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Exploring Liquidity Risk Management in Payment SYSTEM: In Search of Profitability

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Abstract: Very basic function of banking is accepting deposits for the purpose of lending; banking is a key organ of financial system. Banks have vital role in development of the Nation and growth of economy. Banks simplify the payments by offering various payment methods with easeness Banks as a financial organization deals the demand and supply of liquidity in optimal way with several specifications to avoid risks. Risk is inevitable in banking business hence we cannot avoid the risk despite it is to mitigate to avoid the disaster. There are several risks associated with payment systems in 21st century an era of digital/ electronic payments such as NEFT, RTGS, IMPS, and NECS etc in Indian Financial system. There are several risks in banking which are to be managed and mitigated; the liquidity issue happens due to failures in the managing of resources. This paper is mainly focused to study liquidity risk in banks with in Indian Territory using prediction through Multiple Regression Equation based on historical data. NEFT and RTGS are the facilities which eases customers to transfers their funds to one bank account to another different bank account. This happens at their finger tips. This sometimes causes sharp imbalance on CRR and SLR which are statutory to maintain. Optimal utilization of Liquid funds leads increase in NIM for Banks. NIM is key factor for Banks profitability.

Key Words: Multiple Regression, Liquidity risk, NEFT, SBI, NIM

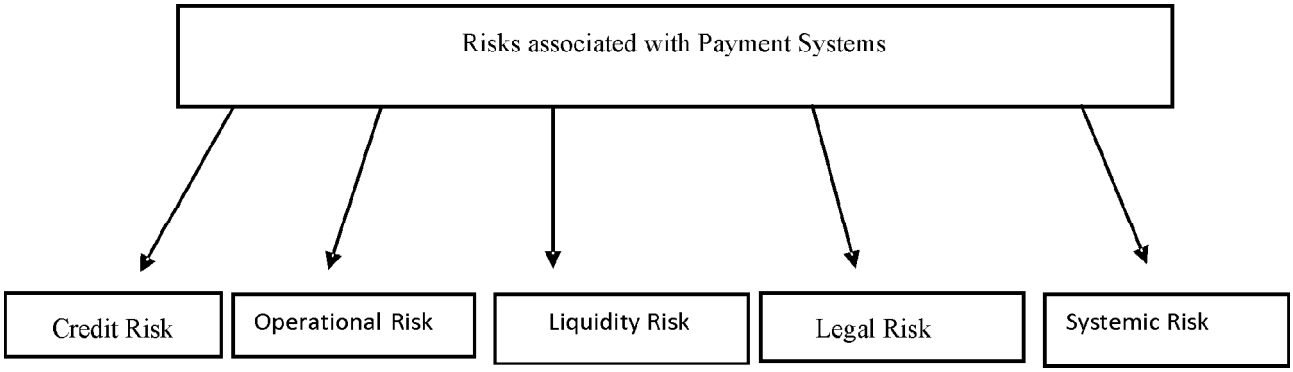
JEL classification: E42, C53, G32

INTRODUCTION

Cash is considered the standard for liquidity because it can most quickly and easily be converted into other assets. The traditional functions of commercial banks (depositories) are the transformation of maturity and the provision of liquidity. Banks transform short-term liquid liabilities into long-term illiquid assets. In performing these functions banks provide liquidity to demand depositors and also to borrowers to whom

they provide lines of credit. However, in performing these functions they are transferring liquidity risk from their customers to the bank, thus exposing the bank to this risk.

Risks associated with Payment Systems



Liquidity risk is one of the major risks faced by financial intermediaries and banks in particular. Its management is, therefore, crucial to the viability of banks. In this paper we are trying to measure the impact of NEFT transaction facilities on CRR and SLR which policy variables of the bank. Any short fall in CRR and SLR invites penalty as prescribed and stipulated by RBI.

Liquidity in banking is conventionally defined as the ability to meet its obligations as they become due. Banks may encounter liquidity risks – the inability to meet its liquidity needs because of bank-specific problems or because of a market liquidity shortage in times of a financial crisis. Bad news about bank-specific events such as ratings downgrades may lead to a loss of market confidence in the bank adversely impacting its liquidity position. In recent years increase in off-balance sheet activities and a shift to more volatile funding sources have increased this type of risk. Liquidity is a major risk in banking and that liquidity management should be a top priority for bank management and regulators. To manage its liquidity needs the bank can raise liquidity on the liability side or act on the asset side. The bank can hold high quality liquid assets and draw on them in the event of liquidity shortage. Of course, liquid assets offer lower returns. Thus, holding more liquid assets and better matching cash-flows of assets and liabilities will reduce the liquidity risk of the bank and protect it from insolvency but also reduce its profitability. Liquidity management, therefore, involves finding the right balance between liquidity risk and profitability.

The Reserve Bank of India (RBI) is India's central banking institution, Head quarter in Mumbai, which controls the monetary policy of the Indian rupee. It commenced its operations on 1 April 1935 during the British Rule in accordance with the provisions of the Reserve Bank of India Act, 1934. Main functions of RBI are Financial Supervision, Regulator and supervisor of the financial system, Managerial of exchange control, Issue of currency and Banker's bank. RBI decides policy rates such as CRR, SLR.

A scheduled bank, in India, refers to a bank which is listed in the 2nd Schedule of the Reserve Bank of India Act, 1934. Banks not under this Schedule are called non-scheduled banks. Scheduled banks are usually private, foreign and nationalized banks operating in India. However, cooperative banks are allowed to seek scheduled bank status if they satisfy certain criteria. A scheduled bank is eligible for loans from the Reserve Bank of India at bank rate. They are also given membership to clearing houses.

Cash Reserve Ratio (CRR)

Cash Reserve Ratio is a certain percentage of bank deposits which banks are required to keep with RBI in the form of reserves or balances. Higher the CRR with the RBI lower will be the liquidity in the system and vice versa. RBI is empowered to vary CRR between 15 percent and 3 percent. But as per the suggestion by the Narsimham committee Report the CRR was reduced from 15% in the 1990 to 5 percent in 2002. As of 24 October 2016, the CRR is 4.00 percent.

Penal interest will be charged as under in cases of default in maintenance of CRR by SCBs :

1. In case of default in maintenance of CRR requirement on a daily basis which is presently 70 per cent of the total CRR requirement, penal interest will be recovered for that day at the rate of three per cent per annum above the Bank Rate on the amount by which the amount actually maintained falls short of the prescribed minimum on that day and if the shortfall continues on the next succeeding day/s, penal interest will be recovered at the rate of five per cent per annum above the Bank Rate.
2. In cases of default in maintenance of CRR on average basis during a fortnight, penal interest will be recovered as envisaged in sub-section (3) of Section 42 of Reserve Bank of India Act, 1934. SCBs are required to furnish the particulars such as date, amount, percentage, reason for default in maintenance of requisite CRR and also action taken to avoid recurrence of such default.

Statutory Liquidity Ratio (SLR)

Every financial institution has to maintain a certain quantity of liquid assets with themselves at any point of time of their total time and demand liabilities. These assets have to be kept in non cash form such as G-securities precious metals, approved securities like bonds etc. The ratio of the liquid assets to time and demand assets is termed as the Statutory liquidity ratio. There was a reduction of SLR from 38.5% to 25% because of the suggestion by Narshimam Committee. The current SLR is 20.75%.

Penalties

If a banking company fails to maintain the required amount of SLR, it shall be liable to pay to RBI in respect of that default, the penal interest for that day at the rate of three per cent per annum above the Bank Rate on the shortfall and if the default continues on the next succeeding working day, the penal interest may be increased to a rate of five per cent per annum above the Bank Rate for the concerned days of default on the shortfall.

State Bank of India (SBI): SBI is an Indian multinational, public sector banking and financial services company. It is a government-owned corporation with its headquarters in Mumbai, Maharashtra. As of 2016-17, it had assets of (US$460 billion) and more than 14,000 branches, including 191 foreign offices spread across 36 countries, making it the largest banking and financial services company in India by assets. The company is ranked 232nd on the Fortune Global 500 list of the world's biggest corporations as of 2016.

Net interest margin (**NIM**): NIM is a measure of the difference between the interest income generated by banks or other financial institutions and the amount of interest paid out to their lenders (for example, deposits), relative to the amount of their (interest-earning) assets.

National Electronic Fund Transfer (NEFT)

National Electronic Fund Transfer is a nationwide payment system facilitating one-to-one funds transfer. It settles the transactions under batches. Under this scheme, individuals, firms and corporate can electronically transfer funds from any bank branch to any individual, firm or corporate having an account with any other bank branch in the country participating in the scheme. Individuals who do not have a bank account (walk-in customers) can also deposit cash (Max. Rs. 50,000/-) at the NEFT enabled branches with instructions to transfer funds using NEFT. NEFT operates through the core banking system in India [through core banking all banking operations of all banks can be connected to a central computer kept at a data centre. Only NEFT enabled banks can provide this NEFT service. Fund Limit: There is no limit on the amount to be transferred as minimum but maximum amount possible is Rs. 2 Lakhs but can vary between banks. Also NEFT transactions are conducted between banks on net settlements basis, meaning they are conducted in batches and not at the same time as the transactions. NEFT is widely popular among general public since it evolved as alternate to Demand Draft in payments. NEFT facility costs lower for fund transfer than Demand Draft to perform. Each Branch of Bank has a distinct code called Indian Financial System (IFS) code.

Problem of study

Banking sector of India is facing several severe risks which are affecting profitability of banks. Banks have to manage funds judiciously to mitigate risk and to increase profitability. Much research conducted on Liquidity Risk management from credit default and other angles. Here we are innovatively trying to address a minute level of study on Liquidity management. Now this paper limited to study Liquidity risk arises out of NEFT. Fluctuations of cash flows due to NEFT settlement after netting among banks can cause variation in CRR and SLR. Any short fall in CRR/SLR attracts huge penalty from RBI. Any excess in flow of funds we may utilize for high yielding investments.

To avoid above undesirable events banks has to predict their funds requirement to augment their funds utilization/mobilization. Regression is helpful in doing prediction.

LITERATURE REVIEW

The concept of "Liquidity" is use to address conditions of the bank. Some other researcher explained as "The ability to settle obligations with immediacy". The management of liquidity is essential for financial and financial firm[1].

This is a responsibility of all banks to encounter their fiscal duties; banks convert their current assets into the shape of cash to pay the due obligations. The banks having less amount in current assets will face difficulties in ongoing its processes and if the amount of current assets is too high, this displays that the return on investment for the bank is not in the unspoiled state[2].

A well managed liquidity monitoring regulates more or less managing decisions on the basis on bank liquidity situation to avoid losses[3].

The profitability of banking sector is important with the aim to estimate the constancy and reliability of the financial and banking sector[4].

The profit planning and management is more complex in the highly challenging economic environment[5].

There are many theories demonstrate the link between liquidity and profitability of the banks. Researchers conducted research in on banking sector of United States and proposed that more liquidity is typically costly for banks, signifying that more liquidity cuts profitability of the banks[6].

Liquidity Regulations such as CRR and SLR are for the purpose of the regulation among others is to; ensure that each institution meets the minimum liquidity requirements, guide institutions in the formulation of liquidity risk management strategies, policies, procedures, management information systems, internal controls and contingency plans for unexpected distress situations, protect deposit funds, promote a stable and efficient banking system, and endear confidence in the financial sector. The bank's supervisory department continues to adopt and implement effective and sound supervisory methods in order to minimize the risk inherent in the banking system. The funding gap for commercial banks is managed through a stable funding base along with detailed forecasting.

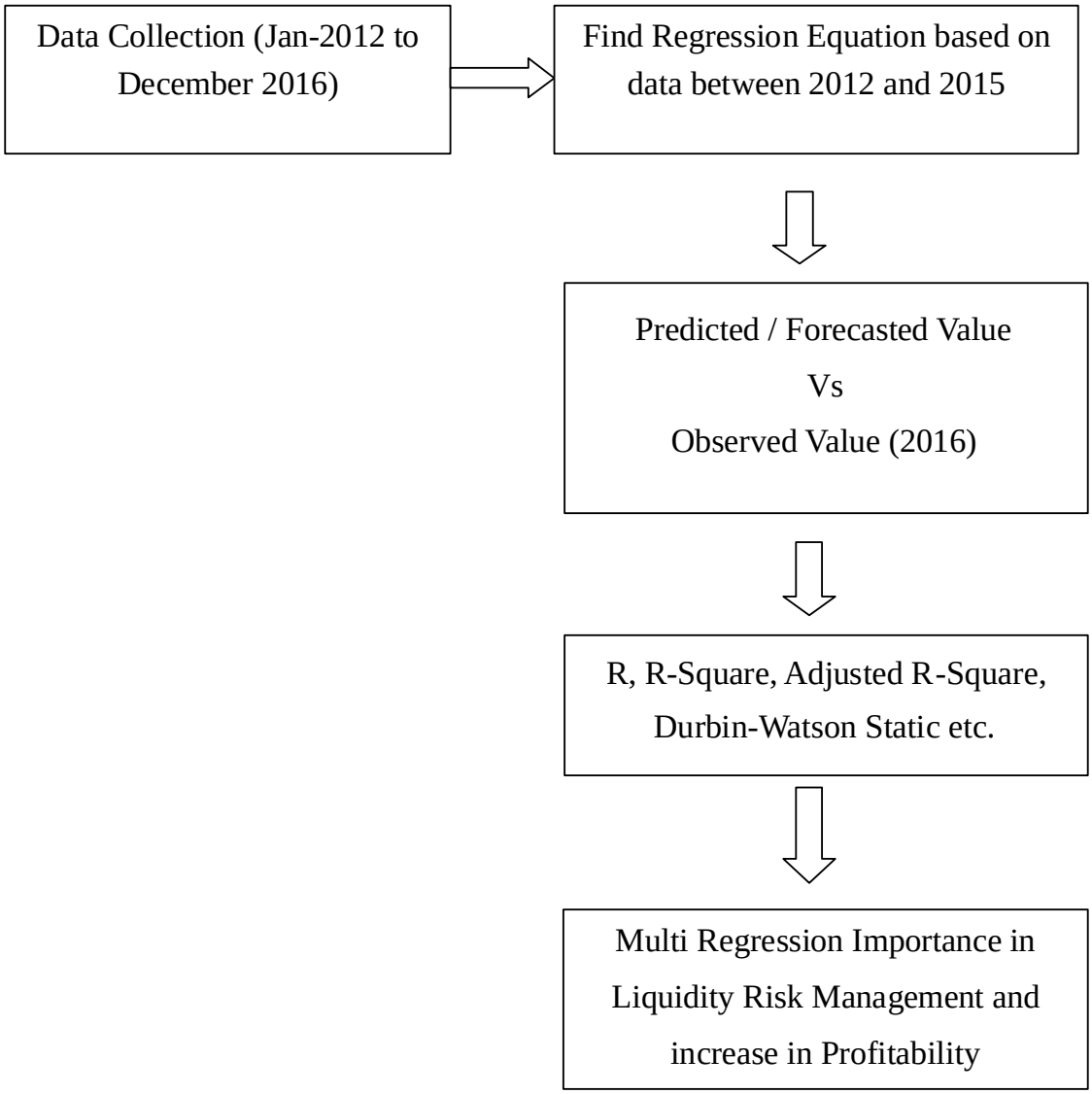
Banks with high liquidity have a lower rate of net interest margins. In the case liquidity crisis, banks may borrow from the market remarkably high rate and this causes decline in the profitability of the banks.

METHODOLOGY

Banks with more low yielding assets supported from high cost liabilities have low NIM or Negative NIM. It is a cause of concern for Bank's management to deal. To avoid such untoward incident bank should do three things.

1. Strategic Balance Sheet Steering: Reprising and cost cutting measure etc..
2. Funding Optimization: Lowering Term Deposit rates and slight increase in Lending rates for borrowers will definitely NIM positively by reducing cost of funds apart from increase in loan yielding.
3. Funding Optimization: Banks has to hold adequate liquidity into the foreseeable future. Banks that make the best use of these liquid assets and eliminate the most costly contingent liabilities that drive the need for liquidity will reap significant rewards. Given the many banks with excess liquidity, there is an opportunity for banks to reduce their liquid assets through improved management of contingent liquidity needs and liquidity forecasting/prediction. There is further opportunity to increase revenue by 1.5 to 2.5 percent through improved investment of remaining Liquid-asset cushion (With conservative Risk appetite) by changing the mix of diversified investments. Here forecasting/Prediction play a vital role.

This paper is mainly focuses on quantitative prediction based on historical data available with RBI website. Focal theme of this paper is to find a Multiple Regression equation for funds flow in a bank based on historical data. There after evaluation of effectiveness of the Multiple Regression in predicting requirements.



Sources of Data

The research used aggregated monthly reports on NEFT transactions which are available in the Reserve bank of India website. Hence data gathered for the study is highly authenticated and reliable.

Multiple regression is an extension of simple linear regression. It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The variables we are using to predict the value of the dependent variable are called the independent variables (or sometimes, the predictor, explanatory or regressor variables).

Assumptions

To analyze data using Multiple Regression the data need to pass eight assumptions to give a valid result.

Those eight assumptions are as follows:

- Assumption 1: Dependent variable should be measured on a continuous scale (i.e., it is either an interval or ratio variable).
- Assumption 2: Data should have two or more independent variables, which can be either continuous (i.e., an interval or ratio variable) or categorical (i.e., an ordinal or nominal variable).
- Assumption 3: Data should have independence of observations (i.e., independence of residuals), which can easily check using the Durbin-Watson statistic.
- Assumption 4: There needs to be a linear relationship between (a) the dependent variable and each of the independent variables, and (b) the dependent variable and the independent variables collectively.
- Assumption 5: Data needs to show homoscedasticity, which is where the variances along the line of best fit remain similar as one move along the line.
- Assumption 6: Data must not show multi co linearity, which occurs when data have two or more independent variables that are highly correlated with each other.
- Assumption 7: There should be no significant outliers, high leverage points or highly influential points.
- Assumption 8: Finally, need to check that the residuals (errors) are approximately normally distributed. One method to check this assumption is a Normal Q-Q Plot of the studentized residuals.

The Durbin Watson test, with a value from 0 to 4, where:

- Statistic Test value 2 is no autocorrelation.
- 0 to <2 is positive autocorrelation.
- >2 to 4 is negative autocorrelation.
- A **rule of thumb** is that test statistic values in the range of 1.5 to 2.5 are relatively normal. Values outside of this range could be cause for concern. Generally experts suggest that values under 1 or more than 3 are a definite cause for concern.

Limitations: The current study has certain limitations, those are as follows,

1. Paper is limited only State Bank of India.
2. Day wise data not available hence aggregated month wise analysis made.
3. Data considered from January 2012 to December 2016 only.
4. Assumed that external factors are normal.
5. Excluded other Payment Systems which are available in India such as IMPS, RTGS etc.

RESULT AND DISCUSSION

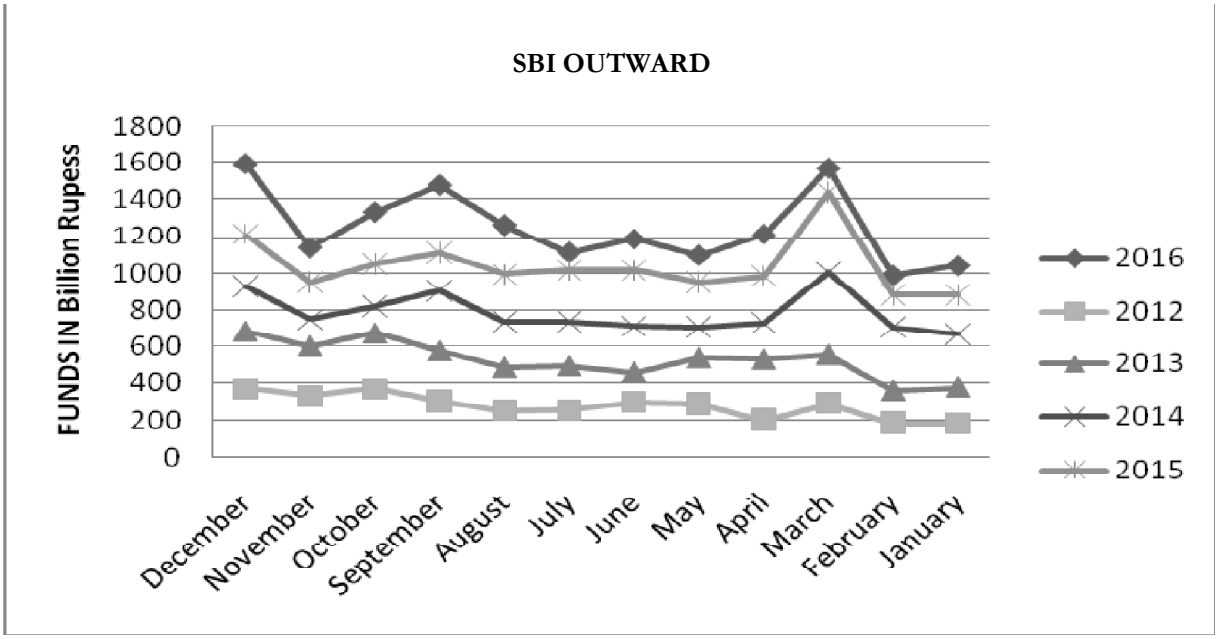
Dependent Variable (Data for the Year 2016) and Independent Variables (Data for the Years 2012 to 2015).

Table 1
Month wise aggregate NEFT funds flow in Billion Indian Rupees

Bank: SBI	*Outward NEFT Funds Flow (In Billion Rupees)*					*Inward NEFT Funds Flow (In Billion Rupees)*				
Month/Year	*2016*	*2012*	*2013*	*2014*	*2015*	*2016*	*2012*	*2013*	*2014*	*2015*
December	1594	367	683	928	1212	1617	394	561	780	1069
November	1143	330	602	749	949	1234	360	516	719	842
October	1337	368	673	820	1051	1465	400	604	727	942
September	1480	302	575	905	1110	1515	308	536	763	908
August	1267	252	485	735	993	1165	361	532	736	888
July	1116	255	493	736	1015	1161	450	589	599	930
June	1191	298	457	712	1014	1494	351	600	693	846
May	1101	287	537	709	948	1112	331	503	750	746
April	1216	202	530	731	983	1503	438	628	692	1146
March	1570	289	555	1002	1441	1432	308	477	732	872
February	991	187	360	709	882	993	231	364	504	641
January	1045	184	378	670	879	1058	337	462	561	680

SBI Outward funds flow analysis

Chart 1: 2D Line Chart for Outward Fund flow



By seeing Chart1: One can observe is similarity in Monthly Outward Fund flow

Table 2
Multiple Regression Prediction & Related Statistics (SBI Funds Outward Flow)

Multiple Linear Regression - Estimated Regression Equation (SBI Funds Outward Flow)

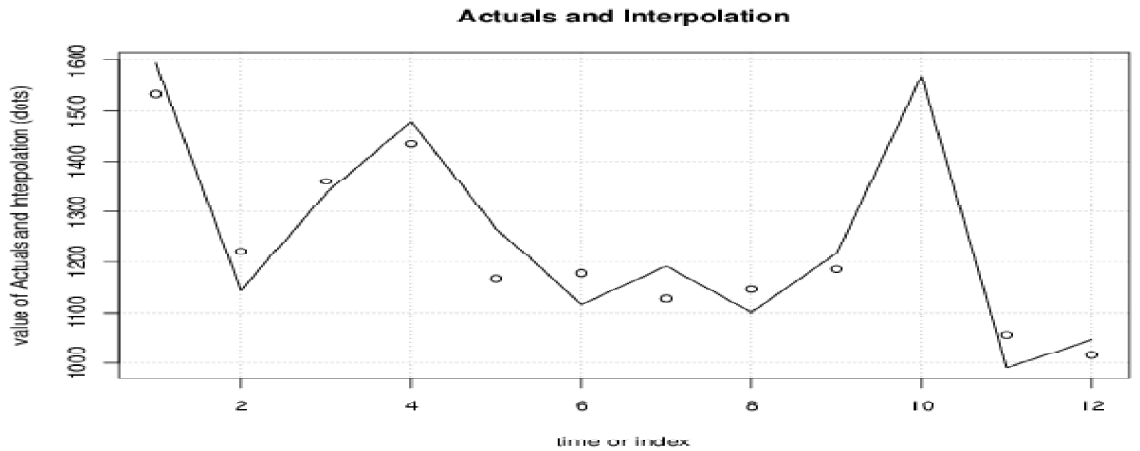
2016[t] = -163.352 -0.0895067‘2012‘[t] + 0.472304‘2013‘[t] + 1.17693‘2014‘[t] + 0.26044‘2015‘[t] + e[t]

Multiple Linear Regression - Regression Statistics	
Multiple R	0.9531
R-squared	0.9084
Adjusted R-squared	0.8561
F-TEST (value)	17.36
F-TEST (DF numerator)	4
F-TEST (DF denominator)	7
p-value	0.0009718
Multiple Linear Regression - Residual Statistics	
Residual Standard Deviation	76.44
Sum Squared Residuals	40910.00

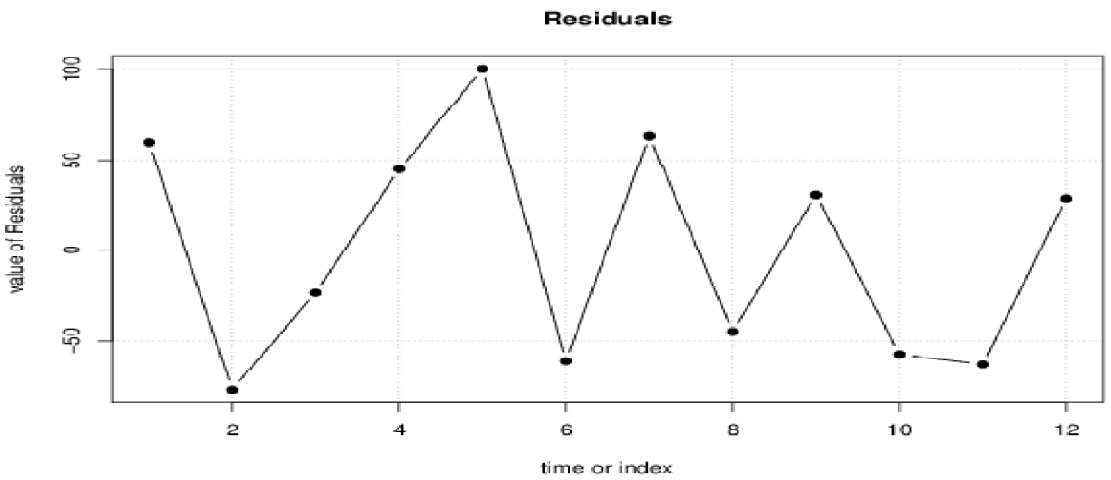
Multiple Linear Regression - Actuals, Interpolation, and Residuals

Time or Index	*Actuals*	*Interpolation Forecast*	*Residuals Prediction Error*
1	1594	1534	59.77
2	1143	1220	-77.12
3	1337	1360	-23.38
4	1480	1435	44.6
5	1267	1167	100.2
6	1116	1177	-61.24
7	1191	1128	63.12
8	1101	1146	-44.93
9	1216	1185	30.76
10	1570	1627	-57.49
11	991	1054	-63.09
12	1045	1016	28.82

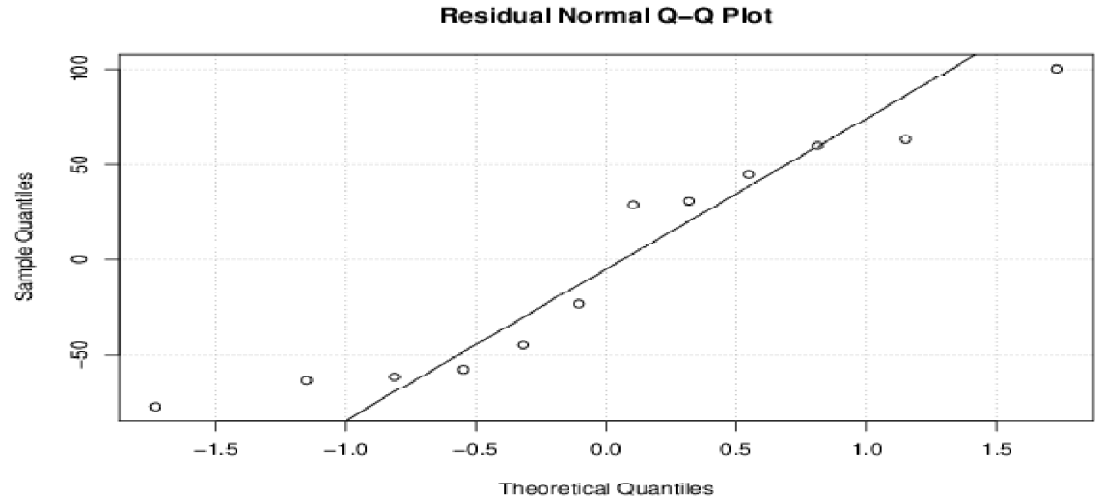
Graphical Representation of Actuals vs Forecasted(Interpolation) Values



Graph suggets that Observed values and predicted values are approximatly close. There are no outlier. Mulitple Regression Model Fitted well



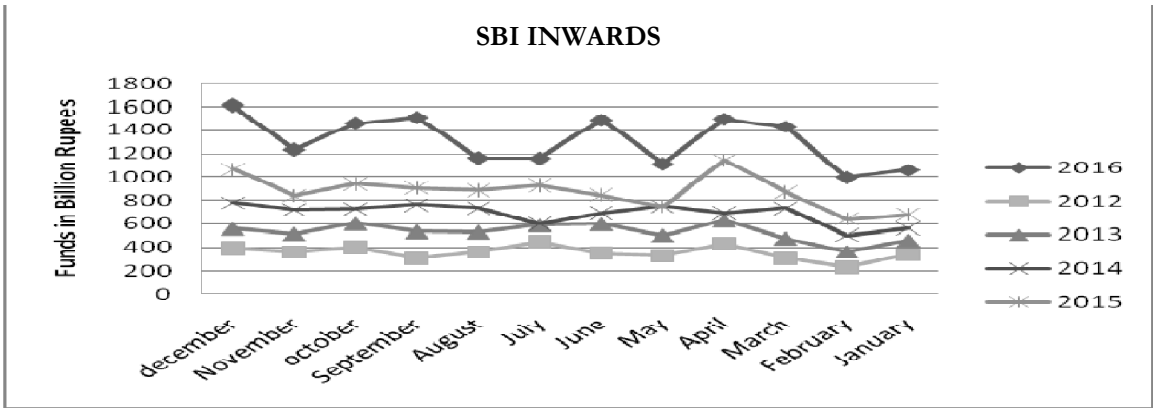
Multiple Regression model is appropriate for the data



There are no outlier. Regression Model suitable

SBI Inward funds flow analysis

Chart 2: 2D Line Chart for Inward Fund flow



By seeing Chart2: One can observe is similarity in Monthly Inward Fund flow

Table 3
Multiple Regression Prediction & Related Statistics (SBI Funds Inward Flow)

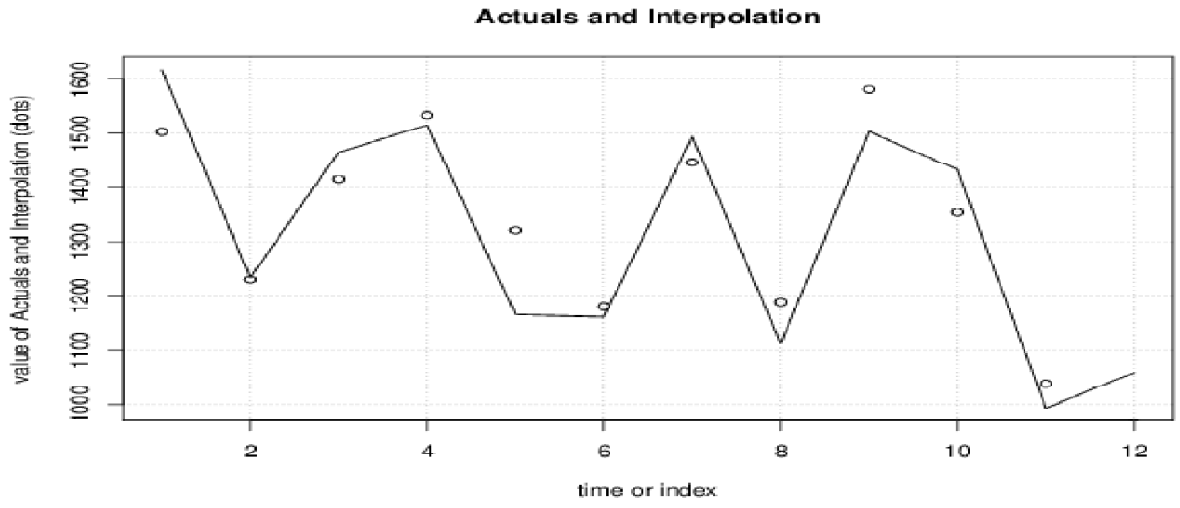
Multiple Linear Regression - Estimated Regression Equation(SBI Funds Inward Flow)
2016[t] = + 127.255 -3.28909‘2012‘[t] + 2.2087‘2013‘[t] + 0.185734‘2014‘[t] + 1.20417‘2015‘[t] + e[t]

Multiple Linear Regression - Regression Statistics	
Multiple R	0.9249
R-squared	0.8554
Adjusted R-squared	0.7728
F-TEST (value)	10.35
F-TEST (DF numerator)	4
F-TEST (DF denominator)	7
p-value	0.004592
Multiple Linear Regression - Residual Statistics	
Residual Standard Deviation	101.5
Sum Squared Residuals	72070

Multiple Linear Regression - Actuals, Interpolation, and Residuals

Time or Index	*Actuals*	*Interpolation Forecast*	*Residuals Prediction Error*
1	1617	1503	114.4
2	1234	1230	3.676
3	1465	1415	49.97
4	1515	1533	-18.18
5	1165	1321	-155.9
6	1161	1179	-18.22
7	1494	1445	48.56
8	1112	1187	-75.15
9	1503	1582	-79.2
10	1432	1354	78.24
11	993	1037	-43.92
12	1058	962.3	95.72

Graphical Representation of Actuals vs Forecasted (Interpolation) Values



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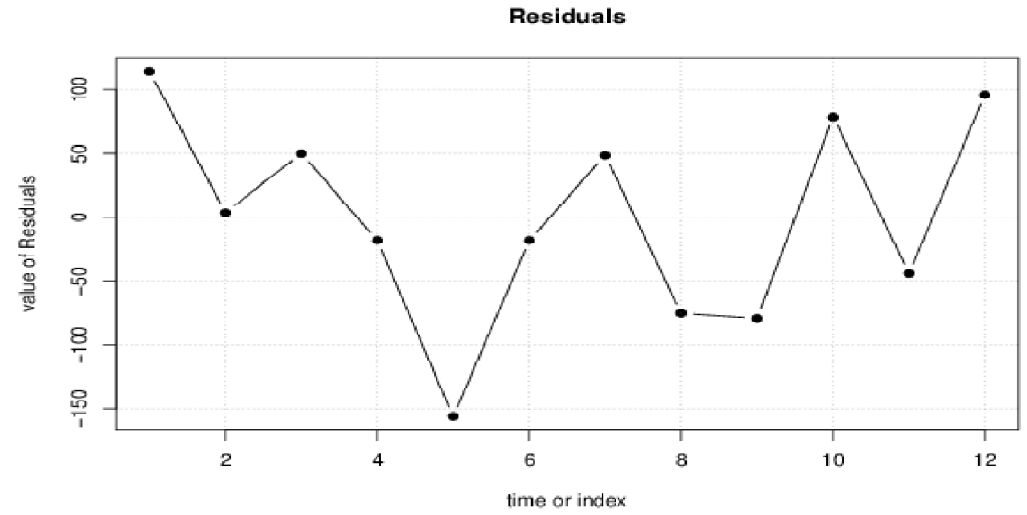
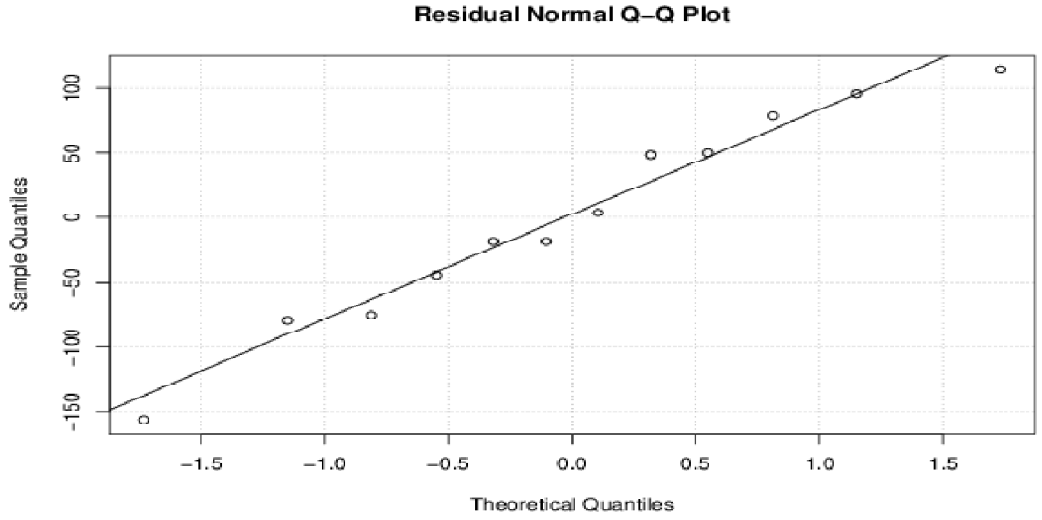


Multiple Regression model is appropriate for the data



There are no outlier. Regression Model suitable

Interpretation of results and Major findings

S.No	*Statistic Measure*	*SBI Outward*	*SBI Inward*	*Interpretation / Finding*
1	R	0.9531	0.9249	High degree of Positive Relation between Predicted value and Observed Value
2	R-Square	0.9084	0.8554	Explained Variation Observed at Considerably By Regression Model
3	Adjusted R-Square	0.8561	0.7728	Fitness of Regression Model is 85.6% and 77.28%.
4	F-Test Value	17.36	10.35	Critical value at probability level 0.05 is 4.1203, Hence Null Hypothesis Rejected. Regression Model better explained at above probability level.
5	p-Value	0.0009718	0.004592	Regression Model better explained at Significance level 0.05

6	Mean Absolute Error	54.5	65.08	Based on this we can say that Regression Model have significance in prediction.
7	Mean relative Error (In %)	4.44244	5.09571	Based on this we can say that Regression Model have significance in prediction.
8	Durbin-Watson Static evaluation	2.55561	1.88811	Static values lie between 1.5 and 2.5 are considered normal. Regression model outcome is considerable

Mean Relative error between predicted values and Observed Values stood at 4.44% and 5.09 % for Outward and Inward flows respectively. It clearly states that we can predict Liquidity position up to 95%. According to Mckinsey Risk management papers by doing better management of highly liquid funds, Banks can augur their revenue 1.5 to 2.5 percent per annum. Total Outward fund flow from SBI is Rs.15050 Bn Crores and Inward Fund flow is about Rs.15749 Bn Crores. An average Outward and Inward fund flow per month stood at Rs.1254.2 Bn Crore and Rs.1312.4 Bn Crore Respectively. By applying Multiple Regression banks can increase NIM by giving very short credits, call money and Money market investments etc whenever there is excess inflow of funds through NEFT. Even small fractional increase in NIM through better management of liquid funds, such as 0.01% can yield more than Rs.100 crore profit. Early prediction of short fall is very much useful to borrow funds at low cost which is in turn useful for reduction in cost funds apart from avoiding penalty from RBI for short fall in CRR and SLR.

CONCLUSION

Multiple Regression model is suitable for Liquidity Risk Management by predicting funds flow. There is wide scope and necessity for research in this area as Banks has to maintain adequate liquidity to maximize profitability**.** This can be extended to any bank and also useful in Asset and Liability management. Based on the outcome and analysis of this paper it is concluded that better management liquidity arises out of payment system will mitigate Liquidity Risk and increases NIM.

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