vs. NPB	3.12 ^{***}		-1.27	
PSB vs. FB	-5.91 ^{***}		-5.09 ^{***}	
OPB vs. NPB	4.48 ^{***}		0.31	
OPB vs. FB	-3.77 ^{***}		-3.16 ^{***}	
NPB vs. FB	-6.63 ^{***}		-2.50 ^{**}	

4.5 Multivariate framework

The univariate tests presented earlier are not free from shortcomings. We could not control for bank-specific variables. By way of example, margins could differ by bank size or capital, since bigger banks would have greater flexibility in determining the

⁵***, ** and * indicate the significance levels of 1 per cent, 5 per cent and 10 per cent respectively.

pricing strategy. We also could not take into account the structure of the banking industry. The macroeconomic environment could also play a part as well.

To overcome these drawbacks, we employed a multivariate regression approach to identify the determinants of NIM for Indian banks.

The baseline regression for bank 'b' at time 't' is assumed to be of the following form:

$$NIM_{b,t} = \alpha_{bt} + \beta BS_{b,t} + \gamma BI_t + \delta M_t + \varepsilon_{b,t}$$

where, NIM is NIM for a bank (b) at year (t).

The right hand side consists of three sets of variables. **BS** denotes the set of bank specific variables; **BI** indicates the variables related to the banking sector and finally, **M** is the set of macro-economic variables and $\varepsilon_{b,t}$ uncorrelated disturbances for bank (b) at year (t). α, β, γ and δ are the unknown coefficients to be estimated, which will give the magnitude and direction of influence of the associated variable. To account for the possible autocorrelation in the model, we cluster the standard errors at the bank-level.

5. Results and Discussions

Discussion of results is organized into three parts.

- a) **General discussion:** The summary results are shown in *Table 4*. Important findings emanating from the analysis are summarized as under:
 - i) Big banks with high deposit concentration could operate with high margin. Similar observation was also reported by Tan (2012), Ghosh (2008), Athanasoglou *et al.* (2006) and Barajas *et al.* (1999).
 - ii) Banks with higher NPAs have to tolerate lower margins. Our disaggregation of NIMs earlier had indicated that margins were dampened by provisions. Combining that with the present results would suggest that banks with higher NPAs would need to increase provisions, which, in turn, lower their margins. Several studies, both in the Indian context and internationally as well, arrived at similar conclusions (Kannan *et al.*, 2001; Doliente, 2005; Ascarya *et al.*, 2010).
 - iii) Study on effect of sector-wise NPAs on to banks' margin revealed that banks' margin came under pressure due to high accumulation of NPAs with foreign banks. Interestingly, during 2001-2005, average NPA of foreign banks was around 18 per cent, whereas all other bank groups registered less than 10 per cent during the same period. In the remaining period also, foreign banks registered higher NPAs as compared to other banks [*ref. Col (1) in Table 4*].

- iv) Well capitalized banks exhibited higher margins. In particular, the higher the bank's capital position over and above the stipulated regulatory levels, higher was its flexibility in extending loans, which translated into higher margins. The fact that better capitalized banks were able to garner higher margin had been documented in empirical research studies (Sensarma *et al.*, 2004 and Al-Jarrah, 2010).
 - v) Inefficient banks in terms of cost efficiency have lower margins, as expected Burger *et al.* (2008).
 - vi) At the industry level, higher levels of deposit concentration and higher foreign bank share steered to improve banks' margin. Petersen and Rajan (1995) showed deposit concentration as a measure of market power in the loan market. Therefore, these findings appeared to indicate that higher market power provided impetus to banks to increase margins. Greater competition could sometime be detrimental. In their quest for one-up-manship, banks inclined to increase charges on customers, in turn, raising their margins. The positive coefficient of the variable '*foreign dominance*' was consistent with this inference (See, for instance, Tan, 2012).
 - vii) Finally, margins were higher in an upswing as indicated by the positive and significant coefficient of GDP growth. In terms of magnitude, a 50 per cent increase in GDP growth would increase margins by roughly 0.3 percentage points. The findings were in line with those obtained by earlier researchers (Saad *et al.* 2010).
- b) ***Bank ownership and NIM during Financial Crisis:*** In this section, we incorporated the interaction effects of bank ownership with the crisis separately for 2008 and 2009. More specifically, separate dummies are constructed for PSB after interacting with crisis dummies independently for 2008 and 2009. These interaction terms helped us to discern how the margins of PSBs are affected by the crisis separately during 2008 and 2009. Similarly, we generated the interaction effects for other bank groups. The remaining variables are kept unaltered. The regression results are listed under Col. (2) in table 4. Results showed that PSBs margin declined substantially in comparison with other bank groups. Hence, it is apparent that the PSBs are more affected by the crisis as compared to others (ref. Col.(2) point H in table 4).

Consider, for example, Col. (2) and more specifically, the interaction terms *viz.*, *PSB*Crisis 2008* and *PSB*Crisis 2009*. Both the interaction terms are highly significant and the coefficient of these interaction terms is -0.006 (same for both

interaction terms). This indicated that, as compared to old private banks, NIM of PSBs is 0.6 percentage points lower, on an average, in 2008 and also in 2009, as well. On the contrary, NPBs improved their margins in 2009. What this suggests is that the business philosophy and risk appetite of banks across ownership played an important role in influencing their margins during the crisis.

- c) **Bank specific variables and effect of crisis:** Following the monetary transmission literature, we have considered three important variables *viz.*, size, capital and liquidity; and explored the effect of these variables on bank's margin during the crisis. The interaction effects are generated by multiplying the variables with the crisis dummies and considered them in the regression model keeping other variables unaltered.

The regression results are shown in Table 4 [ref. *Col. 3 to 5*]. The outcomes indicated that banks with high liquidity improved their margins during the crisis and also capital rich banks appeared to have exhibited higher margins during the initial period of the crisis.

- d) **Effect of crisis on strong and weak banks:** The strong and weak banks are identified based on the top and bottom 25 percentile position of the banks in respect of above three variables (size, capital and liquidity). These effects are estimated after incorporating interaction effects of these variables with the crisis dummies (separately for 2008 and 2009). The effects of these interaction terms are shown in Table 4 [ref. *Col (6) to Col (11)*].

In this connection, the following findings appear to be noteworthy:

- i) Size of the bank does not have any role to be played in managing banks' margin during crisis. No significant impact has been found on the margin determination either for big or small banks.
- ii) Big banks with high capital and adequate liquidity do not exhibit any impact on their margin during the initial part of the crisis. However, during the second half, well capitalized banks increased their margin.
- iii) During the initial part of the crisis, small banks with limited capital and liquidity could operate without any pressure on their margin.
- iv) During the second half of the crisis, small banks could maintain profitability without altering the margin; but banks with low capital and liquidity support could not withstand the hit and were compelled to reduce their margin.

Table 4: Multivariate Panel Regression results

Variables	All	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
A. Bank specific Variables												
Bank size	0.004** (0.047)	0.003* (0.083)	0.003* (0.070)	0.004** (0.039)	0.003* (0.057)	0.004* (0.060)	0.004** (0.038)	0.004** (0.047)	0.004* (0.051)	0.004* (0.063)	0.004** (0.045)	0.004** (0.050)
Liquid Asset	-0.0001 (0.999)	-0.002 (0.865)	-0.006 (0.674)	0.0009 (0.946)	-0.003 (0.849)	0.003 (0.817)	-0.0002 (0.986)	0.003 (0.826)	0.0003 (0.980)	-0.003 (0.847)	0.001 (0.930)	0.001 (0.924)
Asset Share	-0.032* (0.056)	-0.029* (0.075)	-0.031* (0.074)	-0.031* (0.058)	-0.031* (0.062)	-0.030* (0.066)	-0.032** (0.049)	-0.034* (0.056)	-0.031* (0.059)	-0.031* (0.060)	-0.033* (0.057)	-0.031* (0.056)
Non-Performing Assets	-0.031*** (0.000)	----	-0.030*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.029*** (0.000)	-0.030*** (0.000)
Cost inefficiency	-0.0003*** (0.000)	-0.0002*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0002*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)	-0.0003*** (0.000)
Capital Cushion	0.002*** (0.000)	0.011* (0.061)	0.0018*** (0.000)	0.011** (0.050)	0.010* (0.094)	0.015*** (0.008)	0.010* (0.091)	0.012** (0.056)	0.010* (0.097)	0.009 (0.107)	0.011* (0.057)	0.009 (0.113)
B. Banking industry												
Foreign dominance	0.104** (0.033)	0.126** (0.011)	0.098** (0.047)	0.113** (0.028)	0.109** (0.030)	0.115** (0.031)	0.112** (0.027)	0.115** (0.025)	0.113** (0.028)	0.110** (0.030)	0.113** (0.027)	0.114** (0.025)
Deposit Concentration	0.172*** (0.000)	0.122*** (0.000)	0.170*** (0.000)	0.146*** (0.000)	0.147*** (0.000)	0.124*** (0.000)	0.150*** (0.000)	0.143*** (0.000)	0.147*** (0.000)	0.148*** (0.000)	0.145*** (0.000)	0.148*** (0.000)
C. Macro Economic												
Economic Growth	0.003*** (0.000)	0.002*** (0.001)	0.003*** (0.000)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.004)	0.003*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.003*** (0.001)
Price Movement	-0.016 (0.357)	-0.006 (0.726)	-0.015 (0.383)	-0.009 (0.584)	-0.010 (0.551)	-0.006 (0.740)	-0.011 (0.542)	-0.009 (0.581)	-0.010 (0.540)	-0.011 (0.537)	-0.009 (0.573)	-0.011 (0.521)
D. Ownership Dummies (control OPB)												
For PSB	-0.002 (0.376)	-0.0003 (0.161)	-0.0007 (0.749)	-0.002 (0.346)	-0.002 (0.391)	-0.002 (0.354)	-0.002 (0.423)	-0.002 (0.308)	-0.002 (0.360)	-0.002 (0.430)	-0.002 (0.382)	-0.002 (0.365)
For NPB	-0.006* (0.055)	-0.004 (0.324)	-0.007** (0.048)	-0.006* (0.052)	-0.006** (0.049)	-0.006** (0.048)	-0.006* (0.054)	-0.007** (0.044)	-0.006** (0.047)	-0.006** (0.049)	-0.007** (0.042)	-0.007** (0.046)
For FB	0.003 (0.244)	0.004* (0.059)	0.002 (0.458)	0.002 (0.230)	0.002 (0.262)	0.003 (0.229)	0.003 (0.219)	0.003 (0.243)	0.003 (0.249)	0.003 (0.266)	0.003 (0.245)	0.003 (0.241)

E. Merger dummy												
	0.0007 (0.759)	0.001 (0.602)	0.0008 (0.720)	0.001 (0.645)	0.0009 (0.690)	0.001 (0.628)	0.001 (0.670)	0.0009 (0.694)	0.0009 (0.698)	0.001 (0.619)	0.001 (0.614)	0.0009 (0.703)
F. Crisis dummies												
For 2008	-0.003 (0.193)	-0.004** (0.041)	-0.001 (0.518)	0.027 (0.146)	-0.005 (0.507)	-0.009*** (0.000)	-0.001 (0.713)	-0.005** (0.012)	-0.004 (0.120)	-0.002 (0.389)	-0.005** (0.019)	-0.004* (0.098)
For 2009	-0.002 (0.285)	-0.004* (0.078)	-0.002 (0.329)	0.009 (0.604)	-0.016** (0.014)	-0.006*** (0.008)	-0.0005 (0.904)	-0.004* (0.085)	-0.004 (0.100)	0.001 (0.866)	-0.005*** (0.008)	-0.003 (0.226)
G. Sector wise NPA's effect on NIM												
NPA of PSB		-0.009 (0.512)										
NPA of OPB		-0.023 (0.108)										
NPA of NPB		-0.064 (0.504)										
NPA of FB		-0.034*** (0.000)										
H. Ownership during crisis												
PSB x Crisis_2008			-0.006*** (0.000)									
NPB xCrisis_2008			0.002 (0.154)									
FB x Crisis_2008			0.005 (0.160)									
PSB x Crisis_2009			-0.006*** (0.000)									
NPB x Crisis_2009			0.005* (0.087)									
FB x Crisis_2009			0.007 (0.105)									
I. Bank specific variables during crisis												
Bank size x Crisis_2008				-0.005* (0.075)								

Bank size x Crisis_2009					-0.002 (0.431)								
Liquid Asset x Crisis_2008						0.005 (0.862)							
Liquid Asset x Crisis_2009						0.062* (0.051)							
Capital cushion x Crisis_2008							0.002*** (0.010)						
Capital cushion x Crisis_2009							0.0009 (0.227)						
J. Top/bottom 25 per centile banks													
Size_top x crisis_2008												-0.004 (0.112)	
Size_top x crisis_2009												-0.005 (0.147)	
Size_bot x crisis_2008												0.014 (0.143)	
Size_bot x crisis_2009												0.0008 (0.902)	
Liquidity_top x crisis_2008												-0.002 (0.803)	
Liquidity_top x crisis_2009												0.006 (0.319)	
Liquidity_bot x crisis_2008												-0.003 (0.167)	
Liquidity_bot x crisis_2009												-0.006** (0.024)	
Capital_top x crisis_2008												0.004 (0.259)	
Capital_top x crisis_2009												0.006* (0.060)	
Capital_bot x crisis_2008													0.002 (0.489)
Capital_bot x crisis_2009													-0.008*** (0.000)
Constant	-0.075***	-0.052***	-0.071***	-0.067***	0.064***	-0.053***	-0.068***	-0.065***	-0.064***	-0.063***	-0.064***	-0.065***	-0.065***

	(0.000)	(0.008)	(0.000)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No. of observations	948	948	948	948	948	948	948	948	948	948	948	948
No. of Banks	64	64	64	64	64	64	64	64	64	64	64	64
R2	0.258	0.272	0.287	0.269	0.266	0.274	0.266	0.269	0.263	0.269	0.268	0.264
Adjusted R ²	0.245	0.256	0.270	0.254	0.251	0.259	0.251	0.255	0.248	0.254	0.253	0.248

N.B.

a) ***, ** and * indicate the significance levels of 1 per cent, 5 per cent and 10 per cent respectively.

b) Columns of Table 4 indicate the regression results as detailed below:

- i) (All): baseline regression
- ii) (1): regression for finding the effect of sector-wise NPA
- iii) (2): regression for finding the effect of ownership during crisis
- iv) (3) – (5): regression for finding the effect of bank specific variables during crisis
- v) (6) – (11): regression for finding the effect of crisis on strong and weak banks

6. Concluding remarks

Indian banks are still operating with relatively high interest margin as compared to international benchmark. It is, therefore, prudent to seek productivity augmentation by reducing the margin through limiting the intermediation costs. Given the structure of the banking system in India, foreign banks are operating with relatively high margins as compared to other bank groups. However, after the globalization and introduction of several regulatory policy measures by the Central Bank, the overall efficiency increased in terms of other parameters.

Challenges remain in dealing with increasing NPAs for banks in maintaining their margin. Although the NPA level has significantly reduced to around 2 per cent in 2010 from as high as 11 per cent during 2004, banks still maintain provision (in 2010), as high as 40 per cent, for the bad debt in their books of accounts which could be due to changing composition of credit portfolio.

The study observed that variables such as size, NPA, cost (in) efficiency, capital cushion, deposit concentration and economic growth are important in determining the banks' behavior regarding their interest margin.

Interestingly, the global financial crisis which posed a threat to the banking stability of major economies around the world eventually had some impact on the interest margin of banks in India. The public sector banks (PSBs) appears to be the worst affected as compared to other bank groups. A reduction measuring 0.6 percentage points in overall margin was observed for public sector banks during 2008, followed by a further reduction of 0.6 percentage points in 2009. While banks with high capital and liquidity could sustain the margin during the entire period of the crisis, the banks with low capital and liquidity found it difficult to maintain the margin.

Table A1: Data definitions and possible impact

	Variable Name	Description	Rationale	Expected Sign
Dependent Variable				
1	Net Interest Margin (NIM)	Net interest income scaled by total assets	-----	----
Bank specific variables				
1	Bank Size	Logarithm of total asset	Positive: Large banks' have market power, credibility and stability. They can mobilize low cost deposits. Negative: Large banks can operate with relatively low margin due to scale efficiencies.	Positive/ Negative
2	Asset Share	Share of bank assets in total assets.	Positive: Banks with relatively high asset share are likely to lead in the margin movement. Negative: Big banks with the help of additional share of assets can force aggressive pricing strategy, resulting in reduction of banks' margin.	Positive/ Negative
3	Non-Performing Asset (NPA)	Non- performing assets to total assets.	Positive: Banks try to increase interest income to offset the loss on non-performing loans. Negative: High provisioning requirement will put pressure on banks' margin.	Positive/ Negative
4	Capital cushion	CRAR to regulatory capital requirement.	Increased level of capital strength is an indicator of banks stability. Additional security enhances depositors' confidence, leading to availability of low cost deposit.	Positive
5	Liquid Asset	Cash balance, balance with RBI, 50 per cent haircut on money at call and short notice, investments in and outside India. The sum total of these is scaled by total assets.	Positive: Liquidity support helps banks to increase lending rate to improve upon interest income. Negative: Excess liquidity helps banks to move with aggressive pricing strategy to acquire market share by compromising interest income.	Positive/ Negative
6	Cost (in)efficiency (CIR)	Operating expenses of the bank scaled by the interest income.	Increasing operating cost of the banks forced banks to increase deposit rate to have access to additional fund, resulting in a drop of margin.	Negative
Banking Industry Specific				
1	Deposit Concentration	Ratio of total deposits of top five banks to total deposits.	Market is controlled by big banks. It implies less competition or high margin.	Positive

2	Foreign dominance	Foreign banks' assets over the total assets.	Foreign banks with additional external support can lead the market in increasing margin.	Positive
Macro-Economic				
1	Economic Growth	Real GDP growth (nominal adjusted for inflation).	Positive: Economic growth increase loan demand. The lending rate increase, resulting in increasing margin. Negative: GDP growth increases the loan demand and aggressive lending increase the default rate.	Positive/ Negative
2	Price Movement	Inflation: measured as the change in WPI level (Indian scenario).	Positive: With increasing price level, the market credit demand will increase and thus banks have a chance to increase their lending rate. Negative: With increasing inflationary pressure, banks face difficulty in deposit accumulation and forced to increase the deposit rate. Interest income reduces.	Positive/ Negative
Dummy variables				
Ownership dummies				
1	For PSB(Public sector banks)	Equal to 1, if the respective bank is a public sector bank and 0, otherwise.	-----	-----
2	For OPB (Old Private Sector banks)	Equal to 1, if the respective bank is an Old Private Sector bank and 0, otherwise.	-----	-----
3	For NPB (New Private Sector banks)	Equal to 1, if the respective bank is a new private sector bank and 0, otherwise.	-----	-----
4	For FB (Foreign banks)	Equal to 1, if the respective bank is a foreign bank and equal to 0, otherwise.	-----	-----
Other Dummies				
5	Bank Merger	Equal to 1, against the bank merged with other bank and 0, otherwise.	-----	-----
Financial Crisis impact				
6	Effect of crisis in 2008	Equal to 1 against year 2008 and equal to 0 otherwise.	-----	-----
7	Effect of crisis in 2009	Equal to 1 against year 2009 and equal to 0, otherwise.	-----	-----

Table A2: Descriptive statistics of variables (ownership)

Variables	All Banks		PSB		OPB		NPB		FB	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
NIM	0.029	0.011	0.028	0.007	0.029	0.009	0.024	0.009	0.034	0.017
Size	5.887	0.774	6.395	0.519	5.481	0.557	6.112	0.798	5.321	0.710
Asset share	0.014	0.032	0.030	0.042	0.003	0.003	0.018	0.026	0.004	0.006
NPA	0.093	0.114	0.094	0.077	0.081	0.061	0.040	0.032	0.119	0.190
Capital Cushion	0.140	0.122	0.118	0.081	0.136	0.070	0.139	0.073	0.181	0.199
Cost inefficiency	0.619	2.061	0.621	0.245	0.563	0.342	0.493	0.153	0.700	4.070
Foreign dominance	0.067	0.012	0.067	0.012	0.066	0.012	0.068	0.013	0.067	0.012
Deposit Concentration	0.439	0.036	0.439	0.037	0.440	0.037	0.431	0.031	0.440	0.037
Economic Growth	0.067	0.022	0.067	0.022	0.067	0.022	0.071	0.019	0.067	0.022
Price movement	0.065	0.029	0.065	0.029	0.066	0.029	0.058	0.023	0.066	0.029
Liquid Asset	0.253	0.058	0.264	0.047	0.251	0.048	0.245	0.057	0.238	0.077

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