

Econometric Analysis of Credit Deposit ratio of Scheduled Commercial Banks in India

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ABSTRACT

In this paper, the author explains the nature and behavior of credit deposit ratio of scheduled commercial bank in India from 1980 to 2017 using RBI data. The paper showed trend line, structural breaks, cyclical behavior, volatility and forecast value of 2030 of credit deposit ratio. The paper explores cointegration and vector error correction models for credit deposit ratio, inflation rate, lending rate, GDP and NPA from 1996-97 to 2017-18 in Indian scheduled commercial banks and concludes that there are long run causalities from inflation, GDP, and NPA to lending rate and from credit deposit ratio, inflation rate and GDP to NPA which are significant. But, insignificant long run causalities were found from GDP, inflation, NPA to credit deposit ratio. Moreover, there are significant short run causalities from NPA to inflation rate and from GDP to NPA of scheduled commercial banks in India.

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I. Introduction

Credits and deposits are the outflows and inflows of banks. Both of them are the barometer of the bank. Credit deposit ratio is a tool of management of bank, liquidity and its profitability. If credit deposit ratio is high profit of bank may suffer. Credit Deposit ratio measures the credit control and utilization of resources of banking system. It is used as an activity of banks and can show inter-state disparities of investment. A low credit deposit ratio might result recession and a high credit deposit ratio leads to inflation. In case of high credit deposit ratio government can take two options, [i] it can raise yields on securities to make investment by banks in government securities attractive and [ii] it will force RBI to take securities into books. All the monetary policy measures are related to credit deposit ratio of banks directly or indirectly which can determine a part of the money supply of the economy. Disparities among states could be controlled by the tool of credit deposit ratio because if the sigma divergence of credit deposit ratio is growing among the states then disparities will grow higher because investment in the states might differ which affects state domestic product unequally through sectoral imbalance. Controlling credit deposit ratio may help to accelerate banking integration process. Now a days, credit deposit ratio maintenance is incorporated with some of the macroeconomic fundamentals along with capital market. Banking crisis that may led to financial crises is not completely avoided without stability and stationarity of credit deposit ratio.

In this context, the paper endeavours to analyse the nature of credit deposit ratio of scheduled commercial banks in India (i.e. 27 public sectors banks with 5 associates and 19 Nationalised banks) from 1980 to 2017 and also to show long run association between credit deposit ratio with inflation

rate, lending rate, GDP and NPA from 1996 to 2017. Moreover, short run and long run causalities were also established.

II. Literature Review

Das and Maity (1998) analysed the movement of credit deposit ratio of commercial banks in West Bengal and compared with other states and found that it tends downward in every state and had wide variations. Bhowmik(2004;2015) showed the behavior of credit deposit ratio of scheduled commercial banks in India during 1969-2010 and also established the significant positive relation between GDP growth and deposit growth and insignificant negative relation between growth of GDP and credit growth in public sector banks, private banks and regional rural banks in India during the period from 1995 to 2015Q1.

Bhatia, Mahajan and Chander (2012) showed that the credit deposit ratio of 23 private sector banks in India from 2006-07 to 2009-10 affected profitability of those banks positively but the result is insignificant at 5% level. Singh Sethi and Bajaj (2013) studied 17 scheduled commercial banks in 17 states in India from 1991-92 to 2011-12 and showed that there are wide variations of credit deposit ratios among states. There is an inverse association between credit deposit ratio and the extent of instability in the ratio. Standard deviation of credit deposit ratios of states is rising upwards i.e. sigma divergence exists. The panel data of the random effect model showed that States having higher per capita real income and associated with a larger share of non-primary sector in GSDP showed a tendency to possess higher credit deposit ratio. Bami (2014) showed in his PhD thesis that there are significant positive impact of loan, deposit, GDP and inflation rate on rate on returns in Albanian commercial

banking during 2005-2014 except in total deposit. Pandya (2014) studied profitability of nationalized banks in India from 2001-02 to 2010-11 and found that there is positive correlation between credit deposit ratio with returns on assets in Bank of India, Punjab National Bank, Canara Bank, and Dena Bank. NPA/Advance ratio is negatively correlated with returns on assets in Bank of India, Central Bank, Punjab National Bank and Dena Bank. Profit per employee is positively correlated with returns on assets in all five banks stated above. Hence, credit deposit ratio, profit per employee and NPA/Advance are the most influencing factors which can determine profitability of nationalized banks in five banks as shown by factor analysis. Sharifi and Akhtar (2016) empirically verified that credit deposit ratio is positively related with returns on assets insignificantly affected returns on equity positively and significantly impacted positively on net interest margin insignificantly. Goel and Kumar (2016) examined 5 public sector banks from 2009-10 to 2013-14 and found that credit deposit ratio differs significantly in those 5 public sector banks, namely SBI, Allahabad Bank, Andhra Banks, Bank of Baroda, and Bank of India. Kedia (2016) verified statistically that the regression coefficient between NPA and credit deposit ratio is -0.799, between NPA and net profit is -0.560 and between credit deposit ratio and net profit is 0.639 in Indian banks from 2006 to 2013 which are significant at 5% level where the credit deposit ratio is the largest effect on net profit. Econometric study of Mushtaq (2016) examined in Pakistan from 1961 to 2013 that there are short run and long run causalities from GDP growth to bank lending activities significantly. Singh, Bharadwaj Pemmaraju and Das(2016)examined econometrically in India during the period from 1973 to 2014 and showed that there is long term cointegration relationship exists between credit and GDP in different sectors of the economy and even over all cointegration exists between credit and GDP from 1973 to 2014 in Indian economy .Pallavi and Saluja (2017) explained empirically that credit deposit ratio of scheduled commercial banks is better than returns on assets and returns on equity from 2010-11 to 2014-15.Iqbal and Sami(2017) verified that credit deposit ratio affects positively on GDP in India and on number of bank branches from 2007-08 to 2013-14 significantly. Goyal and Verma(2017) studied the link between NPA, advance, GDP growth, inflation, repo rate and so on in India from 2005 to 2015 taking 51 banks of annual panel data and found from simple OLS that significant positive impact of gross advance, GDP growth rate, repo rate and significant negative impact of inflation on NPA exist but all results are spurious because all series are nonstationary. But, in GMM model adding trend variable, they found same results with negative trend value which indicated that growth became weakly positive and inflation continued to reduce NPA.

Koju, Koju and Wang (2018) examined 50 Indian commercial banks in India from 2000 to 2013 and concluded that the negative effect of returns on assets on NPA implies that strong financial performance reduces the chances of risky lending behavior. Anwar and Shaikh(2018) examined in 27states/UT and six regions in India from 1990 to 2015 under panel data and found that a one crore increase in deposit mobility led to a 0.81 crore increase in credit disbursement. One per cent increase in credit causes a 0.46 per cent increase in NSDP and 1% increase in deposit led to a 0.57 per cent increase in NSDP significantly.

Above all, new empirical researches are required to focus on recessionary and expansionary phases of income cycles in relation to the changes in credit deposit ratio in India. In this study, the paper claims over the advantages in explaining cointegrating relationship including long run and short run causalities among the credit deposit ratio, lending rate, inflation rate, GDP and non-performing assets of the scheduled commercial bank in India from 1996 to 2017 in a single model although it could not avoid the gap about the causal relationship between credit deposit ratio and the bank's profit and the relation between NPA and the bank profit during the same period.

III. Methodology and the source of data

Semilog linear regression model and double log multiple regression model were used to calculate relationship among the variables. Structural breaks were shown by Bai-Perron model (2003). ARIMA (1,0,1) model was used for volatility and forecast. Hodrick-Prescott Filter model (1997) was utilized to find out trend and minimization of cycles. Johansen cointegration and vector error correction model (1988) were used for analyzing long run association and causality. Wald test (1943) verified the short run causality. The data on credit deposit ratio and Non -Performing Assets of scheduled commercial banks from 1980 to 2017 and from 1996-97 to 2017-18 were collected from the Reserve Bank of India. The data on GDP and GDP per capita of India at current prices in US dollar and the lending rate of banks were taken from the World bank. The inflation rate which is measured by consumer price index with base year=2000 were taken from UNCTAD. The paper assumes that y = credit deposit ratio of scheduled commercial banks in India, x_1 =inflation rate, x_2 = lending rate of commercial banks, x_3 = GDP of India, x_4 =GDP per capita in India and x_5 = NPA of scheduled commercial banks.

IV. Observations from econometric models

A. Characteristics of credit deposit ratio

The linear trend equation of the credit -deposit ratio of scheduled commercial banks of India from 1980 to 2017 states that credit deposit ratio has been increasing at the rate of 0.60% per year significantly.

$$\text{Log}(y) = -0.562394 + 0.006005t$$

$$(-13.67)^* \quad (3.26)^*$$

$R^2 = 0.228$, $F = 10.669^*$, $DW = 0.157$, y =credit deposit ratio of scheduled commercial banks in India, t = year, $*$ =significant at 5% level.

This estimated linear trend line is plotted in Figure 1, which is rising upward steadily.

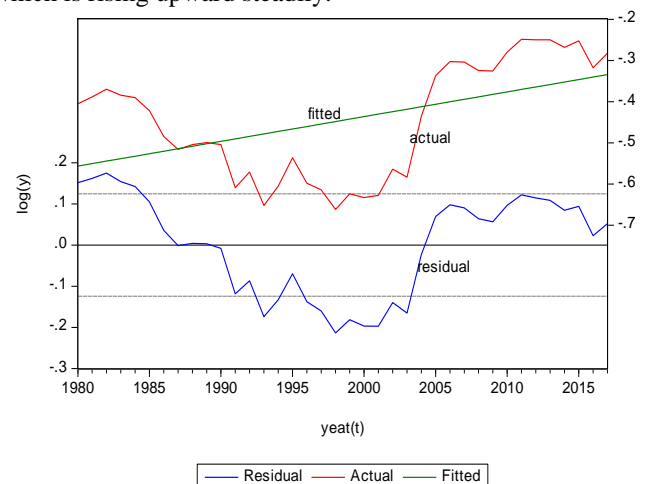


Figure 1. Trend line of credit deposit ratio
Source-Plotted by author

This credit deposit ratio is showing cyclical pattern having broadly downward and then upward rising. The predicted value in 2030 will be 0.885 which is significant at 5% level and is depicted in Figure 2.

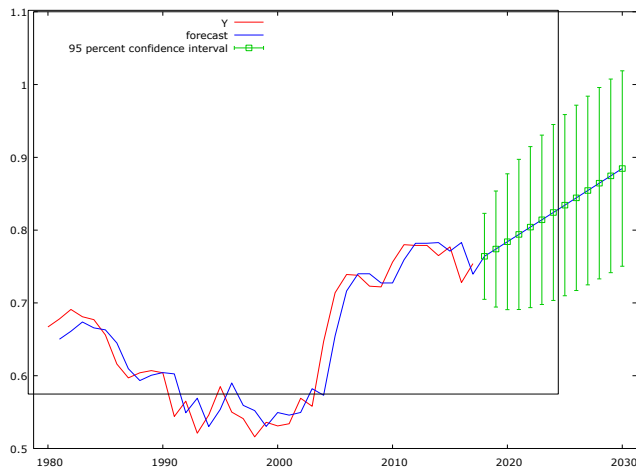


Figure 2. Predicted and actual value of credit deposit ratio
Source-Plotted by author

The linear behavior of credit deposit ratio from 1980 to 2017 showed two types of structural breaks such as downward in 1987 and then upward in 2004 and 2010 respectively which are significant at 5% level. They are illustrated in Table 1. The structural breaks have been estimated through Bai-Perron (2003) model assuming trimming=0.15, level, maximum 5 breaks, with the technique of HAC standard errors and covariance(Bartlett Kernel and Newey-West fixed band width=4.00) and significant at 5% level.

Table 1. Structural breaks.

Variable	Coefficient	Std. Error	t-Statistic	Probability
			1980 - 1986 -- 7 obs	
C	-0.406224	0.016107	-25.22006	0.0000
			1987 - 2003 -- 17 obs	
C	-0.582442	0.019633	-29.66664	0.0000
			2004 - 2009 -- 6 obs	
C	-0.338104	0.018472	-18.30366	0.0000
			2010 - 2017 -- 8 obs	
C	-0.268459	0.008874	-30.25183	0.0000

$R^2=0.90$, $F=103.419$, $DW=1.31$, Source-Calculated by author.

These downward and upward structural breaks of credit deposit ratio have been plotted in Figure 3 pointing out years and breaks distinctly.

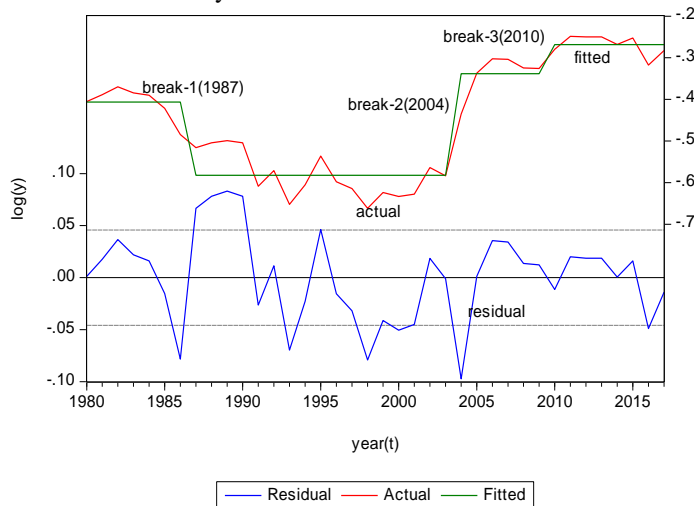


Figure 3. Structural breaks of credit deposit ratio.
Source-Plotted by author

The nonlinear trend of credit deposit ratio of scheduled commercial banks from 1980 to 2017 has been minimized through Hodrick-Prescott filter model (1997) which clearly showed one downward cycle followed by upward cycle. In Figure 4 the cyclical trend line, actual credit deposit ratio and the cycles are clearly visible.

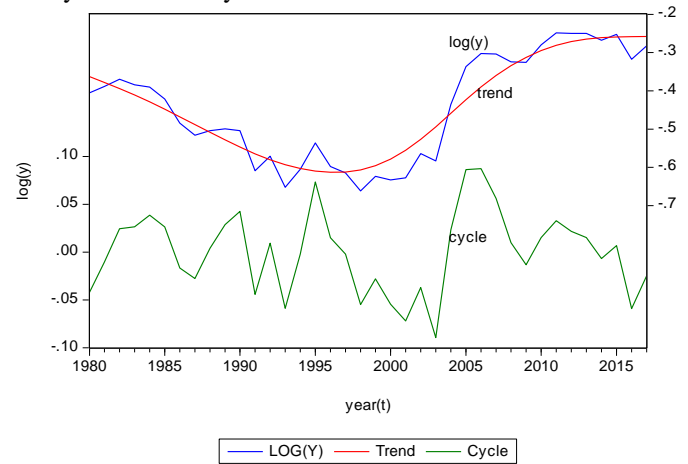


Figure 4. Cyclical trend of Credit Deposit Ratio (H.P.Filter model)
Source- Plotted by author

This behavior of credit deposit ratio can be further explained by the Autoregressive Integrated Moving Average model which confirmed that the autoregressive process of credit deposit ratio is convergent and significant and the moving average process is convergent but insignificant where AR root=1.0799 and MA root=-107.098 so that the ARIMA is unstable and nonstationary and that's why it is too volatile and nonlinear.

$$\text{Log}(y_t) = -0.40458 + 0.92603 \text{log}y_{t-1} + \epsilon_t + 0.05357 \epsilon_{t-1}$$

$$(-4.63)^* \quad (17.108)^* \quad (0.369)$$

AR root=1.0799, MA root=-18.667, AIC=-113.649, SIC=-107.098, *=significant at 5% level

The predicted value of log(y) in 2030 from ARIMA model was calculated as log(y)=-0.35862 which is significant and the volatility is declining which is observed in Figure 5.

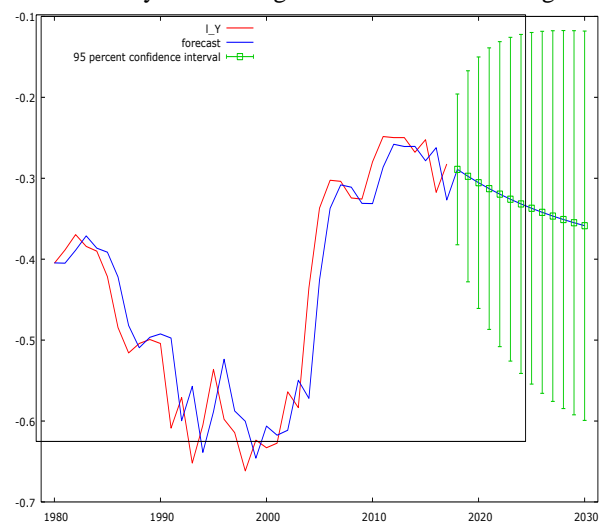


Figure 5. ARIMA-2030.
Source-Plotted by author

The credit deposit ratio has been stepping up at the rate of 0.60% per year from 1980 to 2017 and the non-performing asset has been increasing at the rate of 11.26% per year significantly from 1996 to 2017.

$$\text{Log}(x_5) = 3.7489 + 0.1126t$$

$$(7.59)^* \quad (6.53)^*$$

$R^2=0.69$, $F=42.71^*$, $DW=0.147$, where x_5 =NPA of scheduled commercial banks in India in billion rupees.

In the forecast model, NPA in 2030 will become 21047 billion rupees with the base year 1996-97=473 billion rupees which is plotted below in Figure 6. It is significant at 5% level.

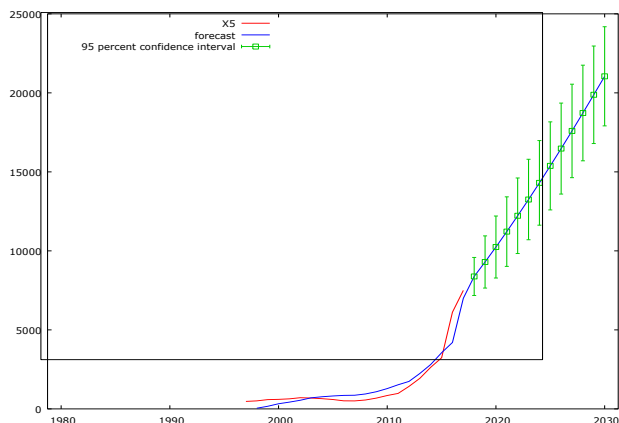


Figure 6. Forecasted Non-Performing Asset.

Source- Plotted by author

The credit deposit ratio of scheduled commercial is negatively related with inflation rate, lending rate and NPA from 1996 to 2017 which are insignificant at 5% level but credit deposit ratio is positively related with GDP in India significantly. The result showed high R^2 with no autocorrelation problem.

$$\text{Log}(y) = -1.6558 - 0.1376\text{log}(x_1) - 0.72158\text{log}(x_2) + 0.3689\text{log}(x_3) - 0.0629\text{log}(x_5)$$

$$(3.99)^* \quad (-0.66) \quad (-0.68) \quad (3.76)^* \quad (-1.66)$$

$R^2=0.946$, $F=71.08^*$, $DW=1.32$, *=significant at 5% level where x_1 = inflation rate, x_2 = lending rate of commercial banks, x_3 =GDP of India, x_5 =NPA of commercial banks. The regression equation indicates that one per cent rise in inflation, lending rate and NPA per year led to 0.1376% ,0.7215% and 0.0629% decrease in credit deposit ratios per year and one per cent increase in GDP per year led to 0.368% increase in credit deposit ratio per year from 1996-97 to 2017-18 in India.

B. Cointegration and Vector Error Correction model

Johansen unrestricted cointegration rank test confirmed that there are at least three cointegrating equations among the first difference series of credit deposit ratio, inflation rate, lending rate, GDP, and NPA from 1980 to 2017 (sample adjusted from 1999 to 2017) as indicated by Trace and Max Eigen statistic. The observations of Johansen test have been arranged in the Table 2. The results indicate that the variables are cointegrated and there are long run associations among them.

Since the variables are cointegrated then the Vector Error Correction model is to be tested. The estimated Vector Error Correction Model indicates that $\Delta\text{log}(x_1)$ is positively related with $\Delta\text{log}(x_5(-1))$ significantly and $\Delta\text{log}(x_5)$ is negatively related with $\Delta\text{log}(x_3(-1))$ significantly. Cointegrating equation one of $\Delta\text{log}(x_5)$ and cointegrating equations two and three of $\Delta\text{log}(x_2)$ have been tending towards equilibrium significantly. The estimated values of the coefficients and their t values are given in Table 3.

Table 2. Cointegration test.

Hypothesized	Eigenvalue	Trace	0.05	
No. of CE(s)		Statistic	Critical Value	Probability**
None *	0.972098	140.5906	69.81889	0.0000
At most 1 *	0.845288	72.58814	47.85613	0.0001
At most 2 *	0.744430	37.13058	29.79707	0.0060
At most 3	0.439633	11.20969	15.49471	0.1989
At most 4	0.010762	0.205583	3.841466	0.6502
		Max Eigen Statistic		
None *	0.972098	68.00242	33.87687	0.0000
At most 1 *	0.845288	35.45756	27.58434	0.0040
At most 2 *	0.744430	25.92089	21.13162	0.0098
At most 3	0.439633	11.00411	14.26460	0.1540
At most 4	0.010762	0.205583	3.841466	0.6502

* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values
Source-Calculated by author.

Table 3. Estimated Vector Error Correction Model.

	$\Delta\text{log}(y)$	$\Delta\text{log}(x_1)$	$\Delta\text{log}(x_2)$	$\Delta\text{log}(x_3)$	$\Delta\text{log}(x_5)$
CointEq1	-0.152325	-0.042714	1.148097	0.479502	-3.304071
t value	[-0.32848]	[-0.68572]	[1.45359]	[0.65516]	[-3.65524]*
CointEq2	-0.037927	0.106563	-0.849441	-0.029723	-0.273753
t value	[-0.24402]	[5.10416]*	[-3.20874]*	[-0.12117]	[-0.90357]
CointEq3	0.024511	0.042373	-1.231112	-0.143656	0.149891
t value	[0.11946]	[1.53748]	[-3.52294]*	[-0.44363]	[0.37479]
$\Delta\text{log}(y(-1))$	-0.091703	0.038557	-1.277283	-0.305225	1.436623
t value	[-0.19270]	[0.60316]	[-1.57581]	[-0.40637]	[1.54868]
$\Delta\text{log}(x_1(-1))$	-0.022248	-0.072491	-0.022964	-0.179327	1.893357
t value	[-0.03002]	[-0.72831]	[-0.01820]	[-0.15334]	[1.31085]
$\Delta\text{log}(x_2(-1))$	-0.113890	-0.015816	0.233510	-0.204806	0.265795
t value	[-0.77976]	[-0.80614]	[0.93866]	[-0.88845]	[0.93358]
$\Delta\text{log}(x_3(-1))$	0.174604	-0.057564	-0.176395	-0.113830	-1.176955
t value	[0.71340]	[-1.75093]	[-0.42315]	[-0.29468]	[-2.46699]*
$\Delta\text{log}(x_5(-1))$	-0.140997	0.064199	-0.109399	-0.032500	-0.633692
t value	[-0.79300]	[2.68801]	[-0.36124]	[-0.11581]	[-1.82838]
C	0.024034	0.061668	0.037865	0.121239	0.189483
t value	[0.37463]	[7.15610]*	[0.34653]	[1.19739]	[1.51522]
R-squared	0.270893	0.957935	0.619337	0.259478	0.819431
F-statistic	0.464426	28.46568	2.033745	0.437997	5.672558

Source-Calculated by author

The equations $\Delta\log(x_2)$ and $\Delta\log(x_5)$ of VECM have been moving towards equilibrium significantly. The speeds of error correction of $\Delta\log(x_2)$ were found as 84% and 123% per year respectively but the speed of error correction of $\Delta\log(x_5)$ was 330% per year. They are shown below.



Figure 7. Estimated lending rate

Source-Plotted by author

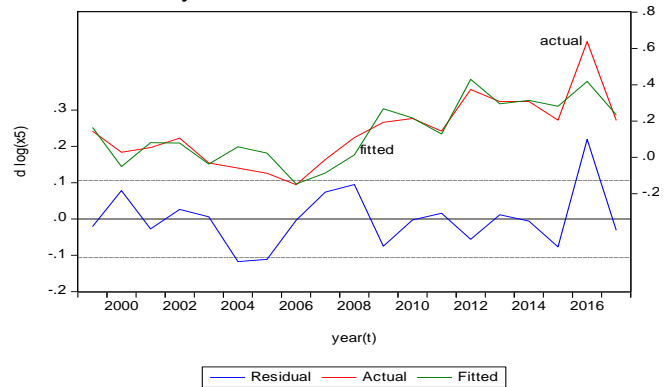


Figure 8. Estimated Non-Performing Asset

Source-Plotted by author

There are insignificant long run causalities from GDP, inflation, and NPA to credit deposit ratio but there are significant long run causalities from inflation, GDP and NPA to lending rate. Even, credit deposit ratio, inflation and GDP have significantly causal relation with NPA. But GDP has insignificantly causal relationship from inflation and NPA and inflation is insignificantly causal relation with GDP and NPA in the long run. These long run causalities have been shown in the estimated cointegrating equations from the system equations which are shown in the Table 4.

The estimated VECM produced three cointegrating equations and the three normalized cointegrating equations have been plotted below.

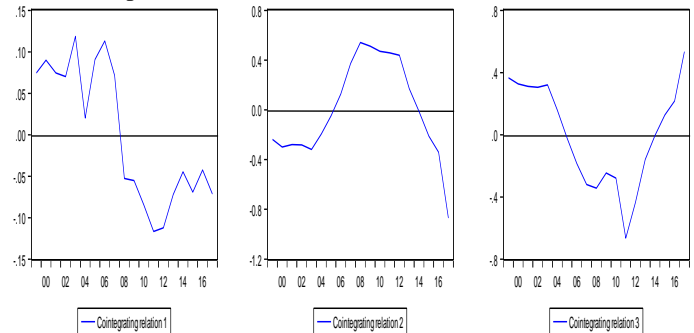


Figure 9. Cointegrating equations.

Source-Plotted by author.

According to the Wald test, it states that there are significant short run causalities from NPA to inflation and from GDP to NPA respectively.

More or less, the similar conclusions can be drawn if the paper replaces GDP per capita (x_4) instead of GDP during the same period. A significant long run cointegrating relationship to credit deposit ratio from all the variables in India from 1996-97 to 2017-2018 must require to stabilize inflation rate and the lending rate. Also, strict monetary policy is needed to offset NPA.

Table 4. Cointegrating equations in the system equations.

	$\Delta\log(y(-1))$	$\Delta\log(x_1(-1))$	$\Delta\log(x_2(-1))$	$\Delta\log(x_3(-1))$	$\Delta\log(x_5(-1))$	C
[1] $\Delta\log(y)$ EC ₁	-0.1523			-0.4564	0.11391	2.778
t values	-0.3284			[-21.706]*	[5.129]*	
EC ₂		-0.037927		0.351638	-0.951837	-0.94723
t values		-0.037927		[5.7049]*	(0.06509)	
EC ₃			0.024511	-0.627390	0.630318	-2.38472
t values			0.119465	[-11.1487]*	[10.6070]*	
[2] $\Delta\log(x_1)$ EC ₁	-0.0427			-0.4564	0.11391	2.778
t values	-0.68			[-21.706]*	[5.129]*	
EC ₂		0.1065		0.351638	-0.951837	-0.94723
t values		5.104*		[5.7049]*	[0.06509]	
EC ₃			0.0423	-0.627390	0.630318	-2.38472
t values			1.537	[-11.1487]*	[10.6070]*	
[3] $\Delta\log(x_2)$ EC ₁	1.48			-0.4564	0.11391	2.778
t values	1.45			[-21.706]*	[5.129]*	
EC ₂		-0.8494		0.351638	-0.951837	-0.94723
t values		-3.208*		[5.7049]*	[0.06509]	
EC ₃			-1.2311	-0.627390	0.630318	-2.38472
t values			-3.522*	[-11.1487]*	[10.6070]*	
[4] $\Delta\log(x_3)$ EC ₁	0.4795			-0.4564	0.11391	2.778
t values	0.65			[-21.706]*	[5.129]*	
EC ₂		-0.0297		0.351638	-0.951837	-0.94723
t values		-0.121		[5.7049]*	(0.06509)	
EC ₃			-0.1436	-0.627390	0.630318	-2.38472
t values			-0.443	[-11.1487]*	[10.6070]*	
[5] $\Delta\log(x_5)$ EC ₁	-3.30407			-0.4564	0.11391	2.778
t values	-3.65*			[-21.706]*	[5.129]*	
EC ₂		-0.273		0.351638	-0.951837	-0.94723
t values		-0.903		[5.7049]*	[0.06509]	
EC ₃			0.1498	-0.627390	0.630318	-2.38472
t values			0.374	[-11.1487]*	[10.6070]*	

Source-Calculated by author. *=significant at 5% level. EC=Error correction term

V. Conclusion and Remarks

The credit deposit ratio of scheduled commercial banks in India has been catapulting at the rate of 0.60% per year from 1980 to 2017 whose value is predicted in 2030 as 0.885 as against 0.667 in 1980. It has three structural breaks in 1987, 2004 and 2010 respectively in which first break is obtained downward and others are upward. The cyclical pattern of credit deposit ratio was found downward and reached at bottom and then it went to upward with minimization of trends. It showed highly volatile which was found as declining from ARIMA forecast model. NPA of scheduled commercial banks has been increasing at the rate of 11.26% per year from 1996-97 to 2017-18 and its value in 2030 will be 21047.50 billion rupees as against 473 billion rupees in 1996-97. The credit deposit ratio is negatively related insignificantly with inflation, lending rate and NPA and is positively related with GDP significantly from 1997 to 2017. There are three cointegrating equations among credit deposit ratio, inflation, lending rate, GDP and NPA of scheduled commercial banks in India from 1996-97 to 2017-18. The vector error correction model signified that change of inflation is positively related with the change of NPA of previous period significantly which is not significantly related with change of GDP negatively. Among three cointegrating equations two equations tend to equilibrium significantly. Long run causalities were found from inflation, GDP, and NPA to lending rate and from credit deposit ratio, inflation rate and GDP to NPA which are significant. But, insignificant long run causalities were found from GDP, inflation, NPA to credit deposit ratio. Moreover, there are significant short run causalities from NPA to inflation rate and from GDP to NPA of scheduled commercial banks in India.

The model can be extended if repo rate, return on assets, convergence/divergence of credit deposit ratios of Indian states are included during the study period. Also, the behaviours of credit deposit ratios can be compared with several banks including private and foreign banks. Bank's profit may be a crucial determinant of credit deposit ratio. The forthcoming researches will endeavor to explain such limitations with great care and knowledge.

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