

Statistical Study on NPA Movements

Consistently rising non-performing assets (NPAs) have become a serious concern for the Indian banking system today. A widely held notion in this regard is that high interest rates and slowing economic activity have impacted viability of project investments, thus affecting revenue streams and in turn their ability to service debt.

This note seeks to test the above mentioned hypothesis; by analysing trends in the gross NPA ratio juxtaposed against GDP growth, credit growth and interest rates. The methodology, findings and conclusions are discussed in detail below -

Dataset and Methodology

- Data on gross NPAs (GNPAs), total advances and NPA ratio (defined as the ratio of GNPAs to total advances) is collected across 38 banks over 24 quarters (quarters ending September 2007 to June 2013).
- NPA ratio is calculated at the aggregate level for all 38 banks put together.
- Movement of system-level NPA ratio is regressed on GDP growth, credit growth, interest rates (proxied by 10-year GSec yields) and combinations of lagged variables.

Results

A. Correlation exercise

In order to understand movements between NPA ratio and prevailing growth scenario, a correlation analysis is performed. Growth variables include overall GDP growth, agri-sector growth and IIP growth. The rationale for inclusion of sectoral growth is, to identify which sector contributes to rise in NPAs.

It may be noted that ideally, while only farm-production must be looked at to capture agri-sector growth, disaggregated data excluding allied agri-activities (for example, fishing, forestry and horticulture) is not available for the time-series under consideration. Hence, overall agri-sector growth has been considered. One expects a dip in agri-activity to result in farm loans going bad and hence, contribute to a rise in overall NPA ratio.

Similarly, IIP growth is representative of industrial activity. Higher industrial activity, in general hints at higher profit margins, timely servicing of debt and lower NPAs for banks.

Table 1: Correlation Matrix

NPA ratio with	Correlation coefficient	T-stat	Significance
GDP growth	-0.599	-3.509	Yes
GDP growth lag 1	-0.607	-3.424	Yes
GDP growth lag 2	-0.589	-3.265	Yes

- GDP growth and NPA ratio have a negative correlation of -0.599, which yields a significant t-stat of -3.509. This means that higher GDP growth rates are related to lower NPA ratios. Intuitively it may be implies that when the economy does well, build-up of NPAs would be slower.
- Both agri-sector growth and IIP growth are found to have negative coefficients of correlation, as expected. However, they are not significant and have been dropped in further analysis.
- There is motivation to gauge correlation with lags in GDP (for instance, does moderation in GDP growth today, take time to translate or materialise in a rise in NPAs tomorrow?). One-period and two-period lags in GDP growth are seen to have significant negative correlation with NPA ratio.

B. Regression Analysis

We first conduct a regression analysis of NPA ratio on GDP growth, including lagged effects. In other words, GDP growth and one-quarter (GDP_{lag1}) and two-quarter (GDP_{lag2}) lag in GDP growth and combinations of the same form the set of explanatory variables and NPA ratio is the dependent variable.

1. Regression of NPA ratio on GDP growth

- 35.9% of variation in NPAs is explained by GDP growth
- A unit decrease in GDP growth would result in an increase of 0.12 units in NPA ratio.

Table 2(a): Regression – NPA and GDP growth

R-square	Coefficient	T-stat	Significance
0.359	-0.12	-3.509	Yes

2. Regression of NPA ratio on GDP growth, (GDP_{lag1}) and (GDP_{lag2})

- 51.5% of variation in NPAs is explained by the set of independent variables (GDP growth and its lags).
- However, t-statistics for none of the variables under consideration are significant here.

Table 2(b): Regression – NPA, GDP growth and lags in GDP growth

	R-square	Coefficient	T-stat	Significance
GDP growth	0.515	-0.086	-1.799	No
(GDP_{lag1})		-0.019	-0.320	No
(GDP_{lag2})		-0.076	-1.565	No

3. Regression of NPA ratio on GDP growth and two-quarter lag (GDP_{lag2})

- 51.2% of variation in NPAs is explained by the set of independent variables (GDP growth and its second-quarter lag).
- The model suggests that a unit decrease in GDP growth would result in an increase of 0.095 units in NPA ratio and unit increase in the two-period lag of GDP growth would result in increase in NPA ratio by 0.085 units and vice-versa.

Table 2(c): Regression – NPA, GDP growth and lags in GDP growth

	R-square	Coefficient	T-stat	Significance
GDP growth	0.512	-0.095	-2.531	Yes
(GDP _{lag2})		-0.085	-2.198	Yes

C. Regression analysis introducing other variables

In order to examine the movement of NPAs in a more comprehensive manner, it is important to introduce other explanatory variables. For this purpose, we add growth in credit and interest rates (10-year GSec yields) and lags in interest rates, as independent variables, to the above model.

GSec yields have been used as proxy for lending rates in this model. Ideally, lending rates are reflective of the prevailing interest rate regime, cost of financing and hence, debt-service. They are thus expected to have a positive relation with NPAs. However, data on lending rates is not available on a quarterly frequency, as required for the study. The use of GSec yields is helpful in capturing the current interest-rate scenario with the assumption being that lending rates move along with GSec yields which may not always be the case. Although, GSec yields may, on account of market dynamics incorporate changes in interest-environment faster than lending rates (which change slowly due to incomplete pass-through and/or gradual monetary transmission), the use of lags makes up for this response function.

1. Regression of NPA ratio on GDP growth, credit growth and interest rate – significant

- The model has an R-square value of 0.672, implying that 67.2% of the variation in NPAs is explained by these explanatory variables; which is robust.
- The coefficient for GDP growth is -0.104, suggesting that a unit decrease in GDP growth would result in an increase of 0.104 units in NPA ratio and vice-versa. Similarly, coefficient for credit growth is -0.041.
- On the other hand, the interest rate coefficient is positive (0.354), as expected (higher interest rates cause NPAs to build up).

Table 3(a): Regression – NPA, GDP growth, credit growth and interest rate

	R-square	Coefficient	T-stat	Significance
GDP growth	0.672	-0.104	-3.591	Yes
Credit growth		-0.041	-2.669	Yes
Interest rate		0.354	3.976	Yes

2. Regression of NPA ratio on GDP growth, credit growth and interest rate and interest rate lags (R_{lag1} and R_{lag2}) – significant

- Model R-square is 0.737 i.e. 73.7% variation in dependent variable is explained by variation in the set of explanatory variables.
- Only credit growth and interest rate variables are significant, with coefficients of -0.058 and 0.289. Lagged interest rates do not matter.

Table 3(b): Regression – NPA, GDP growth, credit growth, interest rate and R-lags

	R-square	Coefficient	T-stat	Significance
GDP growth		-0.070	-1.329	No
Credit growth		-0.058	-2.854	Yes
Interest rate	0.737	0.289	2.194	Yes
R _{lag1}		0.051	0.319	No
R _{lag2}		0.136	0.818	No

Conclusions

- Movement in NPA ratio is well explained by prevailing macroeconomic environment. Macroeconomic environment, here, is captured by indicators such as GDP growth, credit growth and interest rate. Inclusions of agri-sector growth and industrial growth independently do not yield robust results.
- Lags in GDP growth (two-period lags) are seen to have significant impact on NPA ratio, indicating that moderation in economic activity gradually builds-up to bad debts of banks, causing the NPA ratio to rise significantly after some period of time (analysed here as two quarters).
- Explanatory power of the regression model of NPA ratio on GDP growth, credit growth, interest rates and interest rate lags is the highest. However, only two variables, namely credit growth and interest rate are significant. Interest rate is the only variable having positive relation with NPA ratio.
- A regression of NPA ratio with the interest rate variable and its lags alone is not significant (model not shown in this note); suggesting that interest rate may be viewed in conjunction with credit growth and impact on overall GDP growth to yield meaningful results.

Limitations

- A preferred explanatory variable for interest rates would be actual lending rates. However, unavailability of data restricts analysis to the use of 10-year GSec yields as a proxy. It may be noted that GSec yields are market driven, based on secondary market trades, whereas lending rates are determined by banks and hence, there is bound to be a discrepancy between the two.
- Given constraints on the number of observations, we cannot introduce too many explanatory variables and combinations thereof. This would bring down either robustness (R-square) or significance or both in the model.

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