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The determinants of non-performing loans: dynamic panel evidence from South Asian countries

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Abstract:

Using the GMM estimator, this paper empirically studies the bank-specific, industry specific and macroeconomics specific determinants of non-performing loans of banks in the South Asian countries (Bangladesh, India, Nepal and Pakistan) for the period of 1997-2012. We found that moral hazard problems between the bank management and the depositors in addition to that between the bank management and the shareholders; and the adverse selection of borrowers by the bank significantly affect the bank credit risk. We also found evidence that bad management, cost inefficiency, income diversification, bank size, industry concentration ratio, inflation and GDP growth rate all significantly explain the levels of bank NPLs. Empirical results show a moderate degree of persistence of NPLs and a late-hit of the global financial crisis in the banking sector of the region.

Key words: NPL, cost inefficiency, moral hazard, adverse selection

JEL classification: G21, C23

1. Introduction

Prolonged existence of non-performing loans (NPL) in the bank balance sheet causes the severe bank management problems as it not only deteriorate the asset quality of the bank but also reduce its earning and moral hazard problems between the bank and its funding channels mostly attributed to the depositors. On the other hand, high levels of NPL in the economy also signal the

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bankruptcy possibilities of the borrowers resulting the worsening of business environment and economic conditions of a country. Due to rapid globalization and financial liberalization, the role of banks' in the economic development of a country increased in many folds. But the problems of non-performing loans saddle a bank and cause the prolonged economic stagnation of a country or even the global financial crisis. Reinhart and Rogoff (2010) pointed that NPL can be instrumented as the signal of banking crisis. Hence, this area of research of the problems and the determinants of non-performing loans of banks is equally and in increased importance to the academics and the researchers in present and as it was in the past. Understanding the factors determining the NPLs and solving for those is important to the bank management and the regulatory bodies in order to apposite functioning of the bank and to rehabilitate the economy.

Over the past decades, majority of the research on the determinants of non-performing loans viewed NPLs as the functions of macroeconomic and bank specific determinants. Macroeconomic views of the determinants of NPL focus primarily on the macro-prudential factors. Fundamentals of the theoretical relationships between the NPL and the macroeconomic factors can be found in the Bernanke, Gertler and Gilchrist (BGG, 1998) framework of 'financial acceleration' and later expansion by Gertler and Kiyotaki (2011) where credit market is pro-cyclical and the role of asymmetric information and frictions affect the credit market. Rinaldi and Sanchis-Arellano (2006) found household disposable income; unemployment and monetary conditions have strong relationship with non-performing loans in the European Union banking.

Literature of the microeconomic determinants of non-performing loans emphasizes on the bank-specific factors. Berger and DeYoung (1997) analyzed the Granger-causality relationship between the NPLs and his so called 'bad luck', 'bad management', 'skimping' and 'moral hazard, where the empirical variables were cost efficiency and the capital adequacy. Among others,

Williams (2004) followed the Berger and DeYoung hypotheses and came out the same kind of relationship in the European banking.

Salas and Saurina (2002) studies of Spanish banking during 1985 to 1997, found that along with macroeconomic factors the bank specific variables also explain the future changes in NPLs of banks. Similar strand of literature include Louzis et al. (2012), who studies the determinants of NPL in Greek banking. However, no single study was out of criticism due to insufficiently selection of variables or failure to implement the appropriate econometric methodology (Athanasoglu, 2008).

We study the determinants of bank non-performing loans as a function of macroeconomic factors, industry specific factors and the bank specific factors using the Generalized Methods of Moments (GMM) estimator for the panel data of 259 banks in the South Asian countries (Bangladesh, India, Nepal and Pakistan) for 1997 to 2012.

This paper will be interesting to the concern researchers, readers, management personnel and the policy makers as we showed that 'adverse selection' of borrowers by the bank in case of credit selection causes higher non-performing loans. We found the individual bank's lending rate positively affect the bad loan ratio not the macroeconomic policy rates. Charging higher rates, bank set aside the safe side borrowers as they cannot afford and create rooms for the borrowers whose business type is high-risk high-return; that could result the higher non-performing loans.

This study empirically showed that in addition to the Berger and DeYoung's (1997) 'moral hazard' hypothesis between the shareholders and the bank management; another 'moral hazard II' between the depositors and the bank management also affect the credit quality of a bank. We showed that when a bank having excess liquidity, its management feels the cost of

liquidity burden and disburse loans and advances without proper screening and ultimately mounting the higher ratio of non-performing loans. In other words, depositors, as a third party cannot monitor the cost of excess liquidity but facing the moral hazard problems as a result of bad loans contracts.

The sample selection for this study was also notable on the ground that most of our sample countries (Bangladesh, India and Pakistan) were under the rule of British colony for around two hundred years. We got the opportunity to study those countries' banking systems all –together considering likely regulatory, social and economic environments. In the near past we found similar studies on developed and developing countries of America, Europe, and Asia but in case of South Asia, this study is a unique addition to the literature of the determinants of bank non-performing loans.

For the rest of the paper, we organized as follows: in section 2, we presented relevant literature on the determinants of bank non-performing loans. In section 3 the empirical approach of our study and in section 4 the sample description has been outlined. In section 5 the result and finally in section 6 we presented the conclusion and policy implications of our study.

2. **The literature of the determinants of non-performing loans**

The literature in the past viewed the determinants of bank non-performing loans (NPL) as a function of bank specific and macroeconomic factors. The bank specific factors may be termed as the microeconomic variables and can be directly found in the financial statements of a bank. On the other hand, the macroeconomic variables are the overall economic, regulatory and legal environment within which a bank operates its business. Extensive literature review found the

three streams of literature on the determinants of non-performing loans are macroeconomic stream, microeconomic stream and the synthesis of macro and microeconomic stream.

Studies on the macroeconomic determinants of non-performing loans focus on the external events such as the overall macroeconomic conditions, which are likely to affect the borrowers' capacity to repay their loans. The classical literature studying the interactions between the macroeconomic environment and financial fundamentals are the models developed by Bernanke and Gertler (1989), Kiyotaki and Moore (KM, 1997), Bernanke, Gertler and Gilchrist (BGG, 1998) and Gertler and Kiyotaki (GK, 2011). BGG (1998) developed the framework of 'financial accelerator' where credit markets are pro-cyclical and the role of asymmetric information between the borrowers and lenders affect the credit market shocks whereas KM (1997) and GK (2011) models allow the business cycle fluctuations and the role of frictions in case of credit market imperfections, respectively.

Rinaldi and Sanchis-Arellano (2006) studied the macroeconomic determinants of the non-performing loans of 7 European Union countries and found strong relationship between the credit risk and the household disposable income, rate of unemployment and the monetary conditions of a country. Ali and Daly (2010) investigated that the same set of macroeconomic conditions affect the default rates of Australia and the US banking differently but the later one found to be more sensitive. The problem of NPL found to be positive to the increase in the nominal interest rates and the number of bankruptcies and negative to the higher CPI inflation, economic growth and property price inflation in Hong Kong, according to the studies of Shu (2002).

Bohachova (2008) found the pro-cyclical nature of default risk where the banks accumulate risks more rapidly in economically good times and some of these risks materialize as asset quality deterioration during recessions in the OECD countries. In the same line, Nkusu (2011) empirically studied the panel of 26 advanced economies and found that macroeconomic vulnerabilities deteriorate the credit portfolios of banks. Espinoza and Prasad (2010), in their dynamic panel estimates over 1995-2008 period of GCC countries showed the persistence of non-performing loans and the inverse relationship with economic growth and the interest rates. Castro (2013) employed dynamic panel data approach to study the macroeconomic determinants of credit risk in Greece, Ireland, Portugal, Spain and Italy (GIPSI) and found that credit risk is negatively affected by the GDP growth rate and the share and housing price indices but positively affected by the unemployment rate, interest rate, credit growth and an appreciation of the real exchange rate. Skarica (2014) found the primary cause of high levels of NPL is the economic slowdown and deterioration in the state of employment and inflation in the seven central and Eastern European countries in the period of Q:3 2007 and Q:3 2012.

Group of literature on microeconomic determinants of non-performing loans were interested more at the variability of NPL across banks attributes to the bank level factors. Berger and DeYoung (1997) evidenced the four mutually non-exclusive two-way causalities over the default risk in their studies of the US commercial banks during the period of 1985-94. They found that 'bad luck', 'bad management', 'skimping' and 'moral hazard' could affect the same bank at the same time. They argued that, bad luck could befall a poorly managed bank that also happens to be skimping on loan monitoring costs and for any loss of capital due to these factors, banks respond to moral hazard incentives and take increased risks. Williams (2004), Podpiera and Weil (2008) and Louzis, Vouldis and Metaxas (2010) studies follow the Berger and

DeYoung (1997) hypotheses and came out with same kind of results who studied the European savings banks, Czech banks and Greek banking sectors for different time periods, respectively.

Keeton and Morris (1987) found that banks taking higher risk including in the form of excess lending eventually incur greater losses. In a comparative study of the credit risk determinants of banks in the developed and the emerging economies, Ahmad and Ariff (2007) found that regulatory capital and the management quality significantly determine banks credit portfolios.

As the synthesis of macroeconomic and the microeconomic determinants of non-performing loans, Salas and Saurina (2002), using the GMM estimation technique for the panel data from 1985-1997 of Spanish commercial and savings banks found that GDP growth rate, firm and family indebtedness, rapid past credit or branch expansion, inefficiency, portfolio composition, size, net interest margins, capital ratio and the market power significantly affect the credit risk of a bank. In a similar kind of study, Louzis et al. (2012) found that along with GDP growth rate and unemployment rate, inefficiency and performance indicators also greatly explain the credit problems of Greek banking sector. Rajan and Dahl (2003) found the terms of credit and macroeconomic and business conditions affect the NPLs in the Indian banking. Festic and Repina (2011) studied the five EU countries (Bulgaria, Romania, Estonia, Latvia and Lithuania) and found that macroeconomic slowdown and skimping on loan supervision are important for the deterioration of credit quality.

Among others Zribi and Boujelbene (2011) concluded that the macro prudential policies and the regulatory capital and ownership structure significantly affect the NPL of Tunisian banks. Chaibi and Ftiti (2015) studied the French and German banking sector and found a set of

macroeconomic variables like GDP growth, interest rate, unemployment and exchange rate along with the bank specific variables like loan loss provisions, inefficiency and the firm size affect the non-performing loans ratio of the banks.

This study focuses on the synthesis of the macroeconomic and the bank specific determinants of non-performing loans of banks in the South Asian countries. We extended the literature of the determinants of non-performing loans by empirically showing that instead of macroeconomic policy rates, the individual bank's lending rate and the information asymmetry between the depositors and the bank is prominently determine the NPL. In this study, the panel data of 259 commercial banks for the period of 1997-2012 which is relatively large that we studied empirically will allow the better insight into the factors determining the banking credit risk.

3. Empirical Approach of the determinants of non-performing loans study

3.1. Econometric Model

We viewed the determinants of non-performing loans (NPL) of banks as the function of bank-specific, industry specific and the macroeconomic specific variables and the general model to be estimated is of the following linear form:

$$\mathbf{NPL_{it} = c + \sum_{j=0}^{J} \beta_j X_{it}^j + \sum_{l=0}^{L} \beta_l X_{it}^l + \sum_{m=0}^{M} \beta_m X_{it}^m + \varepsilon_{it}}$$

$$\mathbf{where, \ \varepsilon_{it} = \nu_i + \upsilon_{it}} \ ......\text{Equation (1)}$$

Where, NPL_{it} is the ratio of non-performing loans of bank i at time t where i = 1,.....,N, t = 1,.....,
T and c is a constant term. The superscripts *j, l* and *m* of X_{it} denote the bank-specific, industry specific and macroeconomic specific determinants respectively. ε_{it} is the disturbance with v_i the unobserved bank-specific effect and υ_{it} the idiosyncratic error. The error components of the regression model also distributed as $v_i \sim$ IIN (0, σ_v^2) and independent of $\upsilon_{it} \sim$ IIN (0, σ_υ^2).

We adopted a dynamic specification of a model that includes a lagged dependent variable in the right hand side among the regressors to account for the time persistence in the NPL structure following the recent literature in panel data studies (see, Salas and Saurina, 2002, Louzis et al., 2012). The dynamic specification model of the determinants of non-performing loan is:

$$\mathbf{NPL_{it} = c + \delta NPL_{i,t-1} + \sum_{j=0}^{J} \beta_j X_{it}^j + \sum_{l=0}^{L} \beta_l X_{it}^l + \sum_{m=0}^{M} \beta_m X_{it}^m + \varepsilon_{it}}$$ ..Equation (2)

Where, $NPL_{i,t-1}$ is the one-period lag of non-performing loans and δ is the speed of adjustment to the equilibrium. A value of $0 < \delta < 1$ implies the persistence of NPL in the industry but tends to return to the normality level.

Literature usually applies the fixed effects (FE) or the random effects (RE) modeling in static type of relationships but in dynamic relationships these models produce biased (especially when time dimension T gets smaller) and inconsistent estimates (see Baltagi, 2001). Thus we precede the following five step issues for the econometric model of NPL determinants.

Firstly, we tested our data for non- stationarity using the Fisher test which does not require a panel to be balanced. This test is a question when the use of a relatively large T in a model of non-performing loans may be criticized on grounds of non-stationarity.   The null of non-stationarity has been rejected at 1% level at every level.

Secondly, we examined whether the individual effects are fixed or random. The relevant Hausman test for equation 1 confirms the evidence in favor of a FE modeling[2]. Also the estimation result confirms the existence of individual effect since the F-statistics is significant (F $(126, 687) = 15.11$, Prob $> F = 0.0000$). However, the least square (within) estimator of the FE model in the presence of a lagged dependent variable among regressors is both biased and inconsistent[3].

Thirdly, we proceed with the estimation of our model using the one step generalized methods of moments (GMM) estimator of Arellano and Bond (1991) paradigm which suggest that consistency and efficiency gains can be obtained by using all available lagged values of the dependent variable along with the exogenous regressors as instruments.

Fourthly, we dealt with the problem of endogenuity with estimation of bank non-performing loan. The question is whether capital variable (E/TA) is endogenous or not. To confirm such, we ran the same model twice separately. First time we treated capital variable as strictly exogenous and second time as endogenous.   Sargan test[4] for over-identifying restrictions indicates that no endogenuity assumption is valid for capital variable in NPL modeling and we treated capital variable as strictly exogenous.

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[2] The relevant Hausman test chi-squared statistics was $\chi^2(11) = 3905.20$ with p-value is 0.0000

[3] The Monte Carlo studies that measured the corresponding bias in the coefficients of the lagged dependent variables have found that the bias is significant for small values of T but goes to zero as T increases (see Judson and Owen, 1999).

[4] In both the cases $\rho = 0.00$ which means the question of endogenuity is irrelevant for capital variable in NPL modeling.

Finally, we addressed the unobserved time effects in the error components of our model as follows:

$$NPL_{it} = c + \delta NPL_{i,t-1} + \sum_{j=0}^{J} \beta_j X_{it}^j + \sum_{l=0}^{L} \beta_l X_{it}^l + \sum_{m=0}^{M} \beta_m X_{it}^m + \varepsilon_{it}$$

$$\textbf{where, } \varepsilon_{it} = \nu_i + \lambda_t + \upsilon_{it} \text{ ......Equation (3)}$$

Where λ_t is the unobservable time effect and we tested the joint significance of time effects as $H_0 = \lambda_2 = \lambda_3 = \lambda_T = 0$. The relevant LM test[5] approves the inclusion of time dummies. We experimented for time dummies for all years jointly and separately but found the year dummies 2003, 2009 and 2010 are significant. Considering all these, we estimated the determinants of non-performing loans by the following dynamic equation:

$$NPL_{it} = c + \delta NPL_{i,t-1} + \sum_{j=0}^{J} \beta_j X_{it}^j + \sum_{l=0}^{L} \beta_l X_{it}^l + \sum_{m=0}^{M} \beta_m X_{it}^m + \gamma D_{03} + \gamma D_{09} + \gamma D_{10} + \varepsilon_{it}$$

$$\textbf{where, } \varepsilon_{it} = \nu_i + \upsilon_{it} \text{ ......Equation (4)}$$

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[5] The relevant LM test chi-squared statistics was $\chi^2(12) = 85.73$ with p-value = 0.0000.

3.2. Empirical determinants of non-performing loans of banks

For this empirical study of the econometric model of the determinants of non-performing loan developed in section 3.1, we have used 3 categories of proxy variables namely (a) firm specific, (b) industry specific and (c) macroeconomic specific (see table-1 for a summary of these variables).

3.2.1. The dependent variables

Non-performing loan ratio

We used the ratio of nonperforming loan to total loan (NPL/TL) as the dependent variable in our model. By non-performing loans, we mean the volume of impaired loans and by definition, a loan is impaired when, based on current information and events, it is probable that a creditor will be unable to collect all amounts due according to the contractual terms of the loan agreement (see FASB, 2008). Alternatively, this ratio has been used to proxy the credit risk measures in many of the past literature (see V. Castro, 2013, B. Imbierowicz et. al., 2014).

3.2.2. The explanatory variables

(a) Bank-specific explanatory variables

(i) Return on assets

We used return on average assets (ROA) as the proxy for the bank performance which negatively influences the levels of non-performing loans of a bank. Past performance can reflect the high quality of management (Louzis et. al., 2012), leading to a low level of NPL.

 (ii)   Equity to Total Assets ratio

    The ratio of equity to total assets measures the capitalization strength of a bank considering the regulatory requirements regarding the minimum equity holdings. Anticipating impact of this variable on bank non-performing loan is negative as low financial capital will cause high non-performing loan (Berger and DeYoung, 1997). To address the 'moral hazard' hypothesis, when third party is bearing the risk of the excessive risk taking cost of another party but cannot easily be charge for or prevent that risk taking behavior of the bank, we expect equity to total assets ratio will significantly affect bank non-performing loan ratio.

(iii)   Cost to income ratio

    Cost to total income ratio is the proxy for inefficiency variable and we expect statistically significant and negative relationship to the non-performing loan. Berger and DeYoung (1997) examined different intertemporal relationships of this measured cost efficiency/inefficiency and those subsequently affect the non-performing loan of a bank. In their so called 'bad luck' hypothesis, increases in problem loans due to exogenous effects precede the decreases in measured cost efficiency whereas in 'bad management' hypothesis have the opposite temporal order where low measured cost efficiency occur before causing higher problem loans. On the other hand, according to their 'skimping' hypothesis, when management chose short run cost efficiency in exchange of long run profitability will experience the mounting of non-performing loans in their balance sheet.

(iv)   Bank size

Bank size has been measured in terms of natural logarithm of a bank's total assets and assumed the predictive capacity of this variable is negative over NPL under the 'diversification' hypothesis where the theoretical argument that larger banks are mostly diversified to manage their loan portfolio and 'bad' borrowers (Zribi and Boujelbene, 2011).

(v)   Off-balance sheet income

Banking business has been diversified many folds now a day. Following Louzis et. al. (2012), we examined the effect of off-balance sheet income on NPL and expect a statistically significant negative relationship. The net non-interest income (non interest expense less non-interest income) over total assets (NNII/TA) has been taken as the proxy for the off-balance sheet income and expects positive impact of this variable on non-performing loans.

(vi)   Liquidity ratio

Higher liquidity ratio reduces the liquidity risk of a bank and fosters the ability of the management for loan servicing and monitoring that result the lower levels of non-performing loan. On the other hand, excess liquidity is a good proxy of moral hazard problems between the bank management and the depositors because they cannot monitor and make the management bound for effective utilization of the fund. We calculated the liquidity ratio (LA/D&STF) as the liquid assets of a bank over the deposits and short term funding in percentage form and expect a statistically significant and inverse relationship with non-performing loan.

(vii)   Growth rate of total loan

One of the fundamentals of bank management is loan management which is directly related to the quality control of the credit disburse. By increasing the volume of loans, management may try to offset or reduce the ratio of non-performing loans to total loans. We expect the growth of total loan will significantly reduce the non-performing loan ratio of a bank.

(viii)   Interest income to total loan ratio

We introduced the ratio of interest income to total loan as the proxy for the lending rate of a bank and how this affects the credit quality of its balance sheet. The intuition of such introduction was to compare the predictive nature of the individual lending rate and the macroeconomic policy rates. Again, higher individual bank lending rate will invite the risky borrowers whose business type is high risk- high return type because the safe side customers may not afford the higher cost of loans. In that sense, we may assume that due to the adverse selection of borrowers by the bank is one of the main reasons of higher non-performing loans. Our hypothesis is the higher the lending rate; the higher will be the default risk as such rate deteriorates the borrowers' ability and also the willingness to repay the loan.

(b). **Industry-specific variables**

(ix)   Concentration ratio

Concentration ratio (CR3) is the proxy variable for the market concentration and its impact on bank non-performing loan in our empirical study. This is a common and widely used measure

of market concentration where higher concentration means lower competition and vice versa and calculated as the ratio of the sum of total assets of largest three (3) banks to that of the industry. According to the structure-conduct-performance (SCP) hypothesis, banks in highly concentrated markets earn monopoly rents, because they tend to collude (Gilbert, 1984) and thus deteriorate the market competition. We expect the negative influence of higher concentration on NPL because in absence of perfectly competitive market scenario, borrowers may feel reluctant to repay the loans.

(c). **Macroeconomic-specific variables**

(x)   Standard deviation of short term interest rate

As the proxy for the short term lending rate, we used the annualized standard deviation of monthly average of daily call money rates (SDint) and expect the positive relationship with the non-performing loan ratio of a bank.

(xi)   Term spread of interest rate

Term spread of interest rate is the proxy variable for the long term interest rate in our present study. We used the difference of yield spread of 10 year and 5 year treasury bonds as the proxy of term structure of interest rate (R) and its impact on the bank non-performing loan ratio. Previous literature (see Castro, 2013, Nkusu, 2011) emphasized the impact of long term interest rate on the problem loan of a bank. An increase in the lending rate simultaneously weakens the debt servicing capabilities of a borrower hence we expect positive relationship with NPL of a bank.

(xii)   GDP growth rate

Stable Gross domestic product (GDP) growth rate represents the stability of an economy and thus affect the demand and supply of loans and deposits directly. We assume that as GDP growth ensures the stability of the economy and in that stable economic environment a borrowers' business risk reduces significantly and increases the ability of debt servicing (Salas and Saurina, 2002). We expect statistically significant inverse relationship with GDP growth and non-performing loan of a bank.

(xiii)   Rate of inflation

The effect of inflation on the non-performing loan ratio of a bank is not deterministic in the past literature. Theoretically, inflation should reduce the real value of debt and hence make debt servicing easier but also high inflation may pass through to nominal interest rates, reducing borrowers' loan servicing capacity (B. Skarika, 2014). Although Rinaldi and Sanchis-Arellano (2006) reported positive relationship, following Shu (2002), we expect inflation and NPL will have statistically significant inverse relationship.

4. Sample and data

In this research of the determinants of the non-performing loans of banks, we studied the unbalanced panel of 259[6] South Asian banks over the period of 1997-2012. By banks we mean the financial intermediary who takes deposits and provide loans and advances in the ordinary courses of business. We excluded the data of Islamic banks from our sample as in India and

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[6] By countries, India represents 60% banks in our total sample while Bangladesh, Nepal and Pakistan represent 12%, 10% and 18% respectively.

Nepal there is no or very limited Islamic banking operation. For our analyses, we collected data from various sources. The dependent variable and the bank specific explanatory variables, we collected data from the *Bureau Van Dijk's Bank Scope database* (Bank Scope 2013) using the universal model of banking database. We took the primary data set from the Bank Scope but calculated by our own to get the concentration ratio (CR3) which we used as the industry specific explanatory variables. For macroeconomics specific variables, we collected data from two sources. We collected the data of short term money market rates[7] and the term spread of interest rate[8] from the *central banks websites* of the respective countries. From *International Financial Statistics (IFS) database (IFS 2014)*, we collected yearly data of rate of inflation and the growth rate of gross domestic product (GDP).

In table-2 in the following the descriptive statistics of the empirical variables used in the present study has been presented. As we see in South Asia, the non-performing loan to total loan ratio was quiet high (more than 8%) in the studied period.

Among other key indicators, ROA was around 1% and the cost to income ratio was more than 61%. Also the average equity to capital ratio was around 10% and the liquid assets to the deposit and short term funding 19.71% indicates the quiet level of solvency of the South Asian banks. Average rate of inflation was slightly higher than 7% and the South Asian nation's GDP grew more than 6% on an average during the period.

<Table-2>

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[7] We used the annualized standard deviation of monthly average of daily call money rates as the proxy of short term interest rates.

[8] Term structure of interest rate is proxied as the difference between the yields spread of 10 year and 5 year Treasury bonds (T-bond). Also for Nepal, we sampled the development bond yield as the equivalent to 5 year T-bond and the national savings certificates yield as equivalent to 10 year T-bond as they have no such classified maturity bonds.

5. Empirical results

5.1. The baseline result

Table-3 in the following presents the GMM regression output of equation 4 of the determinants of non-performing loans (NPL) of the banks in South Asia for the total sample period of 1997-2012. The first column of the table presents the name of the dependent and the deterministic variables including bank specific, industry specific and macroeconomic specific while each column of model 1, model 2 and model 3 presents the coefficient and standard error respectively.

The Wald-test confirms the fine goodness of fit of our panel data set and the Sargan-test shows no evidence of over-identifying restrictions. According to the results of AB (AR1) test a negative first order autocorrelation exists but does not imply the inconsistency of the estimates. Inconsistency would imply if there is the second-order autocorrelation (Arellano and Bond, 1991) but is rejected by AB (AR2) test subsequently.

Empirical results show a moderate degree of persistence of non-performing loans in South Asian banking as the one-period lagged dependent variable (δ (one period lagged NPL/TL) = 0.38604) is statistically significant also justify the use of GMM dynamic panel estimation of our model. This level of persistence of NPL in the South Asian region seems similar to the French and German banking market (Chaibi et. al., 2015).

<Table-3>

The statistically significant negative coefficient of the performance variable (proxied by return on asset (ROA) implies the 'bad management' hypothesis where performance serves as a proxy for the quality of management and lowering the levels of non-performing loans.

Results support the 'moral hazard' hypothesis that low capitalized banks leads to an increase in non-performing loans. Statistically significant coefficient of capital variable (E/TA) indicates that for every 1 percent decrease in equity to total asset ratio would increase NPL by approximately 23 basis points.

Empirical evidence found that 'skimping hypothesis' is also persists in the South Asian banking region. Short-run cost efficiency burgeon the future level of NPL. Our empirical results support the so called 'diversification hypothesis' in both proxied variables size (lnTA) and net non-interest income ratio (NNII/TA). Statistically significant negative coefficients of both the deterministic variables predict that banks having the capabilities of income diversification in terms of size and other non-interest income will have low levels of non-performing loans.

We found empirical evidence in favor of the 'liquidity hypothesis' that banks with no liquidity shortage become able to expand their loans and advances and can reduce the non-performing loans ratio significantly. Numerically speaking, if a bank can increase the liquid assets to deposit and short term funding and subsequently increase the total loans by 1 percentage point then the NPL is supposed to be reduced by 4 basis point.

Also we empirically proved that in the South Asian banking, rather than macroeconomic policy rates, individual bank's lending rate significantly determines its non-performing loan ratio. In model 1 of table-3, we included the individual bank lending rate as the determinant of NPL.

Whereas, in model 2 and model 3, we included the short term lending rate (proxy of which is the annualized standard deviation of monthly average of daily call money rates, SDint) and the long term interest rate/term spread of interest rate (proxied by the difference between the yields spread of 10 year and 5 year Treasury bonds, R) as the determinants of NPL. Models outcome show, if the bank increases its lending rate by 1 percent then its NPL ratio goes up by 36 basis points which are statistically significant whereas the coefficients of the SDint and R are statistically insignificant.

Industry factor is also a significant determinant of non-performing loans in South Asia. Our proxy variable concentration ratio (CR3) is statistically significant and having negative coefficient means the higher ratio of non-performing loan is significantly due to the lack of fare competition in the banking industry.

As our hypothetical expectation, the systematic factors affect the non-performing loan ratio of individual bank inversely. GDP growth rate significantly reduces the NPL. Also the significant negative coefficient of inflation rate implies that higher inflation weakens the borrowers' ability to debt service by reducing their real income and these findings are consistent to the previous literature (see Chaibi et al. 2015).

Our empirical results also evidence that in the year of 2003, 2009 and 2010, the non-performing loan was significantly high may be due to the hit of the global recession which was confirmed by the positive coefficients of the year dummies in the baseline model.

5.2. Robustness check

In table-4 we presented the result of our empirical model of the determinants of non-performing loans in South Asia using the fixed effect[9] panel estimator as an alternative to the GMM estimator.

However, we found no change in signs and no significant change in values of the coefficients of the explanatory variables in the alternative estimator which confirm that our baseline GMM estimation output is robust and the coefficients of the estimation can be interpreted with confidence.

<Table-4>

6. Conclusion and implications of the study

We studied the cross-country panel data set with micro and macro level variables and present the empirical results on how bank specific, industry specific and macroeconomics specific factors affect the bank non-performing loans. We followed the single stage model of NPLs determinants for the empirical study that included four South Asian countries' that is Bangladesh, India, Nepal and Pakistan banking sector data covering the period of 1997-2012. Our empirical findings are consistent with our theoretical analysis and significantly positive persistence of NPLs behavior in the sample region justify the use of GMM estimator, an up-to date econometric methodology that we effectively addressed the issues that profits show a tendency to persist over time, reflecting impediments to market competition, informational opacity and/or sensitivity to regional/macroeconomic shocks.

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[9] The Hausman test allows the null hypothesis that the individual effect and the explanatory variables are uncorrelated, rejected in all the cases.

Among the bank specific determinants, statistically significant coefficients of the proxy variables support the Berger and DeYoung's (1997) 'bad management', 'skimping' and 'moral hazard' hypotheses and the Louzis et al. (2012) 'diversification' and 'too big to fail' hypotheses. The findings also support that 'moral hazard II' where the depositors are mainly affected and the 'adverse selection' of borrowers by the banks are also significantly affect the level of non-performing loans of a bank. Significantly negative coefficients of inflation and GDP growth rate reveal the 'bad luck' hypotheses of Berger and DeYoung (1997) where the external elements affect the mounting of NPLs. In case of South Asia, concentration ratio of banks still has some deterministic capacity of non-performing loans along with some adverse effect of the global financial crisis.

For the policy implications, we suggest the banks to take appropriate actions to achieve cost efficiency and the excellence of management so to address the moral hazard and adverse selection issues to minimize the non-performing loans ratio. The policy makers should focus the macro prudential policies so that the bank level lending rate remains within justified range to reduce the credit risk problems of each bank. Hoping these initiatives will benefit the society as a whole.

In this paper, we comprehensively addressed the question of how microeconomic and macroeconomic forces affect the non-performing loans of a bank. But studies on a number of additional explanatory variables like corporate tax rates, ownership structure, deposit insurance, rate of unemployment, and portfolio effect, those could not be tested due to limitation of data and the degrees of freedom or for the potential multicollinearty problem, would be tested as the extension of the model.

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Table-1: Description of variables used in the study of non-performing loans of banks

Variables		Notation	Description	Expected effect
Dependent variables				
Non-performing loan ratio		NPL/TL	Non-performing loan (%) over total loan is a proxy variable for credit quality or credit risk exposed to a bank	
Independent variables				
(a). Bank-specific variables				
	Return on average assets	ROA	Net income over average total assets (%)	-
i.	Equity to total assets ratio	E/TA	Equity to total assets ratio (%) is a measure of capital adequacy of respective bank	-
ii.	Cost to income ratio	C/TI	Total cost over total revenue (%)	-
iii.	Bank size	ln(TA)	Natural logarithm of total assets of a bank	-
iv.	Off-balance sheet income ratio	NNII/TA	Net non-interest income over total assets (%)	-
v.	Liquidity ratio	LA/D&STF	Liquid asset to total deposits and short term funding ratio (%) express the liquidity position of a bank	-
vi.	Growth of total loan	GTL	Annual growth rate (%) of loan	-
vii.	Interest income to Total loan ratio	i	Total interest income over total loan (%)	+
(b). Industry-specific variables				
viii.	Concentration ratio	CR3	Sum of total assets of largest three banks over that of the industry	-
(c). Macroeconomic-specific variables				
ix.	Standard deviation of short term interest rate	SDint	Annualized standard deviation of monthly average of daily call money rates	+
x.	Term spread of interest rate	R	Difference between the yields spread of 10 year and 5 year Treasury bonds, R (%)	+
xi.	Rate of inflation	%Inf	Annual rate of inflation (%)	-
xii.	Economic growth rate	%GDP	Real economic growth rate as a % change in GDP	-

Table-2: Descriptive statistics of the variables of non-performing loans model

Variables	Mean	Median	Standard Deviation
Dependent Variable			
Non-performing loan ratio (NPL/TL)	8.3432	4.2800	10.4056
Independent variables			
Bank specific			
Return on Average Assets (ROA)	0.9950	1.1450	3.3746
Equity to Total Asset ratio (E/TA)	9.9883	7.0900	12.3831
Cost to income ratio (C/TI)	61.2300	48.5100	53.5445
Size (lnTA)	7.1870	7.1253	2.0547
Net non-interest income ratio (NNII/TA)	0.8788	0.6945	3.3148
Liquidity ratio (LA/D&STF)	19.7128	14.4250	28.8512
Growth rate of total loan (GTL)	26.7537	19.7450	46.5776
Interest income to total loan ratio (i)	12.4542	10.5900	19.9496
Industry specific			
Concentration ratio (CR3)	0.5598	0.5412	0.1798
Macroeconomics specific			
Short term interest rate (Sdint)	1.3430	0.9992	1.1464
Term spread of interest rate (R)	1.0741	0.6000	1.2237
GDP growth rate	6.1365	6.1800	2.2592
Rate of inflation	7.0261	6.3700	3.4116

Table-3: Determinants of non-performing loan (NPL) of banks in South Asia, 1997-2012, total sample

Variables	Model1		Model2		Model3	
Dependent variable: Non-performing loan ratio (NPL/TL)	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Independent variables						
Bank specific						
One period lagged NPL/TL	.38604***	0.03275	.38268***	0.03312	.2555***	0.04235
Return on Asset (ROAA)	-.89498***	0.08190	-.89981***	0.08228	-.85744***	0.08573
Equity to Total Asset ratio (E/TA)	-.22691***	0.04090	-.22004***	0.04128	-.25058***	0.04735
Cost to income ratio (C/TI)	-.00558*	0.00300	-.00548*	0.00301	-0.00445	0.00310
Size (lnTA)	-2.588***	0.27484	-2.6939***	0.27950	-2.2267***	0.37601
Net non-interest income ratio (NNII/TA)	-.22295*	0.13306	-.23793*	0.13396	0.04667	0.16507
Liquidity ratio (LA/D&STF)	-.04484***	0.01200	-.04534***	0.01216	-.03005**	0.01320
Growth rate of total loan (GTL)	-.04396***	0.00597	-.04433***	0.00631	-.04023***	0.00690
Interest income to total loan ratio (i)	.36009***	0.05069	.36556***	0.05105	.29436***	0.05846
Industry specific						
Concentration ratio (CR3)	-2.4719***	0.80702	-2.4921***	0.82473	-2.604**	1.14280
Macroeconomics specific						
Short term interest rate (Sdint)			-0.04647	0.07552	-0.02061	0.08061
Term spread of interest rate (R)					-0.0531	0.14793
GDP growth rate	-.35605***	0.04973	-.347***	0.05090	-.23719***	0.06644
Rate of inflation	-.08256**	0.04103	-.07584*	0.04128	-.08165*	0.04657
Year 2003 (Dummy)	1.3335***	0.35420	1.287***	0.36302	1.2001	0.93165
Year 2009 (Dummy)	.78418***	0.23774	.73405***	0.24331	.67239**	0.26626
Year 2010 (Dummy)	1.5772***	0.24039	1.5915***	0.24644	1.4354***	0.27692
Intercept	29.078***	2.48970	29.913***	2.55090	26.69***	3.36610
Number of observations	639		632		502	
Wald test (p-value)	χ2(15) = 1675.96	0.0000	χ2 (16) = 1646.42	0.0000	χ2 (17) = 462.37	0.0000
Sargan test(p-value)	χ2 (97) = 432.55	0.0000	χ2 (97) = 425.98	0.0000	χ2 (84) = 356.51	0.0000
AB test AR(1)(p-value)	z = -2.2202	0.0264	z = -2.2588	0.0239	z = -1.8947	0.0581
AB test AR(2)(p-value)	z = -2.0702	0.1257	z = -2.032	0.2076	z = -1.2372	0.2160

Note: The table reports the regression output from GMM estimation of the determinants of non-performing loan of banks. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test shows the fine goodness of fit of the model while Sargan test is the test for over-identifying restrictions in GMM dynamic model estimation. AB test AR(1) and AR(2) refer to the Arellano-Bond test that average auto covariance in residuals of order 1 and order 2 is 0 (H_0: no auto correlation).

Table-4: Robustness check (Fixed effect estimator as an alternative to GMM estimator) of the determinants of non-performing loan (NPL) of banks in South Asia, 1997-2012, total sample

Variables	Model1		Model2		Model3	
Dependent variable: Non-performing loan ratio (NPL/TL)	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Independent variables						
Bank specific						
Return on Average Assets (ROA)	-.29541**	0.11459	-.3269***	0.11357	-.24456***	0.0946
Equity to Total Asset ratio (E/TA)	-.17608***	0.04761	-.17636***	0.04745	-.47348***	0.04425
Cost to income ratio (C/TI)	.02456***	0.00564	.02502***	0.00557	.01126**	0.0046
Size (lnTA)	-3.5787***	0.33512	-3.6271***	0.34529	-1.585***	0.46202
Net non-interest income ratio (NNII/TA)	-1.4154***	0.17854	-1.5544***	0.18002	.42223**	0.20303
Liquidity ratio (LA/D&STF)	.03345*	0.01843	.03282*	0.01852	.02712*	0.0162
Growth rate of total loan (GTL)	-.04813***	0.00688	-.06076***	0.00807	-.03899***	0.00684
Interest income to total loan ratio (i)	0.12737*	0.08085	.14825*	0.08087	0.1046	0.07403
Industry specific						
Concentration ratio (CR3)	-5.201***	1.2007	-5.0306***	1.1942	-4.5399***	1.2959
Macroeconomics specific						
Short term interest rate (Sdint)			-.37423***	0.13045	-.25632**	0.11137
Term spread of interest rate (R)					-0.24544	0.17054
GDP growth rate	-.40553***	0.08368	-.40277***	0.08552	-.19983**	0.08981
Rate of inflation	-.28727***	0.06852	-.26805***	0.06887	-.21166***	0.0596
Year 2003 (Dummy)	1.2868*	0.67518	0.91775	0.67769	0.45174	1.2951
Year 2009 (Dummy)	0.62774	0.45839	0.30917	0.46391	0.39496	0.39086
Year 2010 (Dummy)	2.1735***	0.45633	2.3779***	0.45519	2.0481***	0.41501
Intercept	42.554***	2.6669	43.63***	2.7281	26.969***	3.9521
Number of observations	825		811		669	
R2	0.4713		0.4899		0.379	
Wald test (p-value)	F (14, 684) = 43.55	0.0000	F (15, 669) = 42.83	0.0000	F(16, 526) = 20.06	0.0000
Hausman test, $\chi2$ (p-value)	39.5.20	0.0000	1443.44	0.0000	123.82	0.0000

Note: The table reports the regression output from Fixed Effect estimation of the determinants of NPL. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator.

Table-A5: Correlation matrix* of the variables studied for the model of the determinants of non-performing loan of banks in South Asia

Variables**	npltl	roa	i	eta	ladstf	cti	lnta	gtl	nniita	cr3	gdp	inf	ltint	sdint	_cons
L.npltl	1														
roa	-0.1508	1													
i	0.3061	-0.2478	1												
eta	0.2795	-0.2408	0.0231	1											
ladstf	-0.5165	0.1037	-0.2717	-0.2112	1										
cti	-0.157	0.2829	0.1156	0.0562	0.0465	1									
lnta	0.1036	0.001	-0.1808	0.121	0.0078	-0.0014	1								
gtl	-0.2126	-0.0448	-0.0769	-0.0181	0.074	0.0364	0.0339	1							
nniita	-0.144	0.3205	0.3011	-0.2617	0.035	-0.1725	0.2357	0.0381	1						
cr3	-0.0426	0.0469	0.1655	-0.0584	0.0402	-0.0236	0.2043	0.0941	0.0519	1					
gdp	0.1192	0.0464	0.1476	-0.0639	0.0342	0.038	0.3403	-0.0394	0.175	0.0101	1				
inf	0.2694	-0.0664	-0.0203	-0.0926	-0.0959	-0.1173	0.2529	0.0882	-0.0452	-0.047	-0.1092	1			
ltint	-0.0312	0.0563	0.0619	-0.0482	-0.0282	0.0471	-0.0448	-0.0425	-0.1188	0.1962	-0.2015	0.3663	1		
sdint	0.0832	-0.0413	0.0947	-0.0836	-0.0649	-0.021	-0.017	0.1213	0.0977	-0.0732	0.0784	0.0364	-0.3027	1	
_cons	0.2301	0.0371	-0.0287	-0.2077	0.0501	-0.0634	0.9431	-0.0412	-0.1779	-0.3233	-0.4239	0.1455	0.0537	-0.0213	1

* Output of Stata

** Refer to the table-1 of summary statistics for elaboration of the names of the variables