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Abstract

If banks solve an inter-temporal problem under adverse selection and moral hazard, then bank specific factors, regulatory and supervisory features, market structure, and macroeconomic factors affect banksâ€™ loan interest rates and their spread over deposit interest rates. To examine post financial-reform interest rate pass through for Indian banks after controlling for all these factors, we estimate the determinants of commercial banksâ€™ loan pricing decisions, using dynamic panel methods. The several factors commercial banks consider, apart from the policy rate, limit policy pass through. More competition reduces policy pass-through but it can improve monetary transmission provided it improves managerial efficiency.

Keywords: Banks, panel data, interest rates, net interest income, operating cost

JEL Code: G20, G21, C230, E43, L10

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1. Introduction

In the wake of a balance of payment crisis, India adopted banking reform as part of a revamp of the financial system. Although the reforms focused on removing financial repression through reductions in statutory pre-emptions, while stepping up prudential regulations, they encompassed various dimensions. First, the level of competition was gradually increased within the banking system by allowing greater participation of domestic private and foreign banks while giving banks greater freedom in pricing and allocation of credit. Second, measures were taken to develop various segments of financial markets such as money, bond, credit, foreign exchange and equity. Newer instruments were introduced to allow financial institutions, savers and investors opportunities for diversification, optimization of return and risk on their portfolios and effective management of liquidity and other risks. Third, in order to ensure stability of the financial system, banks were subjected to international best practices in prudential regulation and supervision tailored to Indian requirements. Fourth, measures were taken to improve the institutional arrangements including the legal framework and technology platform for effective, cost efficient and sound payment and settlement system. Finally, consistent with the new institutional architecture for the financial system in general and the banking sector in particular, the monetary policy framework made a phased shift from direct instruments of monetary management such as cash reserve and statutory liquidity requirements to an increasing reliance on indirect instruments such as short term policy interest rate including repo and reverse repo rates. The shift from a traditional quantum of money to an interest rate channel of monetary transmission mechanism envisaged that banks would be guided by market conditions and balance sheet pressures along with regulatory and prudential requirements, while pricing their assets and liability components.

Commercial banks' loan pricing decisions are important for policy. First, competitiveness and efficiency of banks in financial intermediation affects price discovery in the loan market. This is measured by loan interest rates and their spreads over deposit interest rate and risk free yield on government securities. Loan interest rates in turn affect economic growth and macroeconomic stability (Levine, 1997). Second, loan interest rates affect banks' loan asset quality and credit risks which have implications for the stability of a bank based financial system. Third, for successful conduct of monetary policy through the interest rate channel commercial banks should adjust loan interest rates in tandem with policy actions. However, the policy interest rate can constitute only one of the several factors considered by banks in the determination of loan interest rates. Numerous studies have examined the rigidity in banks' lending decisions in response to a policy shock.

If banks solve an inter-temporal problem under adverse selection and moral hazard in adjusting to a change in policy rates, market structure, bank specific factors, regulatory and supervisory indicators and macroeconomic factors can all be expected to affect banks' loan interest rates and their spread over deposit interest rates. It is useful to assess (i) interest rate pass through, after controlling for these factors, and (ii) how extensive financial reform has changed these factors and their impact.

After the initiation of financial sector reforms in the early 1990s, various steps were initiated to deregulate the lending rates of commercial banks. The credit limit size classes of scheduled commercial banks, on which administered rates were prescribed, were reduced to three slabs in April 1993. The slabs under the revised guidelines consisted of three categories: (i) advances up to and inclusive of INR 25,000; (ii) advances over INR 25,000 and up to INR 2 lakh; and (iii) advances over INR 2 lakh. In October 1997, banks were given the freedom to announce separate Prime Term Lending Rates (PTLR), for term loans of 3 years and above, while PLR remained applicable to the loans taken for working capital and short-term purposes. To align with international practice and provide further operational flexibility to commercial banks in deciding their lending rates, the Reserve Bank relaxed the requirement of PLR being the floor rate for loans above INR2 lakh. Banks were allowed to offer loans at below-PLR rates to exporters or other creditworthy borrowers including public enterprises following a transparent and objective policy approved by their respective boards. Thus beginning April 19, 2001 commercial banks were allowed to lend at sub-PLR rates for loans above INR2 lakh. Competition had forced the pricing of a significant proportion of loans in a non-transparent manner far out of alignment with BPLRs. As a consequence, this had undermined the role of the BPLR as a reference rate. Furthermore, there was a public perception that there was under-pricing of credit for corporates while there could be overpricing of lending to agriculture and to small and medium enterprises.

Moreover, transmission of policy rates was inadequate. Illustratively, in the wake of recent global crisis in 2008-09, the Reserve Bank of India (RBI) pursued a softer interest rate policy stance to stimulate the economy by way of slashing the policy rate by 475 basis points. However, banks' lending rates declined only by 100 to 250 basis points. Subsequently, RBI raised the policy rate 13 times in response to hardening of inflation.

However, banks did not adequately revise deposit and lending rates. In this milieu, RBI set up a committee to review the system of benchmark prime lending rate. Based on the recommendations of the committee, a base rate system was introduced with effect from 2010-11. The Base Rate represents the minimum rate below which it will not be viable for the banks to lend. The Base Rate System is applicable for loans with maturity of one year and above (including all working capital loans). Banks could give loans below one year at fixed or floating rates without reference to the Base Rate. A year later, drawing lessons from the banks' response to the base rate system, the RBI again set up a committee to look into the pricing decisions of banks.

Transmission had still not improved. So analysis of factors influencing banks' loan pricing decisions would be a useful input for policy. Moreover, studies on the subject are non-existent in the Indian context. We estimate the determinants of commercial banks' loan pricing decisions, using the dynamic panel data methodology and annual data for a sample of 33 banks including public, private and foreign banks over the period 1996-2011. Results show commercial banks consideration of several factors apart from the policy rate limits policy pass through.

The structure of the paper is as follows: Section 2 presents review of literature followed by methodology and data in Section 3, summary statistics and empirical findings in Section 4 and conclusion in Section 5.

2. The Literature

The seminal works of Klein (1971), Monti (1972) and Ho and Saunders (1981), have inspired numerous studies to analyse commercial banks' loan pricing decisions. Klein (1971) and Monti (1972) postulated a theory of a banking firm and demonstrated how in a static setting demands and supplies of deposits and loans simultaneously clear both markets. The banking firm framework has been further explored by Zarruk (1989) and Wong (1997). Zarruk found that when the deposit supply function becomes more volatile, the bank's spread narrows, which implies a decline in the quality of the bank's assets. Wong pointed out that marginal administrative cost of loans is one the key factors in determining the interest rate spread. Carbó and Rodríguez (2005) developed the theoretical model by including both traditional and non-traditional activities, with the aim of studying the effect of specialization on bank margins in Europe using a multi-output model. For this purpose, they used a dynamic model taking into account the fact that banks needed to match the random supply of deposits with the random demand for lending and non-traditional activities.

Ho and Saunders (1981) developed a dealership model in which banks were assumed to be risk-averse utility maximizing intermediaries for collecting deposits and granting loans over a single-period. Transaction uncertainty arising due to the asymmetry between the supply of deposits and the demand for loans and market power were considered two significant factors driving interest margins. Ho and Saunders (1981) also empirically estimated the model for the U.S. banks, using a two-step approach. In the first step, a regression model explained bank interest margin in terms of bank-specific factors such as implicit interest rate, opportunity cost of reserves, default premium, operating costs, and capital-asset ratio. The constant term of this regression represented an estimate of the 'pure spread' component for the banks, i.e. the portion of the margin that cannot be explained by bank-specific characteristics. In the second stage, they estimated a regression of pure spread against variables reflecting macroeconomic factors. The inclusion of a constant term in second step aimed at capturing factors that are neither bank-specific nor macroeconomic in nature but attributable to market structure and risk aversion.

McShane and Sharpe (1985), Allen (1988) and Angbazo (1997) have extended and modified the dealership model to a greater extent. McShane and Sharpe (1985) considered interest uncertainty from loan and deposit returns to money market rates. Allen (1988) extended the model for various types of loans with interdependent demands. Angbazo (1997) introduced credit and interest rate risk, and interaction between the two, into the theoretical model. The dealership model has been criticised on the grounds that it failed to recognize the bank as a firm having a certain production function associated with provision of intermediation services (Lerner, 1981). Cost inefficiencies in the production process across banks can have a distortionary effect on the margin. Thus, Maudos and Fernández de Guevara (2004) made an interesting contribution while expanding the theoretical model by considering the importance of operating costs, market power (Lerner index) and providing a detailed description of the link between riskiness and the margin. Their model specifically differentiated between market risk and credit risk, as well as their interaction as separate factors affecting the margin. The model was then estimated empirically for the main European banking sectors in the period 1992-2000. The opportunity cost variable (OC) was approximated, by the yield on Government securities investment. This variable was included in the profitability equation to reflect the substitution effect among different bank assets, and more specifically to capture the changing remuneration conditions of substitutes for the traditional loans granted by banks (the assets for which banks are price-takers). The expected effect of this variable on bank net margin is unknown (Wong, 1997) and depends on the position (net lender or borrower) of the bank in the money market (Angbazo, 1997).

Taking inspiration from the theoretical literature, empirical studies have applied a variety of econometric models including ordinary least square, pooled least square (Demirguc-Kunt and Huizinga 1999, Angbazo 1997), fixed effect and random effect panel regression (Naceur and Goaied 2004, Maudos and Guevara 2003, Maudos and Solisc 2009, Hamadi and Awdeh 2012, Afanasieff et al. 2002) and dynamic panel data technique (Liebeg and Schwaiger 2007, Hossain, 2010). Broadly, the factors concerning loan pricing can be summarized under four broad categories: (i) bank specific factors (ii) institutional, policy and regulatory factors (iii) market structure, and (iv) macroeconomic factors. Bank specific factors such as bank size, capitalization, liquidity, managerial efficiency, non-interest operating expenses, loan quality, deposit growth, interest rate risk, credit risk, ownership, non-interest incomes, and risk aversion are identified by multiple studies as the important determinants of interest margins. Regulatory and institutional factors subsume determinants such as implicit and explicit taxation (reserve requirements), central bank discount rate, and inter-bank rate. The market structure focuses on the competition in the banking sector (market power), bank concentration, and financial sector liberalization. Finally, the macroeconomic view focuses on inflation rate, GDP growth, exchange rate, interest rate policies, gross national savings, and investment and capital formation as factors driving interest spreads and margins in the banking system.

Leibeg and Schwaiger (2007) in a study for Austria and Hossain (2010) for Bangladesh found a negative influence of bank size on interest rate margins. On the contrary, Demirguc-Kunt et al. (2004) in a cross-country study showed high net interest margins tend to be positively associated with market share of banks. Similarly, Berger and Humphrey (1997), and Altunbas et al. (2001) found economies of scale for larger banks whereas Vennet (1998) and Pallage (1991) found economies of scale for small banks or diseconomies for larger banks.

Estrada et al. (2006) argue that interest margin is positively affected by inefficiency. Similar studies by Hamadi and Awdeh (2012), Maudos and Guevara (2003), and Maudos and Solisc (2009) postulate that efficiency/quality of management is negatively correlated with net interest margin. Studies on credit risk show both negative and positive impact. Liebeg and Schwaiger (2007), Williams (2007), and Hamadi and Awdeh (2012) provided evidence of a negative impact of credit risk on the interest margin. On the contrary, Maudos and Guevara (2003), and Maudos and Solisc (2009) showed a positive sign for credit risk as well as interest rate risk. Hamadi and Awedh (2012) found liquidity negatively correlated with net interest margins for domestic banks. However, Doliente (2003) in his study of Southeast Asia held a divergent view, while showing margins to be partially explained by liquid assets.

As regards to operating cost, risk aversion and loan quality; Liebeg and Schwaiger (2007), Maudos and Guevara (2003), Maudos and Solisc (2009), Doliente (2003), Mannasoo (2012) and Hossain (2010) in their respective studies show a positive impact of either one or all of these variables on interest margin. Implicit taxes include reserve and liquidity requirements whose opportunity cost tend to be higher as they are remunerated at less than market rates. In contrast, explicit taxes translate into higher interest margins. Studies suggest that corporate tax is fully passed on to customers in poor as well as rich countries. This is aligned with the common notion that bank stock investors need to receive a net of company tax returns that is independent of the company tax (Demirguc-Kunt and Huizingia, 1999).

Most of the studies on banking structure generally produce ambiguous results regarding the impact of competition. Studies like Liebeg and Schwaiger (2007), Maudos and Guevara (2003), and Maudosa and Solisc (2006) demonstrated that competition in banking sector positively affected the interest margin. Chirwa and Mlachila (2004) found that interest rate spreads in Malawi increased significantly after implementation of financial liberalization reforms partially due to high monopoly power within the industry, which stifled competition. They concluded that high interest rate spreads in developing countries will persist if financial sector reforms do not alter the structure of banking system. Estrada et al. (2006) and Männasoo (2012) provided evidence in support to this argument and concluded with market power as a key determinant of interest margin.

Goyal (2014) provided evidence in support of monetary transmission through the banks in Indian context for the pass through of call money rates to bank lending rates, for different sectors and by type of bank ownership. Pass through was also affected by size and the degree of competitiveness. Since pass through falls with competitiveness, it is higher to the extent the Indian banking sector is less competitive (Ansari and Goyal, 2011).

Mendoza (1997) identified the low level of competition in the Belizean banking system as a primary reason for a higher interest spreads than in Barbados, a country with similar exchange rate regime and high reserve requirement. The price cost margin (PCM) is widely used as a measure of competition. However, the theoretical foundations of PCM as a competition measure are not robust. Theoretical papers like Amir (2003), Bulow and Klemperer (1999), Rosentahl (1980) and Stiglitz (1989) present models where more intense competition leads to higher PCM instead of lower margins. Boone (2008) assumes that more efficient firms (that is, firms with lower marginal costs) will gain higher market shares or profits, and that this effect will be stronger the heavier competition in that market is. In order to support this intuitive market characteristic, Boone develops a theoretical measure, found to be more robust than any other methods, viz. PCM, HHI, H-statistic.

The studies support that macroeconomic factors are important determinants in explaining variations in interest margin. Afanasieff et al. (2002) uncovers the main determinants of bank interest spreads in Brazil and suggests that macroeconomic variables are the most relevant elements. Studies have found inflation to be associated with higher interest margins as it entails higher transaction costs (Demirguc-Kunt and Huizingia, 1999). Birchwood (2004) explicitly examined the impact of macroeconomic influences on nominal and real interest spreads in the Caribbean region and concluded that inter-region differences may be due to economic cycles and inflation. As far as impact of GDP growth on interest margin is concerned, Liebeg and Schwaiger (2006) and Hamadi and Awdeh (2012) have contrasting views. While the former argues that GDP growth rate has a positive impact the latter concludes economic growth to be negatively correlated to net interest margin. The introduction of intermediaries shifts the composition of savings toward capital, causing intermediation to promote growth. In addition, intermediaries generally reduce socially unnecessary capital liquidation, again tending to promote growth (Bencivenga, 1991).

To summarize, the above discussion suggests that determinants and impacts of bank interest margins vary considerably. Multiple factors contribute to high spreads and margins especially in a less developed financial system. Generally, interest spreads are higher in developing countries than developed countries due to a mix of the factors explained above[1]. Therefore country, time and context specific studies are required.

3. Methodology

Panel data analysis is used in the literature for analysing commercial banks' loan pricing decisions. This method is useful for identifying and measuring effects that are not detectable in pure cross-section or pure time-series data; for dealing with the problem of heterogeneity;

[1] See Barajas et al. 1999, Brock and Rojas-Suarez 2000, Chirwa and Machila 2004, Beck and Hesse 2009.

and to investigate the dynamics of change due to external factors affecting dependent variables.

Panel data methodology comprises static and dynamic models. Static models again can be differentiated in terms of group effects, time effects, and both time and group effects. These effects can be either fixed effect or random effects. A fixed effect model assumes differences in intercepts across groups or time periods, whereas a random effect model explores differences in error variances. Static panel data models are based on a key assumption, that is, the absence of correlation between the error components and the explanatory variables. However, endogeneity issues make the fixed-effect and random-effects estimator biased and inconsistent (Verbeek, 2008). Dynamic panel data analysis solves this problem using Generalized Methods of Moments (GMM) (Arellano and Bond 1991).

Theoretical arguments in favour of using dynamic panel data model for analysing loan pricing decisions of banks derive from asymmetric information and adverse selection. Asymmetric information can lead to a sluggish adjustment process to the long-run equilibrium, implying some delay in the response of market interest rates to changes in the policy rate depending upon bank characteristics. Specifically, in the short run, banks may solve an inter-temporal problem characterized by a cost of adjusting too slowly to the long-run equilibrium and a cost of moving too fast. This latter cost is due to adverse selection and moral hazard problems in the banking industry. For instance, if a bank increases the lending rate in response to an increase in the money market rate, the bank's adjustment to its new long-term equilibrium may involve attracting debtors that have a lower repayment probability, thereby lowering the bank's profits. At the same time, moral hazard arises because a higher interest rate gives debtors incentives to invest in riskier projects, which would also decrease the bank's profits.

As in this framework, we assume that there are some adjustment costs stemming from asymmetric information[2]. This is modelled as a quadratic loss function following Nickell (1985), Scholnick (1991), and Winker (1999), which is tractable because it generates a linear decision rule. The loss function for bank k in period t is the following:

[2] Lago-González and Salas-Fumás (2005) found that loan price adjustment speed first decreases and later increases with market concentration, which was consistent with predictions from models that assumed quantity adjustment costs.

$$\Gamma t,k = \sum^{\infty} \varphi_k^s \, [\Omega_{1,k}(r_{L,k,t+s} - \varphi_k \, r_{P,t+s})^2 + \Omega_{2,k}(r_{L,k,t+s} - r_{L,k,t+s-1})^2 \quad (2.1)$$

where Ω_1 and Ω_2 represent the weight that the bank gives to achieving the long-run target value for the lending rate (r_L) and the cost of moving to that target value, respectively. The variable (r_P) represents the policy rate of interest. The φ_k is a function of the demand elasticity and the probability of repayment that bank k faces, whereas Ω_j, j = 1,2, depends on the bank's average loan risk. If the portion of past-due loans for bank k is higher, the adverse selection or moral hazard problem for that bank becomes more important and the bank will give more weight to changes in the interest rate, which implies a slower adjustment. On minimizing equation (2.1) with respect to r_L, we obtain

$$r_{L,k,t+s} = (\Omega_{1,k}/(\Omega_{1,k} + \Omega_{2,k})) \, \varphi_k \, r_{P,t+s} + (\Omega_{2,k}/(\Omega_{1,k} + \Omega_{2,k})) \, r_{L,k,t+s-1} \quad (2.2)$$

Equation (2.2) shows that the impact coefficient depends on the size of $\Omega_{1,k}$ relative to $\Omega_{1,k} + \Omega_{2,k}$ and the mark up, φ_k. Therefore, the long-run coefficient is always larger than the short-term coefficient. The bank's loan risk determines φ_k and $\Omega_{2,k}$, the lower the probability of repayment (higher risk), the higher are both φ_k and $\Omega_{2,k}$. If the debtors are too risky and the effect on $\Omega_{2,k}$ is more important, the bank may not completely pass through a money market interest rate increase (in the short run) because of debtor moral hazard. In the long run, however, the interest rate charged will reflect the risk characteristic of the debtor. In other words, unpaid loans should have a negative effect on the impact coefficient and a positive effect on the long-term multiplier.

A dynamic panel data model that accounts for risk persistence and endogeneity of the bank-specific controls, (Beck and Levine 2004), and for the time persistence in the loan pricing structure, is adopted[3]. The main feature of a dynamic panel data specification is the inclusion of a lagged dependent variable in the set of explanatory variables i.e.

$$y_{i,t} = \alpha y_{i,t-1} + \beta(L) X_{i,t} + \eta_i + \varepsilon_{i,t}, |\alpha| < 1, i = 1,\dots,N, t = 1,\dots,T \quad (2.3)$$

where the subscripts *i* and t denote the cross sectional and time dimension of the panel sample respectively, $y_{i,t}$ is the lending rate, $\beta(L)$ is the lag polynomial vector, X_{it} *is* $(1 \times k)$

[3] This follows the recent literature on panel data banking studies: Salas and Saurina (2002), Athanasoglou et al. (2008) and Merkl and Stolz (2009).

vector of explanatory variables other than $y_{i,t-1}$, η_i is the unobserved individual (bank specific) effects and $\varepsilon_{i,t}$ are the error terms.

As the lagged dependent variable, $y_{i,t-1}$ is inherently correlated with the bank specific effects, η_i, OLS estimation methods will produce biased and inconsistent parameters estimates. Equation (2.3) is consistently estimated utilizing GMM[4] based on the first difference transformation of equation (2.3) and the subsequent elimination of bank-specific effects:

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \beta(L)\Delta X_{i,t} + \Delta\varepsilon_{i,t}\,, \qquad i = 1,\ldots,N\,, t = 1,\ldots,T \tag{2.4}$$

Where Δ is the first difference operator. In equation (2.4), the lagged dependent variable, Δy_{it-1} is, by construction, correlated with the error term, $\Delta\varepsilon_{it}$ imposing a bias in the estimation of the model. Nonetheless, y_{it-2}, which is expected to be correlated with Δy_{it-1} and not correlated with $\Delta\varepsilon_{it}$ for $t = 3,...,T$, can be used as an instrument in the estimation of (2.4), given that ε_{it} are not serially correlated. This suggests that lags of order two, and more, of the dependent variable satisfy the following moment conditions:

$$E[y_{i,t-s}\Delta\varepsilon_{i,t}\ ] = 0\ for\ t = 3,\ldots,T\ and\ s \geq 2 \tag{2.5}$$

A second source of bias stems from the possible endogeneity of the explanatory variables and the resultant correlation with the error term. In the case of *strictly exogenous* variables, all past and future values of the explanatory variable are uncorrelated with the error term, implying the following moment conditions:

$$E[X_{i,t-s}\,\Delta\varepsilon_{i,t}\ ] = 0, \qquad t = 3,\ldots,T\ and\ for\ all\ s. \tag{2.6}$$

The assumption of strict exogeneity is restrictive and invalid in the presence of reverse causality i.e. when $E\,[X_{is}\varepsilon_{it}] \neq 0$ for $t < s$. For a set of *weakly exogenous* or *predetermined* explanatory variables, only current and lagged values of X_{it} are valid instruments and the following moment conditions can be used:

$$E[X_{i,t-s}\,\Delta\varepsilon_{i,t}\ ] = 0, \qquad t = 3,\ldots,T\ and\ for\ s \geq 2. \tag{2.7}$$

[4] As proposed by Arellano and Bond (1991) and generalized by Arellano and Bover (1995) and Blundell and Bond (1998).

The orthogonality restrictions described in (2.5) – (2.7) form the underpinnings of the one-step GMM estimation which produces, under the assumption of independent and homoscedastic residuals (both cross-sectionally and over time), consistent parameter estimates. Arellano and Bond (1991) propose another variant of the GMM estimator, namely the two-step estimator, which utilizes the estimated residuals in order to construct a consistent variance covariance matrix of the moment conditions. Although the two-step estimator is asymptotically more efficient than the one-step estimator and relaxes the assumption of homoscedasticity, the efficiency gains are not that important even in the case of heteroscedastic errors[5]. This result is further supported by the empirical findings of Judson and Owen (1999), who performed Monte Carlo experiments for a variety of cross sectional and time series dimensions and showed that the one-step estimator outperforms the two-step estimator. Moreover, the two-step estimator imposes a downward (upward) bias in standard errors (t-statistics) due to its dependence to estimated values (as it uses the estimated residuals from the one-step estimator) (Windmeijer, 2005), which may lead to unreliable asymptotic statistical inference (Bond, 2002, Bond and Windmeijeir, 2002). This issue should be taken into account, especially in the case of data samples with relatively small cross section dimension (Arellano and Bond, 1991 and Blundell and Bond, 1998).

As noted above, the validity of the instruments used in the moment conditions as well as the assumption of serial independence of the residuals is crucial for the consistency of the GMM estimates. The Sargan test for over-identifying restrictions is based on the sample analog of the moment conditions used in the estimation process so as to determine the suitability of the instruments. Under the null hypothesis of valid moment conditions, the Sargan test statistic is asymptotically distributed as chi-square. Furthermore, the fundamental assumption that the errors, ε_{it}, are serially uncorrelated can be assessed by testing for the hypothesis that the differenced errors, $\Delta\varepsilon_{it}$ are not second order autocorrelated. Rejection of the null hypothesis of no second order autocorrelation of the differenced errors implies serial correlation for the level of the error term and thus inconsistency of the GMM estimates. However, as noted by Roodman (2009), the system GMM can generate moment conditions prolifically. Too many instruments in the system GMM over fits endogenous variable even as it weakens the Hansen test of the instruments' joint validity. Therefore, in order to deal with the instruments proliferation, this study will use two main techniques in limiting the number of instruments – such as using only certain lags

[5] See Arellano and Bond (1991), Blundell and Bond (1998) and Blundell et al. (2000)

instead of all available lags for instruments and combining instruments through addition into smaller sets by collapsing the block of the instrument matrix.

This study has used one-step system GMM estimation. However, for robustness checking, the two-step estimation in the system GMM was also considered. Three specifications tests[6] for the validity of instruments are used. First, the Hansen test of over-identifying restrictions, which tests the overall validity of the instruments by analysing the sample analogue of the moments conditions used in the estimation process. If the moment condition holds, then the instrument is valid and the model has been correctly specified. Second, it is important to test that there is no serial correlation among the transformed error term. Third, to test the validity of extra moment's conditions on the system GMM, the difference in Hansen test is used. This test measures the difference between the Hansen statistic generated from the system GMM and the difference GMM. Failure to reject the three null hypotheses gives support to the estimated model.

We have measured competitiveness index using Augmented Relative Profit Difference (ARPD). Boone (2008) proposed a competition measure, based on Relative Profit Differences (RPD), with robust theoretical properties. Using a bank level panel data set we test the empirical validity of the Augmented RPD measure for competition in the Indian loan market. Theoretically, loan market competition increases in two ways. First, competition increases when the produced services of various banks become closer substitutes and when entry costs decline. Boone et al (2004) prove that market shares of more efficient banks, i.e., with lower marginal costs, increase both under stronger substitution and amid lower entry costs. So the following relationship between market share and marginal cost can be set up (Leuvensteijn, 2007):

$$\ln(s_i) = \alpha + \beta \ln(mc_i) \quad (2.8)$$

Where the loan market share of bank i, (s_i) = (loan)i/total loan, and parameter β is the Boone measure of competition. A more negative beta reflects stronger competition. We calculate marginal costs instead of approximating this variable with average costs. Since marginal costs are unobservable, we have calculated marginal costs from Translog Cost Function (TCF) with linear homogeneity in the input prices and cost exhaustion restrictions using individual bank observations. Such a function assumes that the technology of an individual

[6] As suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998)

bank can be described by one multiproduct production function. Under proper conditions, a dual cost function can be derived from such a production function, using output levels and factor prices as arguments. A TCF is a second-order Taylor expansion around the mean of a generic dual cost function with all variables appearing as logarithms. It is a flexible functional form that has proven to be an effective tool in explaining multiproduct bank services. The TCF has the following form:

$$\ln(c_{it}) = \alpha_0 + \sum \alpha_{di} + \sum t\delta_t d_t + \sum\sum \beta_j \ln(x_{ijt})\, d_i + \sum\sum\sum \gamma_{jk} \ln(x_{ijt}) \ln(x_{ikt})\, d_i + \nu_{it} \quad (2.9)$$

Where the dependent variable c_{it} reflects the production costs of bank *i*(*i*= 1, .., *N*) in year *t* (*t* =1, .., *T*) in d_i dummy for type category of the bank, that is, public sector banks, private sector banks or foreign sector banks. The variable *dt* is a dummy variable, which is 1 in year *t* and otherwise zero. The coefficient γ_{jk} indicates general substitution parameters between inputs and outputs. The explanatory variables x_{ikt} represent three groups of variables (*k* = 1,...,*K*.). The first group consists of (*K1*) bank output components, such as loans, securities and other services (proxied by other income). The second group consists of (*K2*) input prices, such as wage rates, deposit rates (as price of funding) and the price of other expenses (proxied as the ratio of other expenses to fixed assets). The third group consists of (*K-K1-K2*) control variables (also called 'netputs'), *e.g.* the capital equity ratio. The parameters δ_t are the coefficients of the time dummies and v_{it} is the error term.

The marginal costs of output category *j* = *l* (of loans) for bank *i* in year *t*, mc_{ilt} are defined as:

$$\mathrm{mc}_{ilt} = \frac{\partial c_{it}}{\partial x_{ilt}} = (c_{it}/x_{ilt}) \frac{\partial \ln(c_{it})}{\partial \ln(x_{ilt})} \quad (2.10)$$

The term $\partial\ln(c_{it})/\partial\ln(x_{ilt})$ is the first derivative of the TCF. This leads to the following equation of the marginal costs for output category loans (*l*) for bank *I* during year *t*,

$$\mathrm{mc}_{ilt} = (c_{it}/x_{ilt})(\beta_l + 2\gamma_l \ln(x_{ilt}) + \sum \gamma_{lk} \ln(x_{ikt})\, d_i) \quad (2.11)$$

Given the estimated marginal costs (Ansari and Goyal, 2011), we are able to estimate the Boone measure by using the following equation:

$$\ln(s_{it}) = \alpha + \sum \beta_t \ln(mc_{it}) + \sum \gamma_t d_t + u_{it} \quad (2.12)$$

Where s stands for market share, mc for marginal costs, i refers to bank, and t to year; d_t are time dummies, and u_{it} is the error term. This provides us with the coefficient β, the Boone Competitiveness Index.

In our empirical analysis we have considered alternative measures of banks' loan pricing decisions in terms of the dependent variables bank lending interest rate (LR) and the spread of loan interest rate over deposit interest rate (RS). The models estimated, after incorporating the competitiveness index (ARPD), are as follows.

$$LR_{i,t} = \alpha LR_{i,t-1} + \theta mp_t + \gamma ARPD_t + \beta ARPD_t * mp_t + CoF_{it} + \sum \alpha_k X_{i,t} + \eta_i + e_{i,t} \quad (2.13a)$$

$$LR_{i,t} = \alpha LR_{i,t-1} + \theta mp_t + \gamma ARPD_t + \phi ARPD_t * MI_t + CoF_{it} + \sum \alpha_k X_{i,t} + \eta_i + e_{i,t} \quad (2.13b)$$

$$RS_{i,t} = \alpha RS_{i,t-1} + \theta mp_t + \gamma ARPD_t + \beta ARPD_t * mp_t + \sum \alpha_k X_{i,t} + \eta_i + e_{i,t} \quad (2.14a)$$

$$RS_{i,t} = \alpha RS_{i,t-1} + \theta mp_t + \gamma ARPD_t + \phi ARPD_t * MI_t + \sum \alpha_k X_{i,t} + \eta_i + e_{i,t} \quad (2.14b)$$

where, $\mathrm{i} = 1 \ldots \mathrm{n}, \mathrm{k} = 1 \ldots \mathrm{m}, \mathrm{t} = 1 \ldots \mathrm{T}$, *CoF* is the cost of fund and X is the vector of control variables and bank specific characteristics viz., bank size, CRAR, loan maturity, managerial inefficiency (MI), product diversification, return on equity, bank liquidity and asset quality. Finally, η_i is a bank-specific effect.

3. Empirical Analysis

3.1 Sample and variables

The empirical analysis based on the dependent variable interest rate spread rests on the assumption of a complete adjustment of loan interest rate $(r_{L,t}^1, r_{L,t}^2 \ and \ r_{L,t}^3)$ with respect to deposit interest rate $(r_{D,t}^1, r_{D,t}^2 \ and \ r_{D,t}^3)$ and the spread is attributable to a host of other factors. In the second instance, we relax this assumption and thus study the loan interest rate as the dependent variable as a function of various explanatory variables including the deposit interest rate.

In this context, it is useful to take note of a caveat here. In the real world, commercial banks' loan portfolio could comprise numerous borrowers with different loan interest rates, reflecting different characteristics of borrowers. A similar argument could hold for depositors.

Accordingly, empirical research has to rely on a derived measure of loan and deposit interest rates based on banks' balance sheet data. We have experimented with three measures of loan interest rates based on annual balance sheet data for total interest income $R_{L,t}$ generated from loans and advances and the outstanding loans 'L' as shown below:

$$r_{L,t}^1 = \frac{R_{L,t}}{L_t} \quad (3.1)$$

$$r_{L,t}^2 = \frac{R_{L,t}}{L_{t-1}} \quad (3.2)$$

$$r_{L,t}^3 = \frac{R_{L,t} + R_{L,t-1}}{L_t + L_{t-1}} \quad (3.3)$$

The first measure LR1 ($r_{L,t}^1$) could account for effective loan interest rate. The second measure LR2 ($r_{L,t}^2$) recognises that the interest income earned in the current period relates to loans extended in the beginning of the year (previous year). The third measure LR3 ($r_{L,t}^3$) recognises stock-flow (SF) concept, i.e., banks could not only earn interest income from loans extended in the previous period but also current period. In the same manner, we derived deposit interest rates ($r_{D,t}^1$, $r_{D,t}^2$ and $r_{D,t}^3$).

As regards the explanatory variables, we have used monetary policy rate and regulatory variable prudential capital to risk weighted assets ratio (CRAR) consistent with India's monetary policy and banking sector regulation frameworks. For bank specific variables, we have indicators of bank size (SIZE) defined in terms of ratio of a bank's total assets to the banking industry aggregate measure; liquidity ratio, i.e., liquid assets less liquid liabilities to total assets ratio; operating cost to assets ratio as an indicator of managerial inefficiency; asset quality measured by gross non-performing loans to total loans ratio; earnings and profitability in terms of return on equity (ROE); product diversification represented by non-interest income to total asset ratio; return on investment as the ratio of interest received on G-sec investment divide by total investment in G-sec[7]; and loan maturity defined as the share of term loans in total loans. For macro variables, we have used real GDP growth rate and inflation rate from the wholesale price index.

[7] Corresponding to the three regressions this variable is defined as: Interest received on investments / total investments in G-sec; Interest received on investments / total investments in G-sec(-1); Interest received on investments(average) / total investments in Gsec(average).

Our sample consists of 33 banks comprising 27 public, three private and three foreign banks, which together account for the bulk of commercial banking system in India with three-fourth share in total deposits, credit, investment and other indicators. The majority of the sample comprises the public sector banks. We are not be able to control for the ownership variable here due to the low number of bank sampling units under private and foreign sector bank groups.

3.2 Descriptive Statistics

Our data set is the annual accounts of 33 commercial banks over the period 1996 to 2012. The data source is RBI published 'Statistical Tables Relating to Banks in India. Table 1 and Table 2 provide descriptive statistics for some bank specific variables.

Table 1. Bank specific descriptive statistics

Year	Loan Maturity	Product Diversification	Managerial Inefficiency	Return on Equity	Liquidity	Size
1996	29.5(13.3)	1.4(0.6)	3.2(0.9)	19(23.9)	9.6(56.8)	3.0(4.7)
1997	33.0(15.3)	1.4(0.6)	2.9(0.5)	13.7(8.1)	0.5(7.6)	3.0(4.6)
1998	34.5(15.2)	1.5(0.7)	2.7(0.5)	14.9(7.2)	1.4(6.4)	3.0(4.6)
1999	35.4(12.4)	1.3(0.6)	2.7(0.5)	14.2(7.0)	-0.2(9.4)	3.0(4.7)
2000	36.1(13.1)	1.4(0.5)	2.5(0.5)	14.6(6.7)	-1.5(12.4)	3.0(4.6)
2001	36.4(11.6)	1.4(0.5)	2.7(0.5)	13.1(7.7)	-3.6(18.5)	3.0(4.8)
2002	40.3(13.1)	1.7(0.6)	2.4(0.5)	15.3(7.2)	-8.9(26.6)	3.0(4.4)
2003	43.5(12.7)	1.9(0.5)	2.4(0.4)	19.3(7.5)	-3.5(11.8)	3.0(4.3)
2004	48.1(10.7)	2.0(0.5)	2.3(0.5)	22.2(6.1)	-3.4(13.3)	3.0(4.0)
2005	53.0(11.1)	1.5(0.5)	2.2(0.6)	15.9(6.2)	-15.1(49.5)	3.0(3.8)
2006	55.3(10.9)	1.1(0.5)	2.1(0.4)	13.8(5.4)	-16.8(26.5)	3.0(3.6)
2007	58.0(11)	1.1(0.5)	1.9(0.4)	15.8(4.1)	-13.8(15.8)	3.0(3.4)
2008	57.5(11.6)	1.3(0.6)	1.7(0.5)	16.2(4.8)	-11.2(10.4)	3.0(3.5)
2009	58.2(12.4)	1.3(0.7)	1.6(0.4)	16.2(4.7)	-12.2(10.3)	3.1(3.6)
2010	57.7(12.5)	1.2(0.5)	1.6(0.4)	16.0(4.9)	-12.0(10.9)	3.1(3.5)
2011	56.5(12.1)	1.0(0.4)	1.7(0.4)	15.1(3.9)	-15.5(12.7)	3.2(3.4)
2012	57.4(11.9)	1.1(0.3)	1.5(0.5)	15.9(4.0)	-13.6(11.9)	3.3(3.2)

Note: Standard deviation in parenthesis

Table 1 shows reduction in managerial inefficiency of banks as the operating cost to assets ratio fall. However, the return on equity variable showed greater cross-section variability than loan interest rate spreads. The non-interest income ratio, reflecting product diversification, showed an increasing trend during 1996-2007 and some moderation thereafter. The size variable exhibited steady trend during the sample period, reflecting banks' ability to maintain their competitiveness in financial intermediation. Banks, however, showed more substantial variation in net liquidity ratio than in loan and deposit interest rates. Loan maturity showed an increasing trend during the sample period.

Loan interest rate and their spreads over deposit interest rates showed some moderation during 2002-2007 as compared with the late 1990s (Table 2). For the more recent period from 2008, loan spreads have shown some firming up as compared with the first half of the 2000s but they remain lower than the late 1990s. This trend also was observed in terms of cross-section variability (standard deviation) of loan interest rates and spreads. Deposit interest rates more or less showed lower variability than loan interest rates during the late 1990s, except for the year 1997.

Table 2. Interest rate spreads and loan rates: Descriptive statistics

Year	RS1	RS2	RS3	LR1	LR2	LR3
1996	5.5(1.7)	9.1(7.7)	5.1(1.1)	12.4(2.3)	17.3(9.1)	11.8(1.2)
1997	6.6(1.5)	4.2(15.2)	6.1(1.3)	14.0(2.0)	17.0(6.9)	13.3(1.8)
1998	5.1(1.4)	5.9(2.1)	5.8(1.3)	12.1(1.4)	14.7(2.1)	13(1.5)
1999	4.5(1.1)	5.0(1.5)	4.7(1.1)	11.7(1.4)	14.0(1.9)	11.9(1.3)
2000	3.8(0.9)	5.2(1.8)	4.1(0.9)	10.9(1.0)	13.7(1.8)	11.2(1.1)
2001	3.8(1.1)	5.0(1.7)	3.8(1.0)	10.7(1.0)	13.0(1.3)	10.8(0.9)
2002	3.1(1.4)	4.4(1.8)	3.3(1.3)	9.6(1.6)	12.1(1.6)	10.0(1.5)
2003	3.5(1.1)	4.1(0.9)	3.3(0.9)	9.4(0.9)	11.0(1.3)	9.5(0.9)
2004	3.4(1.0)	4.2(1.2)	3.5(1.0)	8.2(0.9)	9.8(1.1)	8.8(0.9)
2005	3.2(0.9)	5.3(3.9)	3.3(0.9)	7.3(0.8)	10.1(3.6)	7.7(0.9)
2006	3.3(1.0)	4.8(1.0)	3.2(0.9)	7.3(0.5)	9.6(0.7)	7.3(0.5)
2007	3.5(0.9)	4.9(1.2)	3.4(0.9)	8.0(0.6)	10.5(0.8)	7.7(0.5)
2008	3.5(1.2)	4.5(1.6)	3.5(1.1)	9.0(0.8)	11.2(1.1)	8.5(0.7)
2009	4.1(1.6)	4.9(1.8)	3.8(1.4)	9.8(1.3)	11.9(1.5)	9.4(1.0)
2010	3.8(1.4)	4.3(1.2)	3.9(1.5)	8.9(0.9)	10.3(0.8)	9.3(1.1)
2011	3.9(0.8)	5.0(0.9)	3.9(1.1)	8.6(0.7)	10.5(0.8)	8.7(0.7)
2012	3.8(1.0)	4.9(1.1)	3.6(0.9)	8.7(0.8)	9.9(0.9)	8.6(0.9)

Note: Standard deviation in parenthesis

3.3 Results

We have used the Augmented Relative Profit Difference (ARPD) measure. We have estimated the marginal costs using *Translog Cost Function*. Competition measured by using the ARPD in Table. 3, is statistically significant in a consistent manner for our sample. This table also contains the estimated non-parametric RPD measure estimated as area under the curve and two other traditional but non-robust measures of competition.

As is known from the theory proposed by Boone (2008), higher the coefficient in absolute sense, higher is the competition. The absolute value of the APRD measure is used in our regressions since it has a straightforward interpretation.

Over all the competition in the banking sector increased after 2002 except a marginal decrease during 2006-07. All the values of the coefficient lie between 0 and 1 which indicates the monopolistic nature of competitiveness in the loan market in India. The ARPD measure quantifies the impact of marginal costs on performance, measured in terms of market shares. The original Boone's RPD is improved by calculating marginal costs instead of approximating marginal costs by average variable costs.

Table.3: The Augmented RPD (ARPD) Measure of Competition

Year	ARPD (Parametric Measure)	RPD (Non-parametric Measure)	H-stat	PCM
1996	-0.315(0.086)**	0.557	0.666	0.514
1997	-0.340(0.087)**	0.615	0.734	0.553
1998	-0.356(0.085)**	0.347	0.646	0.504
1999	-0.307(0.086)**	0.399	0.627	0.463
2000	-0.384(0.091)**	0.479	0.633	0.427
2001	-0.359(0.088)**	0.392	0.615	0.427
2002	-0.453(0.091)**	0.185	0.440	0.344
2003	-0.404(0.086)**	0.434	0.466	0.423
2004	-0.384(0.080)**	0.513	0.646	0.454
2005	-0.390(0.067)**	0.468	0.656	0.467
2006	-0.341(0.061)**	0.429	0.458	0.462
2007	-0.360(0.051)**	0.521	0.616	0.448
2008	-0.388(0.061)**	0.620	0.584	0.397
2009	-0.452(0.050)**	0.668	0.492	0.332
2010	-0.448(0.059)**	0.691	0.503	0.381
2011	-0.493(0.063)**	0.632	0.514	0.402
2012	-0.501(0.057)**	0.563	0.509	0.391

Note: 1.Figures in parenthesis are standard deviation of estimates; 2.** indicates level of significance at 5%.

The empirical findings on alternative measures of loan interest rate and its spread are presented in Tables 4 and 5. The results give interesting insights about the determinants of banks loan pricing decisions.

Comparing the maximum likelihood value of all the three interest rate specifications, shows the second specification has the highest value, then the next highest is for third specification and the least value is for the first specification in the static framework. So we can conclude that the second specification is the better proxy which could be used to measure the lending rate.

Table. 4a: Determinants of bank lending rate(LR) with competition-policy interaction

Variables	LR_1			LR_2			LR_3		
Bank Lending Rate	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**
LR(t-1)	0.460***	0.067	6.860	0.164*	0.096	1.710	0.626***	0.055	11.440
Policy Rate(MP)	0.270***	0.072	3.740	0.238*	0.140	1.710	0.225***	0.061	3.710
Competitiveness Index(ARPD)	-0.334**	0.169	-1.980	-0.098	0.268	-0.360	-0.056	0.144	-0.390
ARPD*MP	-0.753***	0.136	-5.550	-1.159***	0.246	-4.710	-0.532***	0.132	-4.030
Cost of deposit fund	0.791***	0.089	8.850	0.947***	0.178	5.330	0.504***	0.103	4.880
Return on investment	-0.199**	0.094	-2.130	-0.187**	0.092	-2.050	-0.141*	0.081	-1.740
Loan Maturity	0.001	0.006	0.010	0.005	0.008	0.580	-0.001	0.005	-0.120
Managerial Inefficiency(MI)	0.015	0.097	0.150	0.267*	0.156	1.720	0.094	0.084	1.120
Product diversification	-0.220	0.194	-1.130	-0.396**	0.197	-2.010	-0.346**	0.147	-2.360
Return on equity	0.003	0.008	0.350	0.018*	0.011	1.570	0.004	0.008	0.550
Size	-0.027***	0.010	-2.690	-0.057***	0.011	-5.110	-0.022**	0.010	-2.160
Bank liquidity	-0.002	0.003	-0.780	-0.040**	0.016	-2.450	-0.001	0.002	-0.370
Asset quality	0.017	0.014	1.150	0.052***	0.020	2.600	0.000	0.013	0.000
CRAR	0.005	0.033	0.140	0.009	0.032	0.270	0.013	0.028	0.480
GDP growth	0.191***	0.043	4.390	0.076*	0.041	1.870	0.171***	0.031	5.570
Inflation	0.081***	0.028	2.950	0.071*	0.040	1.770	-0.020	0.023	-0.860
Intercept	1.226	1.021	1.200	5.011***	1.270	3.940	0.500	0.795	0.630

Note: ***, ** and * indicate level of significance at 1%, 5% and 10%, respectively.

Table. 4b: Determinants of bank lending rate(LR) with competition-efficiency interaction

Variables	LR_1			LR_2			LR_3		
Bank Lending Rate	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**
LR(t-1)	0.454***	0.068	6.700	0.160*	0.096	1.660	0.618***	0.056	11.120
Policy Rate	0.500***	0.079	6.350	0.590***	0.134	4.400	0.395***	0.070	5.650
ARPD	-0.919***	0.191	-4.810	-0.996***	0.273	-3.650	-0.488***	0.178	-2.730
ARPD*MI	-1.933***	0.355	-5.450	-2.987***	0.647	-4.620	-1.436***	0.352	-4.080
Cost of deposit fund	0.807***	0.089	9.070	0.962***	0.176	5.450	0.522***	0.103	5.080
Return on investment	-0.199**	0.090	-2.200	-0.182**	0.089	-2.040	-0.145*	0.078	-1.850
Loan Maturity	-0.001	0.006	-0.100	0.005	0.008	0.680	-0.000	0.005	-0.060
Managerial Inefficiency(MI)	0.010	0.095	0.100	0.270*	0.155	1.740	0.090	0.082	1.100
Product diversification	-0.215	0.192	-1.120	-0.402***	0.121	-3.311	-0.341**	0.141	-2.420
Return on equity	0.003**	0.008	0.390	0.018*	0.012	1.600	0.005	0.008	0.610
Size	-0.027*	0.010	-2.690	-0.057***	0.011	-5.100	-0.022**	0.010	-2.170
Bank liquidity	-0.002**	0.003	-0.780	-0.040**	0.017	-2.450	0.001	0.002	0.360
Asset quality	0.016*	0.014	1.120	0.052***	0.020	2.580	0.001	0.013	0.070
CRAR	0.002***	0.032	0.060	0.005	0.032	0.150	0.012	0.027	0.430
GDP growth	0.196*	0.044	4.500	0.085**	0.040	2.090	0.175***	0.031	5.710

Inflation	0.090***	0.027	3.300	0.084**	0.041	2.060	-0.014	0.023	-0.610
Intercept	1.124	1.024	1.100	4.774***	1.260	3.790	0.436	0.798	0.550

Note: ***, ** and * indicate level of significance at 1%, 5% and 10%, respectively.

Table.5a: Determinants of Interest rate spread (RS) with competition-policy interaction

Variables	**RS_1**			**RS_2**			**RS_3**		
Interest Rate spread	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**
IRS(t-1)	0.538***	0.069	7.750	0.171**	0.090	1.890	0.766***	0.043	17.670
Policy Rate(MP)	0.178**	0.082	2.190	0.242**	0.037	6.051	0.030	0.061	0.490
ARPD	-0.220	0.174	-1.260	-0.097	0.271	-0.360	0.024	0.134	0.180
ARPD*MP	-0.665***	0.135	-4.920	-1.060***	0.240	-4.420	-0.441***	0.112	-3.940
Return on Investment	-0.124*	0.084	-1.470	-0.147*	0.096	-1.530	-0.077	0.059	-1.310
Loan Maturity	0.003	0.006	0.460	0.003	0.008	0.370	-0.004	0.004	-0.850
Managerial Inefficiency	0.029	0.086	0.340	0.252*	0.140	1.800	0.069	0.060	1.140
Product diversification	-0.170	0.183	-0.930	-0.378**	0.177	-2.130	-0.266**	0.122	-2.180
Return on equity	0.007	0.007	1.060	0.017	0.012	1.470	0.007	0.005	1.320
Size	-0.026***	0.009	-2.930	-0.059***	0.011	-5.150	-0.015**	0.007	-2.120
Bank liquidity	-0.001	0.003	-0.330	-0.039***	0.016	-2.460	0.000	0.002	0.150
Asset quality	0.000	0.012	0.030	0.049***	0.020	2.420	0.010	0.010	0.980
CRAR	0.023	0.035	0.680	0.015	0.031	0.480	0.013	0.020	0.660
GDP growth	0.105***	0.035	3.040	0.031	0.039	0.790	0.097***	0.022	4.450
Inflation	0.074***	0.028	2.650	0.062**	0.033	1.840	0.015	0.021	0.730
Intercept	0.341	0.723	0.470	2.597**	1.110	2.340	0.039	0.520	0.080

Note: ***, ** and * indicate level of significance at 1%, 5% and 10%, respectively.

Table.5b: Determinants of Interest rate spread(RS) with competition-efficiency interaction

Variables	**RS_1**			**RS_2**			**RS_3**		
Interest Rate spread	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**	**Coef.**	**Std. Err.**	**t**
IRS(t-1)	0.534***	0.071	7.570	0.169**	0.090	1.870	0.762***	0.044	17.200
Policy Rate	0.379***	0.094	4.020	0.569***	0.124	4.580	0.169***	0.064	2.620
ARPD	-0.722***	0.208	-3.470	-0.915***	0.274	-3.340	-0.322***	0.157	-2.050
ARPD*MI	-1.639***	0.361	-4.540	-2.702***	0.632	-4.270	-1.142***	0.300	-3.800
Return on Investment	-0.118*	0.070	-1.680	-0.141*	0.094	-1.500	-0.076*	0.046	-1.650
Loan Maturity	0.002	0.006	0.380	0.004	0.008	0.460	-0.004	0.004	-0.790
Managerial Inefficiency(MI)	0.028	0.086	0.330	0.251**	0.140	1.790	0.068	0.059	1.150
Product diversification	-0.162	0.180	-0.900	-0.395***	0.123	-3.20	-0.269**	0.116	-2.310
Return on equity	0.007	0.007	1.060	0.018	0.012	1.500	0.008	0.005	1.370
Size	-0.026***	0.009	-2.950	-0.059***	0.011	-5.150	-0.016**	0.007	-2.130
Bank liquidity	-0.001	0.003	-0.310	-0.039***	0.016	-2.440	0.001	0.002	0.570
Asset quality	-0.002	0.012	-0.130	0.048***	0.020	2.360	-0.010	0.010	-1.010
CRAR	0.021	0.034	0.610	0.012	0.031	0.370	0.012	0.020	0.600
GDP growth	0.109***	0.035	3.160	0.038	0.040	0.960	0.100***	0.022	4.570
Inflation	0.081***	0.027	2.980	0.071***	0.033	2.150	0.019	0.020	0.960
Intercept	0.250	0.730	0.340	2.416***	1.114	2.170	-0.100	0.525	-0.190

Note: ***, ** and * indicate level of significance at 1%, 5% and 10%, respectively.

First, regarding the interest rate pass-through or the impact of policy rate on loan interest rate, the policy rate has a statistically significant positive effect on loan interest rates but the magnitude of impact, as measured by the size of the coefficient of policy rate, is quite moderate. The short term interest rate pass-through ranges from 17 to 56 basis points for RS specification and 23 to 60 basis points for LR specification. This suggests an imperfect monetary transmission mechanism and the rigidity in loan pricing decisions of banks due to various factors as explained by the other control variables[8].

Second, the interest rate pass-through depends significantly on the competitiveness index (ARPD). The impact of competition on interest rate pass-through for both the LR specification and RS specification are negative and highly significant. The long-run (dynamic) pass-through coefficient could be calculated using the formula ($\frac{\theta+\beta*ARPD_t}{1-\alpha}$). The long run interest rate pass-through depends upon the intensity of competition and the persistence coefficient of the model.

The LR model shows that the cost of funds is fully recovered while pricing a loan. A positive policy shock lead to increase in the cost of funds and hence a lower spread. The spread depends on the difference between the lending rate and the cost of funds and not only between lending rate and the deposit rate. Further the policy multiplicative coefficient of the competitiveness index is higher in the RS specifications (1 and 3) as compared to LR (1 and 3). This indicates that there is a possibility of competition in both the deposit market and in the loan market. This implies a rise in policy rates reduces RS more than LR. Additionally, the lag effect (persistence) is higher in the RS specification which could lead to lower pass-through.

Results from interaction of managerial inefficiency with the competitiveness index are also very intuitive and significant. Managerial inefficiency increases rates and spreads, but its interaction with competition decreases both. The coefficient of competition-managerial inefficiency interaction is double that of the interaction of competition with policy rate. This implies that if the banking system is very efficient then an increase in competition would increase policy pass-through. On the other hand if the banking system is less efficient, then an increase in competitiveness in the loan market may lead to less policy pass-through.

[8] Apart from rigidity in loan markets, the low pass-through of policy rate could be attributable to central bank's liquidity management and monetary policy communication and transparency (Poirson, 2009).

Third, banks recover the cost of deposit funds from borrowers and earn a positive spread. This is captured by the intercept term in the regressions. The intercept terms are 4.7 and 5.2 under the LR_2 specification in Table 4a and Table 4b respectively. Alternatively, the pass-through of cost of funds is reflected in the coefficient of deposit interest rate in the loan interest rate equations. Here, the coefficient varies from 0.94 to 0.96 under the different scenarios. The second specification of the interest spread is also highly significant for the intercept terms, i.e. the peer mean spread are 2.41 and 2.59 under the two interaction specifications given in Table.5a and Table.5b.

Fourth, the capital to risk adjusted assets ratio (CRAR) has a positive effect on loan pricing but is statistically significant in only one of the regressions. Many studies find a positive impact of CRAR on loan pricing. According to Saunders and Schumacher (2000), banks hold capital to insulate themselves against both expected and unexpected credit risk, and therefore, it reflects banks' risk aversion. Specifically, while capital requirements constitute the minimum level, banks often endogenously choose to hold more capital against unexpected credit losses or market discipline may induce them to hold more capital (Flannery and Rangan, 2006). However, holding equity capital is a more expensive funding source than debt (because of tax and dilution of control reasons). Thus, banks that have a relatively high capital ratio for regulatory or credit reasons can be expected to seek to cover some of the increase in the average cost of capital by operating with higher loan interest rate and its spread over deposit interest rate. Berger (1995) finds that there is no relationship between ROE and capital during normal times, which may reflect the fact that the smaller competitive advantage of capital during normal times may be offset entirely by the negative mechanical effect of higher capital on ROE. Gambacorta and Mistrulli (2004) suggested that bank capital is a potentially critical factor affecting banks' behaviour, particularly in times of financial stress and showed that bank capital affects lending even when regulatory constraints are not binding and that shocks to bank profits, such as loan defaults, can have a persistent impact on lending. Another viewpoint is that since capital is considered to be the most expensive form of liability, holding capital above the regulatory minimum is a credible signal of creditworthiness on the part of the bank (Claeys and Vennet, 2003) and thus, it is expected to have positive influence on banks' loan interest rates.

Fifth, a positive relationship, *a priori,* is expected between asset quality variable and bank loan interest rate, reflecting the notion that banks tend to push the cost of nonperforming loans to customers. Moreover, a neoclassical finance theory perspective entails that higher credit risk is expected to be associated with higher return in terms of loan interest rate. A contrarian perspective entails that banks are likely to follow softer loan interest rate policy in order to avoid more loan defaults. But our results show that the effect is not consistent in loan pricing or in the determination of spread. Asset quality of loans and advances as reflected in gross non-performing loans ratio is statistically significant and positive in LR_1, RS_2, LR_2. In other specifications it is sometimes negative but insignificant. The positive impact of asset quality on interest rates dominates in the Indian context.

Sixth, managerial efficiency which is measured by non-interest operating expenses to average assets ratio, captures expenses in processing loans and the servicing of deposits. In addition, some portion of operating cost may arise on account of non-funded activities with regard to a variety of banking transaction services. Thus, two scenarios are possible. One, banks may recoup some or all of such costs by factoring them into loan pricing. Two, banks may recover a portion of such costs from non-funded activities by way of other non-interest income, thereby, charging only a fraction of operating cost to loan interest rate to borrowers. As per the analysis, we found that a positive effect of managerial inefficiency, i.e., higher operating cost ratio on loan interest rates and their spread over deposit interest rates. From the Tables 4(a&b) and 5(a&b), we can see that the operating cost put on average 10 to 27 percentage point weights on the loan pricing which is positive and highly significant. This is a critical finding because such effects persist in the presence of non-interest income variable, characterising product diversification.

Seventh, a stable and sustainable banking system entails that banks should earn sufficient profit to satisfy shareholders while keeping credit and liquidity risks under tolerable levels. The return on equity (ROE) measures the rate of return on the money invested by common stock owners and retained earnings by the bank. It demonstrates a bank's ability to generate profits for shareholders' equity (also known as net assets or assets minus liabilities). In other words, ROE shows how well a bank uses investment funds to generate growth. Interest income is clearly a function of the yield curve and credit spreads posited under the stress scenario, but what the net impact of rising or falling rates are on bank profitability remains ambiguous[9]. As expected it is positive in all the specifications but is significant only under LR_1, and LR_2. From the Table 4 and 5, we see that the coefficient

[9] English (2002) found that the co-movements of long- and short-term interest rates were sufficiently close to make the effects hard to identify if both variables were included in the regression. Such multicollinearity did not appear to be a general problem, however, since neither the short-term nor the long-term rate entered alone was significant.

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varied from 0.3 per cent to 1.8 per cent under different scenarios viz. current loan interest rate, lagged loan interest rate spread and stock-flow measure of loan interest rate.

Eighth, liquidity affects loan pricing behaviour of banks. As the liquidity ratio increases, liquidity risks increase, implying a higher margin set by banks. However, banks with more liquid assets are expected to find it easier to fund loans on the margin, so there may be a negative sign for this variable. Our results show a negative and significant differential impact of banks' liquidity with regard to differential measure of loan interest rates. Under the second specification we have a negative and highly significant impact of liquidity on loan pricing.

Product diversification measured by the non-interest income variable has a significant negative coefficient in all our panel data estimations suggesting possible cross-subsidization of traditional lending activities. However, Stiroh and Rumble (2006) have shown that diversification gains are frequently offset by the costs of increased exposure to volatile activities. The results in Tables 4 and 5 show that the coefficient of non-interest income (the income share of commission and fee income) are negative and significant. Our results are consistent with the hypothesis that banks decrease their lending rate when they are more reliant on fee generating products. The coefficient ranges from 22 per cent to 40 per cent depending on the lending rate structure chosen for the analysis. For interest rate spread, the coefficient ranges from 16 per cent to 39 per cent, which is significant under second and third specifications.

The role of loan maturity in loan pricing derives from the terms of lending and management of asset-liability mismatches (Ranjan and Dhal 2003). In the Indian context, the introduction of maturity-based pricing reflects bank's continuous commitment to safeguard its financial strength based on sound banking principles, while striving to provide resources for development lending at the lowest and most stable funding costs and on the most reasonable terms[10]. The brokerage function and term transformation functions of banks are blurred in the Net Interest Margins (NIMs) and Average Spreads, since all interest income and expenses are aggregated to create implicit returns on assets and liabilities. Nevertheless, the NIM and the Average Spread are important because aggregation highlights the overall profitability of bank management across different loan and deposit

[10] Brock and Franken (2002), found matched maturity spreads are conceptually similar to bid-ask spreads in securities markets, an idea that was originally put forward by Ho and Saunders (1981). In contrast, the long spread captures the premium that banks charge for bearing duration risk.

activities, as well as the role of noninterest income activities. According to Segura and Suarez (2012) banks' do not have an incentive to set debt maturities as short as savers might ceteris paribus prefer. Their incentive for longer debt comes from the fact that there are events (called systemic liquidity crises) in which their normal financing channels fail and they have to turn to more expensive sources of funds. In this context, we find that the coefficients are positive but not significant. The coefficient of the maturity ranges from 0.1 per cent to 0.5 per cent. In the Indian banking system, there is no evidence of discount to the customers to keep a long term relationship and hence, price rises with loan maturity.

Lastly, on the bank specific variables, bank size is normally important in the loan price decision of banks. According to the literature, larger banks are expected to have greater market power and better access to government safety net subsidies relative to smaller banks. Relatively smaller banks may be at a competitive disadvantage in attracting the business of larger loan customers. Accordingly, bank size is expected to influence bank's lending activities differentially. The theoretical model predicts a positive relationship between the size of operations and margins, since for a given value of credit and market risk, larger operations are expected to be connected to a higher potential loss. On the other hand, economies of scale suggest that banks that provide more loans should benefit from their size and have lower margins. Therefore, we do not have a particular prior regarding the expected sign of this coefficient. Our results show negative effects of bank size on different measures of loan interest rate and its spread over corresponding deposit interest rate. The coefficients of size range from -11% to -22% under the bank lending rate whereas it ranges from 15% to 19% under the interest spread. In the Indian context only the State Bank of India has a bigger size (22%) and rest are within the range of 1 to 5 per cent. So loan pricing power may not be effective.

Macroeconomic factors such as growth and inflation are expected to influence the loan market from demand as well as supply sides. From a theoretical standpoint, there is a positive relationship between economic activity and banks' spreads. As the economy expands, the demand for loans increases and this in turn can lead to higher lending rates, which can serve to widen spreads[11]. Economic activity is proxied by the growth rate of real gross domestic product. Within Indian context, the expected sign is positive. The coefficient

[11] Bikker and Hu (2002) emphasized bank profitability and business cycle relationships and found that profit appears to move up and down with the business cycle, allowing for accumulation of capital in boom periods. Provisioning for credit losses rises when the cycle falls, but less so when net income of banks is relatively high, which reduces procyclicality.

ranges from 9 to 19 per cent depending on various measures of spreads and lending rates, and is mostly positive and significant. Inflation is included because if inflation shocks are not passed on equally in terms of magnitude as well as speed to deposit and lending rate, then the spread would change. As expected the impact of inflation on interest spread is positive when it is significant.

4. Conclusion

We investigated a large number of factors that affect commercial banks' loan pricing decisions using dynamic panel data methodology and annual accounts data of 33 Indian commercial banks over the period 1996 to 2012. The determinants of loan interest rate and spreads were classified into (i) regulatory and policy variables such as capital adequacy, and the repo rate (ii) bank specific variables pertaining to asset quality, managerial efficiency, earnings, liquidity, bank size, loan maturity, cost of funds (iii) competition as a market structure variable and (iv) macro variables including the rate of growth of GDP and WPI inflation rate.

We find while policy variables positively impact loan interest rates and spreads, the latter are also influenced by various market structure, bank specific and macro factors. More competition reduces transmission by reducing the loan rate but a positive policy shock increases the cost of funds and reduces the spread.

The interaction between policy rate and competition in the banking sector had a negative and highly significant coefficient, which is the impact of competition on interest rate pass-through. Under the 'competition-efficiency' hypothesis (Demsetz, 1973), increases in competition precipitate increases in profit efficiency. An exogenous shock (e.g., deregulation under the Indian banking reform) forces banks to minimize costs, offer services at lower prices, and at the same time forces them to increase profits, e.g. through shifts in outputs. Efficient banks (i.e. those with superior management and production technologies, that translate into higher profits) will increase in size and market share at the expense of less efficient banks. In our study, it is found that the competition-managerial inefficiency interaction puts a significant downward pressure on loan pricing which leads to increased market share in a competitive loan market, which in turn increases profits and hence the bank soundness by reducing the default rate. The competition-inefficiency interaction coefficients range from 1.4 to 2.9. They are negative in sign and highly significant. In the case of competition-managerial inefficiency interaction the interest rate pass-through increases by almost twice as compared to the interaction of competition with policy rate. It implies that if the banking system is very efficient then an increase in competition increases the policy pass-through and the vice-versa.

Regarding the bank specific variables, loan interest rates and their spreads showed statistically significant relationship with operating cost, profitability and capital adequacy, loan maturity, asset quality, bank size and liquidity indicators. Macro variables such as GDP growth and inflation rate also had a positive impact on loan interest rates.

Managerial inefficiency raises rates and spreads and product diversification reduces both. Reform had mixed effects to the extent managerial inefficiency fell but is still high, and product diversification improved but reduced again after 2004. Competition increased but with a dip in the middle. More competition can improve monetary transmission provided it improves managerial efficiency. Regulatory requirements raised loan rates and spreads. Costs of deposits were passed on to loan rates. These findings highlight the roles of operating efficiency, risk aversion, asset-liability management, and credit risk management in commercial banks loan pricing decisions.

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