A PROJECT REPORT

ON

“Statistical Analysis on the Various Factors of Money and Banking”

SUBMITTED TO

THE DEPARTMENT OF STATISTICS

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

IN PRATIAL FULFILLMENT OF DEGREE OF

Master of Science in Applied Statistics

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DECLARATION:

We hereby declare that the project that the project report certified" Statistical Analysis of Various Factor of Money and Banking sector " under the guidance of Mrs. Jayshree Pandey (Dept. of statistics) and all faculties of department. The project has been completed for the partial fulfilment of the degree of Master of Science in Applied Statistics from Veer Narmad South Gujarat University Surat. We also declare hereby that this same report will not be utilized for any other degree course and fellowship to other similar titles by any other institution or person. We again declare that we will not use the project report in submission to any other university or any publisher.

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ACKNOWLEDGEMENT

At the outset, let me express my genuine & constant appreciation to the God whose silent words directed my steps & whose invisible presence always lighted my paths.

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It brings a smile on my face as I express my gratefulness & thanks to my research guide Mrs. Jayshree Pandey providing constant inspiration & guidance from inception till completion of project.

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And the most precious part of our life, our parents who have showed their love and support which can never be repaid on any form because without them this achievement could not have been achieved.

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Chapter-1

Introduction: Various Factors of Banking & Money

What is Bank?

A bank is a financial institution that accepts deposits from the public & creates credit. Lending activities can be performed either directly or indirectly through capital markets. Due to their importance in the financial stability of a country, banks are highly regulated in most countries.

Most nations have institutionalised a system known as fractional reserve banking under which banks hold liquid assets equal to only a portion of their current liabilities.

The banking system in India comprises commercial & co-operative banks of which the former accounts for more than 90% of banking systems assests. Besides a few foreign & Indian private banks, the commercial banks comprise nationalised banks with the government. For many years the presidency banks had acted as quasi-central banks, as did their successors, until the Reserve Bank of India was established in 1935, under the Reserve Bank of India Act, 1934.

ORIGIN OF RBI

The genesis of Reserve Bank of India (RBI) started in 1926 when the Hilton-Young Commission or the Royal Commission on Indian Currency and Finance made recommendation to the British Government of India for creation of a central bank. The chief objective of such recommendation were twofold:

- To separate the control of currency and credit from the government
- To augment banking facilities throughout the country.

To give effect to above recommendations, a bill was introduced in Legislative Assembly in 1927 but this bill was withdrawn because

Various sections of the people were not in agreement.

The recommendation to create a reserve bank was made by White

Paper on Indian Constitutional Reforms. Thus, a fresh bill wasintroducedand was enacted in 1935.

Thus, Reserve Bank of India was established via the RBI Act of 1934 as the banker to the central government. RBI launched its operations from April 1, 1935.

Its headquarters were in Kolkata in the beginning, but it was shifted to ShahidBhagat Singh Marg, Mumbai in 1937. Prior to establishment of RBI, the functions of a central bank were virtually being done by the Imperial Bank of India, which was established in 1921 by merging three Presidency banks. It was mainly a commercial bank but also served as banker to the government to some extent.

It's worth note that RBI started as a privately owned bank. It started with a Share Capital of Rs.5 Crore, divided into shares of Rs.100 each fully paid up. In the beginning, this entire capital was owned by private shareholders.

Out of this Rs.5 Crore, the amount of Rs.4, 97, 8000was subscribed by the private shareholders while Rs.2, 20,000 was subscribed by central government.

After independence, the government passed Reserve Bank (Transfer to Public Ownership) Act, 1948 and took over RBI from private shareholders after paying appropriate compensation. Thus, nationalisation of RBI took place in 1949 and from January 1, 1949, RBI started working as a government owned central bank of India. Reserve Bank of India is India's central bank, headquartered at Bombay. Central bank of a country execute multiple functions such as overseeing monetary policy, issuing currency, managing foreign exchange, working as a bank of government and as banker of scheduled commercial banks, etc. It also works for overall economic growth of the country.

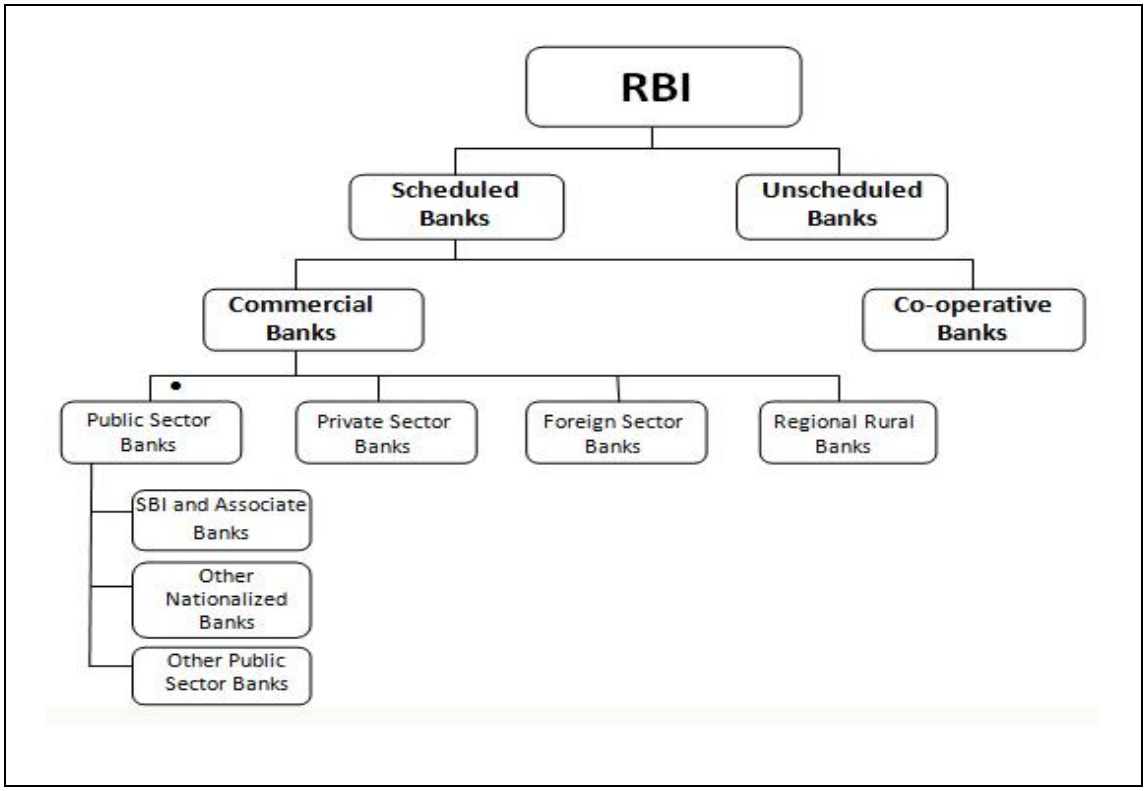
Branches and support bodies

The RBI has four zonal offices at Chennai, Delhi, Kolkata and Mumbai. It has 20 regional offices and 11 sub-offices. Regional offices are located in Ahmedabad,Bangalore,Bhopal,Bhubaneswar, Chandigarh, Chennai, Delhi, Guwahati, Hyderabad, Jaipur, Jammu, Kanpur, Kochi, Kolkata, Dewas, Lucknow, Mumbai, Nagpur, Patna, Dehradun and Thiruvananthapuram and sub-offices are located in Agartala, Aizawl, Gangtok, Imphal, Panaji, Raipur, Ranchi, Shillong, Shimla and Srinagar.

The RBI has four regional representations: North in New Delhi, South in Chennai, East in Kolkata and West in Mumbai. The representations are formed by five members, appointed for four years by the central government and with the advice of the Central Board of Directors serve as a forum for regional banks and to deal with delegated tasks from the Central Board.

It has two training colleges for its officers, viz. Reserve Bank Staff College, Chennai and College of Agricultural Banking, Pune. There are three autonomous institutions run by RBI namely National Institute of Bank Management (NIBM), Indira Gandhi Institute of Development Research (IGIDR), Institute for Development and Research in Banking Technology (IDRBT).There are also four Zonal Training Centres at Mumbai, Chennai, Kolkata and New Delhi.

STRUCTURE OF RBI



Reserve Bank of India (RBI)

The country had no central bank prior to the establishment of the RBI. The RBI is the supreme monetary and banking authority in the country and controls the banking system in India. It is called the Reserve Bank' as it keeps the reserves of all commercial banks.

Scheduled & Non –scheduled Banks

A scheduled bank is a bank that is listed under the second schedule of the RBI Act, 1934. In order to be included under this schedule of the RBI Act, banks have to fulfil certain conditions such as having a paid up capital and reserves of at least 0.5 million and satisfying the Reserve Bank that its affairs are not being conducted in a manner prejudicial to the interests of its depositors. Scheduled banks are further classified into commercial and cooperative banks. Non- scheduled banks are those which are not included in the second schedule of the RBI Act, 1934. At present these are only three such banks in the country.

Commercial Banks

Commercial banks may be defined as, any banking organization that deals with the deposits and loans of business organizations. Commercialbanks issue bank checks and drafts, as well as accept money on term deposits. Commercial banks also act as moneylenders, by way of installment loans and overdrafts. Commercial banks also allow for a variety of deposit accounts, such as checking, savings, and time deposit. These institutions are run to make a profit and owned by a group of individuals

Types of Scheduled Commercial Banks

Public Sector Banks

These are banks where majority stake is held by the Government of India. Examples of public sector banks are: SBI, Bank of India, Canara Bank, etc.

Private Sector Banks

These are banks majority of share capital of the bank is held by private individuals. These banks are registered as companies with limited liability. Examples of private sector banks are: ICICI Bank, Axis bank, HDFC, etc.

Foreign Banks

These banks are registered and have their headquarters in a foreign country but operate their branches in our country. Examples of foreign banks in India are: HSBC, Citibank, Standard Chartered Bank, etc.

Regional Rural Banks

Regional Rural Banks were established under the provisions of an Ordinance promulgated on the 26th September 1975 and the RRB Act, 1976 with an objective to ensure sufficient institutional credit for agriculture and other rural sectors. The area of operation of RRBs is limited to the area as notified by GoI covering one or more districts in the State.

RRBs are jointly owned by GoI, the concerned State Government and Sponsor Banks (27 scheduled commercial banks and one State Cooperative Bank); the issued capital of a RRB is shared by the owners in the proportion of 50%, 15% and 35% respectively.

Cooperative Banks

A co-operative bank is a financial entity which belongs to its members, who are at the same time the owners and the customers of their bank. Co-operative banks are often created by persons belonging to the same local or professional community or sharing a common interest. Co-operative banks generally provide their members with a wide range of banking and financial services (loans, deposits, banking accounts, etc.).

They provide limited banking products and are specialists in agriculture-related products.

Cooperative banks are the primary financiers of agricultural activities, some small-scale industries and self-employed workers.

Co-operative banks function on the basis of “no-profit no-loss”.

Anyonya Co-operative Bank Limited (ACBL) is the first co-operative bank in India located in the city of Vadodara in Gujarat.

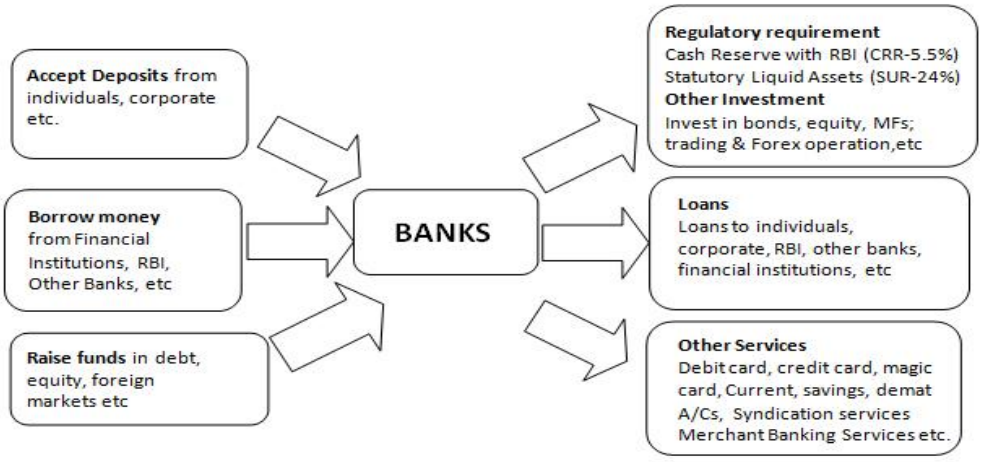
The co-operative banking structure in India is divided into following main 5 categories:

- Primary Urban Co-op Banks
- Primary Agricultural Credit Societies
- District Central Co-op Banks
- State Co-operative Banks
- Land Development Banks

How Banks Function

Banks make money by lending your money out at interest and by charging you for services provided. Banks keep on lending money.

The other big revenue items generated by banks are the fees they charge. Bank charge for every service, whether it is for an electronic transaction, or permitting a transfer through the Internet banking system.



The banking industry in India is highly regulated. Few important regulations are mentioned below:

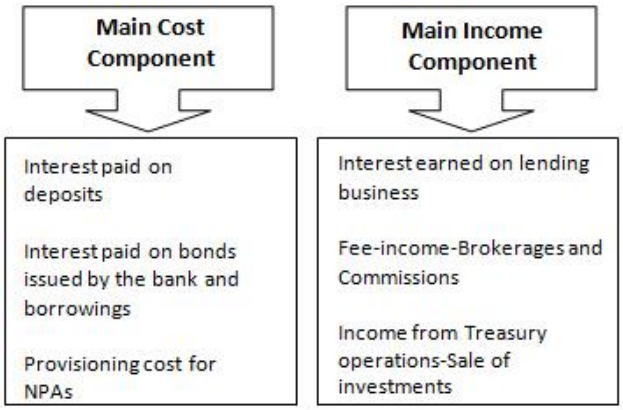
Regulatory Requirements

A bank has to set aside a certain percentage of total funds to meet regulatory requirements. The primary regulatory ratios are **Cash Reserve Ratio (CRR)** and **Statutory Liquidity Ratio (SLR).** RBI uses both these instruments to regulate money supply in the economy.

CRR is the percentage of net total of deposits a bank is required to maintain in form of cash with RBI. Currently this ratio is at 5.5%. This is used to control the liquidity in the economy. Higher the CRR, the lower is the amount that banks will be able to use for lending activities and vice versa.

SLR is the minimum percentage of deposits that the bank has to maintain in form of gold, cash and/or other approved securities. Currently, the SLR is 24%. This is used to regulate the credit growth

The core operating income of a bank is interest income (comprises 75-85% in the total income of almost all Indian Banks). Besides interest income, a bank also generates fee-based income in the form of commissions and exchange, income from treasury operations and other income from other banking activities. As banks were assigned a special role in the economic development of the country, RBI has stipulated that a portion of bank lending should be for the development of under-banked and under-privileged sections, which is called the priority sector. Current rules stipulate that domestic banks should lend 40% and the foreign banks should lend 32% of their net credit to the priority sector. On the cost sides, the major items for a bank are interest paid ondifferent types of deposits, bonds issued and borrowings, and provisioning cost for Non-performing Assets (NPAs).



Objectives

- To test the significance difference between Liabilities of Issue Department and Bank Department.
- To test the significance difference between Assets and Liabilities of Bank Department.
- To check the significant difference among Sources of money stock.
- To check the significant difference between Agricultural and industrial finances.
- To check the significant difference between Deposit and credit of RBI.
- To check the significant difference between saving deposits with commercial banks: Indian banks and foreign banks.
- To check the significant differenceof the Liquidity Adjustment Facility.
- Classify Non-Food Gross Bank credit amount to significant homogenous groups.
- To check the significant difference of Saving Deposits With Commercial Bank.
- To check theproportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks.
- To check the significant difference of Scheduled Commercial Banks' advances to small industries and allied services between Small Enterprises and Small Road and Water Transport Operators.
- To check theproportion of Population Group wise Number of Branches of Scheduled Commercial Banks.
- To check the significant difference of Loans and Advances.
- To test the significance difference of Non-Performing Assets of rural Co-Operative Banks for short term structure.
- To test the significance difference of Non-Performing Assets of rural Co-Operative Banks for long term structure.

DATA COLLECTION

Data collection is the process of gathering and measuring information on targeted variables in an established systematic way, which then enables us to answer relevant question and evaluate outcomes.

Generally, there are two types of Data Collection methods and they are:

I. Primary Data Collection

II. Secondary Data Collection

Primary Data can also be known as first hand or unorganized data. Its information collected from sources such as personal interviews, questionnaires or surveys with a specific intention and on a specific subject. It can be a lengthy process but does provide first-hand information.

Secondary Data can also be called second hand data. It's an information that is already available somewhere, whether it be in journals, on the internet, in corporate or government archives.

Here we've used Secondary data taken from the Handbook of statistics on Indian economy RBI during year 2016-17.

Chapter – 2

Review of the selected references

1. Amit K.Parmar and Dr. A. R. Kulkarni "**Productivity Analysis OF Commercial Banks in India': A Comparative Study of Selected Public and Private sector Banks**." Advance and deposits of a branch together reflect the overall banking system and its productivity. The ratio shows the productivity efficiency of two banks. So, with the help of the data ratio have been calculated to understand the performance of the selected banking groups. The F-statistics is simply a ratio of two banks. Banks are a measure of dispersion. Therefore, it can be concluded that there was significant difference in profit per employee ratio in selected banking sector in India.

2. H. M. Shah and A. J. Rajyaguru, "**Study for the relationship of share of sectors in credit utilization and GDPR for Gujarat and other selected states**". They consider State wise percentage share of sectors to GDPR and total credit utilization. They compared both percentage shares by KW test and then Jonkheretreatptra test for multiple ordered comparisons and fit the regression model for GDPR on Share of tertiary in GDPR and credit utilization. They conclude the State wise relationship between percentage share of sectors to GDPR and percentage share of sectors to total credit utilization has statistically significant relationship. The fitted model for GDPR has significant and there is no co-linearity between Share of tertiary in GDPR and credit utilization by VIF.

3. Sanjay Kumar Hansda**"Fiscal Monetary Policy Co-ordination and Institutional arraangements for government debt. And cash management: A Medium term outlook".** He considersGFDR (Gross Fiscal Deficit to GDP) and Call rate as study variables. From Granger causality for uni-directional or bi-directional test he found the fiscal deficit to GDP (Gross Domestic Product) Ratio uni- directionality caused a change in the call rate. A regression analysis is a set of statistical processer for estimating relationship between GFDR (Gross Fiscal Deficit to GDP) and Call rate. He develop the regression model for dependent variable call rate and one or a more independent variable GFDR, inflation gap, output gap

and dummy variables, such as stressed domestic liquidity condition in foreign exchange market and easing of domestic liquidity condition. He found the significant regression model with 75% variation and all parameters are statistically significant.

4.Samuel O. Fadare "**Banking Sector Liquidity and Financial Crisis in Nigeria**". To trace the development and impact of Nigerian banking liquidity regulations, a liquidity demand model was specified by taking into account of lagged ratio of total loan to total Banking Sector deposits, ratio of total specified liquid assets to total current liabilities, volatility of the ratio of currency in circulation to total Banking Sector deposits.

He found that banking loans have small, often negative and insignificant effects on variables. The model explains over 67 per cent of the variation in Banking Sector liquidity over the 30-year estimation period. The adjusted R-squared (58 per cent) and root MSE (0.10) indicates "a good" fit of the model for the provided data.

Results of both the Breusch–Godfrey serial correlation Lagrange multiplier test and Durbin-Watson alternative test of autocorrelation confirms the assumption of no serial dependence within the time series data as null hypotheses are not rejected because $p>0.05$.

The results suggest that during non-financial crisis periods, deposit money banks either hold excess liquidity or hold liquidity consistent with policy benchmarks. However, during financial crises periods, deposit money banks are significantly illiquidity relative to benchmarks, therefore, significantly increasing their vulnerability to distress.

5. AlmirAlihodzic-University of Zenica&Hye-jin-cho-University of Paris," Analysis of Systematic Liquidity Risk for the Banking Sector in Bosnia &Herzegovina". Here they did ANOVA test on Bosnia & Herzegovina for

profitability index & debt ratio on the theme of correlation. In addition, they test liquidity risk by Monte Carlo simulation, which allows the distribution of liquidity as well as probability of insolvency. They compare value of assets of financial intermediaries in BH for 2011-2013. They compared the performance indicators of the banking sector in BH for the quarter 4 of 2013-quarter 4 of 2014(in %) & also they calculate index value with base year 2013. They fitted the multiple linear regression model between parameters liquidity-liquid assets / total assets (LA / TA) of the banking sector in BH is used as a dependent variable and the NPLs / total loans (NPLs / TL) ,average profitability on equity capital (APEC), non-interest expenses / total revenue (NIE / TR), the average required reserve (ARR), total loans (TL), the money supply in the wider sense (M2), net capital / risk weighted assets (NC / RWA) and NPAs / Total assets (NPA / TA) are used as independent variables. In this paper, the Analysis of systematic liquidity risk has done between economics & finance. They also did analysis between assets & liabilities with the balance principle. The purpose of this paper is to relate the Danish concept of balance principle. The parameter liquidity i.e. liquid assets /total assets will be observed as a dependent variable & non-performing loans/total loans, average profitability on equity capital, non-interest expenses /total revenue, the average required reserve etc. are observed as in dependent variables.

Chapter – 3

Statistical Methodology

Independent t test:

Assumption:

1. The experiment is interested in the two population means, $\mu_1 - \mu_2$
2. The two samples, one from each population, are independent.
3. Both population are normal, or at least approximately so.
4. The population variance are unknown but are the same for both population, $\sigma_1^2 = \sigma_2^2 = \sigma^2$

Procedure: inference About Two Independent Sample

Assumption: normality or at least symmetry and unimodality

σ_1^2, σ_2^2 unknown $\sigma_1^2 = \sigma_2^2$ and n_1 or $n_2 < 30$

Confidence Interval on $\mu_1 - \mu_2$

$$CI_{1-\alpha} : \overline{y_1} - \overline{y_2} \pm t_{\alpha/2,n1+n2-2} \sqrt{\frac{S^2p}{n_1} + \frac{S^2p}{n_2}}$$

$$S^2p = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

Test of hypothesis:

$H_0 : \mu_1 - \mu_2 = (\mu_1 - \mu_2)_0$
$H_1 : \mu_1 - \mu_2 \neq (\mu_1 - \mu_2)_0$ OR
$\mu_1 - \mu_2 > (\mu_1 - \mu_2)_0$ OR
$\mu_1 - \mu_2 < (\mu_1 - \mu_2)_0$

Significance level:α

Test statistics:

$$t = \frac{\overline{y_1} - \overline{y_2} - (\mu_1 - \mu_2)_0}{\sqrt{\frac{S^2p}{n_1} + \frac{S^2p}{n_2}}} \qquad \text{with } S^2P \text{ as above}$$

Region rejection: $|t| \geq t_{\alpha/2,n1+n2-2}$ or $t_{\alpha,n1+n2-2,}$ respectively.

One Way ANOVA:

Introduction:

Analysis of variance is a technique for testing the simultaneous significance of the difference among the mean of several categories as developed by prof. R.A.Fisher in 1920's.

Assumption:

1. Samples are randomly drawn from the population.

2.Samples are independently drawn.

3.Samples are drawn from normally distributed population.

4. Population variances are equal.

5. There should be at least two observations which each class otherwise analysis of variance technique can not be applied.

Application of ANOVA:

$\rightarrow$ In design of experiments for comparing different treatment, we use CRD (Complete randomized block design) it is similar to one way ANOVA.

$\rightarrow$ For testing the significance of regression model.

If we want to compare type of fertilizer with treatment given as we use RBD (Randomized block design) it is similar to two-way ANOVA

Test based on more than two mean:

Suppose there are K normal populations with means $\mu_{1,}\mu_{2,\ldots\ldots\ldots}\mu_k$ and common variance σ^2. Further, let K random samples, one from each population, are drawn from these populations. Let n_i,(i=1, 2,….k)be the size of the sample from i'th population using the sample information, we wish to test.

MNOVA (Multivariate Analysis Of Variance)

(Comparing several multivariate population mean)

Often more than two population need to be compare random samples collected from (g) group of population are arranged as population.

1	$X_{11}, X_{12}, \ldots\ldots X_{1n1}$
2	$X_{21}, X_{22}, \ldots\ldots X_{2n2}$
;	; ; ;
;	; ; ;
g	$X_{g1}, X_{g2}, \ldots . X_{gng}$

MANOVA is used first to investigate whether the

Population mean vector are the same and if not which means components are for significant.

Assumption For MNOVA:

1. $X_{11}, X_{12}, \ldots\ldots X_{1n1}$ is a random sample of size nand l from a population with $\mu_{1,} l = 1.2.....g$. The random sample from different population is independent.
2. All population has a common co-variance matrixΣ.
3. Each population is multivariate normal condition three can be relaxed by appealing to the central limit theorem when the sample size n_i.

Hypothesis and model:

We want to test equality of mean parameters so we have to hypothesis.

$$H_0 : \mu_1, \mu_2 ..., \mu_g$$

$H_1 : \mu_i \neq \mu_j$ For at least one pair (i, j) ε (1, 2, 3…g)

Now we have the model,

$$X_{ij} = \mu + T_i + e_{ij}$$

j=1, 2 … n_i

i=1, 2 … g

Where $X_{ij} = j^{th}$ observation i^{th} sample

$T_i = i^{th}$ treatment effect

μ = overall mean

ε_{ij} ~i.i.d. NP (0,Σ)

For the case we have to compare means of g greater than two normal populations. Here g follows N ~(μ_i , ε) for g independent samples.

Now we get MNOVA table for comparing population mean vectors.

MNOVA table

Source of Variation	**D.F.**	**Matrix of Sum of Square**
Between(treatment)	g-1	$B = \sum_{i=1}^{g} n_I (\overline{X_I} - \overline{\overline{X}})(\overline{X_I} - \overline{\overline{X}})^{-1}$
Residual (Error)	n-g	W= $\sum_{i=1}^{g} (n_i - 1)S_i$
Total	n-1	$T = B + W$

Here test $H_0 : T_1 = T_2 = T_3 = ...T_g = 0$ involves generalized variance. We reject H_0 if the ratio of genel'y variance.

$$\Lambda = \frac{|W|}{|B + W|}$$

Here the quantity Λ is known as willks Λ critical,

Here F –test to be we for the hypothesis no treatment effects in the particular case.

$$F_{cal} = \left(\frac{n-p-2}{p}\right) * \left(\frac{1-\sqrt{\Lambda}}{\sqrt{\Lambda}}\right)$$

$$F_{tab} = F_{\alpha(2p,2(n-p-1))}$$

Large sample Approximation:

When a is large than use large sample like BARTLETTS approximation than follows χ^2 - distribution with p (g-1) d.f. Then we reject H_0 at significant level of alpha.

$$\chi^2_{cal} = -m * \ln\Lambda$$

Where m= (n-1)-$\left(\frac{p+g}{2}\right)$

$$\chi^2_{tab} = \chi^2_{\alpha,p(g-1)}$$

Here $F_{cal} > F_{tab}$, so we can say that the reject H_0 at significant level of alpha.

Non-parametric MANOVA

Performs analysis of one way multivariate data, for small samples using Nonparametric techniques. Using approximation for ANOVA Type, Wilks' Lambda, Lawley Hotelling, and Bartlett Nanda Pillai Test statistics, the package compares the multivariate distributions for a single explanatory variable. The comparison is also performed using a permutation test for each of the four test statistics. The package also performs an all subsets algorithm regarding variables and regarding factor levels.

Mann Whitney U Test:

Another procedure for testing the null hypothesis of equal population location parameter was proposed by 'Mann and Whitney'. Although Festiner, White, and Wilcoxon have proposed equivalent procedure, the test is usually referred to as the 'Mann-Whitney' test. The test is sometime also referred to as the 'Mann-Whitney-Wilcoxon' test. Wilcoxon considered only case of equal sample size and used a rank sum as the test statistic. Mann and Whitney who seem to have been the first treat the

case of unequal samp,le size, point out the relationship between their test statistic, as given below, and that of Wilcoxon.

Assumption:

- That data consist of a random sample of observation X_1X_2…….,X_{n1} from population-I with unknown median M_x, and another random sample of observation Y_1Y_2…….,Y_{n2} from population-I with unknown median M_y.
- The two samples are independent.
- The variable observation is a continuous random variable.
- The measurement scale employed is at least ordinal.
- The distribution functions of the two population differ only with respect to location, if they differ at all.

Hypothesis:

- **Two sided**

  H_0: $M_x = M_y$

  V/S

  H_1: $M_x \neq M_y$

Test statistic:

- **Large Sample Approximation:**

  When either n1 or n2 is greater then ___, we can not use table. When n1 and n2 are both larger, however, the central limit theorem applies. Then,

$$Z = \frac{T - n_1 n_2/2}{\sqrt{n_1 n_2 (n_1 + n_2 + 1)/12}}$$

OR

$$Z = \frac{T - \mu_T}{\sigma_T}$$

Where, $\mu_T = \frac{n_1 n_2}{2}$

$$\sigma_T = \frac{n_1 n_2 (n_1 + n_2 + 1)}{12}$$

Decision Rule: If p-value is less then significance level then we rejects H_0 otherwise we accept H_0.

Wilcoxon Signed Ranks Test

Why:

Comparing to related samples:

The Wilcoxon signed-rank test considers information about both the sign of the differences and the magnitude of the differences between pairs. Because the Wilcoxon signed-rank test incorporates more information about the data, it is more powerful than the sign test.

Hypothesis:

Null Hypothesis: $H_{0:}\ M_D = 0$

Alternative Hypothesis: A. $H_1: M_D \neq 0$ (two)

B. $H_1: M_D > 0$ (right)

C. $H_1 : M_D < 0$ (left**)**

Steps:

1. Obtain each of the sign differences Di= Yi – Xi
2. Rank the absolute value of these differences from smallest to largest that is |Di| = |Yi – Xi|
3. Assign to each of the resulting rank the sign of the differences most absolute value yield that rank.
4. Compute T+ = the sum of ranks with positive signs and T- = the sum of ranks with negative signs and T+ or T- is the statistic depending on the alternative hypothesis.

Interpretation:

A. $H_1 : M_D \neq 0$ (two)

Reject H0at α level of significant if T= min (T+, T-), statistic T is smaller then or equal to tabulated T for n and pre-selected $\alpha/2$

B. $H_1: M_D > 0$ (right)

Reject H0at α level of significant if T- is smaller than or equal to tabulated T for n and pre-selected α

C. $H_1 : M_D < 0$ (left)

Reject H0at α level of significant if T+ is greater than or equal to tabulated T for n and pre-selected α

Kruskal-Wallis test:

Assumptions:

- The data for analysis consist of k random of size n1,n2…..nk
- The observations are independent both within and among sample.
- The variable of interest is continuous.
- The measurement scale is at least ordinal.
- The population is identicalexceptfor a possible difference in location for at least one population.

Hypothesis:

H_0**:** The k population distribution functions are identical.

V/S

H_1**:** The k population do not all have the same median.

Test statistic:

$$H = \frac{12}{N(N+1)} \sum \frac{1}{ni} \left[R_i - \frac{n_i[N+1]}{2} \right]^2$$

Where; Ri is the sum of the ranks assign to observation.

Decision Rule:

1. When k>2 and ni, i=1,2,3.. computed value of H is to be compared with the critical value. Where table value are available.
2. when we can not use table with compare calculated H with chi-square statistics with k-1 degree of freedom at significant level of α. i.e.

$$H > \chi^2_{k-1(\alpha(}$$

BOX-Ljunk TEST

The Box-Ljunk test(1978) is a diagnostic tool used to test the lack of fit of a time series model. The test is applied to the residuals of a time series after fitting an ARMA(p,q) model to the data.The test examines m autocorrelations of the residuals.If the autocorrelations are very small,we conclude that the model does not exhibit significant lack of fit.

Hypothesis:

H_0: The model does not exhibit lack of fit.

V/S

H_1: The model exhibit lack of fit.

Test statistic:

$$Q = n(n+2)\sum_{k=1}^{m}\frac{\hat{r}^2 k}{n-k}$$

Where $\hat{r}^2 k$ is the estimated autocorrelation of the series at lag k and m is the number of lags being tested and Significance level : α

Critical region:

The Box-Ljung test rejects the Null hypothesis (indicating that model has significant lack of fit) if $Q > \chi 2_{1-\alpha,h}$

Where $\chi 2_{1-\alpha,h}$ is the chi-square distribution table value with h degrees of freedom and significance level α.

Because the test is applied to residuals,the degree of freedom must account for the estimated model parameters so that h=m-p-q,where p and q indicate the number of parameters from the ARMA(p,q) model fit to the data.

Correlation:

Often several quantitative variables are measured on each member of a sample. If we consider a pair of such variable, it is frequently of interest to establish if there is a relationship between the two; to see if they are correlated.

We can categorize the type of correlation by considering as one variable increase what happens to the other variable.

Correlations are of three types:

- **Positive correlation: -** The other variable hasa tendency to also increase;
- **Negative: -** The other variable hasa tendency to also decrease;
- **No Correlation: -** The other variable does not tend to either increase or decrease.

Regression Analysis:

Multiple Linear Regression Model:

The relation of dependent variable Y with the independent variables X_1, X_2 ...X_k involving the parameters β_0, β_1,β_2,.....β_k of the type.

$Y=\psi(X_1, X_2.....X_k \mid \beta_0, \beta_1,\beta_2,.....\beta_k) + \varepsilon$ is called regression model.

Where, ψ indicates the from of the equation and ε is a random variable

Distributed with mean 0 and variance σ_e^2 and is known as the residual or error term. Such a regression equation is called statistical or probabilistic model. The main advantage of probabilistic model is that enables one to draw inferences about the parameter β_0, β_1,β_2,.....β_k . As special case, a function of the type $Y=\psi(X_1, X_2.....X_k \mid \beta_0, \beta_1,\beta_2,.....\beta_k)$ is known as deterministic model.

More specifically, the statistical model for simple linear regression of Y on X is:

$Y=\beta_0+ \beta_1X+\varepsilon$

In this equation β_0 is the intercept which the line cuts on the X axis of Y and β_1 is the slop of the line and is called the regression coefficient...ε is error which is distribution as $N(0,\sigma_e^2)$.

Assumptions of Linear Regression:

The assumptions of linear regression are:

1) **Liner regression model** i.e. the regression model is linear in the parameters.

2) X values are fixed in repeated sampling.

3) **0 mean value of error term ui**. i.e. given value of X the mean or expected value of error term u_i is 0. $E(u_i) = E(u_i/X_i) = 0$

4) **Equal variance or homoscedasticity of u_i.** i.e. given the value of X the variance of u_i is same for all observations. $V(u_i /X_i)=V(u_i)= E(u_i^2)=\sigma^2$

5) **No autocorrelation between error terms:** given any two X values Xi and Xj (i≠j), the correlation between any two u_i and u_j (i≠j) is 0

i.ecov $(u_iu_j) = E(u_iu_j) – E(u_i) E(u_j)$

$= E(u_i,u_j)$

$=0$

6) **Zero covariance between ui and X_i**

$Cov(u_i X_i) = E(u_i X_i) – E(u_i) E(X_i)$

$= E (u_i X_i)$

$= 0$

Error term and explanatory variables are linearly independent.

7) The number of observations (n) must be greater than Number of parameters to be estimated.

8) **There is no perfect multi-collinearity**: There are no perfect liner relationships among the explanatory variables.

Testing of regression coefficients:

Null Hypothesis:

$H_0: \beta_i=0 \quad i=1,2,3.....,p$

Test statistics:

$$t_{cal} = \frac{\hat{\beta}_i}{SE(\hat{\beta}_i)}$$

$$d.f. = t_{n-p-1}$$

Decision:

If $t_{cal} \geq t_{tab}$ thenReject H_0otherwise do not reject H_0

Goodness of fit:

Null Hypothesis:

$H0: \beta_0= \beta1=\beta2=.....=\beta_p =0$

Test statistics:

$$R^2 = \frac{SSR}{SST} = \frac{\sum_{i=1}^{n}\left(\hat{Y}_i - \bar{Y}\right)^2}{\sum_{i=1}^{n}\left(Y_i - \bar{Y}\right)^2} = 1 - \frac{\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)^2}{\sum_{i=1}^{n}\left(Y_i - \bar{Y}\right)^2}$$

$$F = \frac{R^2 / p}{(1-R^2)/(n-p-1)} \quad where, d.f. = p, n-p-1$$

Decision:

If $F_{cal} \geq F_{tab}$ then Reject H_0 otherwise do not reject H_0.

Under H_0, the mean square ratios has a F- distribution with p, n-p-1 D.f. Based on the ANOVA table, we may calculate the multiple correlation coefficients R^2, related to the F – test, that gives the proportion of variance of the response variable accounted for by the explanatory variables. We will discuss it in more detail later on.

Detection of various assumptions:

Method of detection of Heteroscedasticity:

- **Bartlet's Test**
- Breusch – Pagan – Godfrey Test(BPG)
- Spearmen's Rank correlation Test
- Glejser Test
- Park Test
- General White's Test
- Goldfeld-Quandt Test

Bartlet's test

H0: The error terms are homoscedastic.

H1: The error terms are heteroscedastic.

Following the steps

Step:1 group the observation on Y in to nHo homogeneous group.

Step:2For each group compute $S_i = \sum\left(y_{ij} - \overline{y_i}\right)^2$

Where, $\overline{y_i} = \frac{\sum y_{ij}}{n_i}$ and $n = \sum n_i$

Step:3 Compute the ratio test statistic λ define as

$$\lambda = \frac{\prod\left(\frac{S_i}{n_i}\right)^{n_i/2}}{\left(\frac{\sum S_i}{\sum n_i}\right)^{\sum n_i/2}}$$

If has been shown that $\chi^2_{cal} = -2\log\lambda$ follows χ^2_{m-1} d.f. where m is a no. of group.

Step:4Reject H_0 at a α level of significant $\chi^2_{cal} > \chi^2_{tab}$ (χ^2_{m-1}, α) . Otherwise do not reject H_0.

Detection of Multicollinearity

VIF (Variance Inflating Factor)

The speed with which variance and covariance increases can be seen with VIF which is define as VIF= $\frac{1}{1-r_{23}^2}$ for two explanatory variable X_2 and X_3.

VIF shows how the variance of an estimator is inflated by the presence of multi co linearity.

As r_{23}^2 approaches 1 The VIF approaches infinite (∞) that is extent of co linearity increases the variance of an estimator increases and it become infinite and if there is no co- linearity between X_2 and X_3 then VIF will be 1.

Using the definition we can express the variance of $\hat{\beta}_2$ and $\hat{\beta}_3$ are

$$V(\hat{\beta}_2) = \frac{\sigma^2}{\sum X_2^2\left(1-r_{23}^2\right)} = \frac{\sigma^2}{\sum X_2^2} * VIF$$

$$V(\hat{\beta}_3) = \frac{\sigma^2}{\sum X_3^2\left(1-r_{23}^2\right)} = \frac{\sigma^2}{\sum X_3^2} * VIF$$

Which shows the V ($\hat{\beta}_2$) and V ($\hat{\beta}_3$) are directly proportional to VIF .

Thumb Rule:

When VIF is more than 10 then there is a serious problem of Multi co- linearity and it have to be removed.

•Tolerance (TOL)

Suppose we have linear regression model

$$Y=\beta_1+\beta_2X_2+\beta_3X_3+....+\beta_kX_k+u$$

Where (K+1) variable linear regression model have variance of V ($\hat{\beta}j$)

$$=\frac{\sigma^2}{\sum X_j^2} * \frac{1}{(1-R_j^2)}$$

Where j= 1, 2…k

$\hat{\beta}j$ is estimated partial regression co-efficient

$R_j^2 = R^2$ in the regression of X_j on the remaining (k-1)

repressors

$$\sum X_j^2 = \sum\left(X_j - \overline{X_j}\right)^2$$

$$\& \; V(\hat{\beta}j) = \frac{\sigma^2}{\sum X_j^2} * VIF_j$$

As we can express V ($\hat{\beta}j$) is proportional to σ_u^2 and VIF_j & inversely proportional to $\sum X_j^2$. Thus whether V ($\hat{\beta}j$) is larger or small will depends on three ingridiance σ^2,

VIF & $\sum X_j^2$. It may be noted that the inverse of VIF is called Tolerance (TOL) that is

$$TOL_j = \frac{1}{VIF_j} = (1 - R_j^2)$$

Where R_j^2=1 that is perfect co- linearity then TOL_j=0 and when R_j^2=0 that is no co- linearity then TOL_j=1.

Because of the reverse connection between VIF and TOL the researcher can use any one of them.

Remark:

Generally the Thumb rule is when VIF is greater than 10 and tolerance is nearer to 0 then there is a serious problem of multi co-linearity.

Error terms are normally distributed with 0 mean and variance σ^2:

- Shapiro – Wilk Test
- Kolmogorov Smirnov Test

Dealing with violation in assumptions

- Log transformation

$AR_{(P)}$ Model

In the Box-jenkings approach to analyzing time series, a key question is whether to difference the i.e. to replace the raw data { X_t } by the differenced series { X_t - X_{t-1} }.Experience indicates that most economic time series tend to wander and are not stationary, but that differencing often yields a stationary result. A key example, Which often provide a fairy good description of actual data, is the random walk, X_t = X_{t-1} + ε_t , where $\{\varepsilon\}$ is white noise, assumed here to be independent, each having the same distribution(e.g., normal, t, etc.). The random walk is said to have a unit root.

To understand what thus means, let's recall the condition for stationary of an **$AR_{(P)}$** model. In chapter __, part II we said that $AR_{(P)}$ series

$$X_t = \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + ... + \alpha_t X_{t-p} + \varepsilon_t$$

Will be stationary if he largest root θ of the equation (in the complex variable z)

$z\,p = \alpha 1 zp-1+\alpha 2 zp-2 +\ldots.+ \alpha p-1 z + \alpha p$

Satisfied $|\theta|<1$.So stationary is related to the location of the roots of equation (1).

We can think of the random walks as an AR (1) process, $X_t = \alpha\ xt-1+\varepsilon t$ with $\alpha = 1$. However, since it has $\alpha=1$, the random walks is not stationary .Instead for an AR (1) to be stationary, it is necessary that all roots of the equation $z= \alpha$ have "absolute value" less than 1. Since the root of equation $z= \alpha$ is just α, we see that the AR (1) is stationary if and only if $-1< \alpha<1$. For the random walk, we have a unit root that is a root equal to one. The first difference of a random walks is stationary however,

Since $X_t = X_t\ -1 = \varepsilon_t$,a white noise process. In general, we say that a time series { X_t } is integrated of order 1,, denoted by I (1), if { X_t } is no stationary but the first difference {xt-xt-1} is stationary and invertible . If { X_t } is I (1), it is considered important to difference the data , primarily because we can then use all of the methodologies developed for stationary time series to build a model, or to otherwise analyze , the differenced series . This is turn improves our understanding (e.g., provides better forecasts) of the original series, { X_t } For example, in the Box-Jenkins ARIMA (p,1,q) model , the differenced series is modeled as a stationary ARMA (p ,q) process. In practice, then, we need to decide whether to build a stationary model for the raw data or for the differenced data.

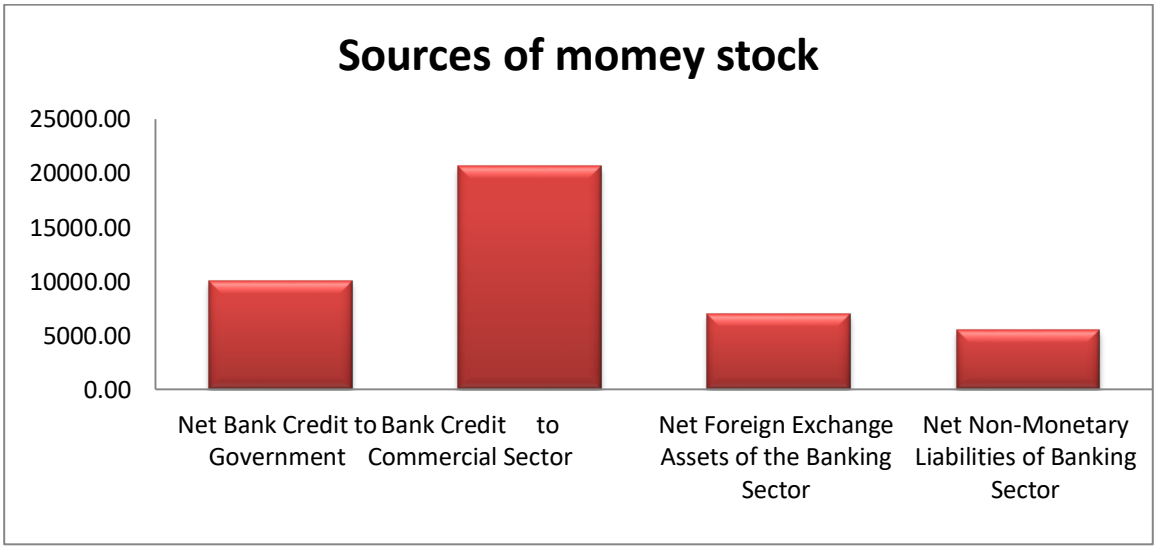
More generally, there is the question of how many times we need to difference the data. In the ARIMA (p, d, q) model, the d'th difference is a stationary ARMA (p, q). The series is integrated order d, denoted by I (d) , where d is an integer with $d \geq 1$, if the series and all its differences up to the d -1'st are no stationary , but the difference is stationary . A series is said to be integrated order zero, denoted by I (0), if the series is both stationary and invertible. (The importance of invariability will be discussed later). If the series { X_t } is I (d) with $d \geq 1$, then the differenced series {xt-xt-1} is I (d-1).

Chapter – 4

Statistical Comparisons of various factors of RBI

Sources of money stock:

RBI covers money stock from four major components (i) Net Bank Credit to Government (ii) Bank Credit to Commercial Sector (iii) Net Foreign Exchange Assets of the Banking Sector and (iv) Net Non-Monetary Liabilities of Banking Sector. Net Bank Credit to Government has sub components such as Net RBI Credit to Central Government, Net RBI Credit to State Governments and other Banks Investments in Government Securities. Bank Credit to Commercial Sector has sub components such as RBI Credit to Commercial Sector and other Banks' Credit to Commercial Sector. Net Foreign Exchange Assets of the Banking Sector has sub components such as Net Foreign Exchange Assets of the RBI and Net Foreign Exchange Assets of other Banks. Net Non-Monetary Liabilities of Banking Sector has sub components such as Net Non-Monetary Liabilities of RBI and Net Non-Monetary Liabilities of other Banks.



Objective

"To check the significant difference among Sources of money stock"

Hypothesis testing

To check the significant difference among sources of money stock first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: All components are normally distributed.

H_1: All components are not normally distributed.

Table-1 Test of Normality

Components	Statistic	p Value
Net Bank Credit to Government	0.952905	0.2176
Bank Credit to Commercial Sector	0.934501	0.0720
Net Foreign Exchange Assets of the Banking Sector	0.910751	0.0179
Net Non-Monetary Liabilities of Banking Sector	0.892846	0.0066

Conclusion: From the above Table-1, we can conclude thatNet Bank Credit to Government and Bank Credit to Commercial Sector are normally distributed while Net Foreign Exchange Assets of the Banking Sector and Net Non-Monetary Liabilities of Banking Sector are not normally distributed. Therefore, we use Kruskal-Wallis Test to check the significant difference among Sources of money stock

Null Hypothesis:

H_0: There is no significant difference among sources of money stock.

H_1: There is significant difference among sources of money stock.

Table-2 The NPAR1WAY Procedure

Components	N	Mean Score
Net Bank Credit to Government	29	64.137931
Bank Credit to Commercial Sector	29	74.448276
Net Foreign Exchange Assets of the Banking Sector	29	50.482759
Net Non-Monetary Liabilities of Banking Sector	29	44.931034

Krushkal-Wallis Test	
Chi-Square	13.7058
DF	3
Pr> Chi-Square	0.0033

Conclusion: From the above Table-2, we can conclude that, there is a significant difference among Sources of money stock.

Table-3 (Multiple Comparisons)

Components	Mean	Groups	
Net Non-Monetary Liabilities of Banking Sector	7.903	A	**
Net Foreign Exchange Assets of the Banking Sector	7.930	A	B
Net Bank Credit to Government	8.752	A	B
Bank Credit to Commercial Sector	9.252	**	B

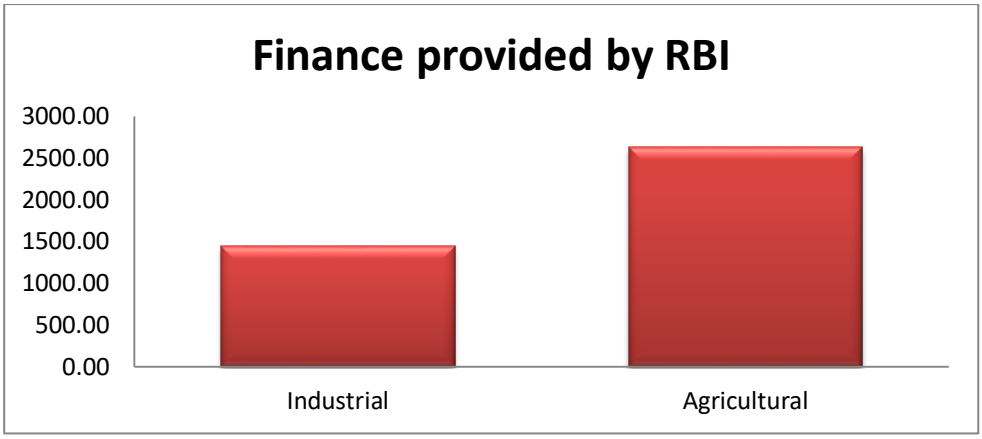
"** indicates that Bank Credit to commercial sector and Net Non-Monetary Liabilities of Banking Sector are statistically significant while alphabets indicate both groups are statistically insignificant."

Interpretation:

From chart and testing, we can conclude that bank credit to commercial sector is higher and a net non-monetary liability of banking sector is lowest sources of money stock. The average bank credit to commercial sector is statistically significant to net non-monetary liabilities of banking sector. From multiple comparisons, we can conclude that, non-monetary liabilities, net foreign exchange assets of the banking sector and net bank credit to government are insignificant also net foreign exchange assets of the banking sector, net bank credit to government and bank credit to commercial sector are insignificant.

Agricultural and industrial finance

Agricultural andindustrial developments are requirement for economic growth of the country. The RBI realizes the basis contributions of the agricultural and industrial sector in the overall economic development. Therefore, it provides the financial help to Agricultural and industrial sectors.



Objective

"To check the significant difference between Agricultural and industrial finances"

Hypothesis testing

To check the significant difference between Agricultural and industrial finances first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Agricultural and industrial finances are normally distributed.

H_1: Agricultural and industrial finances are not normally distributed.

Table-1 Test of Normality

Finance	Shapiro-WilkStatistic	p Value
Agricultural	0.885022	0.0044
Industrial	0.907571	0.1500

Conclusion: From the above Table-1, we can conclude thatIndustrial finance is normally distributed while Agricultural finance is not normally distributed. Therefore, we use Mann-Whitney Test to check the significant difference between both finances provided by RBI.

Null Hypothesis:

H_0: There is no significant difference between Agricultural and industrial finances.

H_1: There is significant difference between Agricultural and industrial finances.

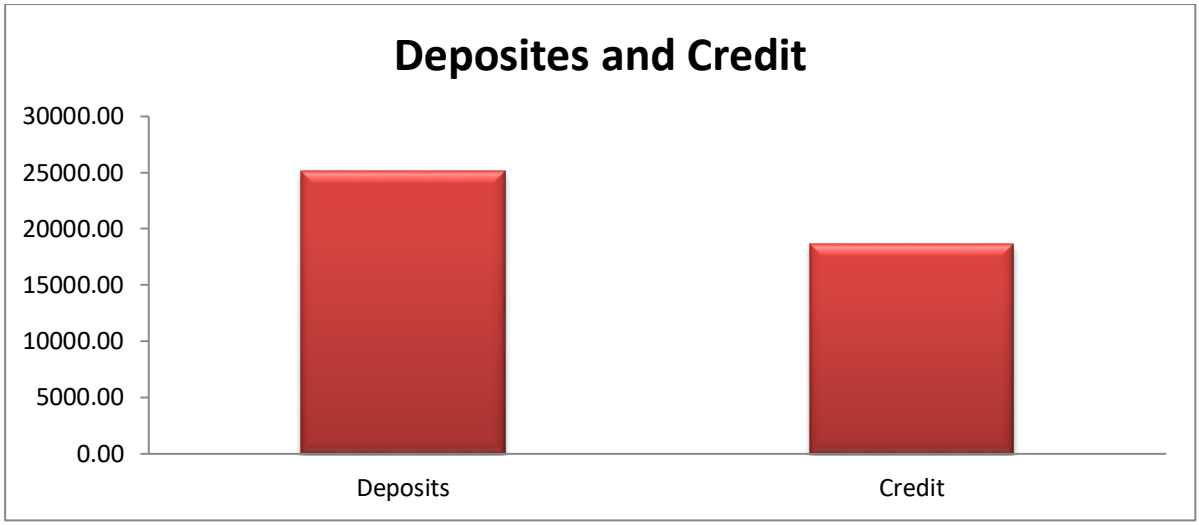
Table-2 The NPAR1WAY Procedure

Statistic	756.0000
Normal Approximation	
Z	-1.5474
One-Sided Pr< Z	0.0609
Two-Sided Pr> |Z|	0.1218
t Approximation	
One-Sided Pr< Z	0.0637
Two-Sided Pr> |Z|	0.1273

Conclusion: From the above Table-2, we can conclude that,there is insignificant difference between agricultural and industrial finances. RBI provides on an average same finance to agricultural and industrial sector for economic development of India.

Deposit and credit of RBI:

An economic system of RBI is affect by credit and deposit. Credit is arrived at by summing up food credit provided by commercial bank, state government and co-operative agencies and non food credit. Deposits represent the cash balance maintained with RBI by central and state government banks, all India financial institutes such as export import.



Objective

"To check the significant difference between Deposit and credit of RBI"

Hypothesis testing

To check the significant difference between Deposit and credit first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Deposit and credit are normally distributed.

H_1: Deposit and credit are not normally distributed.

Table-1 Test of Normality

	Shapiro-WilkStatistic	p Value
Deposit	0.947182	0.1546
Credit	0.938624	0.0923

Conclusion: From the above Table-1, we can conclude thatDeposit and credit are normally distributed. Therefore, we use t-test to check the significant difference between Deposit and credit of RBI.

Null Hypothesis:

H_0: There is no significant difference between Deposit and Credit of RBI.

H_1: There is significant difference between Deposit and Credit of RBI.

t-Tests				
Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	56	1.18	0.2432

Conclusion: From the above Table-2, we can conclude that,there is insignificant difference between Deposit and Credit. RBI provides on an average same Deposit and Credit to various sectors. So, RBI helps to balance the economic growth of India.

Saving deposits with commercial banks:

RBI savings deposits department work with two types of commercial bankssuch as Indian banks which is state-owned financial services company established in 1907 and foreign bankswhich is outside the country.

Objective

“To check the significant difference between saving deposits with commercial banks: Indian banks and foreign banks”

Hypothesis testing

To check the significant difference between saving deposits with commercial banks: Indian banks and foreign banks first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Saving deposits with Indian and Foreign banks are normally distributed.

H_1: Saving deposits with Indian and Foreign banks are not normally distributed.

Table-1 Test of Normality

Components	Statistics	p-value
Indian Banks	0.955825	0.1292
Foreign Banks	0.912319	0.0051

Conclusion: From the above Table-1, we can conclude thatsaving deposits with commercial banks: Indian banks and foreign banks are not normally distributed. Therefore, we use Mann-Whitney Test to check the significant difference between Indian and foreign savings.

Null Hypothesis:

H_0: There is no significance difference in saving deposits with commercial banks: Indian Banks and Foreign Banks.

H_1: There is significance difference in saving deposits with commercial banks: Indian Banks and Foreign Banks.

Table-2 The NPAR1WAY Procedure

Variable	N	Mean Score
Indian Banks	39	0.794872
Foreign Banks	39	0.205128

Statistic	2173.0000
Normal Approximation	
Z	6.3208
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001
t Approximation	
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001

Conclusion:

We can see that, the average saving deposits by Indian Banks is higher than Foreign Banks. We can conclude that, difference between saving deposits with commercial banks: Indian Banks and Foreign Banks are significant. Saving deposits in RBI give proper attention to growth of Indian savings.

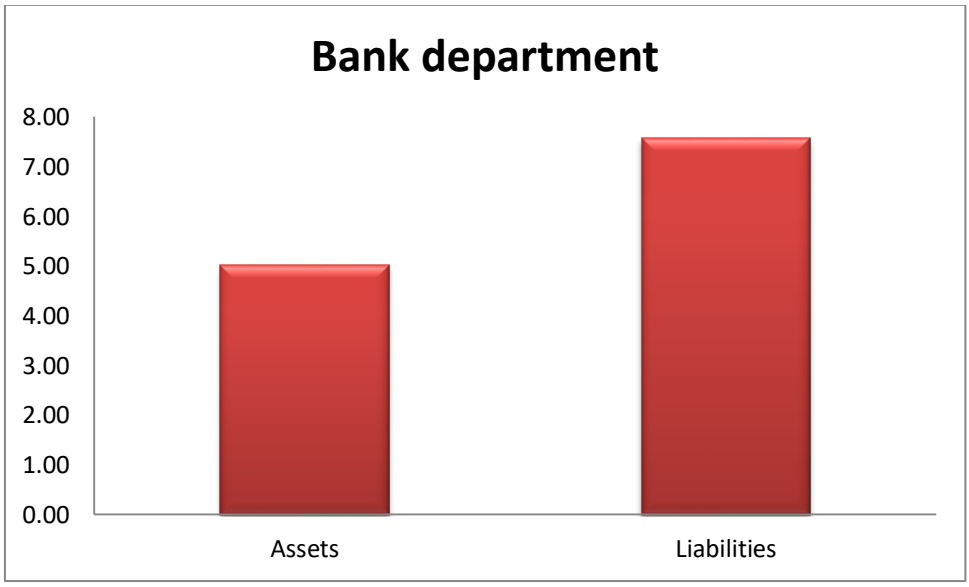
Interpretation:

We can see that,the average saving deposits by Indian Banks is higher than Foreign Banks. We can conclude that, difference between saving deposits with commercial banks: Indian Banks and Foreign Banks are significant. Saving deposits in RBI give proper attention to growth of Indian savings.

Assets and Liabilities of Bank department

A regulatory body established at the state level to ensure that banks are accessible, stable and safe. A state banking department may conduct audits to determine whether banks are complying with financial regulations and followings standard accounting practices. Banking departments usually have jurisdiction over commercial banks, credit unions, money transmitters, check cashing services and non-bank mortgage lenders. A liability is an obligation and it is reported on a company's balance sheet. A common example of a liability is accounts payable. Accounts payable arise when a company purchases goods or services on credit from a supplier. When the company pays the supplier, the company's accounts payable is reduced.

In financial accounting, an asset is an economic resource. Anything tangible or intangible that can be owned or controlled to produce value and that is held by a company to produce positive economic value is an asset. Current assets include inventory, while fixed assets include such items as buildings and equipment.



Objective

"To test the significance difference between Assets and Liabilities of Bank Department"

Hypothesis testing

To check the significant difference between Assets and Liabilities of Bank Department first, we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Assets and Liabilities are normally distributed.

H_1: Assets and Liabilities are not normally distributed.

Table-1 Tests for Normality

Components	Statistics	p-value
liabilities	0.947363	0.1024
Assets	0.904399	0.0060

Conclusion: From the above Table-1, we can conclude that The Assets and Liabilities are not normally distributed. Therefore, we use Wilcoxon Test to check the significant difference between Assets and Liabilities of Bank Department.

Null Hypothesis:

H_0: There is no significant difference between Assets and Liabilities of Bank Department.

H_1: There is significant difference between Assets and Liabilities of Bank Department.

Table-2: The NPAR1WAY Procedure

Variable	N	Mean Score
liabilities	34	49.50
Assets	34	19.50

Statistic	1683.0000
Normal Approximation	
Z	7.6711
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001
t Approximation	
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001

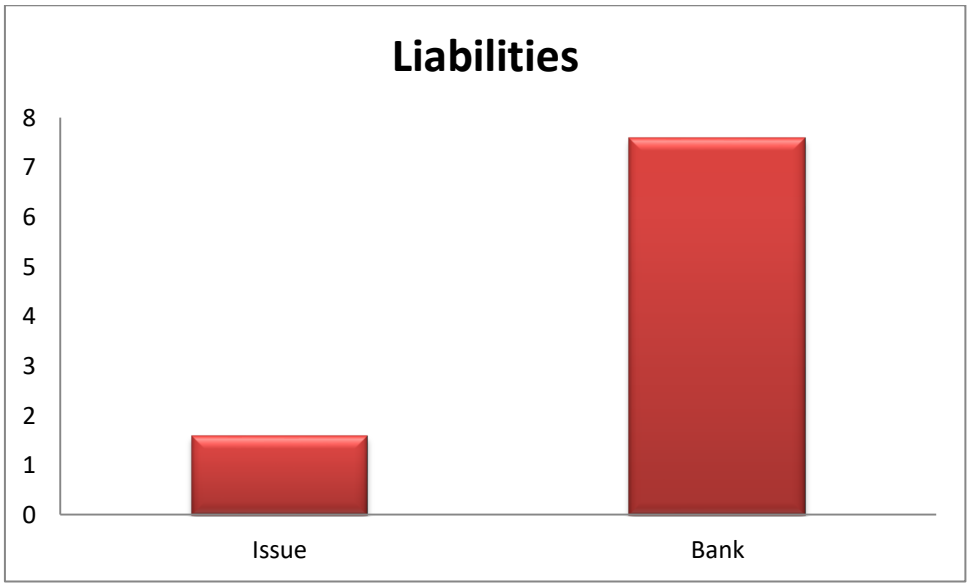
Conclusion: From the above Table-2, we can conclude that, there is significant difference between Assets and Liabilities of Bank Department.

Interpretation:

From chart and testing, we conclude that Liabilities of Bank Department is higher and Assets of Bank Department is lower and Assets and Liabilities of Bank department are significant.

Liabilities of Issue and Bank Department:

RBI collects Liabilities fromtwo-department (i) Issue Department (ii) Banking department.



Objective

"To test the significance difference between Liabilities of Issue Department and Bank Department"

Hypothesis testing

To check the significant difference between Liabilities of Issue Department and Bank Department first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Liabilities are normally distributed.

H_1: Liabilities are not normally distributed.

Table-1 Tests for Normality

Components	Statistics	p-value
Issued liabilities	0.94768	0.1046
Bank liabilities	0.947363	0.1024

Conclusion: From the above Table-1, we can conclude that Liabilities of Issue Department and Bank Department are normally distributed. Therefore, we use Independent T- Test to check the significant difference between Liabilities of Issue Department and Bank Department.

Null Hypothesis:

H_0: There is no significant difference between Liabilities of Issue Department and Bank Department.

H_1: There is significant difference between Liabilities of Issue Department and Bank Department.

Table-2 TTEST Procedure

STATISTICS				
Variable	N	Mean	Std Deviation	Std Error
Issued liabilities	39	6.1791	1.7769	0.2845
Bank liabilities	29	3.4166	0.8725	0.162

T-Tests				
Variable	Variance	DF	t-value	P-value
Issued liabilities	Equal	66	0.05	0.9587
Bank liabilities	Unequal	66	0.05	0.9587

Equality of Variances					
Variable	Method	Num DF	Den DF	F Value	Pr > F
Liabilities	Folded F	33	33	1.03	0.9232

Conclusion: From the above Table-2, we can conclude that, there is insignificant difference between Liabilities of Issue Department and Bank Department.

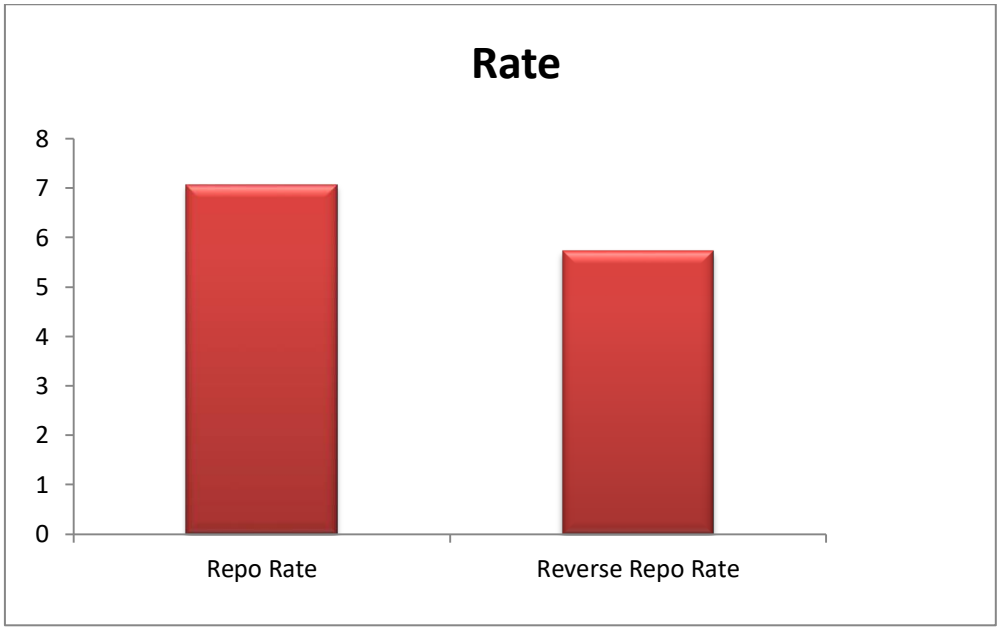
Interpretation:

From chart and testing, We conclude that Liabilities of Bank Department is higher and Liabilities of Issue Department is lower and Liabilities of Issue Department and Bank Department are insignificant.

The Liquidity Adjustment Facility

RBI gives Liquidity Adjustment Facility Rates like Repo Rate, Reverse Repo Rate. Repo rate is the rate at which the central bank of a country (Reserve Bank of India in case of India) lends money to commercial banks in the event of any shortfall of funds. Repo rate is used by monetary authorities to control inflation.

Reverse repo rate is the rate at which the central bank of a country (Reserve Bank of India in case of India) borrows money from commercial banks within the country. It is a monetary policy instrument which can be used to control the money supply in the country.



Objective

"To check the significant difference of the Liquidity Adjustment Facility

Rate"

Hypothesis testing

To check the significant difference of the Liquidity Adjustment FacilityRate first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: Repo Rate and Reverse Repo Rate are normally distributed.

H_1: Repo Rate and Reverse Repo Rate are not normally distributed.

Table-1 Tests for Normality

Components	Statistics	p-value
Repo rates	0.92927	0.0001
Reverse repo rates	0.869639	0.0001

Conclusion: From the above Table-1, we can conclude that Repo Rate and Reverse Repo Rate are not normally distributed. Therefore, we use Mann-Whitney test to check the significant difference of The Liquidity Adjustment Facility Rate.

Null Hypothesis:

H_0: There is no significant difference of the Liquidity Adjustment Facility Rate.

H_1: There is significant difference of the Liquidity Adjustment Facility Rate.

Table-2
The NPAR1WAY Procedure

Variable	N	Mean Score
Repo rates	95	125.95
Reverse repo rates	95	65.047

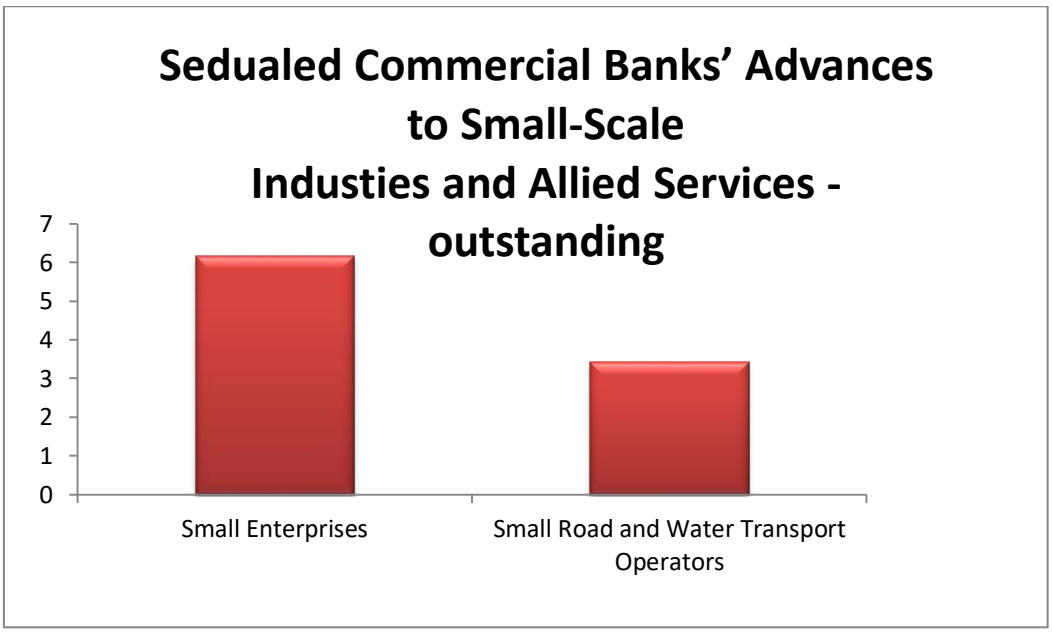
Statistic	11965.5000
Normal Approximation	
Z	7.6711
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001
t Approximation	
One-Sided Pr> Z	<.0001
Two-Sided Pr> |Z|	<.0001

Conclusion: From the above Table-2, we can conclude that, there is a significant difference of the Liquidity Adjustment Facility Rate.

Interpretation:

From chart and testing, we conclude that Repo rate is higher and Reserve Repo rate is lower in RBI. Liquidity Adjustment Facility Rates like Repo rate and Reserve repo rate are significant.

Scheduled Commercial Banks' Advances to Small-Scale Industries And Allied Services – Outstanding



Objective

"To check the significant difference of Scheduled Commercial Banks' advances to small industries and allied services between Small Enterprises and Small Road and Water Transport Operators."

Hypothesis testing

To check the significant difference of Scheduled Commercial Banks' advances to Small Enterprises and Small Road and Water Transport Operators first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: The Scheduled Commercial Banks' advances to Small Enterprises and Small Road and Water Transport Operators are normally distributed**.**

H_1: The Scheduled Commercial Banks' advances to Small Enterprises and Small Road and Water Transport Operators are not normally distributed**.**

Table-1 Tests for Normality

Components	Statistics	p-value
Small Enterprises	0.959126	0.1667
Small Road and Water Transport Operators	0.96811	0.5096

Conclusion: From the above Table-1, we can conclude that The Scheduled Commercial Banks' advances to Small Enterprises and Small Road and Water Transport Operators are normally distributed. Therefore, we use Independent-T test to check the significant difference of Small Enterprises and Small Road and Water Transport Operators.

Null Hypothesis:

H_0: There is no significant difference of Small Enterprises and Small Road and Water Transport Operators.

H_1: There is significant difference of Small Enterprises and Small Road and Water Transport Operators.

Table-2 TTEST Procedure

STATISTICS				
Variables	N	Mean	Std Deviation	Std Error
Small Enterprises	39	6.1791	1.7769	0.2845
Small Road and Water Transport Operators	29	3.4166	0.8725	0.162

		t-tests		
Variable	Variance	DF	t-value	P-value
Small Enterprises	Equal	66	7.70	<.0001
Small Road and Water Transport Operators	Unequal	58.3	8.44	**<.0001**

Equality of Variances					
Variable	**Method**	**Num DF**	**Den DF**	**F Value**	**Pr > F**
balance outstanding	**Folded F**	38	28	4.15	0.0002

Conclusion: From the above Table-2, we can conclude that, there is a significant difference of Small Enterprises and Small Road and Water Transport Operators.

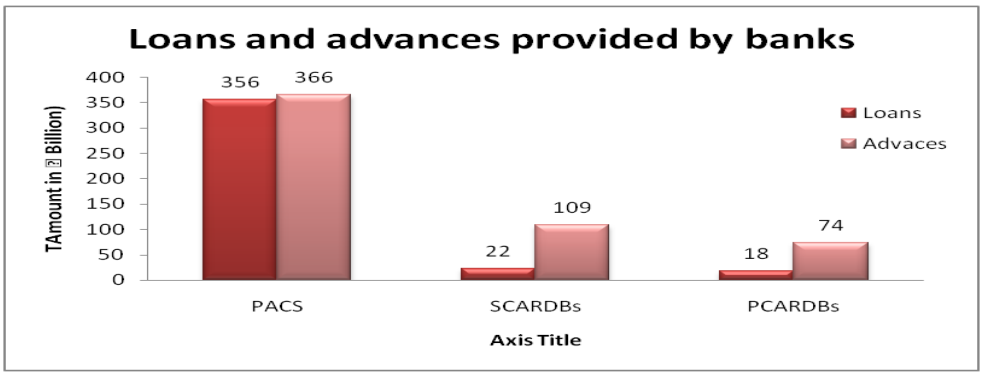
Interpretation:

From chart and testing, we can conclude that the Small Enterprises is higher and Small Road and Water Transport Operators is lower in Scheduled Commercial Banks' Advances to small-scale industries and Allied services-outstanding and difference of Small Enterprises and Small Road and Water Transport Operators are significant.

Loans and Advances

Objective

To check the significant difference among PACS, SCARDBs and PCARDBswith respect to loans and advances.



PACS:-Primary Agricultural Credit Societies

SCARDBs:-State Co-operative Agricultural & rural Developments Banks

PCARDBs:-Primary Co-operative Agricultural & rural Developments Banks

Hypothesis testing

To check the significant difference among PACS, SCARDBs and PCARDBs with respect to loans and advances first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: There is no significant difference among PACS, SCARDBs and PCARDBs with respect to loans and advances.

H_1: There is significant difference among PACS, SCARDBs and PCARDBs with respect to loans and advances.

Non-Parametric MANOVA

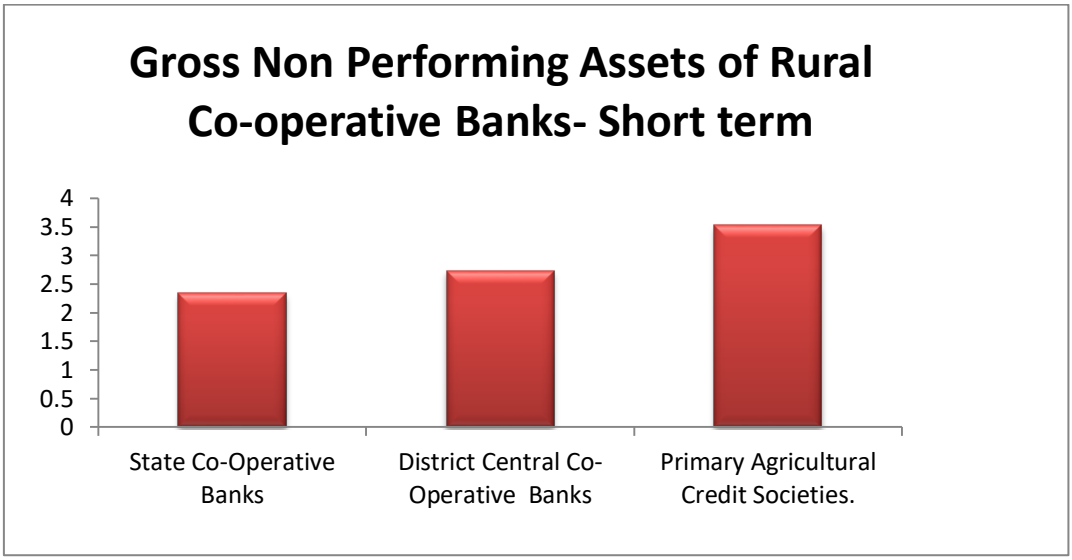
```
$results(Output by R-studio)

Test Statisticdf1df2P-value

ANOVA type test p-value       27.187       2.179     96.8841
0.000

Wilks Lambda                  49.917       4.000    176.0000
0.000

$releffects

            Loans     Advances

PACS        0.81286   0.96250

SCARDB      0.38351   0.48678

PCARDB      0.31590   0.36005
```

Conclusion: From Table-2, we can that PACS, SCARDBs and PCARDBs are significant with respect to loans and advances. In addition "`$releffects`" gives the probability that advances reflect higher in all banks.

Gross Non-performing assets of Co-operative Banks

RBI covers gross non-performing assets of rural co-operative banks. Short term structure from three rural co-operative bank (i)State Co-operative Banks (ii) District Central Co-operative Banks (iii) Primary Agriculture Credit Societies. And long term structure from two rural co-operative bank (i) State Co-operative Agriculture and Rural Development Banks (ii) Primary Co-operative Agriculture and Rural Development Banks.

Short Term Structure



Objective

"To test the significance difference ofNon-Performing Assets of rural Co-Operative Banks for short term structure."

Hypothesis testing

To check the significant difference of Non-Performing Assets of rural Co-Operative Banks for short term structure first we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: All Short Term Structure Rural Co-operative Banks are normally distributed.

H_1: All Short Term Structure Rural Co-operative Banks are not normally distributed.

Table-1 Tests for Normality

Components	Statistics	p-value
STCBs	0.945943	0.4630
DCCBs	0.845106	0.0548
PACS	0.965662	0.7894

Conclusion: From the above Table-1, we can conclude that State Co-operative Banks, District Central Co-operative Banks and Primary Agriculture Credit Societies are normally distributed. Therefore, we use Homogeneity of Variances Test to check the significant difference of Non-Performing Assets of rural Co-Operative Banks for short term structure.

Null Hypothesis:

H_0: There is no significant difference of Non-Performing Assets of rural Co-Operative Banks for short term structure.

H_1: There is significant difference of Non-Performing Assets of rural Co-Operative Banks for short term structure.

Levene Statistic	df1	df2	Sig.
12.873	2	50	.000

Conclusion: From the above Table-2, we can conclude that, the Short Term Structure Rural Co-operative Bank variance is not equal. So, we use welch test.

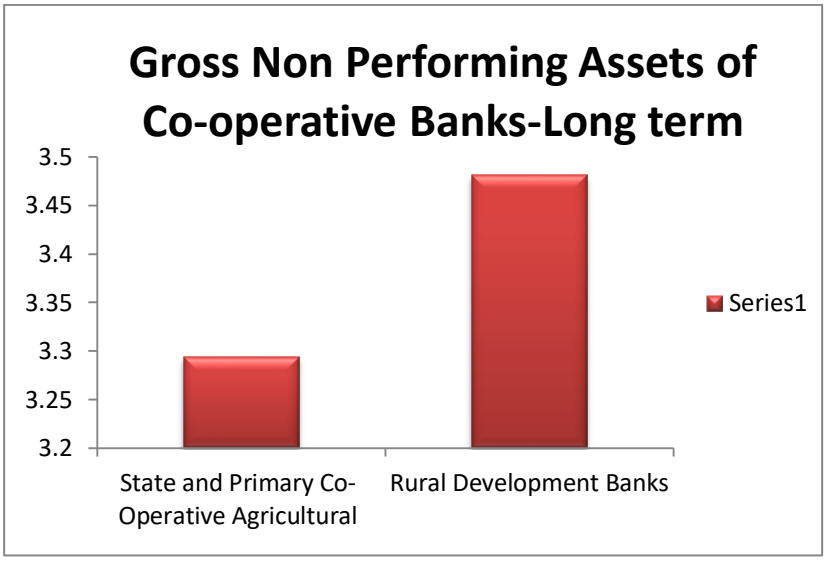
	Statistics	df1	df2	Sig.
Welch	92.041	2	29.311	.000

Conclusion: From the above Table-2, we can conclude that, there is a significant difference of Non-Performing Assets of rural Co-Operative Banks for short term structure.

Interpretation:

From chart and testing, We conclude that that Primary Agricultural Credit Societies is higher and State Co-Operative Banks is lower in Gross Non Performing Assets of Co-operative Banks in Short term and difference of Non-Performing Assets of rural Co-Operative Banks for short term structure is significant.

Long Term Structure:



Objective

"To test the significance difference of Non-Performing Assets of rural Co-Operative Banks for long term structure"

Hypothesis testing

To check the significant difference of Non-Performing Assets of rural Co-Operative Banks for long term structurefirst we check the normality and then the appropriate test statistic is applied.

Null Hypothesis:

H_0: All Long Term Structure Rural Co-operative Bank are normally distributed.

H_1: All Long Term Structure Rural Co-operative Bank are not normally distributed.

Table-1 Tests for Normality

Components	Statistics	p-value
SCARDBs	0.884579	0.0556
PCARDBs	0.91289	0.1500

Conclusion: From the above Table-1, we can conclude that State Co-operative Agricultural and Rural Development Banks and Primary Co-operative Agricultural and Rural Development Banks are normally distributed. Therefore, we use Independent T- Test to check the significant difference of Non-Performing Assets of rural Co-Operative Banks for long term structure.

Null Hypothesis:

H_0: There is no significant difference of Non-Performing Assets of rural Co-Operative Banks for long term structure.

H_1: There is significant difference of Non-Performing Assets of rural Co-Operative Banks for long term structure.

Table-2 TTEST Procedure

STATISTICS				
Variable	N	Mean	Std Deviation	Std Error
SCARDBs	15	3.276	0.2865	0.074
PCARDBs	15	3.4519	0.3646	0.0941

T-Tests				
Variable	Variance	DF	t-value	P-value
SCARDBs	Equal	28	-1.47	0.1529
PCARDBs	Unequal	26.5	-1.47	0.1535

Equality of Variances					
Variable	Method	Num DF	Den DF	F Value	Pr > F
Long term	Folded F	14	14	1.62	0.3777

Conclusion: From the above Table-2, we can conclude that, there is a significant difference of Non-Performing Assets of rural Co-Operative Banks for long term structure.

Interpretation:

From chart and testing, weconclude that Rural Development Banks is higher and State and Primary Co-Operative Agricultural is lower in Gross Non Performing Assets of Co-operative Banks in Long term and difference of Non-Performing Assets of rural Co-Operative Banks for long-term structure is significant.

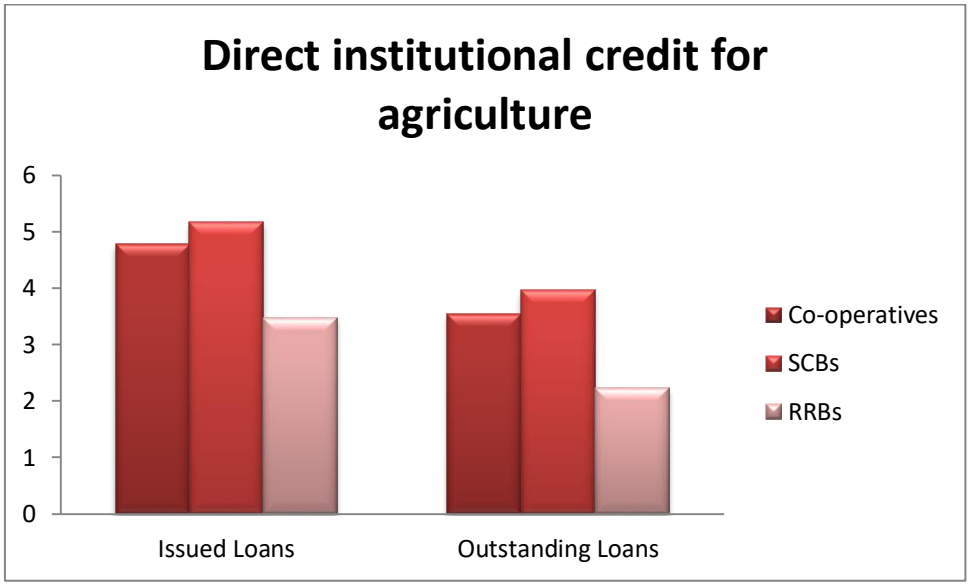
Direct institutional credit for agriculture

RBI provides direct institutional credit for agricultureby issued and outstanding loans to Co-operatives, SC, and RR banks.

Table-1

Tests of Normality				
		Shapiro-Wilk		
		Statistic	df	Sig.
Issued Loans	Co-operatives	0.930733	30	0.051356
	SCBs	0.941342	30	0.098852
	RRBs	0.930272	30	0.049927
Outstanding Loans	Co-operatives	0.919993	30	0.026809
	SCBs	0.938044	30	0.080576
	RRBs	0.95528	30	0.233582

Chart-1



Conclusion: From the above chat, we observed that the Issued Loans and Outstanding Loans are higher in Scheduled Commercial Banks and lower in Regional Rural Banks.

Table-2: Descriptive Statistics

	Types	Mean	Std. Deviation	N
Issued Loans	**Co-operatives**	**4.7799**	**.99643**	**37**
	SCBs	**5.1712**	**1.32511**	**33**
	RRBs	**3.4847**	**1.30127**	**34**
	Total	**4.4806**	**1.39550**	**104**
Outstanding Loans	**Co-operatives**	**3.5426**	**1.04998**	**37**
	SCBs	**3.9721**	**1.49840**	**33**
	RRBs	**2.2365**	**1.44560**	**34**
	Total	**3.2519**	**1.51303**	**104**

Null Hypothesis:

H_0: There is no significant difference between var-cov within outstanding loan and Issued Loan direct institutional credit for agriculture.

H_1: There is significant difference between var-cov within outstanding loan and Issued Loan direct institutional credit for agriculture.

Table-3: Box's Test of Equality of Covariance Matrices

Box's M	**10.237**
F	**1.657**
df1	**6**
df2	**239354.311**
Sig.	**.127**

Conclusion: From Table-3, we can conclude thatthe variances and covariance are same within outstanding loan and Issued Loandirect institutional credit for agriculture.

Null Hypothesis:

H_0: There is no significant difference between outstanding loan and Issued Loandirect institutional credit for agriculture.

H_1: There is significant difference between outstanding loan and Issued Loan direct institutional credit for agriculture.

Table-4: Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Wilks' Lambda	**.016**	**233.248(a)**	**6.000**	**200.000**	**.000**
Hotelling's Trace	**53.338**	**880.075**	**6.000**	**198.000**	**.000**

Conclusion: From Table-4, we can conclude that there is significant difference between outstanding loan and Issued Loandirect institutional credit for agriculture.

Table-5

Outstanding Loan

Types	N	Subset	
		1	2
RRBs	34	3.4847	
SCBs	33		4.7799
Co-operatives	37		5.1712
Sig.		1.000	.182

Issued Loan

Types	N	Subset	
		1	2
RRBs	34	2.2365	
SCBs	33		3.5426
Co-operatives	37		3.9721
Sig.		1.000	.184

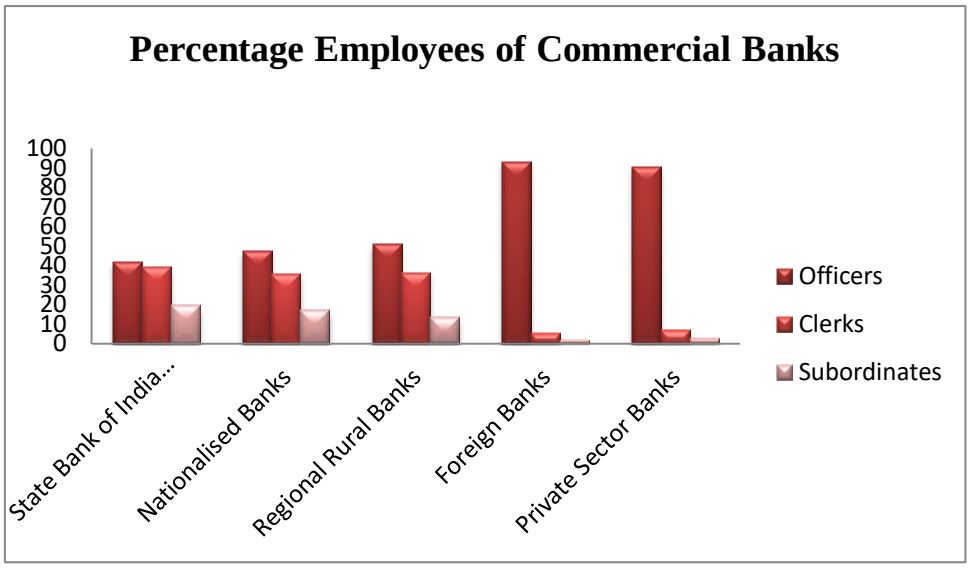
Conclusion: From Table-5,we can conclude that RRB is significantly different from SCB and Co-operatives while these are insignificant to each other in outstanding loan as well as in Issued Loan.

Employees of Commercial banks of RBI

Indian Commercial bank are includes, State Banks, which are multinational, public sector banking and financial services company, Nationalized Banks include transport, communications, energy, banking and natural resources,Regional Rural Banks are scheduled commercial banks operating at regional level in different States of India, Private Sector Banks represent part of the Indian banking sector that is made up of private and public sector banks whose greater parts of share or equity are not held by the government but by private share holder andForeign Banks.

For each commercial bank, employees are distributed in three parts officers, clerks and subordinates.

Chart-1



From Chart-1 we can observed that percentage of officers are higher than clerks and subordinates in all Commercial banks. Also we can observed that percentage of officers are more in foreign and private banks.

Objective

"To check the proportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks"

Hypothesis testing

For each commercial banks the proportion of Bank Group-Wise distribution of Employees are tested by chi-square test.

Null Hypothesis:

H_0: Theproportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks are equal.

H_1: Theproportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks are not equal.

Table- 1

Banks	Officers	Clerks	Subordinates	chi squre	Pvalue	Decision
State Bank of India	112044	105938	52455	35767.46	0.0001	Reject Ho
Nationalized Banks	264156	197817	94873	117595.5	0.0001	Reject Ho
Regional Rural Banks	43318	31082	11325	27359.77	0.0001	Reject Ho
Foreign Banks	23161	1311	406	60054.96	0.0001	Reject Ho
Private Sector Banks	328385	25383	9280	801123.5	0.0001	Reject Ho

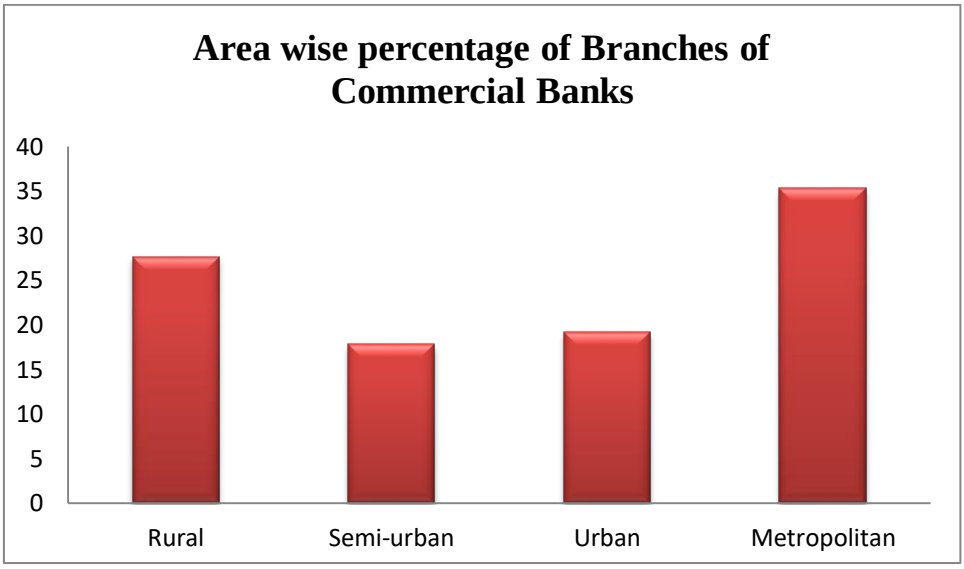
Conclusion: From the above Table-1, we can conclude that, the proportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks like State Bank of India and its Associates, Nationalized Banks, Regional Rural Banks, Foreign Bank and Private Sector Banks are not equal.

Interpretation:

From chart and testing, we can conclude that the proportion of the Officers in Private Sector Banks are higher and in Foreign Banks are lower. Proportion of the Clerks in Private Sector Banks are higher and in Foreign Banks are lower. Proportion of the Subordinates in Private Sector Banks are higher and in Foreign Banks are lower and the proportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks are not equal.

Branches of Scheduled Commercial Banks:

Chart-1



Fromchart-1 we can observed that percentages of branches are higher in metropolitan as compared to other areas.

Objective

"To check the proportion of Population Group wise Number of Branches of Scheduled Commercial Banks"

Hypothesis testing

To check the proportion of area wise Number of Branches of Scheduled Commercial Banks are tested by multiple proportion chi-square test.

Null Hypothesis:

H_0: The proportion of Population Group wise Number of Branches of Scheduled Commercial Banks are equal.

H_1: The proportion of Population Group wise Number of Branches of Scheduled Commercial Banks are not equal.

Table - 1

Chi-square (Observed value)	**14727.467**
Chi-square (Critical value)	**7.815**
DF	**3**
p-value	**< 0.0001**
alpha	**0.05**

Conclusion: From the above Table-1, we can conclude that, the proportion of population group-wise number of branches of scheduled commercial banks like Rural Bank, Urban Bank, semi-Urban Bank, Metropolitan Bank are not equal.

Interpretation:

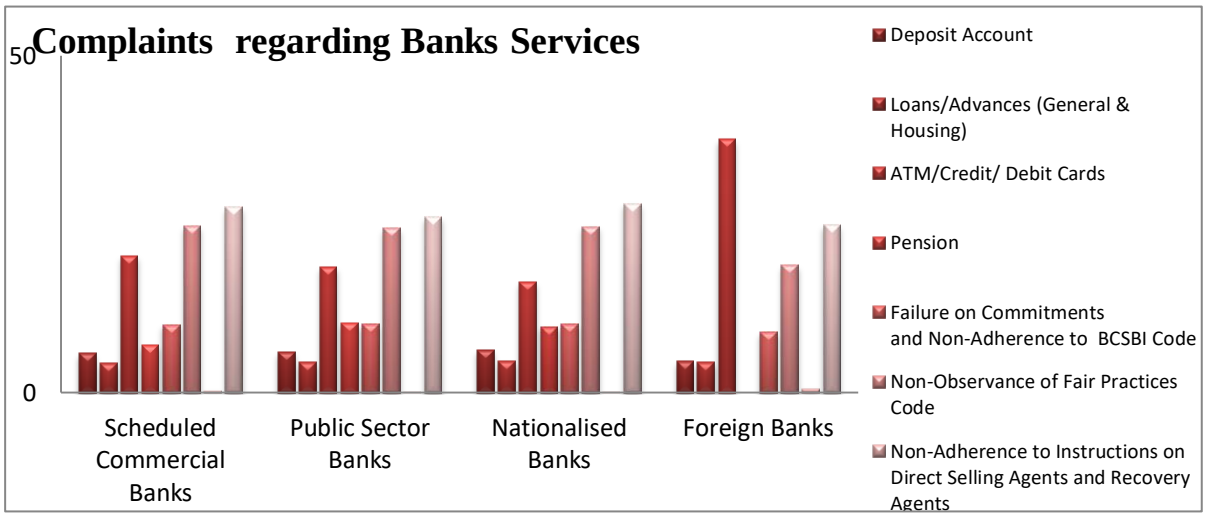
From chart and testing, we can conclude that the proportion of the Population Group wise Number of Branches of Scheduled Commercial Banks are higher in the metropolitan and lower in the semi-urban Bank and the proportion of the Population Group wise Number of Branches of Scheduled Commercial Banks are not same.

Complaints regarding BanksServices:

Table-1

	Deposit Account	Loans/ Advances (General & Housing)	ATM/ Credit/ Debit Cards	Pension	Failure on Commitments and Non-Adherence to BCSBI Code	Non-Observance of Fair Practices Code	Non-Adherence to Instructions on Direct Selling Agents and Recovery Agents	Others
Scheduled Commercial Banks	5.79	4.33	20.29	7.02	10.04	24.67	0.27	27.60
Public Sector Banks	6.01	4.44	18.58	10.29	10.12	24.39	0.11	26.06
Nationalized Banks	6.28	4.65	16.39	9.81	10.14	24.63	0.10	28.01
Foreign Banks	4.63	4.41	37.61	0.00	8.95	18.90	0.58	24.92

Chart-1



Objective

"To check the proportion of complaints regarding Bank services"

Null Hypothesis:

H_0: The proportion of complaints regarding Bank services areinsignificant.

H_1: The proportion of complaints regarding Bank services are significant.

Table-2

	chi cal	P-value	Decision
Scheduled Commercial Banks	**80326.50**	**< 0.0001**	**reject null hypothesis**
Public Sector Banks	**47085.37**	**< 0.0001**	**reject null hypothesis**
Nationalized Banks	**27779.28**	**< 0.0001**	**reject null hypothesis**
Foreign Banks	**3798.76**	**< 0.0001**	**reject null hypothesis**

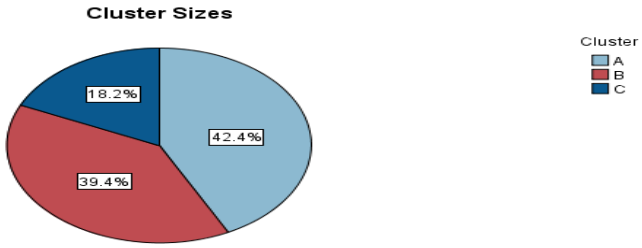
Conclusion: From the chart-1 we can observed that in Scheduled Commercial Banks,Public Sector Banks and Nationalized Banks,the percentages of other complaints are high while in Foreign Banks the percentagesof ATM/Credit/ Debit Cards complaints are more than other banks. From Table-2, we can conclude that, theproportions of complaints regarding Bank services are significant.

Sectoral Deployment of Non-Food Gross Bank Credit:

Objective

"Classify Non-Food Gross Bank credit amount to significant homogenous groups"

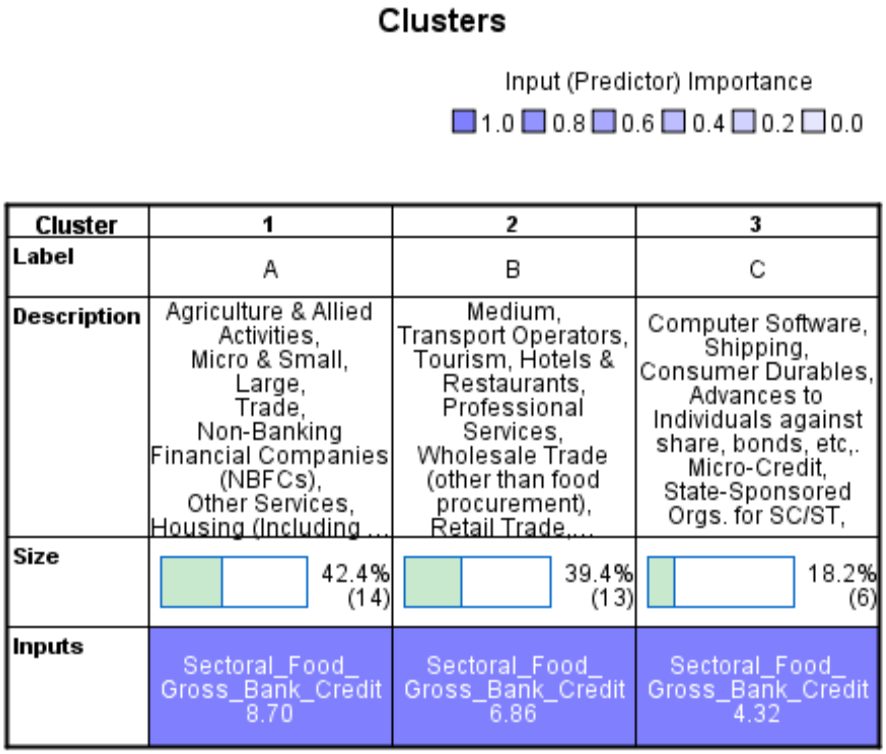
Chart-1



Size of Smallest Cluster	6 (18.2%)
Size of Largest Cluster	14 (42.4%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	2.33

From the Chart-1 we can observe that, Non-Food Gross Bank credit has three cluster in which smallest cluster has 6 components with 18.2% and largest cluster has 14 components with 42.4% of total components. Ratio of sizes is 2.33 which is less than 3 which indicate that the respective clusters are good.

Table-2



From Table-2 we can found cluster A as agriculture and small-large trade etc in which average gross bank credit is 8.7, cluster B as transport and whole sale business etc in which average gross bank credit is 6.86 and cluster C as IT and shipping business etc in which average gross bank credit is 4.32.

Table-3

Tests of Normality							
Two-step Cluster Number		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
Non-Food Gross Bank credit	1	0.199	14	0.136	0.843	14	0.068
	2	0.152	13	.200*	0.939	13	0.450
	3	0.242	6	.200*	0.812	6	0.075

From the Table-3, all three clusters are normally distributed.

Test the significance of three clusters:

H_0: Variances of three clusters are homogeneous.

H_0: Variances of three clusters are heterogeneous.

Table-4

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Sig.
Non-Food Gross Bank credit	3.550	2	30	0.041

Conclusion: From the Table-4, we can conclude that variances of three clusters are not homogeneous. So, we use Welch test to check the significant difference among three clusters.

H_0: Three clusters are statistically insignificant.

H_1: Three clusters are statistically significant.

Table-5

Robust Tests of Equality of Means				
Non-Food Gross Bank credit				
	Statistic	df1	df2	Sig.
Welch	51.811	2	11.619	0.000

Conclusion: From the Table-5 we can conclude that, three clusters are significant. Cluster-A has 14 (42.4%) components, Cluster-B has 13(39.4%) components and Cluster-C has 6(18.2%) ofNon-Food Gross Bank credit with average 8.7, 6.86 and 4.32 respectively.

Chapter – 5

Regression Analysis and Time Series Model

In this chapter, we consider components of RBI that are affecting to GDP. We are try to develop the regression model for GDP on Net Bank Credit to Government, Bank Credit to Commercial Sector, Net Foreign Exchange Assets of the Banking Sector, Net Non Monetary Liabilities of Banking Sector, Industries finance, Agriculture finance, Deposits and Credit. All variable are transform in log.

Null Hypothesis:

H_0: All components are normally distributed.

H_1: All components are not normally distributed.

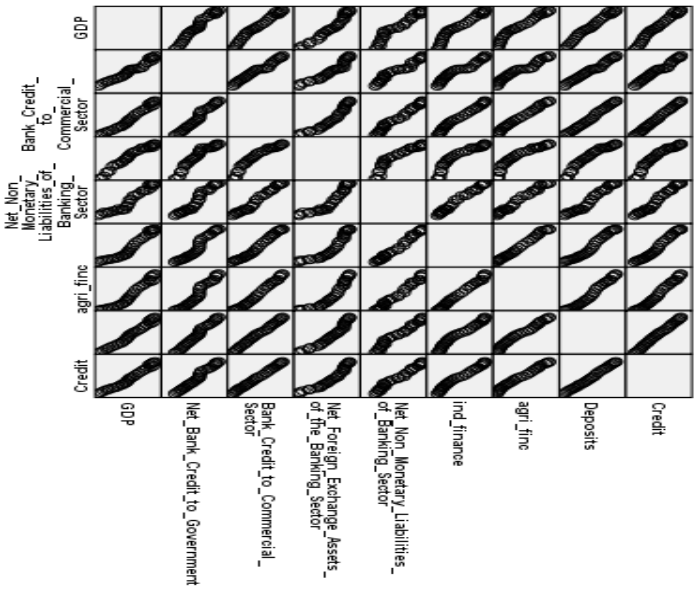
Table-1 Test of Normality

Components	Statistic	p Value
Net Bank Credit to Government	**0.952905**	**0.2176**
Bank Credit to Commercial Sector	**0.934501**	**0.0720**
Net Foreign Exchange Assets of the Banking Sector	**0.910751**	**0.0179**
Net Non-Monetary Liabilities of Banking Sector	**0.892846**	**0.0066**
Agricultural finance	**0.885022**	**0.0044**
Industrial finance	**0.907571**	**0.1500**
Deposit	**0.947**	**0.155**
Credit	**0.939**	**0.092**
GDP	**0.945**	**0.136**

Conclusion:

From Table-1, we can conclude that Net Foreign Exchange Assets of the Banking Sector, Net Non-Monetary Liabilities of Banking Sector and Agricultural finance are not normally distributed (P-value < 0.05), while the remaining components including GDP are normality distributed.

Cahrt-1: Scatter plot:



Conclusion:

From chart-1 we can observed the all selected variable highly correlated to each other.

Linear regression Model:

GDP = $\beta_0+\beta_1$*NBCG +β_2*BCCS+β_3*NFEABS+β_4*NNMLBS + β_5*IF + β_6*AF + β_7*Deposit +β_8* Credit + ui

NBCG: Net Bank Credit to Government

BCCS: Bank Credit to Commercial Sector

NFEABS: Net Foreign Exchange Assets of the Banking Sector

NNMLBS: Net Non Monetary Liabilities of Banking Sector

AF: Agriculture Finance

IF: Industrial Finance

GDP: Gross Domestic Product

Table-2:Model Summary(b)					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error**	**DW**
1	**0.9981065**	**0.996217**	**0.994115**	**0.067625**	**1.873**

Interpretation: Here we found that R^2=0.99, suggest that 99% variation is explained by this fitted regression model. In addition, SE is 0.06 is nearer to zero.In addition, DW is 1.8 indicate 1st order autocorrelation among residuals.

Null Hypothesis:

H_0: The fitted regression model is insignificant.

H_1: The fitted regression model is significant.

Table-3: ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	**21.67467**	**10**	**2.167467**	**473.9593**	**0.00**
	Residual	**0.082316**	**18**	**0.004573**		
	Total	**21.75699**	**28**			

Here we found that F-cal is 473.9593 and P value is 0.00 less than alpha at 5% level of significance. Therefore, we can conclude that model is significant.

Table-4: Regression Coefficient

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tol	VIF
(Constant)	2.71	0.96		2.83	0.01		
NBCG	0.07	0.37	0.09	0.18	0.86	0.00	1061
BCCS	0.99	0.55	1.52	1.80	0.09	0.00	3382
NFEABS	0.15	0.12	0.32	1.30	0.21	0.00	294
NNMLBS	-0.31	0.12	-0.49	-2.62	0.02	0.01	164
IF	0.40	0.25	0.64	1.59	0.13	0.00	778
AF	-0.48	0.31	-0.82	-1.53	0.14	0.00	1346
Deposits	0.09	0.90	0.14	0.10	0.92	0.00	9267
Credit	-0.22	0.47	-0.38	-0.48	0.64	0.00	2962

Conclusion:

From the above Table-4, we can conclude that NBCG, NFEABS, IF, AF, Deposit and Credit are insignificant and only two components BCCS and NNMLBS are significant. In addition, VIF are very large for all components. Therefore, these are symptoms of high multicollinearity among explanatory variables.

Therefore, first we remove the problem of multicollinearity among explanatory variables by Factor analysis.

Factor Analysis:

Table-5: Descriptive Statistics

	Mean	Std. Deviation
Net Bank Credit to Government	**8.752132**	**1.11138**
Bank Credit to Commercial Sector	**9.251599**	**1.35784**
Net Foreign Exchange Assets of the Banking Sector	**7.929546**	**1.84764**
Net Non Monetary Liabilities of Banking Sector	**7.902991**	**1.38457**
Industries finance	**6.488588**	**1.42557**
Agriculture finance	**7.002017**	**1.50409**
Deposits	**9.355506**	**1.36582**
Credit	**8.913408**	**1.48620**

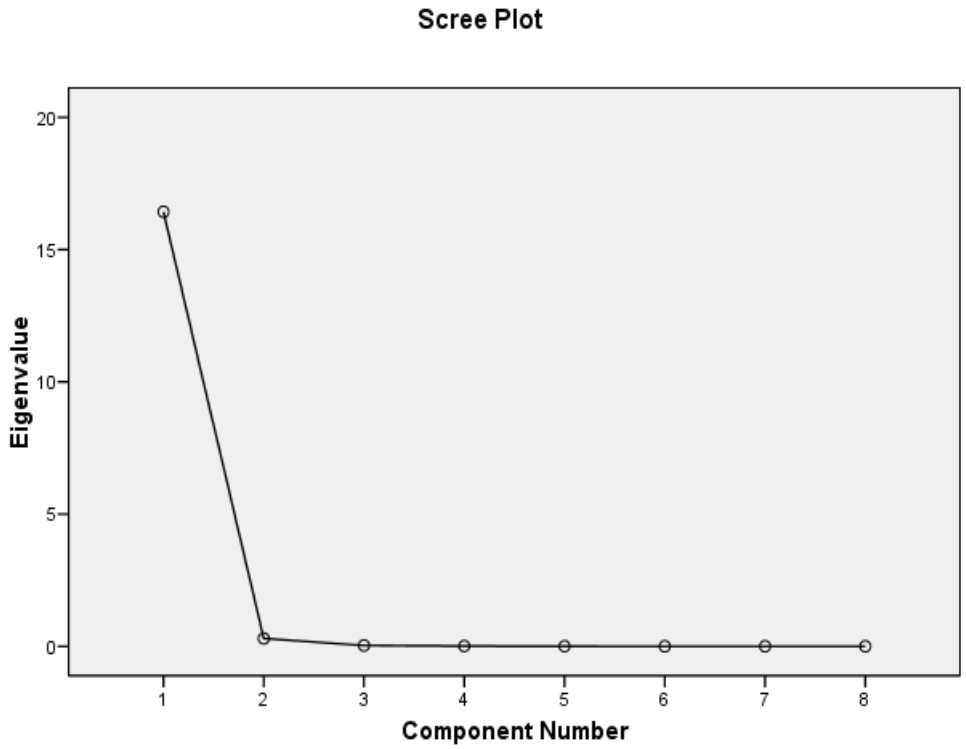
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.876**
Bartlett's Test of Sphericity	**Approx. Chi-Square**	**1176**
	Df	**45**
	Sig.	**0.00**

Bartlett's test of sphericity and Kaiser-Meyer olkin (KMO) measure of sampling adequacy were used to examine the appropriateness of analysis. The approximate chi-square statistics is 1176 with 45 degree of freedom, which is significant at 0.00 levels. The KMO statistic (0.876) is also large (>0.5). The measure of sampling adequacy (MSA), which as far as this research is concerned. It falls the acceptable range (above 0.5) with a value of 0.876. For this data set; it is 0.876, which is large enough, so the KMO supports factor analysis.

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.53	95.28	95.28	9.5277	95.2778	95.278
2	0.38	3.77	99.04			
3	0.07	0.68	99.73			
4	0.02	0.18	99.91			
5	0.01	0.06	99.96			
6	0.00	0.02	99.98			
7	0.00	0.01	99.99			
8	0.00	0.00	100.00			

Cahrt-2



Also, note the scree plot in the component output in common factor analysis. The scree plot is graphic aid produced by cattle. It is simply a plot of the monotonically descending Eigen value. It is intended to help in deciding where a trivial begins one might argue that the Kaiser rule opting for two dimension is fairly well supported by

Scree plot. Here we see that in Scree plot up to first component has variation is more to compare to 2 to 8 component.

Component Score Coefficient Matrix	
	Component
Net Bank Credit to Government	**0.1040775**
Bank Credit to Commercial Sector	**0.1046637**
Net Foreign Exchange Assets of the Banking Sector	**0.1020186**
Net Non Monetary Liabilities of Banking Sector	**0.1038135**
Industries finance	**0.0872428**
Agriculture finance	**0.1047378**
Deposits	**0.1047126**
Credit	**0.1046066**

Null Hypothesis:

H_0: Created factor is normally distributed.

H_1: Created factor is not normally distributed.

Tests of Normality						
	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**P-value**
factor	**0.10183382**	**29**	**0.2**	**0.929264931**	**29**	**0.0527**

Conclusion: From Table we can conclude that created factor is normally distributed (p-value > 0.05)

Linear Regression model

GDP = $\beta_0+\beta_1$ * Factor + ut

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error	Durbin-Watson
1	0.992	0.984	0.984	0.1107	0.295

Interpretation: Here we found that R^2=0.98, suggest that 99% variation is explained by this fitted regression model. In addition, SE is 0.06 is nearer to zero. In addition, DW is 0.29 indicate 1st order autocorrelation among residuals.

H_0: The fitted regression model is insignificant.

H_1: The fitted regression model is significant.

Table-: ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.302	1	21.302	1265.08	0.00
	Residual	0.455	27	0.017		
	Total	21.754	28			

Conclusion: Here we found that Fcal is 1265.08and P value is 0.00 less than alpha at 5% level of significance. Therefore, we can conclude that model is significant.

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	9.130996	0.020565		444.01121	0.00
factor	0.874762	0.020929	0.99236	41.797068	0.00

Conclusion:

From the above Table-, we can conclude that created factor significant. SE is nearer to zero.

Null Hypothesis:

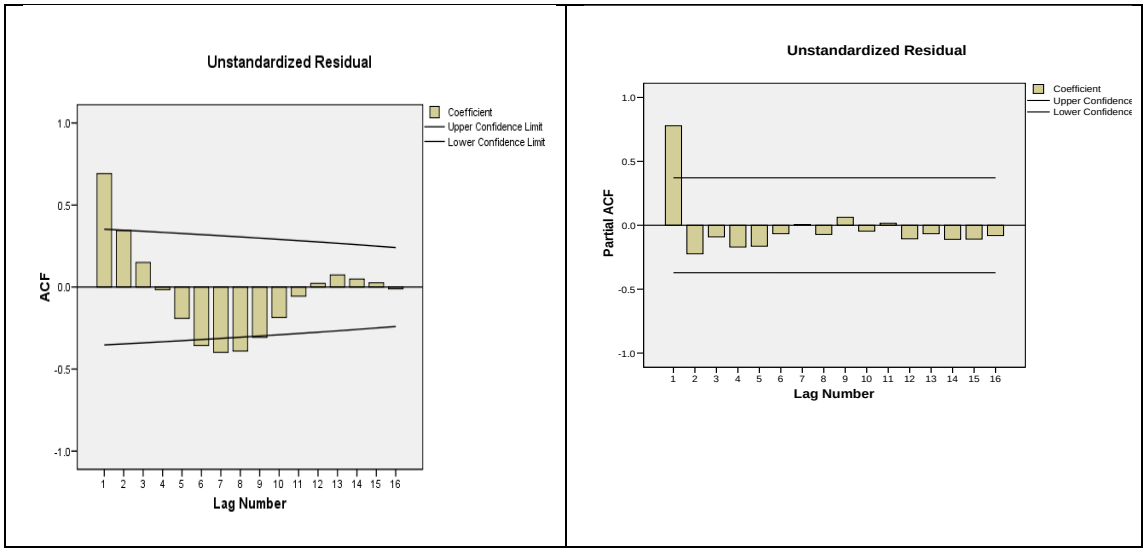
H_0: Error term is normally distributed.

H_1: Error term is not normally distributed.

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual	0.0809	29	0.2	0.9658	29	0.454

Conclusion: From Table we can conclude that created factor is normally distributed (p-value > 0.05).

Chart-3: ACF and PACF



Interpretation: After creating factor by selected components,we are able to remove the problem of multicolinearity but still there is a problem of autocorrelation in residuals of linear regression , which is represented by ACF and PACF graph.

Therefore, to suggest theappropriate model we use AR model method from time series modelling.

AR(1) Model:

$Y_t = \alpha_1 + \alpha_2 * Y_{t-1} + \alpha 3 * X_t + \varepsilon_t$

Model Statistics

	Model Fit statistics		Ljung-Box Q(18)		
GDP-Model_1	**Stationary R-squared**	**R-squared**	**Statistics**	**DF**	**Sig.**
	0.993	**0.993**	**8.053**	**17**	**0.965**

Conclusion: Here R^2 = 0.993 indicate that 99.3% variation is explained by the fitted AR(1) model. The Ljung-Box statistic, also known as the modified Box-Pierce statistic, provides an indication of whether the model is correctly specified. The value of 0.965 shown here is not significant, so we can be confident that the model is correctly specified.

ARIMA Model Parameters

				Estimate	SE	t	Sig.
GDP	No Transformation	Constant		9.078	0.087	104.595	0.00
		AR	Lag 1	0.873	0.095	9.222	0.00
Factor	No Transformation	Numerator	Lag 0	0.902	0.067	13.384	0.00

Conclusion: from Table- we can conclude that the coefficients of 1st lag and factor both are significant.

Null Hypothesis:

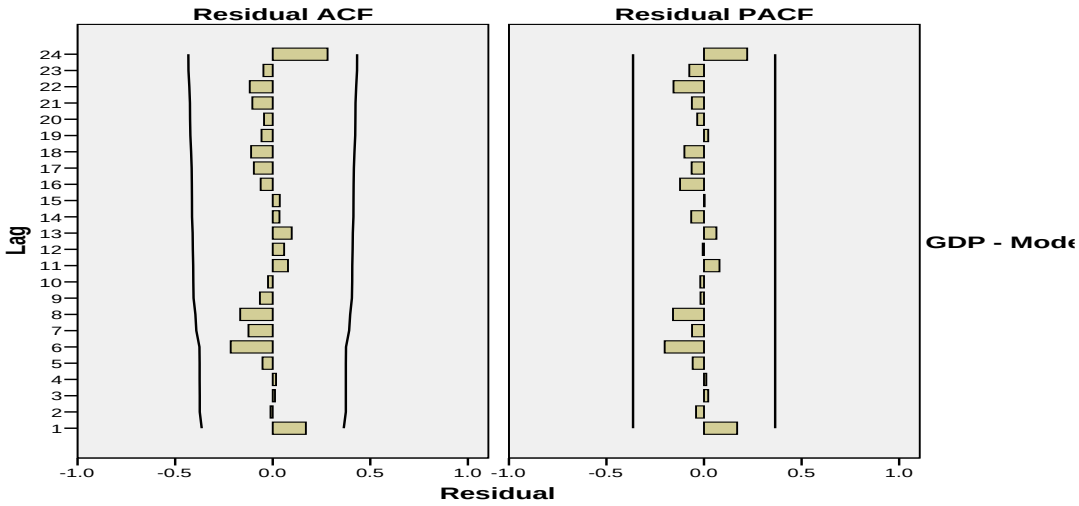
H_0: Error term is normally distributed.

H_1: Error term is not normally distributed.

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual	0.915	29	0.2	1.085	29	0.19

Conclusion: From Table we can conclude that residual of AR(1) is normally distributed (p-value > 0.05).

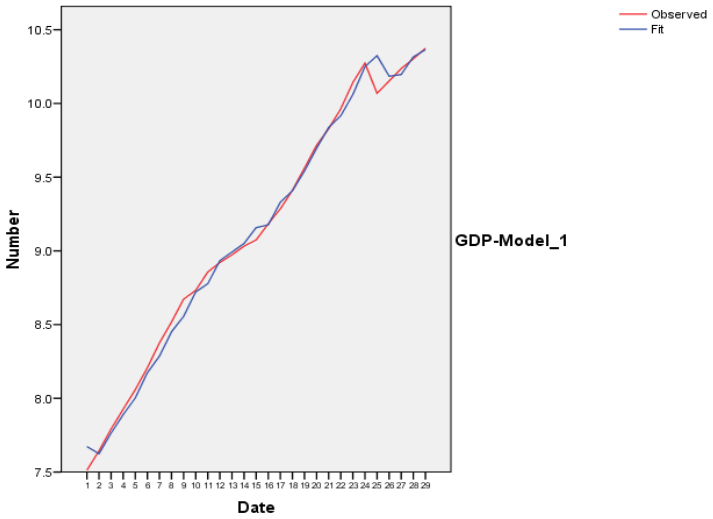
Chart-4: ACF and PACF



Conclusion:

From chart-4 we can observed the residuals of AR(1) model is now not auto correlated.

Chart-5: Fitted and actual GDP

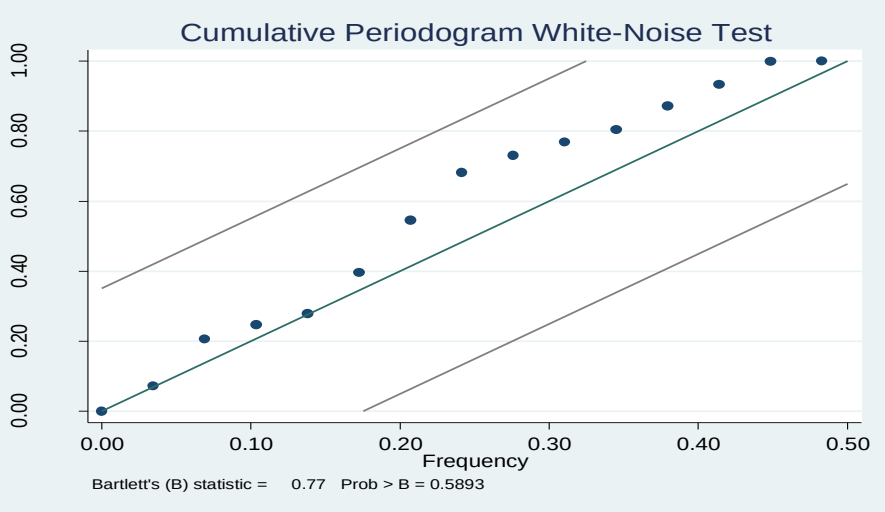


Conclusion:

From chart-5 we can observed the fitted GDP is nearer to actual GDP.

Test of heteroscedasticity:

Chart-6:



Conclusion:

From chart-6 we can observed and by Bartlett's test, we can conclude that the fitted AR (1) has homoscedastic residuals.

Chapter – 6

Findings and Limitations

We found that….

- There is a significant difference between Liabilities of Issue Department and Bank Department.
- There is a significant difference between Assets and Liabilities of Bank Department.
- Non-monetary liabilities, Net foreign exchange assets of the banking sector and Net bank credit to government are insignificant.
- Net foreign exchange assets of the banking sector, Net bank credit to government and Bank credit to commercial sector are insignificant.
- RBI provides on an average same finance to agricultural and industrial sector for economic development of India.
- There is a significant difference between Deposits and Credit.
- There is a significant difference between Repo rate and Reverse Repo rate.
- Three clusters are significant. Cluster-A has 14 (42.4%) components, Cluster-B has 13(39.4%) components and Cluster-C has 6(18.2%) ofNon-Food Gross Bank credit with average 8.7, 6.86 and 4.32 respectively.
- There is a significant difference of Saving deposits with commercial bank between Indian Banks and Foreign Banks.
- The proportion of Bank Group-Wise distribution of Employees of Scheduled Commercial Banks like State Bank of India and its Associates, Nationalized Banks, Regional Rural Banks, Foreign Bank and Private Sector Banks are not equal.
- There is significant difference between outstanding loan and Issued Loandirect institutional credit for agriculture.
- There is a significant difference of Scheduled Commercial Banks' advances between Small Enterprises and Small Road and Water Transport Operators.

- The proportion of population group-wise number of branches of scheduled commercial banks like Rural Bank, Urban Bank, semi-Urban Bank, Metropolitan Bank are not equal.
- There is a significant difference between Non-Performing Assets of Co-Operative Banks like State Co-Operative Banks, District Central Co-Operative Banks and Primary Agricultural Credit Societies.
- There is an insignificant difference of Non-Performing Assets of Co-Operative Banks like State and Primary Co-Operative Agricultural and Rural Development Banks.
- The proportion of different kinds of Complaints in the Scheduled Commercial Banks, Public Sector Banks, Nationalized Banks, and Foreign Banks are different.

Limitations:

- Our data is secondary so may be it is possible that data should be inconsistent.
- Other affected factors of money stock are not included in our study.
- The analysis is done with a time limit & curriculum limits so further analysis can be done for more specific result.

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Basic Econometrics	Damodar Gujarati

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