

# Structural Adjustments of Bank Rate on Assets and Liability Management in India



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*Bank rate adjustments made by RBI with the aim of reducing the rupee volatility during 2013-14 increased the gap between the relative values of assets and liabilities ALM in banks. This research explores the impact of bank rate volatility in ALM. Based on the RBI data collected for the period 2012-14, we measured the impact of bank rate on ALM by applying variance analysis and estimated the relationship with Granular model. We found that bank rate influence the volume of liquidity flows but not the value of cash flows. Hence to reduce ALM gap the costs of cash outflows could be managed in accordance to bank rate. In other way, the ALM gap can be narrow down by balancing long-term deposits and loans during the bank rate revision period.*

## 1. Introduction

Post reforms period in India has witnessed tremendous growth of the Indian money markets. Banks and other financial institutions have been able to meet the high expectations of short term funding of important sectors like the industry, services and agriculture. Functioning under the regulation and control of the Reserve Bank of India (RBI), the Indian money markets have also exhibited the required maturity and resilience over the past about two decades. The stake holders of the banks are considering the money market rates while investing in banking companies. The monetary policy regulator (RBI) of India had done six revisions in the Bank rate during the financial year 2012-13; while it was two revisions in the previous year. Even though the revisions in bank rate aimed at curtailing the rupee volatility, the gap in Asset and Liability of banks increased by two times (CRISL,2014). The NPA increased to 4% in 2013-14 from 3.3% (RBI,2014). The deposits liquidating in one year to total deposits had shown one-third increase (BT,2014). The gap in ALMs is due to the growing divergence in the tenors of loans and deposits. In public sector banks, there is a shortage of ready collateral that could be used to repo with the Reserve Bank in a liquidity squeeze. The India rating of Economic times report quoted that the trend of rising funding gaps in the banking system is unsustainable, particularly as an economic revival may require continued bank funding for longer tenor infrastructure loans. In this context, the present research was done with the purpose of identifying the cascading effect of bank rate volatility in ALM during the liquidity squeeze period.

## 2. Aim

This paper seeks to address the impact of bank rate adjustments in the Assets and Liability management metrics of Indian banks. We aim to find out the gap created between assets and liabilities by the Bank rate. This enables the banks to change the ALM policies during the liquidity squeeze period. The research paves way for bank rate risk exposure management.

## 3. Significance

Indian banks are demanding to reduce the bank rates. The percentage of maturity value of demand deposit to total deposits of Public sector banks in 2002 was 29%; where as it raised to 50% in 2012. In the same period, loans maturing in one year to total loans reduced from 42% to 34%. This ALM gap increased from 4% in March 2002 to 17.5% in March 2012. This paper suggests the way to reduce the ALM gap created at the time of revisions in bank rate by the RBI.

## 4. Review of Literature

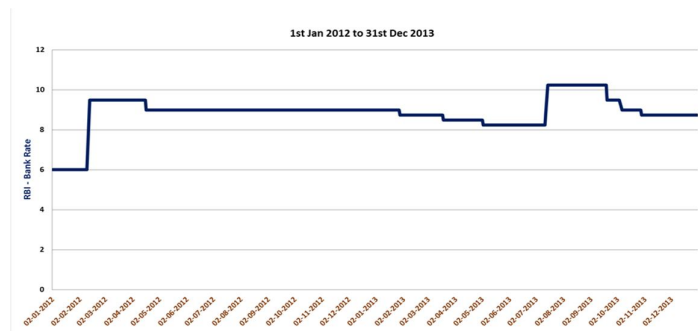
The liberalisation measures have increased competition and eroded banks' market power. RBI has been successful in its implementation of various measures to improve the transparency in the corporate governance of public sector banks in order to broad base ownership and control. (Lakshmi, 2011). The monetary policy changes are having more impact on short-term and medium term lending. (Sumon Kumar Bhaumika, September 2011). The banks with lower charter values tend to have lower equity-assets ratios (lower solvency) and to experience higher credit risk (Vicente, 2003). Macro interest-rate unpredictability found to have a significant effect on bank. Macro policies reduced interest-rate volatility (Anthony, 2000). The bank rate influences the credit policy (Fasea, 1995). The transparency of ALM decreases the chance of severe banking problems and improves overall financial stability (Nier, 2005). Jurg's research contended that reduction in debt service lowers bank equity, and, because of capital adequacy requirements, this in turn reduces bank lending and industry investment. (Jurg blum, 1995). Banks with lower charter values tend to have lower equity-assets ratios (lower solvency) and experience higher credit risk (Vicente Salasa, December 2003). In Indian banking system, the use of technology, increased availability of

lendable resources, heightened competition, a trend towards the market-driven interest rate system and improve the asset quality (Sunil Kumar, 2014). Rangan's research quote that there is a relation between NPA's and interest rates. (Rangan, 2012). Research conducted on ALM revealed that 2/3<sup>rd</sup> banks are not exposed to interest rate risk. Houston's research found that the relationship between bank borrowing and the importance of growth opportunities depends on the number of banks the firm uses and whether the firm has public debt outstanding based on bank rate. (Houston, 1996). But the present research aims to identify the relationship between Bank rate adjustment's impact on the assets and liabilities of the banks.

## 5. Methodology

India's banking sector could become the fifth largest banking sector in the world by 2020 and the third largest by 2025. The assets and liabilities value of the Indian banks are expanding. We collected the total value assets, liabilities and cash flows value of 232 banks from the RBI data base for the period between April 2012 and March 2014 on monthly basis. Bank rate announced by the RBI is considered as the independent variable. The bank rate has been revised nine times during the study period. The exhibit-1 shows the bank rate revisions made by RBI.

### Exhibit-1: Bank Rate Revisions



The analyses have been conducted on three stages. In the first stage, the variations between the ALM variables (the total value of the assets, liabilities and cash flows of the banks) and bank rate are identified by using "F" test. In the second stage, the relationship between ALM variables and bank rate are predicted using Granular model. Under the Granular model, idiosyncratic volatility is constructed by first removing the correlated component of bank rate with a statistical factor model, then volatilities of the residuals are calculated using the following equation (Bekaert, Hodrick, and Zhang (2010).

$$V_i(g_{i,t+1}^{res}) \approx \sigma_\varepsilon^2 \left( 1 + \frac{1}{p_{i,t}} \gamma^2 H_t - \left[ \frac{S_{i,t}}{NE[S_{i,t}]} + \gamma H_t \right]^2 \right)$$

The  $R^2$  value of Granular model is calculated for each ALM variables. If the  $R^2$  values are greater than 0.7, then we assume that the ALM variables are influenced by the changes in bank rate. In the third stage, we use the homogeneity test using Levene statistic and Brown-Forsythe statistics to find out the group variance within the ALM variables having  $R^2$  values greater than 0.7. The significance of the test implies that ALM variables grouped based on the bank rate revision periods are having unequal variations. For the cash flow analysis only "F" test was performed, as they are highly volatile due to external factors other than bank rate. The output of the stages is used to determine the impact of the bank rate on ALM variables.

## 6. Analysis

### 6.1 Impact on Assets

Total banking assets in India stood at US\$ 1.8 trillion in FY13 and are projected to cross US\$ 28.5 trillion in FY25. Interest rate is sensitive and correlated with assets and liabilities. This widens the Assets and Liabilities gap (James, 1984). To study the relationship between the Bank rate and assets, we identify the twenty seven liquid assets values on monthly basis and they are grouped based on the bank rate revision periods. We apply 'F' test to assess that whether the group means of assets values as classified based on the bank rate differs significantly from each other. Bank rate has been considered as an independent variable. There exist nine groups; as bank rate was revised nine times during 2012 and 2013. Two revisions are made with same value; hence seven groups are created. The square of the deviation of each group mean of external factors from the overall mean in the corresponding group is considered as "between group sum of squares" (BSS). The square of the deviation of each observation from the corresponding group of external factor mean is considered as "within group sum of squares" (WSS). We establish the statistical hypothesis of ANOVA as follows:

**H0 (Null Hypothesis)** = There is no significant variation between the assets value as grouped based on the bank rate.

**Ha (Alternative Hypothesis)** = There is a significant variation between the assets value factors as grouped based on the bank rate.

In order to test the above hypothesis, we use the F-test. The F-ratio is computed as:

$$F = \frac{BSS / df_{BSS}}{WSS / df_{WSS}} = \frac{Mean_{BSS}}{Mean_{WSS}}$$

The BSS portrays how large the effect of bank rate on assets, while the WSS indicates the random variation due to other uncontrolled variables. The results of F test and Granular R<sup>2</sup> values are displayed in table 1.

**Table 1 Bank Rate Vs Assets – ANOVA**

S.No	Assets	F Value	Sig.	Granular Quintile-R <sup>2</sup>
1	Cash in hand	26.762	0.000	0.56
2	Bal With RBI All Schedule Bank	9.502	0.000	0.32
3	Balances with bank	91.105	0.000	<b>0.72</b>
4	Balances In current Account	3.282	0.009	0.23
5	Balances In other Accounts	97.488	0.000	0.62
6	Other Assets	3.845	0.003	0.24
7	Investment In India	55.228	0.000	<b>0.71</b>
8	Central and State Government Securities	55.625	0.000	0.54
9	Other approved securities	127.217	0.000	0.64
10	Bank Credit	68.226	0.000	<b>0.74</b>
11	Food Credit	5.004	0.000	0.44
12	Non Food Credit	66.384	0.000	0.46
13	Loan cash credit and overdrafts	67.847	0.000	<b>0.78</b>
14	Inland Bills Purchased	32.109	0.000	0.45
15	Inland Bills Discounted	109.768	0.000	0.50
16	Foreign Bills Purchased	21.573	0.000	0.31
17	Foreign Bills Discounted	39.247	0.000	0.38
18	SLR Securities	55.228	0.000	0.49
19	commercial paper Book Value	11.308	0.000	0.10
20	Shares Public Sector undertakings Book Value	14.818	0.000	0.14
21	Shares Private Corporate Sector Book Value	19.080	0.000	0.15
22	Investments at Book Value	2.561	0.032	0.02
23	Bonds Public Sector undertakings Book Value	26.004	0.000	0.28
24	Bonds Private Corporate Sector Book Value	47.807	0.000	0.42
25	Others (Bonds) Book Value	15.132	0.000	0.13
26	Units of UTI and Other mutual funds Book Value	17.709	0.000	0.19
27	Shares Public Financial Institutions Book Value	37.950	0.000	0.30

The calculated value of F is greater than the table value of F with the degrees of freedom,  $df_{BSS}$  and  $df_{WSS}$ . Hence, the null hypothesis is rejected at the 95% confidence limits. We accept the alternative hypothesis. We conclude that there is a significant variation between bank rate and liquid assets. The revisions made on bank rate influences the liquid assets values. However, we cannot conclude that the bank rate is only one factor that influences the assets before conducting post hoc multiple comparisons. R<sup>2</sup> values are greater than 0.7 only in four cases. It implies that monthly balances with banks, investments, bank credits and cash credit loans are having immediate impact when the bank rates are revised.

In the second stage, we test the homogeneity among the clusters created for assets value based on the bank rate. We compare assets values having Granular R<sup>2</sup> values more than 0.7. Levene's test (Levene 1960) is used to test the equal variances among the clusters. The hypotheses are established as follows;

**H0 (Null hypothesis):** There is no significant variation within the groups created based on the bank rate.

**Ha (Alternative Hypothesis):** There is significant variation within the groups created based on the bank rate

The Levene statistic test results are portrayed in table 2.

**Table 2** Test of Homogeneity of Variances on Assets

Assets	Levene Statistic	df1	df2	Sig.
Balance with banks	13.122	5	95	0.000
Investment in India	11.966	5	95	0.000
Bank credit	13.957	5	95	0.000
Loan cash credit and cash credit	14.128	5	95	0.000

As calculated value of Levene statistic is greater than the table value, we reject the null hypothesis at the 0.05 significance level. There is sufficient evidence to claim that the variances are not equal within the groups. Thus group variances among the assets are not assumed to be equal. As group variances are not equal, the assets such as deposits in other banks, investment in India, bank credit, cash credits are highly influenced by changes in bank rates as announced by RBI.

Since equal variances are not assumed within the external factors, we move on to the next stage to check the robustness of equality of means of assets value as grouped based on bank rate. If the group variances are statistically equal, then F test is invalid. Hence robust test of equality of means is applied. We applied the Welch and Brown-Forsythe statistics which shows the F test from an ANOVA where the response is the absolute value of the difference of each observation and the group median (Brown and Forsythe 1974). The hypotheses are formulated as follows.

**H0 (Null hypothesis):** The variations among the group as created based on bank rate is not having equal variations.

**H1 (Alternative hypothesis):** The variations among the group as created based on bank rate is having equal variations.

The results of Welch and Brown-Forsythe statistics are portrayed in table 3

**Table 3** Robust Tests of Equality of Means on Assets

S.No	Assets	Test	Statistic <sup>a</sup>	df1	df2	Sig.
1.	Balance with banks	Welch	470.617	5	32.43	0.000
		Brown-Forsythe	85.344	5	24.84	0.000
2.	Investment in India	Welch	179.127	5	33.16	0.000
		Brown-Forsythe	55.106	5	31.71	0.000
3.	Bank credit	Welch	375.028	5	28.05	0.000
		Brown-Forsythe	70.188	5	28.73	0.000
4.	Loan cash credit and cash credit	Welch	363.475	5	28.03	0.000
		Brown-Forsythe	69.521	5	28.661	0.000

Since the p value is smaller than  $\alpha$  we reject the null hypothesis. This implies that the variations among the groups are equal. This also supports the validity of F test. Past researchers proved that even the continuous increase or decrease in variables will result in equality of variations among different groups. We conclude that the short-term loans and investments are immediately affected by the changes in bank rate and these are considered as sensitive assets.

The bank rate widens the ALM gap, which reflected in short-term loans and investments from the assets side. Short-term loans of the Indian banking sector are showing increasing trend. It is growing at a CAGR of 18.1 per cent and it will be US\$ 2.4 trillion by 2017. The credit growth of ICICI Bank is 141.6 per cent during financial year 2014 ( Report of Emkay Global Financial Services). It is also due to credit card business which is growing at CAGR of 31.1 per cent. These assets provide a buffer in times of market freezes as banks are able to liquidate these holdings to meet liabilities.

## 6.2 Impact on Liabilities

A change in bank rate is having impact on banks' borrowing costs. This influence both lending and fixed deposit rates. The bank deposits are growing at CAGR of 21.2 per cent. Hence we have to explore the impact of bank rate in liabilities. The variance analysis and Granular test are performed in the similar method used for assets. The results are tabulated as follows

**Table 4** Bank Rate Vs Liabilities – ANOVA

S.no	Liabilities	F	Sig.	Granular Quintile-R <sup>2</sup>
1	Demand and time deposits from bank	18.129	0.000	0.28
2	Liquid Liabilities to the Banking System	14.617	0.000	<b>0.71</b>
3	Borrowing from banks	6.059	0.000	0.26
4	Other demand and time liabilities to banking system	5.519	0.000	0.21
5	Aggregate deposits	234.192	0.000	0.56

6	Demand Deposits to Others	21.078	0.000	0.44
7	Time Deposits to Others	222.856	0.000	<b>0.73</b>
8	Borrowings (Other than from RBI, NABARD, EXIM bank)	69.643	0.000	<b>0.75</b>
9	Other demand and time liabilities to Others	31.720	0.000	0.45
10	Borrowings from RBI All Scheduled Banks	85.136	0.000	<b>0.71</b>

The results indicate that the liabilities are influenced by the bank rate. Among the liabilities, liquid liabilities, time deposits and borrowings are having direct impact. The Levene statistic test results are portrayed in table 5.

**Table 5** Test of Homogeneity of Variances - Liabilities

Liabilities	Levene Statistic	df1	df2	Sig.
Liquid Liabilities to banking system	4.735	5	95	0.001
Time deposits to others	13.340	5	95	0.000
Barrowings other than RBI	7.003	5	95	0.000
Barrowing from RBI all Scheduled banks	28.862	5	95	0.000

As group variances are not equal, the liabilities such as liquid liabilities, time deposits and borrowings are not the only one factor that influenced the bank rate. The robustness test results on liabilities are tabulated in table-6.

**Table 6** Robust Tests of Equality of Means

S.No	Liabilities	Model	Statistic	df1	df2	Sig.
1.	Liquid Liabilities to banking system	Welch	14.808	5	30.355	0.00
		Brown-Forsythe	8.040	5	40.041	0.00
2.	Time deposits to others	Welch	273.815	5	34.209	0.00
		Brown-Forsythe	54.835	5	29.728	0.00
3.	Barrowings other than RBI	Welch	61.331	5	23.210	0.00
		Brown-Forsythe	44.438	5	31.738	0.00
4.	Barrowing from RBI all Scheduled banks	Welch	172.308	5	20.851	0.00
		Brown-Forsythe	23.184	5	32.502	0.00

Since the p value is smaller than  $\alpha$  we reject the null hypothesis. This implies that the variations among the groups are equal. This also supports the validity of F test. We conclude that liquid liabilities, time deposits and borrowings are sensitive to bank rate. The deposits matured created a gap in ALM from the liabilities side. The deposits maturing within one year increased to 50% from 33% within two years (2012-14). If a bank has long term deposits, then it can hold long dated debts without costing much to bank rate risk.

### 6.3 Impact on Cash Flows

The ALM of the bank's balance sheet are nothing but future cash inflows or outflows... (Singh & Tandon, 2012). To study the relationship between the bank rate and cash flows, we use 'F' test in same procedure as applied for assets. We have identified thirty four liabilities to compare with bank rate. Table -7 shows the results.

**Table 7** Bank Rate Vs Cash Flows – ANOVA

S.No	Cash flow	Value		Volume	
		F value	Sig.	F – value	Sig.
1	RTGS	0.552	0.783	5.089	0.003
2	Customer Transactions	1.311	0.307	5.535	0.002
3	Interbank Transactions	0.651	0.709	1.589	0.209
4	Interbank Clearing	1.758	0.166	5.343	0.003
5	CCIL Operated Systems	4.537	0.006	1.950	0.127
6	CBLO	15.979	0.000	6.740	0.001

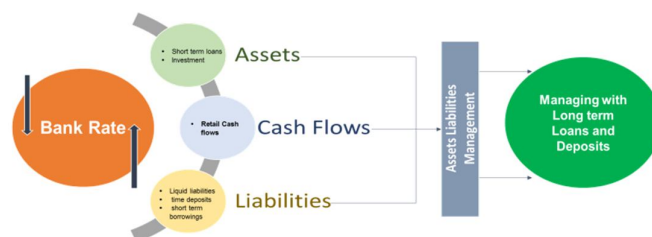
7	Govt. Securities Clearing	4.248	0.008	2.553	0.057
8	Outright Payments	3.841	0.012	2.498	0.061
9	Repo Payments	6.173	0.001	2.972	0.034
10	Forex Clearing	1.300	0.312	1.292	0.315
11	Paper Clearing	0.871	0.550	0.657	0.704
12	Cheque Truncation System	45.387	0.000	66.627	0.000
13	MICR Clearing	35.174	0.000	40.612	0.000
14	RBI Centres clearing	55.468	0.000	44.527	0.000
15	Other Centres Clearing	9.984	0.000	20.063	0.000
16	Non-MICR Clearing	0.336	0.926	1.370	0.283
17	Retail Electronic Clearing	10.117	0.000	21.781	0.000
18	ECS DR	2.131	0.100	6.780	0.001
19	ECS CR (includes NECS)	3.199	0.026	1.866	0.143
20	EFT/NEFT	9.649	0.000	24.048	0.000
21	Immediate Payment Service (IMPS)	74.844	0.000	86.148	0.000
22	Cards Remittance	10.249	0.000	16.254	0.000
23	Credit Cards	10.934	0.000	13.696	0.000
24	Usage at ATMs	3.236	0.025	6.302	0.001
25	Usage at POS	10.939	0.000	13.716	0.000
26	Debit Cards	10.072	0.000	15.141	0.000
27	Usage at POS	4.541	0.006	8.289	0.000
28	Prepaid Payment Instruments (PPIs)	2.034	0.114	23.551	0.000
29	m-Wallet	11.847	0.000	24.493	0.000
30	PPI Cards	7.409	0.000	10.927	0.000
31	Paper Vouchers	0.626	0.728	0.927	0.512
32	Mobile Banking	65.813	0.000	25.116	0.000
33	Cards Outstanding	5.635	0.002	37.691	0.000
34	Total Remittance	1.808	0.155	12.368	0.000

We use 95% confidence limits to test the hypotheses. The result indicates that bank rate is not having impact in five variables. It includes inter-bank transactions, forex clearing, paper clearing, non MICR clearing and paper vouchers. The bank rate is not having impact in the values of six variables. It includes RTGS, customers' transactions, inter-bank clearing, ECS (Dr), pre-paid payment instruments and total remittance. Bank rate is not having any impact on the volume of four variables. It includes CCIL operations, Government securities clearing; out-right payments and ECS (Cr). The revision in bank rates will have impact on the remaining nineteen variables. We have grouped those variables and named as 'retail cash flows'.

## 7. Findings and Implications

The findings of the research clearly indicates that the revisions made in bank rate will have direct impact is having impact on ALM variables. Short-term loans, short investments, liquid liabilities, time deposits, short-term borrowing and retail cash flows are influenced by changes in bank rates. The remittance system in values is not influenced by the bank rate; whereas remittance in volume is affected by changes in bank rate. Exhibit-2 shows the results.

### Exhibit -2: ALM Risk Exposure



Funding the long-term assets with short-term funds is attracting the interest rate exposure. However, long-term assets and liabilities are not directly influenced by the bank rate. Hence, ALM gap can be reduced by cash flows from long term loans and deposits.

## 8. Conclusion

The volatility in the bank rate is having an effect on the volume of cash flows but not on the value of cash flows. Hence we conclude that if the costs of cash outflows increases in proportion with bank rates, the ALM gap can be decreased during the period of the liquidity squeeze. On the other hand, managing with long-term loans with deposits decreases the bank rates exposure.

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