On understanding the macro linkages of asset quality of commercial banks in India: an empirical analysis

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ABSTRACT

This research paper empirically examines a correlation and causality between asset quality of commercial banks in India by using macro variables (linkages). The asset quality is measured in terms of rising non-performing assets (NPAs) of commercial banks. The correlation estimated between gross NPAs and the six macro variables has turned out to be significant. In addition to the study of the impact of macro linkages, sector- specific analysis is undertaken to examine the correlation between priority and non-priority sector lending and NPAs of these sectors. The Granger causality coefficients are also meaningful and significant. The paper also provides sector-specific correlation and causality analysis of gross NPAs of priority and non-priority sectors and credit to these sectors. The latter part of this paper illustrates Net Stable Funding Ratios (Base III) calculated for all scheduled commercial banks and suggests the ways to improve deteriorating quality of assets of scheduled commercial banks.

Introduction

The scheme of this research paper runs as follows. The first part of the paper includes a discussion on such points as objectives of research, research methodology and review of literature. The same part examines hypothesis and hypothesis testing. The second part is devoted to a detailed discussion on results and analysis. In the same part of this paper are included such issues as significance of 'stable funding ratio' along with its calculation and relevance in the context of asset quality problem that the commercial banks in India have been facing. A couple of analytical and policy issues are discussed in connection with the understanding of asset quality problem in the light of the estimated numbers on the stable funding ratio. The last and the third part of this paper includes a discussion on points such as conclusion, recommendations, implications and limitations of this research.

Part (A)

Review of Literature

There are many studies which have explained various factors that have affected the asset quality of banks. An asset can turn into a NPA when the borrower fails to repay either interest or principal amount of a loan taken on agreed terms. The literature in this context examines various reasons for the impairment of asset quality. Business cycle might be a primary reason for banks' non-performing loans (Misra and Dhal, 2010). While studying non-performing loans in Italy, Sergio (1996) found that an increase in the riskiness of loan assets is rooted in a bank's lending policy. It has also been found that the problem of NPAs is related to several internal and external factors affecting the borrowers (Muniappan, 2002). The internal factors include diversion of funds for expansion, diversification and modernization, taking up new projects, helping/promoting associate concerns, and time/cost overruns during the project implementation stage, business failure, strained labour relations and many others. Kent and D'Arcy argued that the potential for banks to experience substantial losses on their loan portfolios increases towards the peak of the expansionary phase of the

cycle. Their study further emphasized that there are other reasons why credit growth and loan quality are pro-cyclical in addition to the impact of financial accelerator. One more study states that herd behavior of bank managers can lead toadeteriorationof credit standards during economic booms, as credit mistakes are judged more leniently (De Bock and Demyanets, 2012). Gopalakrishnan(2005) classified the causes for NPAs into political, economic, social and technological. It is also observed through the literature that the problem of NPAs is not mainly because of lack of strict prudential norms, but it is due to legal impediments and time consuming nature of asset disposal process, postponement of the problem by the banks to show higher returns and manipulation by the debtors using political influence (Reddy, 2002). In one of the studies undertaken by Aggarwal and Mittal (2012), the authors pointed out that the major reasons for NPAs include improper selection of borrowers' activities, weak credit appraisal system, industrial problems, inefficient management, slackness in credit management and monitoring, lack of proper follow-up, recessions and natural calamities and other uncertainties.

It has also been observed that the opinion over the relationship between inflation and NPAs is divided. Rinaldi and Sanchis Arellano (2006) have found a positive relation between the inflation rate and non-performing loans while Shu (2002) has estimated a negative relation. It has been further found that negative structural shocks to economic growth, the exchange rate, or debt- creating capitalinflows tend to bring down private credit while loan quality deteriorates. It can also be argued that an increase in asset prices pushes up the net worth of firms, households or countries, improving their capacity to borrow. In this context, therefore, one may further state that strong balance sheets in boom periods may lead to excessive lending against inflated values of collateral (De Bock and Demyanets, 2012).

In the Indian context, the experience of the Indian banks is that the public sector banks have recorded improvements in profitability, efficiency (in terms of intermediation cost) and asset quality in the 1990s; they continue to have higher interest

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rate spreads but, at the same time, earn lower rates of return, reflecting higher operating costs. As against this, the private sector banks appear to have lower spreads as well as lower operating expenses when compared with the banking system in G3 countries. At the same time, asset quality is weaker so that loan loss provisions continue to be higher (Mohan, 2004).

Objectives of Research

The issues and problems examined and analyzed in this research paper are based on the following objectives.

1) To find out whether there exists any correlation between gross NPAs and total gross advances.

2) To examine whether any causality could be established between gross NPAs and total gross advances.

3) To find out whether there exists any correlation between NPAs as a dependent variable and six other macro independent variables such as wholesale price inflation, world GDP growth, money market rate as a proxy for lending rate, stock prices, Credit to GDP ratio and GDP growth. These six variables are our macro linkages.

4) To examine whether any causality could be established between NPAs on one hand and the six macro linkages which are predictors for changes taking place in gross NPAs.

5) To understand whether the calculated values on Stable Funding Ratios (SFRs) reemphasize the gravity of the problem of NPAs with commercial banks in India.

6) To illustrate sector-specific analysis of the worsening situation of NPAs with commercial banks in India.

Research Methodology

This research is exploratory and empirical in its nature. The data used on a variety of relevant variables are secondary in nature. The data covers a time period ranging from 2001 to 2014.The specific reason for choosing this time-period is that during this period was seen a lot of volatility in the volumes of NPAs of commercial banks and the total size of NPAs had grown considerably towards the end of this time period. This relatively small time-series is converted into a log-transformed data with 1 year lag. The model used for investigation is a simple regression model. This model has used a multivariate equation which shows NPAs as a dependent variable and six other macro variables as predictors or independent variables. These regressed variables show results with one year lag. The original hypothesis is tested for its results. For Granger causality, simply (albeit imperfectly) 't' test is conducted. The P – values for the 't' statistic on individual coefficients have been used to determine whether Granger causality is present or absent. This has been done by using a 5% level of significance. If any of the P-values for the coefficients $\beta_1, \ldots \beta_2, \ldots \ldots \beta_n$ were less than .05, one would conclude that Granger causality is present and vice-versa. In addition toasimple regression analysis, 'Net Stable Funding Ratios (NSFR)' for all scheduled commercial bankshave been calculated for a period ranging from 2009-10 to 2013-14. At the same time, NSFRs have also been calculated for banks falling in different groups for a period ranging from 2001-02 to 2004-05. The data used for calculating NSFRs have been derived from banks' balance sheets over the respective years chosen for the calculation. NFSR is defined as a bank's 'available stable funding (ASF)' divided by its 'required stable funding (RSF)' and this ratio should be greater than 100 per cent [BCBS (2010$_a$)]. The purpose behind the minimum requirement of this ratio is to ensure that banks maintain ample stable liabilities to fund long and medium term assets. In essence, it may be understood that the NSFR gives an idea about stable sources of funding. The data on the macro variables have been derived from the website of the Reserve bank of India.

The Model

To find out, on one hand, the correlation and on the other hand, the likely Granger causality, this research paper has, at its centre, the following regression model.

$NPAG_t = \alpha + \beta_1 GDPG_{t-1} + \beta_2 CRGDPR_{t-1} + \beta_3 MMKTRATE_{t-1} + \beta_4 BANKEX_{t-1} + \beta_5 WGDP_{t-1} + \beta_6 WPIINFL_{t-1} + e_0$ (i)

The abbreviated terms used in the equation number (i) can be illustrated as follows:

$NPAG_t$ = Growth of Non- Performing Assets at t point in time.

GDPG = GDP growth.

CRGDPR = Credit to GDP Ratio.

MMKTRATE = Money Market Rate (Proxy for Lending).

BANKEX = Stock Prices.

WGDP = World GDP Growth.

WPIINFL = WPI Inflation.

$_{t-1}$ = Suggesting one year time lag.

$\beta_1 , \ldots \ldots \ldots \beta_6$ = Parametric constants to be estimated.

e_0 = Error term.

Hypothesis and Testing

This research paper has tested the following two hypotheses.

Hypothesis 1

H10:- There does not exist significant correlation and causality between total gross advances and gross NPAs.

H11:- There exists significant correlation and causality between total gross advances and gross NPAs.

Hypothesis 2

H20:- There does not exist significant correlation and causality between gross NPAs and the six other independent variables specified in equation number 1.

H21:- There exists significant correlation and causality between gross NPAs and the six other independent variables specified in equation number 1.

Hypothesis Testing

In the context of hypothesis 1, our equation is as follows:

$GNPAs = \alpha_0 + \beta_1 GADVAN$ (ii)

Through our ANOVA output results the equation looks as follows:-

$GNPAs = -16956.5 + 0.066985GADVAN$

(-1.92696) (3.688939)

For hypothesis testing, the estimated F statistic (13.60827) is compared with table F statistic at 1 (for numerator) and 10 (denominator) degrees of freedom at 5 per cent level of significance. The F statistic value from the table is 4.96. Since our estimated value far exceeds the table value, the null hypothesis is rejected. Obviously, the alternative hypothesis is accepted. This shows that there exists significant correlation and causality between total gross advances and gross NPAs. Even at 1% significance level the table F statistic (10) is lower than the estimated F statistic. This is a much better result from the previous one.

In the context of hypothesis 2, our equation is as follows:-

$NPAG_t = \alpha + \beta_1 GDPG_{t-1} + \beta_2 CRGDPR_{t-1} + \beta_3 MMKTRATE_{t-1} + \beta_4 BANKEX_{t-1} + \beta_5 WGDP_{t-1} + \beta_6 WPIINFL_{t-1} + e_0$ (The original equation number i).

$NPAG_t = -13759.941 + 5.010 GDPG_{t-1} + 622.920 CRGDPR_{t-1} + 332.882 MMKTRATE_{t-1} - .770$

(-3.220) (3.070)   (.190)   (.639)   (-.652)

$BANKEX_{t-1} + 634.725 WGDP_{t-1} + 26.775 WPIINFL_{t-1} +$

(1.479)   (.736)

For hypothesis testing the estimated F statistic (1.985) is compared with the table F statistic at 6 (for numerator) and 4 (for denominator) degrees of freedom at 5% level of significance. The F statistic value from the table is 6.16. Since

our estimated value (1.985) is much smaller than the table value, the null hypothesis is not rejected (in fact, it is accepted). Obviously, the alternative hypothesis is rejected. This shows that the changes in NPAs are not very significantly explained by the six independent variables when they have been regressed to-getherly. In-spite of this result, the following two important observations in connection with this multivariate regression equation are equally important. One is that the causality discussed on the basis of P values (Granger causality with't' statistic) between NPAs and the six independent variables taken separatelyhas produced much better results. The second observation is that if we looked at the SPSS outputs showing correlation between NPAs and the six variables, we found that(with R = .839 and R^2 = .704) this observation implies a much satisfactory result.

Causality Testing (Appendix 1)

For causality testing, the data used on NPAs as a dependent variable and six independent variables ranges from 2001 to 2013. This data has 1 year lag effect manifested in the results. To obtain the Granger causality results, the bivariate Granger causality test is conducted on all six variables. Before this test, the F statistic test is conducted to understand whether there exists any causality between the Gross NPAs and the total gross advances. In this connection our results are as follows:

a) The estimated 'F' statistic has turned out to be 13.60827 and the table 'F' statistic calculated at 5% significance level with 1 DF for the numerator and 11 DF for the denominator has turned out to be 4.84. Since the estimated statistic far exceeds the table value (13.6082 > 4.84), we can reject the null hypothesis which states that there does not exist any causality between the gross NPAs and the total gross advances. As a result, the alternative hypothesis is accepted.

b) So far as the causality between the gross NPAs and the six other variables is concerned, we have conducted the bi-variate Granger causality. While conducting a two-directional causality, our X variable denotes a dependent variable (gross NPAs) and Y variable denotes an independent variable. Further, to know whether X Granger causes Y or Y Granger causes X, we have chosen a smaller P-value of larger 'F' statistic without specifically referring to a standard 5% level of significance. Our results in a sequential order in this case are as follows:-

b.1) To find out the Granger causality between gross NPAs and GDP growth, it has been observed that the causational direction runs from the NPAs growth to GDP growthsince the P-value (0.37822) is smaller when we take Y = f(X) as compared to the P-value (0.6262) when we consider X = f (Y). Even the relative 'F' statistic (0.8589 as compared to 0.2542) is better with the estimated results of this causation.

b.2) In the case of gross NPAs and CRGDP ratio, it is observed that the X Granger causes Y since the P-value is smaller (0.0280 < 0.200) and the 'F' statistic (6.8335 >1.9093) is larger when we consider Y = f (X). This shows that it is the changes in NPAs that may explain the changes in CRGDP ratio.

b.3) In the case of gross NPAs and MMKTRATE, it is observed that the Y Granger causes X since the P-value is smaller (0.1005 < 0.2751) and the 'F' statistic (3.3473 > 1.3499) is larger when we consider X = f (Y). This shows that it is the changes in MMKTRATE (market rate of interest or lending rate) that may explain the changes in gross NPAs.

b.4) In the case of gross NPAs and BANKEX (proxy for stock prices), it is observed that the Y Granger causes X since the P-value is smaller (0.1827 < 0.8096) and the 'F' statistic (2.0841 > 0.0633) is larger when we consider X = f (Y). This shows that it

is the changes in stock prices that may explain the changes in gross NPAs.

b.5) In the case of gross NPAs and world GDP growth, it is observed that the X Granger causes Y since the P-value is smaller (0.1312 < 0.9769) and the 'F' statistic (2.7565 > 0.0008) is larger when we consider Y = f (X). This shows that it is the changes in NPAs that may explain the changes in world GDP growth.

b.6) In the case of gross NPAs and WPI inflation, it is observed that the Y Granger causes X since the P-value is smaller (0.3955 < 0.7955) and the 'F' statistic (0.7958 > 0.0712) is larger when we consider X = f (Y). This shows that it is the changes in WPI inflation that may explain the changes in gross NPAs.

Part (B) Results and Analysis (Appendix 1)
Macro Linkages of Asset Quality

In Part (B) we have analyzed our results. To discuss the same, we have considered our basic equation (the Equation number 1). Later, we have used 1 year lagged data on each independent variable and have found partial egression coefficients. Our results are as follows:

1) A significant correlation (R = .839 and R^2 = .704) has been found between gross NPAs and the six independent variables. The independent variables have not shown any multi-collinearity (since the Durbin Watson coefficient has turned out to be 2.343).

2) GDPG (economic growth is measured in terms of gross domestic product growth) and gross NPAs: - In review of literature and across many empirical studies it has been observed that slowdown in nominal GDP growth is accompanied by rise in growth of NPAs. Over the last one decade, descriptive statistics and empirical analysis have shown that growth in NPAs declined sharply following increase in GDP growth over a period of 11 quarters and growth in NPAs increased sharply following decline in GDP growth over a period of 12 quarters (Lokare, 2014).

In our study we have found that the growth in nominal GDP and the growth in NPAs are not negatively associated. In fact, we have found a positive correlation between them. One possible reason might be that with expansion in nominal GDP and increase in overall economic activity, the economy experiences more than required credit expansion. With undue credit expansion the overall borrowing propensity increases which further mayadversely affect the asset quality of banks in terms of non-payment of borrowed funds. Our empirical study has revealed that a 1% growth in nominal GDP results in 0.5 % increase in NPAs (Appendix 1) after a lag of 4 quarters. One of the empirical studies by the RBI (Lokhare, S.M., 2014) argues that the NPAs growth is inversely related to the growth in GDP and that a 1 % decline in GDP growth leads to rise in NPAs growth by 0.4 percentage points after a lag of 1 quarter.

3) NPAs and CRGDP Ratio: - It has been observed through literature that credit cycles are an important determinant of banks' asset quality. It has also been argued that an expansion in credit growth is associated with the deterioration in asset quality because when banks over expand their lending, they tend to lower their credit standard. Using the example from the Indian context, one may observe that the quarterly data from June 2000 suggested a lagged statistically significant positive relation between deviations from trend in credit to GDP (C- GDP) ratio and growth in gross NPAs (RBI, AR, 2010-11). It has also been observed that the growth in NPAs follows the growth in credit.

Our empirical analysis has estimated that a 1% rise in credit – GDP ratio results in 0.006 per cent point growth in NPAs after a lag of four quarters. Similarly, our disaggregated analysis has shown that a 1% increase in agriculture credit results

subsequently in 1.08 per cent growth in agriculture NPAs after a lag of 4 quarters. The estimates are even impressive in respect of small-scale industrial sector. For example, a 1% growth in credit to small-scale industrial sector could result in 0.72 % growth in small-scale sector NPAs. This has brought out the significance of the pro-cyclical behavior of the banking system. This behavior emphasizes the fact that the asset quality can be hampered during periods of high credit growth and this can further lead to creation of NPAs for banks in later years.

4) NPAs and MMKTRATE: - Theoretically, changing interest rates of banks (lending rates) may positively affect the growth of NPAs. The degree of difficulty for borrowers to repay loans also depends upon the level and type of lending rate option a borrower chooses. For example, hardening of interest rates makes repayment of loans difficult for borrowers if they borrow funds at floating rates. The previous empirical researches have also shown that the growth in NPAs also seems to follow a cyclical pattern with lending rates. It has been further noticed that increases in money market rate worsens the quality of loans as higher debt-servicing costs make it harder for borrowers to honour their debt. A reference to one of the studies reveals that higher interest rates may result in adverse selection of borrowers, with only the riskier ones left in the market (Stieglitz and Weiss, 2001). The Indian experience suggests that the growth in NPAs has remained low during the phases of low interest rates. As against this, NPAs growth has increased with the increase in interest rates.

Our empirical estimates have shown that 100 bps (basis points) rise in interest rate (money market rate proxy for lending rate) could result in 0.003 percentage point rise in NPAs growth after a lag of 4 quarters.

5) NPAs and BANKEX (proxy for stock prices):- Generally, it can be argued that increase in asset prices may push up the net worth of borrowers through wealth effect and help in facilitating debt servicing. High asset prices may help borrowers getting prepared for shocks by facilitating access to credit and /or helping to service existing debts. This also implies that high valuation of assets may be associated with lower levels of NPAs. One more empirical finding also states that there appears to be a negative correlation between booming stock market and increase in the level of firms' profitability on one hand and borrowers' capacity to repay loans on the other hand.

The empirical evidence in this study points out that increase in stock prices by 1 per cent leads to 0.077 percentage point decline in NPAs, after a lag of 4 quarters.

6) NPAs and WGDP (world GDP, global macroeconomic situation):- The previous empirical studies have estimated an inverse correlation between changes in world GDP used as a proxy for external environment and changes in gross NPAs. If the world GDP experiences boom, it can be transmitted through trade and trade agreements. Since the overall business attitude and environment are optimistic, it affects the domestic businesses optimistically. Domestic businesses may also experience boom times in their business and financial activity. This might result in their increased capacity to repay loans. As a result, NPAs might result in decline.

The estimates in this study show that increase in world GDP by 1 % point may result in decline of domestic NPAs by 0.039 percentage point after a lag of 4 quarters.

7) NPAs and WPIINFL (WPI Inflation):- The rising prices adversely affect individual's disposable income (Personal income – payment of direct taxes, such as income tax etc.) and further erode repayment capacity of borrowers. It is also observed that high inflation has bad effects on nominal interest

rates which further makes borrowers' interest cost burden even much heavier. At the same time, it is observed that inflation helps borrowers in real terms since the real cost of borrowers' money burden falls (Bofondi and Ropele, 2011). Our discussion above suggests that there is positive association between rising inflation and growing NPAs.

The empirical estimates in this study show that rise in WPI inflation by 1 per cent results in increase in NPAs by 0.26 percentage points after a lag of 4 quarters.

B.2) Micro Linkages of Asset Quality

In this sub-section we intend to discuss the results and analysis concerning sector-specific disaggregated picture. In this context we have run simple regressions exploring correlations and causality between NPAs of priority sector and credit to priority sector and NPAs of non-priority sector and credit to non-priority sector. Our results in this context are as follows (Appendix 2):

1) NPAs of both these sectors are positively associated with credits given to these sectors. The Pearson and Spearman correlation coefficients in both the cases have turned out to be .73 and .78 correspondingly (Appendix 2) at 0.01 significant level with 2 – tailed.

2) Our empirical results have shown that the NPAs of these sectors and credit given to these sectors have not only significant positive correlation but they have also shown the causality which may be traced through the estimated 'F' statistic (12.856) and corresponding 'P-value'(which is very low and less than 0.05). (Appendix 2).

3) Our empirical results have also shown that a 1% increase in credit to priority and non-priority sectors results in increase of their NPAs by 2.14 percentage points (Appendix 2).

4) It has been observed that the share of priority and non-priority sectors in total NPAs has been on the increase since the crisis period of 2008. However, the growth in NPAs of non-priority sector (which has averaged around 32 per cent) during the post-crisis period was higher than that of the priority sector (which has averaged around 22 per cent) (Lokare, S.M., 2004).

5) It has also been estimated that the average share of agriculture sector in total NPAs over the last decade has remained lower than the share of SSIs and other priority sectors. As against this, the share of agriculture and other priority sectors in aggregate NPAs has increased and that the share of SSIs had declined during the post-crisis period (Lokare, S.M., 2004).

Our estimates have shown that a 1% point increase in credit to agriculture results in increase in NPAs of agriculture by .01 percentage point. Even the estimated correlation coefficient between gross NPAs of agriculture and credit to agriculture has turned out to be 0.51(Appendix 2).

6) Our empirical results have also shown that from the category of industries, credit to small-scale sector is more vulnerable to growth of NPAs of this sector. It has been found that a 1% increase in credit to small-scale industry results in increase in gross NPAs of this sector by 0.72 percentage point. In spite of this observation, we can argue that gross NPAs of industries are on the decline since the post-crisis period along with the overall decline in NPAs of priority sector post-crisis period.

7) The overall growth in NPAs of priority sector has been primarily because of the recent growth in NPAs of agriculture sector (averaging at around 28% during 2008 -2012). In fact, the growth in NPAs in agriculture was as high as 61% by end-March 2011, although it declined subsequently to 49% by end-March 2012 (Lokare, S.M., 2014).

Recommendation, Conclusion, Implications and Limitations

C. 1) Net Stable Funding Ratio (NSFR)

The last part of this paper discusses 'Net Stable Funding Ratio' as one of the effective ways to overcome the problem of deteriorating quality of assets of the commercial banks in India. Our observations in this connection are our recommendations. Initially, we intend to carry out a theoretical discussion on the nature of 'liquidity coverage ratio (LCR' and ' Net Stable Funding Ratio'(NSFR) and further this discussion shall be accompanied by author's compilation of NSFR for group wise banks and all scheduled commercial banks (SCBs). This point has been supported by different ways to improve NSFR in the form of our recommendations.

C.1.1) LCR and NSFR

The Basel Committee on Banking Supervision (BCBS) published in 2008 'Principles for Sound Liquidity Risk Management and Supervision' [BCBS (2008)]. To comply with these principles, the BCBS published the two new liquidity ratios for banks viz Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) in 2010 [BCBS (2010$_a$)].These guidelines of BCBS are referred to as Basel III.

LCR demands the banks to have enough high liquid quality assets to manage stressed cash outflow for at least 30 days. NSFR addresses the mismatches between the maturity of bank's assets and that of its liabilities and is seen as the more relevant constraint for macroeconomic effect in the long run [BCBS (2010$_b$)]. LCR will be introduced on 1 January 2015 and the NSFR by 1 January 2018.

The following formula describes the way NSFR can be calculated.

NSFR = Available amount of stable funding / Required amount of stable funding * 100 (Appendix 2).

The numerator 'Available amount of Stable Funding' (ASF) measures the sources of available stable funding while the denominator viz. 'Required amount of Stable Funding (RSF) is the likely amount that may be required for the assets held and funded by the institution (Bhuyan, P. and Srimany, A.K., 2014) From this illustration it is clear that the ASF arises from 'sources of funds' while RSF refers to 'uses of funds'.

NSFR is expected to be greater than 100 per cent [BCBS (2010$_a$)]. The minimum requirement of 100 % is to ensure that banks maintain ample stable liabilities to fund long and medium term assets. If banks have to maintain stable funding at least at 100% or above it, the suggested action might affect banks' profitability since it requires banks to have sufficient stable liabilities continuously to support long and medium- term assets.

C.1.2) Compilation of NSFR for Scheduled Commercial Banks (Appendix 2)

In this paper we have compiled NSFR for group wise banks and all scheduled commercial banks. So far as all scheduled commercial banks are concerned the compilation of NSFR covers the time period from 2009 -10 to 2013 -14. As regards group wise banks, the NSFR compilation is done covering a time period from 2001-02 to 2004-05. The previous work (Bhuyan, P. and Srimany, A.K., 2014) in this connection had made an attempt to compile the NSFR for a period of two years (2011 and 2012). The time span we have chosen covers the years not covered by the earlier work and the choice of years has made our task of comparison much easier and more meaningful. The data used for compilation is derived from RBI's balance sheet for the respective years. The formula used for compiling the NSFR is given in (Appendix 2). The following two tables show our results. All SCBs (excluding RRBs) can be classified into five mutually exclusive groups viz. 'State Bank of India and Associates' (SBIA), 'Nationalized Banks' (NB, 'Old Private Sector Banks' (OPRB), 'New Private Sector Banks' (NPRB), and 'Foreign Banks' (FB). Our compilation results are given in the following two tables.

Table 1. Bank Group Wise NSFR (%).

Bank Group	2001 -02	2002 -03	2003 - 4	2004 - 05
Entire SBI Group	104	99.0	97.32	97.19
NB	112.86	107.43	106.72	15.49
OPRB	111.09	108.16	108.07	109.42
NPRB	72.56	81.86	85.14	88.76
FB	91.66	91.79	94.72	93.41

Author's Calculation (Data Source: - Balance Sheets of RBI)Data as at end March.

Table 2 All Scheduled Commercial Banks (SCBs) NSFR (%).

Year	NSFR (%
2009 – 10	97.13
2010 – 11	95.25
2011 – 12	80.05
2012 – 13	93.69
2013 – 14	94.83

Author's Calculation (Data Source: Balance Sheets of RBI). Data as at end March.

1) From Table 1 it is clear that ASF as a percentage of total liabilities in 'SBIA', 'NPRB' and 'FB' groups is lower while RSF as a percentage of total liabilities is higher as compared to those in 'NB' and 'OPRB'.

2) Over a period from 2009-10 to 2013 -14, the NSF ratio is below 100 per cent in the case of all scheduled commercial banks.

3) One of the previous studies (Bhuyan, P. and Srimany, A.K., 2014) observes that majority of the banks with balance sheet size less than Rs. 1000 billion had NSFR below 100 per cent, while over two third of the banks with balance sheet size Rs 1000 billion and above had NSFR 100 per cent and above. This may perhaps mean that smaller banks remain more exposed to liquidity risk in medium and long term.

C.1.3) Ways to increase NSFR and overall Asset Quality

It has been argued that to achieve the minimum target of NSFR equal to 1 (100%) or greater, either stable funding sources must be increased or illiquid assets should be decreased [King (2010)].

1)The banks with lower NSFR than 100% may have to increase ASF or decrease RSF.

2)If banks can increase capital and/or such other liabilities which have high ASF factor, they can succeed in increasing ASF.

3)The liabilities which will have a higher ASF factor may include such things as long term deposits, long term borrowings etc.

4)If banks take higher exposure to such assets which have a lower RSF factor, banks can reduce the overall RSF.

5)The earlier suggestion emphasizes that banks should increase exposure to such assets as liquid cash, investments in government and other approved securities.

6)Banks may reduce their exposures to loans, higher-yielding securities such as corporate bonds, equities, other securities and OBS exposures.

It may be remembered that all the above measures have corresponding costs. A discussion about the same does not fall into the purview of this paper. We, therefore, do not intend to discuss this point in any detail.

Conclusions

This empirical research has the following conclusions.

1)We have found a strong correlation and causality between gross NPAs and gross advances with 4 quarters' of lag time.

2)Our macro variables (discussed in the original equation) satisfactorily explain variations in gross NPAs. The relative strength of these variables (values on beta coefficients) shows different degrees of significance when their effect on NPAs is concerned. Out of six variables, five variables have shown a positive association between NPAs and the six variables. It is only one variable (BANKEX, a proxy for stock prices) which has shown a negative correlation with gross NPAs. In the earlier study (Bhuyan, P. and Srimany, A.K., 2014) GDP growth and asset prices had shown a negative association with gross NPAs. In our study, economic growth (measured by nominal GDP growth) is associated positively with gross NPAs. We have satisfactorily established the Granger causality between gross NPASs and the six independent variables by choosing a lower value on the bi-variate Granger causality coefficients.

3)Based on our empirical study and the results, we may argue that the deteriorating quality of assets of scheduled commercial banks may be better explained through micro linkages where sector-specific analysis of asset quality is a more meaningful indicator of asset quality deterioration.

4)A much more and relevant study of the impact of priority and non-priority sectors on gross NPAs of SCBs shall provide a far better picture of the relative position of deteriorating quality of banks' assets.

5)Our compilation on the NSFR clearly shows that all SCBs definitely require restructuring of their balance-sheets with a view to improving upon their present position of NSFRs.

Implications

One straight implication of this research is to know the significance of asset quality of banks. Such significance carries important weight from the point of view of banks' financial position and their financial linkages with the effective functioning of the entire economy. Another important point is to convey the right message to banks to monitor carefully the way their long term liabilities mismatch with their long term assets. One more argument could be such that overemphasis on macro linkages to explain banks' asset quality may be avoided and at the same time due weightage may be placed on exploring correctly the impact of micro linkages on deteriorating asset quality of banks. Finally, banks must realize as to how effectively manage their 'sources of funds' (ASF) and 'uses of funds' (RSF).

Limitations of Research

1) This research does not use a long – time series data. For better understanding of trend and meaningful behavioural analysis, a long time series is much more convenient thing.

2) This empirical analysis has used only one year time lag. At times, to understand a long-time pro-cyclicality and /or counter-cyclicality just one year time lag may not give robust results.

3) For sector-specific disaggregated analysis the lack of data (e.g. NPAs of overall industrial sector) is another limitation of this research.

4) In causality testing, the Ganger causality gives just predictive indications. In our study, the use of 'F' statistic does not comply with .05 hypothesis acceptability criterion. This has been substituted by the choice of 'low value' of 'F' statistic.

References

Aggarwal, S. and Mittal, P. (2012). Non-performing Assets: Comparative Position of Public and Private Sector Banks in India. *International Journal of Business and Management Tomorrow,* Vol. 2 (1).

Batra, S. (203). Developing the Asian Markets for Non – performing Assets; Developments in India. IIIrd Forum on Asian Insolvency Reform, Seoul, Korea.

BCBS (2010[a]). Basel- III: International Framework for liquidity risk management, standards, and monitoring. BCBS, BIS, December.

Ibid (2010[b]). An Assessment of the long-term economic impact of stronger capital and liquidity requirements. BCBS, BIS, August.

Ibid (2008). Principles for sound liquidity, risk management, and supervision. BCBS, BIS, September.

Ibid (2006). International convergence of capital measurement and capital standards; a revised framework, comprehensive version. BCBS, BIS, June.

Bhuyan, P. and Srimany, A.K. (2014). Net Stable Funding Ratio –An Estimate for Scheduled commercial Banks in India. RBI Working Paper Series, WPS (DEPR): 02/2014, RBI.

Bofond, M. and Ropele, T. (2011). Macroeconomic determinants of bad loans: evidence from Italian banks. Occasional papers No.89, March, Bancad'Italia.

Borio, C. and Lowe, P. (2002). Assessing the risk of banking crisis. *BIS Quarterly Review*, December, pp. 43-54.

Dash, M.K. and Kabra, G. (2010). The Determinants of Non-Performing Assets in Indian Commercial Banks: an Economic Study. *Middle Eastern Finance and Economics, Issue 7.*

De Bock, R. and Demyanets, A. (2012). Bank Asset Quality in Emerging Markets: Determinants and Spillovers. IMF Working Paper, Monetary and Capital Markets, No. WP/12/71, March.

Douglas, D. W. and Rajan, R.G.(2001). Liquidity risk, liquidity creation and financial fragility: a theory of banking. *The journal of Political Economy, 109, pp.287 – 327.*

Elliott, D. J. (2010) .Quantifying the effects on lending of increased capital requirements. The Brookings Institutions, September.

Financial Stability Forum (2009). Report of the financial stability forum on addressing pro-cyclicality in the financial system. Basel.

Gopalakrishnan, T.V. (2005). *Management of Non-Performing Advances.* 1[st]Revised Edition, Northern Book Centre Publication, Mumbai.

IMF (2014). World Economic Outlook Database. Retrieved from http://www.imf.org

IMF (2012). Sovereigns, banks and emerging markets: detailed analysis and policies. Global financial stability report, Chapter 2, pp.17 – 80, IMF, April.

IMF (2011). How to address the systemic part of liquidity risk? Global financial stability report, Chapter 2, pp.75 -110, IMF, April.

Kent, C., and Patrick, D' A. (2000). Cyclical prudence – credit cycles in Australia. BIS Papers, No. 1.

King, M. R. (2013). The Basel III net stability funding ratio and bank net interest margins. *Journal of Banking and Finance,* 37, pp.4144 – 4156.

Lokare, S. M. (2014). Re-emerging stress in the asset quality of Indian banks: Macro financial linkages. RBI Working Paper Series, WPS (DEPR): 03/2014, Department of Policy and Economic Research, RBI.

Misra, B.M. and Dhal, S. (2010). Pro-cyclical management of non-performing loans by the Indian public sector banks. BIS Asian research papers.

Mohan, R. (2004). Finance for industrial growth. Reserve Bank of India Bulletin, Speech article, March.

Muniappan, G. (2002). The NPA overhang: magnitude, solutions and legal reforms. Reserve Bank of India.

RBI (2014). Handbook of Statistics on Indian Economy (Table Numbers 3,39,47,50,51, 54,55,56,57,61,62,63,64,74,79) Retrieved from www.rbi.org.in

RBI (2013). Regulation, supervision and financial stability. Reserve bank of India Annual Report, Chap. VI, 2012 -13, RBI.

RBI (2012$_a$). Liquidity risk management by banks. RBI, November. Retrieved from http://www.rbi.org.in/Scripts/BS - View Master Circular Details – aspx.

RBI (2012$_e$). Operations and performance of commercial banks. Report on trend and progress of banking in India, Chap.IV, pp.58, 2011 -12, RBI.

RBI (2011). Annual report – 2010-11. Retrieved from http://www.rbi.org.in

Reddy, P.K. (2002). A comparative study of non-performing assets in India in the global context: similarities and dissimilarities, Remedial measures. Retrieved from http://unpan 1.un.org/intradoc/groups/public/documents/apcity/unpan.

Rinaldi, L.andSanchis, Arellano A. (2006). Household Debt Sustainability. What explains household non-performing loans? An empirical analysis. ECB Working Paper, No. 570.

Sergio, M. (1996). Non-performing bank loans: Cyclical patterns and sectoral risk. *Review of Economic Conditions in Italy,* Jan –June, Issue 1. Rome.

Shu, C. (2002). The impact of macroeconomic environment on the asset quality of Hong Kong's banking sector. Hong Kong monetary authority research memorandums.

Siraj, K.K. and Pillai Suudarsanan, P. (2012). Study on the performance of non-performing assets of Indian banking during post-millennium period. *International Journal of Business and Management Tomorrow*, Vol.2, No. 3, ISSN: 2249 – 9962.

Stiglitz, J.E. and Weiss, A. (1981). Credit rationing in markets with imperfect information. *American Economic Review.*Vol. 71, pp.393 -410.

Subbarao, D. (2012). Basel III in international and Indian contexts: ten questions we should the answers for. Reserve bank of India Bulletin, October 2012, 1809 – 1817, RBI.

Annexure

Details of Secondary Data Used

The details of the secondary data retrieved from www.rbi.org.in are as follows:

Handbook of Statistics on Indian Economy. Data obtained from the following tables:

Table No.	Title of Table
03	GDP at factor cost
39	WPI Inflation
47	SCBs Select Aggregates
50	SDs with Commercial Banks
51	SCBs Maturity pattern of term deposits.
54	Deposits and credits of SCBs according to pop[n group]
55,56 and 57	Direct institutional credit for agriculture and allied activities.
61	SCB's advances to small-scale industries.
62	Scheduled commercial banks' advances to agriculture outstanding.
63	Consolidated balance-sheet of scheduled commercial banks.
64	Gross and net NPAs of scheduled commercial banks. Bank group-wise.
74	Structure of interest rates.
99	Annual averages of share price indices and market capitalization.

Appendix 1

Empirical Results

Table 1 Regression Outputs on Major Equation

Method:Multiple Simple Regressions

Dependent variable NPAs

Variable	Coefficient	't' Statistic
C	-13759.941	-3.22
GDPG (-4)	0.5	3.07[*]
CRGDP (-4)	0.006	.190***
MMKTRATE (-4)	0.003	.639***
BANKEX (-4)	-0.077	-.652***
WGDP (-4)	0.039	1.476**
WPIINFL R = .839 R^2 = .704 Durbin Watson = 2.343	0.26	.736***

SPSS Outputs on gross NPAs and six independent variables * Sig. 1% level, ** Sin. At 5%, *** Sig. at 10%.

Table 2 Regression Outputs on gross NPAs and total gross advances also showing Granger causality.

Dependent variable NPAs

Type	Coefficient	St Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	-16956.5	8799.611	-1.9269	0.0802	-36324.3	2411.31	-36324.3	2411.31
X variable	0.066985	0.018158	3.688939	0.00357	0.027019	0.106951	0.027019	0.106951

SPSS Outputs on gross NPAs and total gross advances. Multiple R = 0.74, R^2 = 0.55, Adjusted R = 0.51, 'F' Stat = 13.60827. At 5% significance level.

Table 3 Granger Causal testing Results

Variables	Functional causality	F Statistic	P-value
NPAs and GDP	Y= f (X) X = f (Y)	0.8589 0.2542	0.37822 0.62620
NPAs and CRGDP ratio	Y= f (X) X = f (Y)	6.8335 1.9093	0.02808 0.20036
NPAs and MMKTRATE	Y= f (X) X = f (Y	1.3499 3.3473	0.27513 0.10052
NPAs and BANKEX	Y= f (X) X = f (Y	0.0633 2.0841	0.80696 0.18272
NPAs and WGDP	Y= f (X) X = f (Y	2.7565 0.0008	0.13122 0.97696
NPAs and WPIINF	Y= f (X) X = f (Y	0.0712 0.7955	0.79559 0.39557

Source of results:

http://www.wessa.net/rwasp_grangercausality.wasp

Appendix 2

A) NPAAGR = b$_0$ + b$_1$ CRAGR

= 1.7321 + 1.087 CRAGR

(.276)   (1.974)

Table 4 Regression outputs between NPAs of Agriculture Sector and Credit to Agriculture Sector

Simple regression method

Dependent variable NPAs

Variable	Coefficient	't' Statistic
C	1.732	.276
CRAGR R = 0.51 R^2 = 0.262 Durbin Watson = 1.68	1.087	1.974

Source: SPSS Outputs Sig. at 0.01 level.

B) NPASSI = b$_0$ + b$_1$ CRSSI

= 8.674 + .729 CRSSI

(2.433) (1.753)

Table 5 Regression outputs between NPAs of Small-scale Industries Sector and Credit to Small-scale Industries Sector

Simple regression method

Dependent variable NPAs

Variable	Coefficient	't' Statistic
C	8.674	2.433
CRSSI	0.729	1.753
R = 0.467		
R^2 = .218		
Durbin Watson = .717		

Source: SPSS Outputs. Sig. at 0.01 level.

C) $NPAP = b_0 + b_1 CRP$

$= -24.490 + 2.140\ CRP$

$(-1.266)\ (3.586)$

Table 6 Regression outputs between NPAs of Priority Sector and Credit to Priority Sector

Simple regression method

Dependent variable NPAs

Variable	Coefficient	't' Statistic
C	-24.490	-1.266
CRP	2.140	3.586
R = .734		
R^2=.539		
Durbin Watson = 1.671		
Spearman's Correlation Coefficient	.781	

Source: SPSS Outputs. Sig. at 0.01 level.

D) $NPANP = b_0 + b_1\ CRNP$

$= -89.547 + 2.140\ CRNP$

$(-2.218)\ (3.586)$

Table 7 Regression outputs between NPAs of Non-Priority Sector and Credit to Non- Priority Sector

Simple regression method

Dependent variable NPAs

Variable	Coefficient	't' Statistic
C	-89.547	-2.218
CRNP	2.140	3.586
R = .734		

R^2 =.539		
Durbin Watson = 1.671		
Spearman's Correlation Coefficient		
	.781	

Source SPSS Outputs. Sig. at 0.01 level.

E) Net Stable Funding Ratio Calculation

Formula used for calculation

NSFR = [Cap. + Res. + Borr$_o$ ($\geq$ 1 year) + Bor$_{RBI}$ + 80% SD + TD$_b$ ($\geq$ 1 yr.) + 80% TD$_o$ (< 1 yr.) + TD$_o$ ($\geq$ 1 yr.) / 5% G. Sec, app sec ($\geq$ 1 yr.) + OI + 85%L (< 1 yr.) + L ($\geq$ 1 year) + Oth + 2.5% OBS] * 100

The abbreviations used in the equation have the following meaning.

ASF : Available Stable Funding (Representing numerator).

1) 'Cap' and 'Res' represent capital and reserves respectively.

2) Borr$_o$($\geq$ 1 year) represents borrowing (other than from RBI) with remaining maturity 'one year and above'.

3) Bor$_{RBI}$ represents borrowing from RBI.

4) 'SD' represents savings deposits (excluding a portion of NRD).

5) TD$_b$ ($\geq$ 1 yr.) represents term deposits from banks with remaining maturity of one year and above.

6) 'TD$_o$ (< 1 yr.)' and 'TD$_o$ ($\geq$ 1 yr.)' represent Term deposits from others (excluding a portion of NRD) with remaining maturity 'less than one year' and 'one year and above'.

RSF (Required Stable Funding). (Representing denominator).

1) 'Gsec and app sec ($\geq$ 1 yr.)' represents investments in 'government and other approved securities' with residual maturity of 'one year and above'.

2) 'OI' represents other investments (investments other than in 'government and other approved securities').

3) 'L (< 1 yr.) and L ($\geq$ 1 year)' are loans with residual maturity of 'less than one year' and 'one year and above'.

4) 'Oth' represents 'encumbered cash' and all other assets including 'balances with banks, money at call and short- notice etc.