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The Applicability of Principal Component Analysis: A Review of the Nigeria Gross Domestic Products (GDP)

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Abstract:- In 2014, Nigeria was largest and fastest growing economy in Africa, and this is determine by year on year Gross Domestic Product (GDP), which is the major tools use by the rest of the world to determine the capacity of a country. Furthermore National Bureau of Statistics (NBS) releases both quarterly and yearly growth of Nigeria GDP, while the data source in this project is from NBS, starting from 1980 to 2017. Moreover the Nigeria GDP comprises many components. The major PCs use are Agriculture, Building and Construction, Industry, Wholesale and Retail Trade, and Services. It was observed that there is yearly growth in Nigeria gross domestic products due to increase in all contributors factored components from 1980 to 2017, Agriculture had the highest number activities to this per capital income followed by Industry, Services, wholesale and retail trade, and building and construction. Also the overall accumulated variance for the GDP for the studied period is 10.7 for a 56% coefficient of variation. All the contributors (Agriculture, Industry,……) maintained a positive correlation all through the period of study expect for Services that affect/shirk the GDP along the year. Wholesales experienced the strongest doling of taking care of the GDP with 98%, followed by Building and Construction, industry and agriculture with 86%, 78% and 6% respectively. However for Nigeria to maintain the largest economy in Africa It will strongly advice that the economy team should look properly on agriculture and industry and if this two increases certainly wholesale and retail trade with building and construction will be affected positively while extended to services, therefore the GDP will also be stabilise.

I. INTRODUCTION

➢ *Background to the Study*

Nigeria become the fastest growing economy in Africa in 2012 by the Rebasing (GDP) released from the bulletin published by the National Bureau of Statistics (NBS) which make Nigeria to become the largest economy in Africa and reached the peak in fourth quarter of 2014 with certain amount of about N24,205,863.34 million with a nominal GDP. Based on the Balance Trade by Kimberly 2018, the Nigerian GDP was worth 375.77 billion US dollars in 2017. The GDP value of the Nigerian economy represents 0.61% of the world economy. GDP in Nigeria averaged 97.52 USD Billion from 1960 until 2017. The Gross Domestic Product per capita of the economy was previously recorded as 2412.41 US dollars in 2017.

➢ *Objectives of the Study*

The objectives of this study are to determine the yearly growth of Nigeria Gross Domestics Products.

- *The Specific Objectives of this Study are:*

✓ To examine the yearly growth pattern of the Nigeria GDP
✓ To determine the contribution of each sector contributing to national GDP for adequate policy making
✓ To predict yearly growth of Nigeria GDP

➢ *Principal Component Analysis (PCA)*

This is a dimension tool that is used to reduce large sets of variables to small sets and still retain most of the information in the large sets. It is used to transforms numbers of probably correlated variables into a smaller number of uncorrelated variables known as principal components.

➢ *Reason for Principal Component Analysis*

The main reasons for the PCA includes

- To reduces a larger number of variables to a smaller number of factors
- To choose a fraction of variables from a whole, based on the original variables that have the highest correlations with the principal component.

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➢ *Gross Domestic Product (GDP)*

The GDP comprises of the total values of goods and services produced by the country. However indicates if what is produced is owned by the citizens or foreign-owned companies. It is also the monetary value of all finished goods and services produced by a country within a specific time period. it is usually computed within a year. It involves in total all the private and public consumption, government outlays, investments, private inventories, paid-in construction costs and the foreign balance of trade (exports are added, imports are subtracted). Gross National Product (GNP), measures the total production of the citizens of a country, and of those living abroad, such that domestic production by foreigners is excluded. GDP is used as an instrument to measure the state of the economy of a country, also to determine country's standard of living.

II. METHODOLOGY

A secondary source of data was employed in this work extracted from the Bulletin of the National Bureau of Statistics. The Principal Component Analysis (PCA) was adopted for the analysis, the major PCs use are GDP, Agriculture, Building and Construction, Industry, Wholesale and Retail Trade, and Services.

III. RESULTS AND DISCUSSION

A. Results

The Gross Domestic Product is made up some contributing factors of which are Agriculture, Industry, Building and Construction, Wholesales and retails trade and Services. The time plots adopted zigzag (unidirectional) and uncategorized form due to the factoring nature as indicated below in fig.1 to fig. 6.

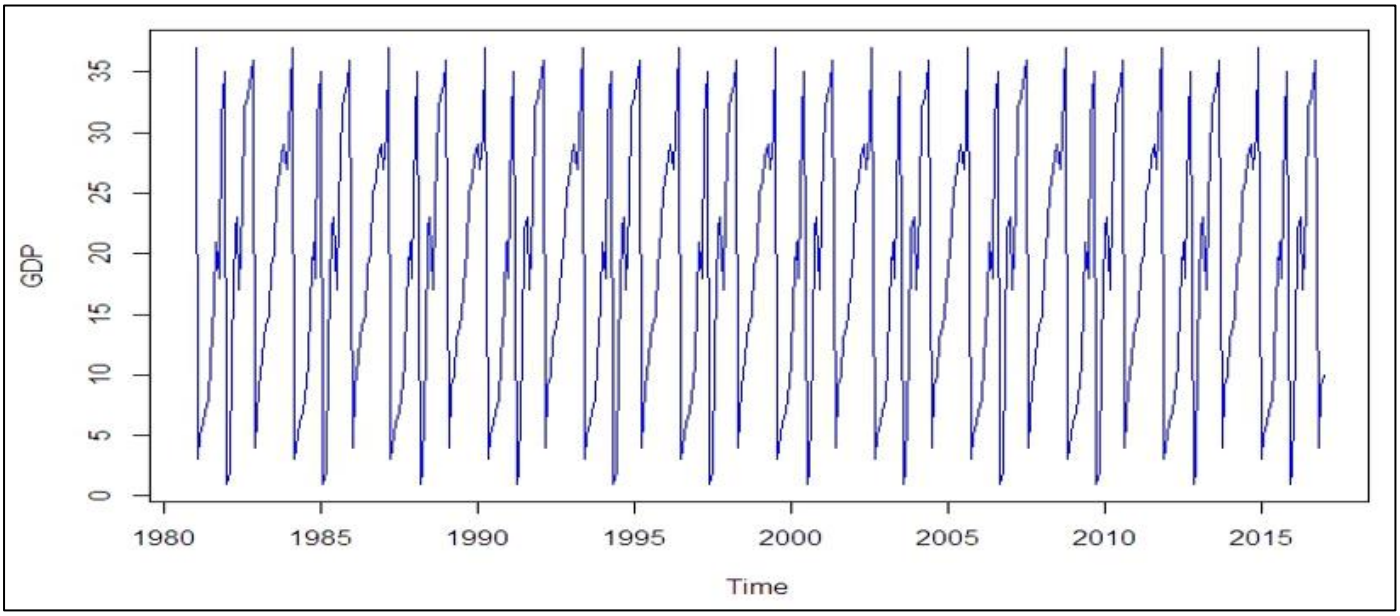

Fig 1 (A Plot showing a Zigzag Direction of GDP over Time)

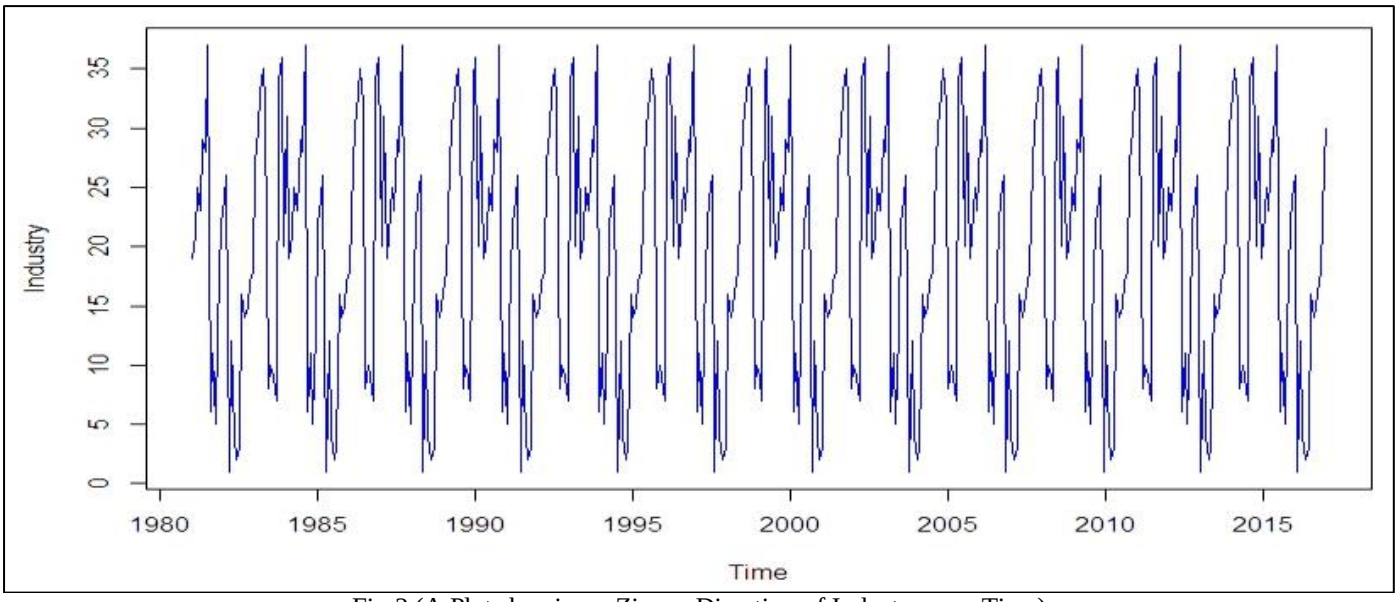

Fig 2 (A Plot showing a Zigzag Direction of Industry over Time)

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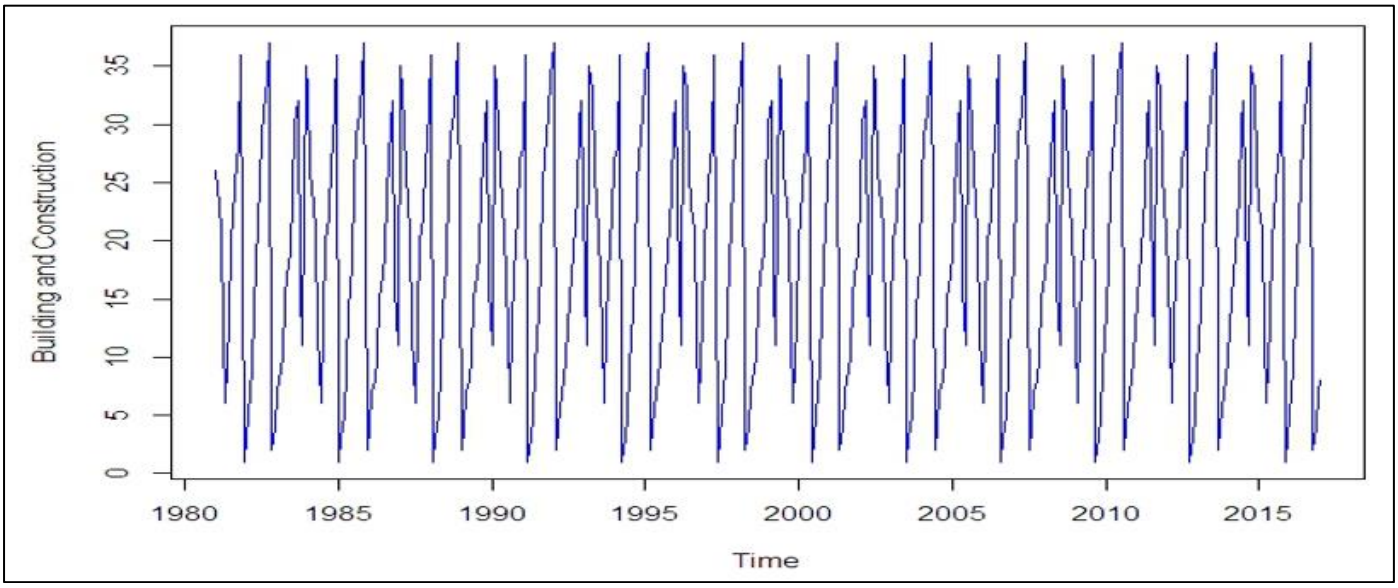

Fig 3 (A Plot showing a Zigzag Direction of Building and Construction over Time)

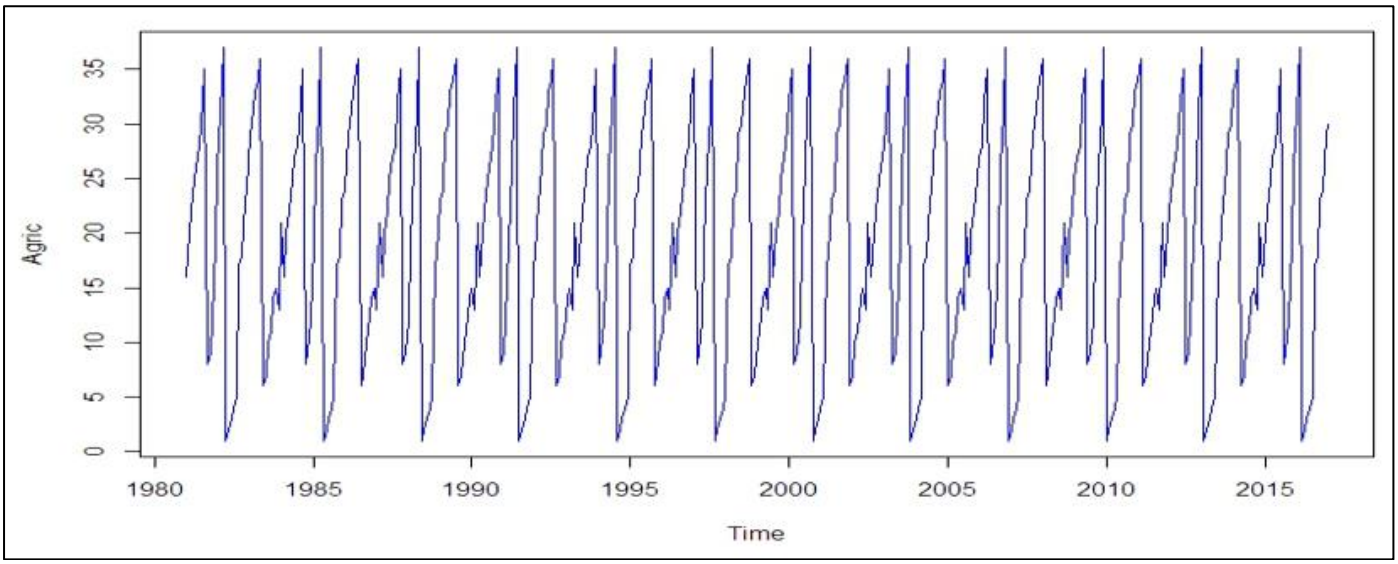

Fig 4 (A Plot showing a Zigzag Direction of Agriculture over Time)

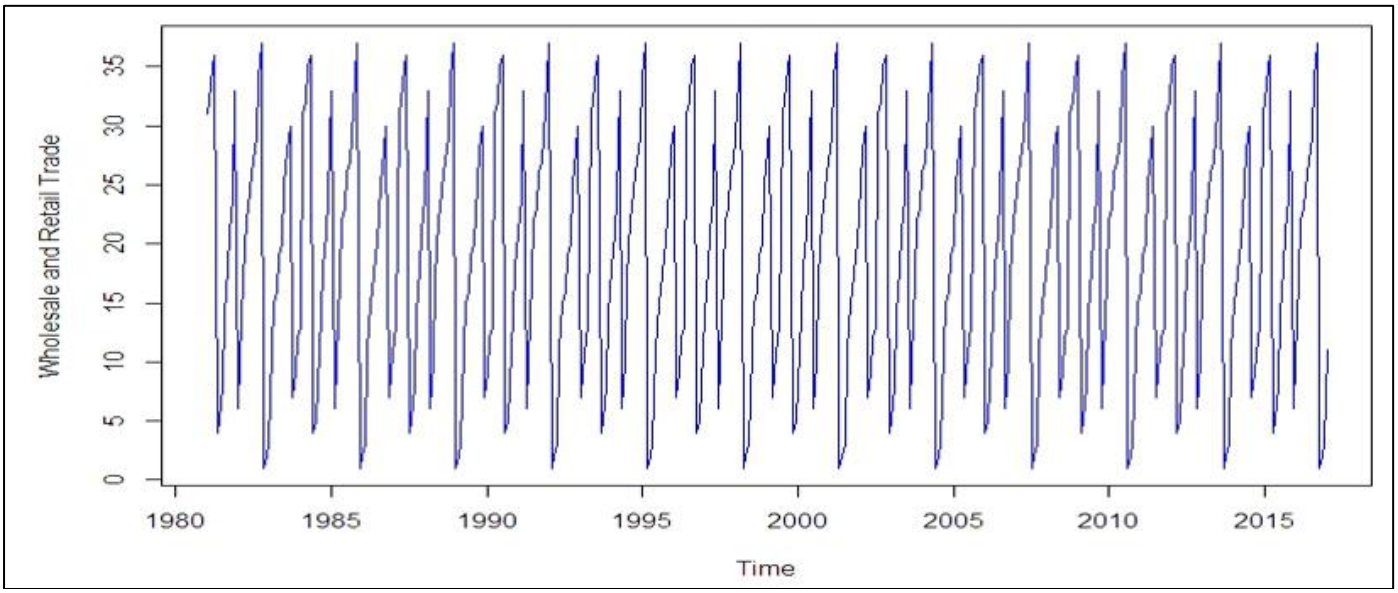

Fig 5 (A Plot showing a Zigzag Direction of Wholesale and Retail over Time)

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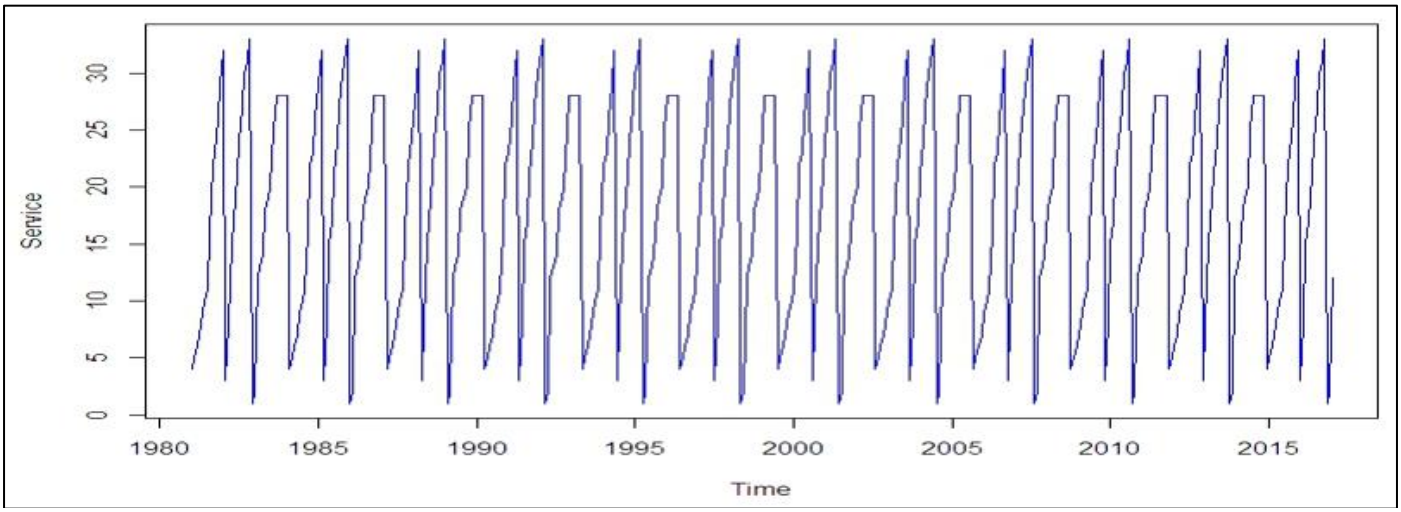

Fig 6 (A Plot showing a Zigzag Direction of Services over Time)

From the histograms of the contributors, it is note that all the contributors are factored components due to their increasing factor from 1981 to 2017 to the Nigeria GDP as it is shown below in fig 7 to 12.

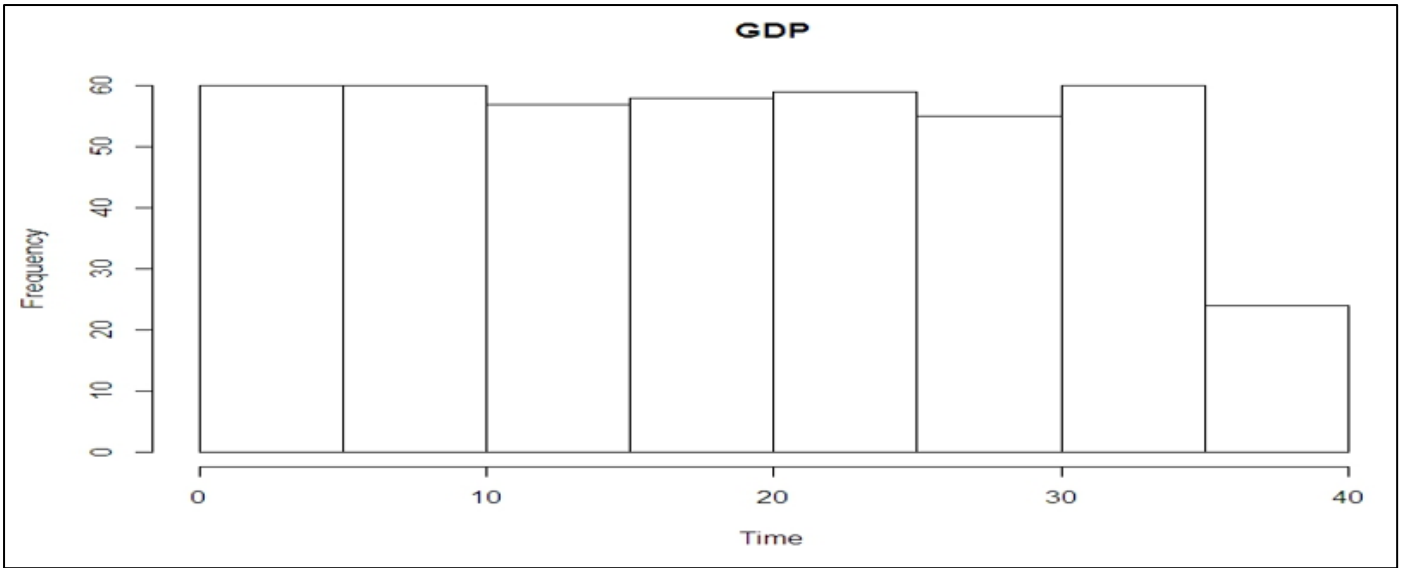

Fig 7 (Histogram showing the Contribution of the GDP over Time)

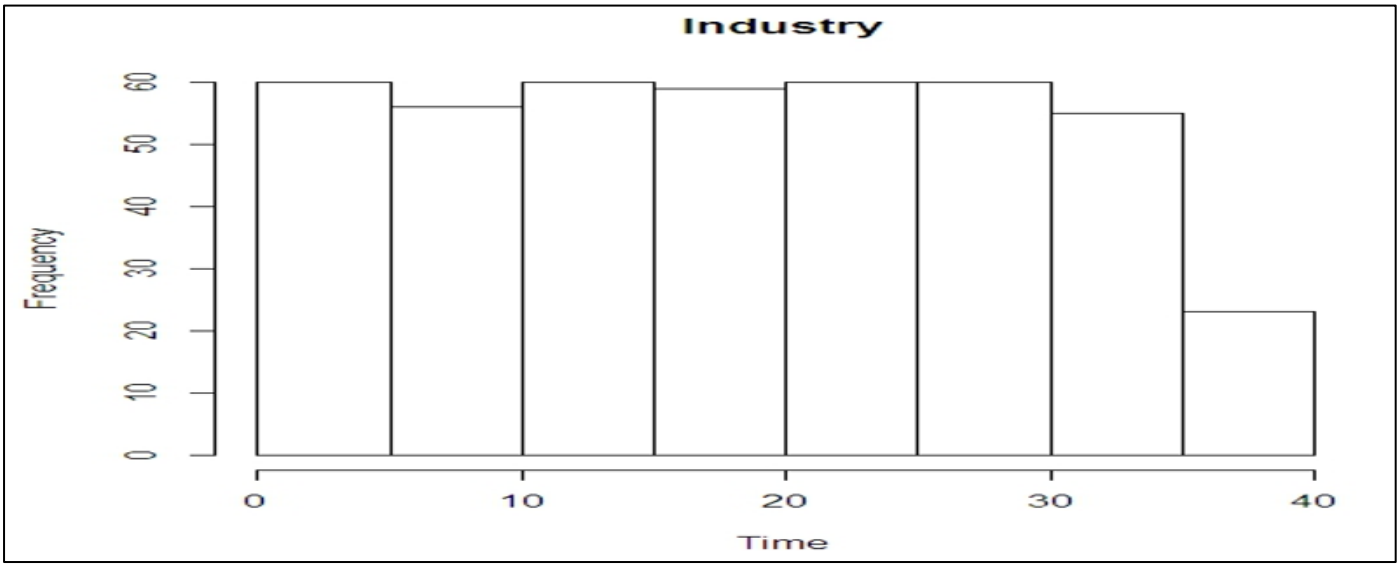

Fig 8 (Histogram showing the Contribution of the Industry over Time)

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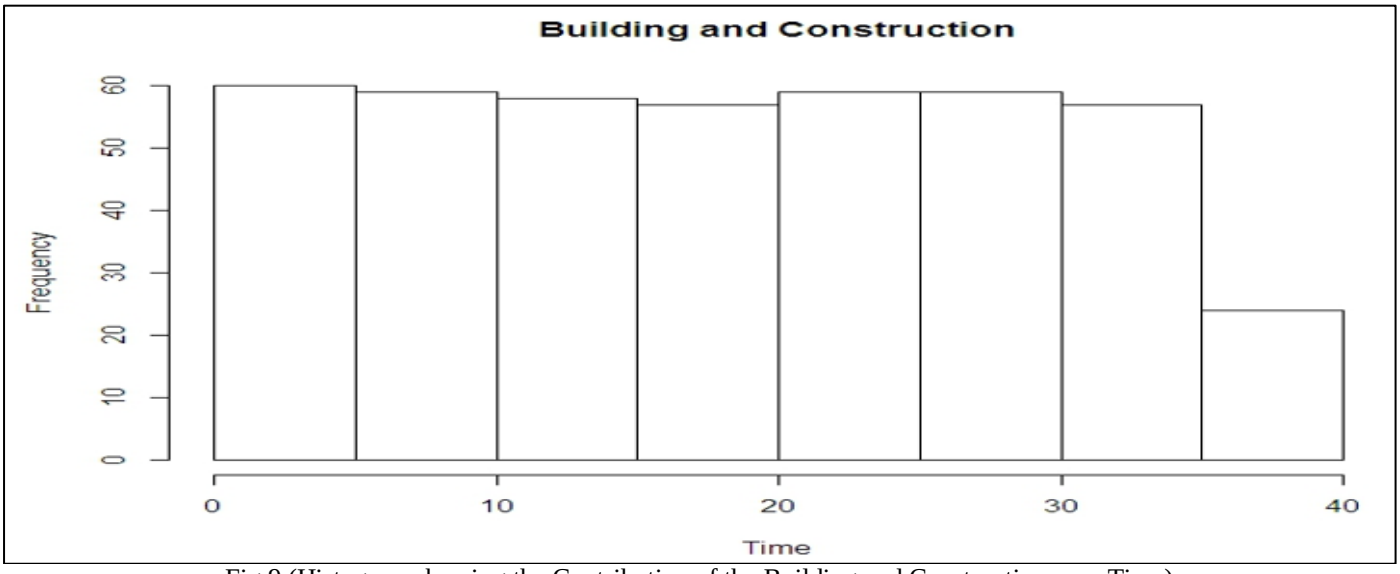

Fig 9 (Histogram showing the Contribution of the Building and Construction over Time)

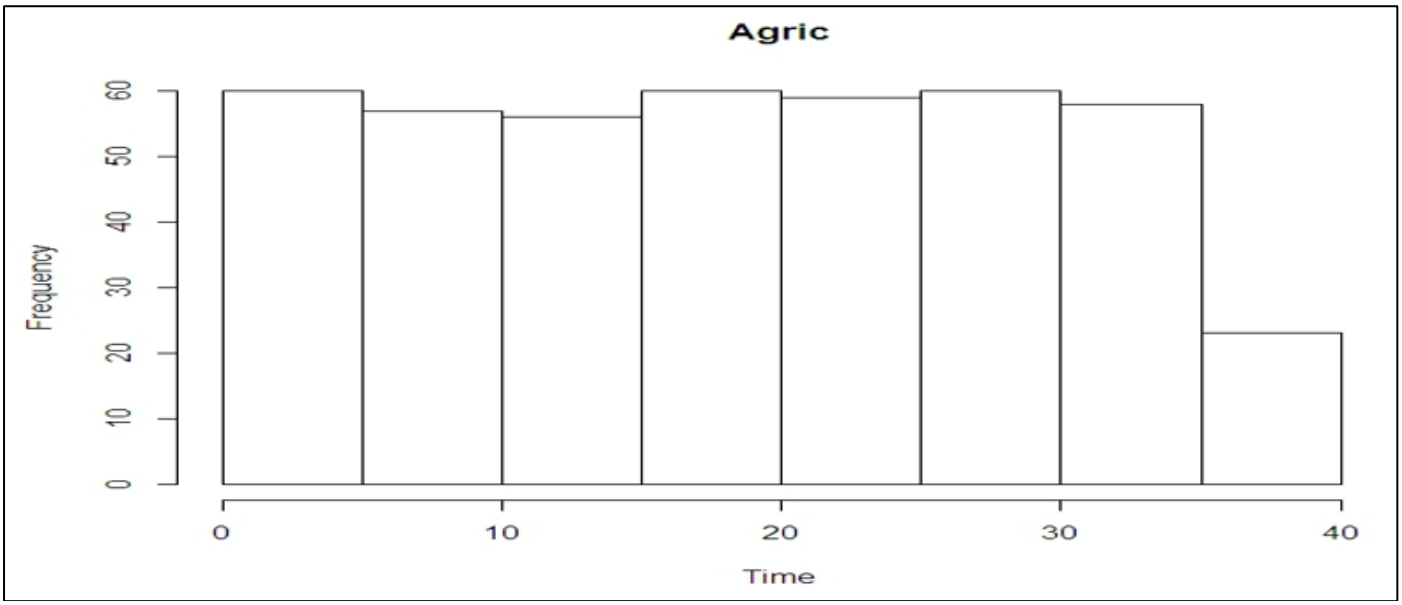

Fig 10 (Histogram showing the Contribution of Agriculture over Time)

Fig 11 (Histogram showing the Contribution of wholesale and Retail Trade over Time)

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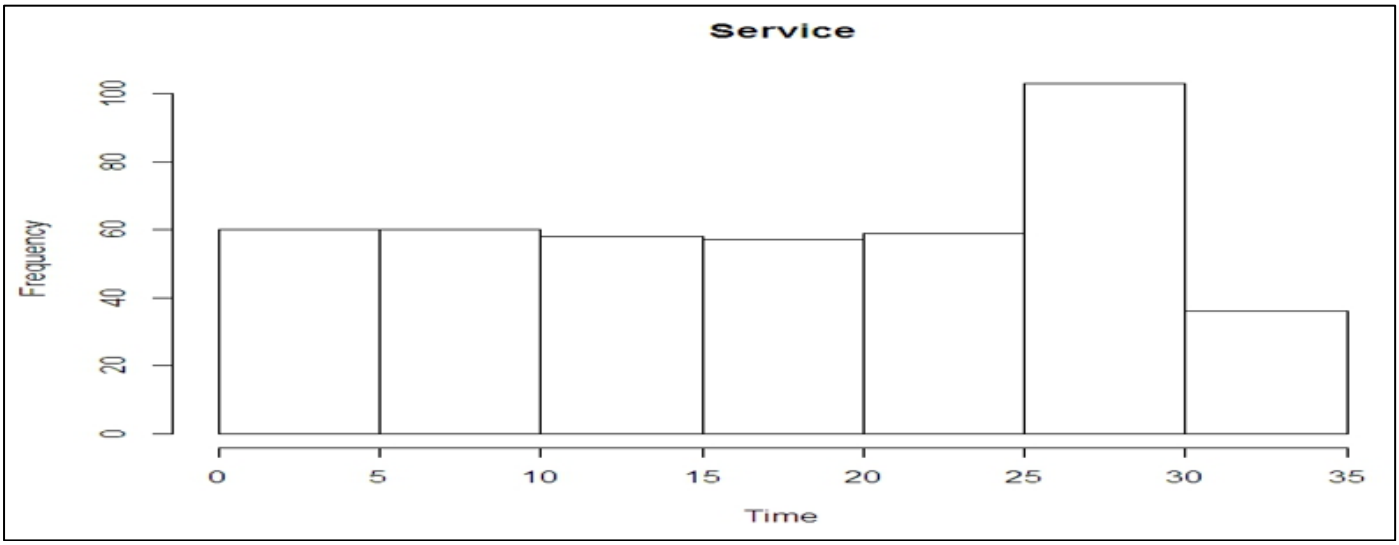

Fig 12 (Histogram showing the Contribution of Services over Time)

- *Q–Q (Quantile-Quantile) Plot below, shows the Contribution Factors are Normal q-q Plot.*

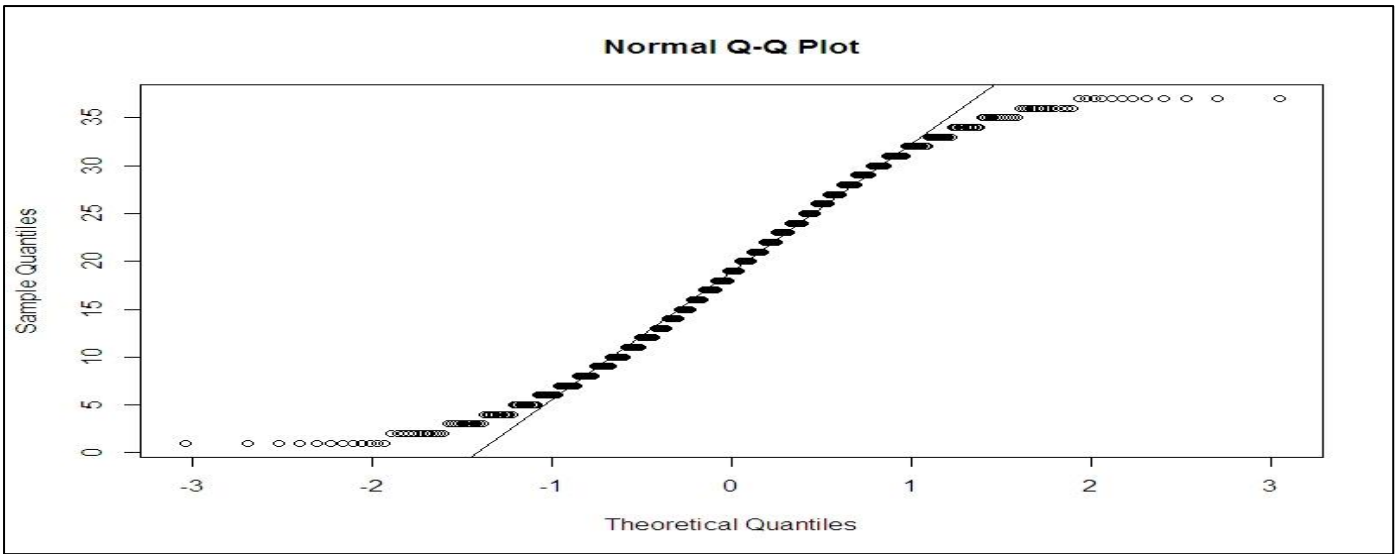

Fig 13 Q–Q (Quantile-Quantile) Plot shows the Contribution Factors are Normal q-q Plot

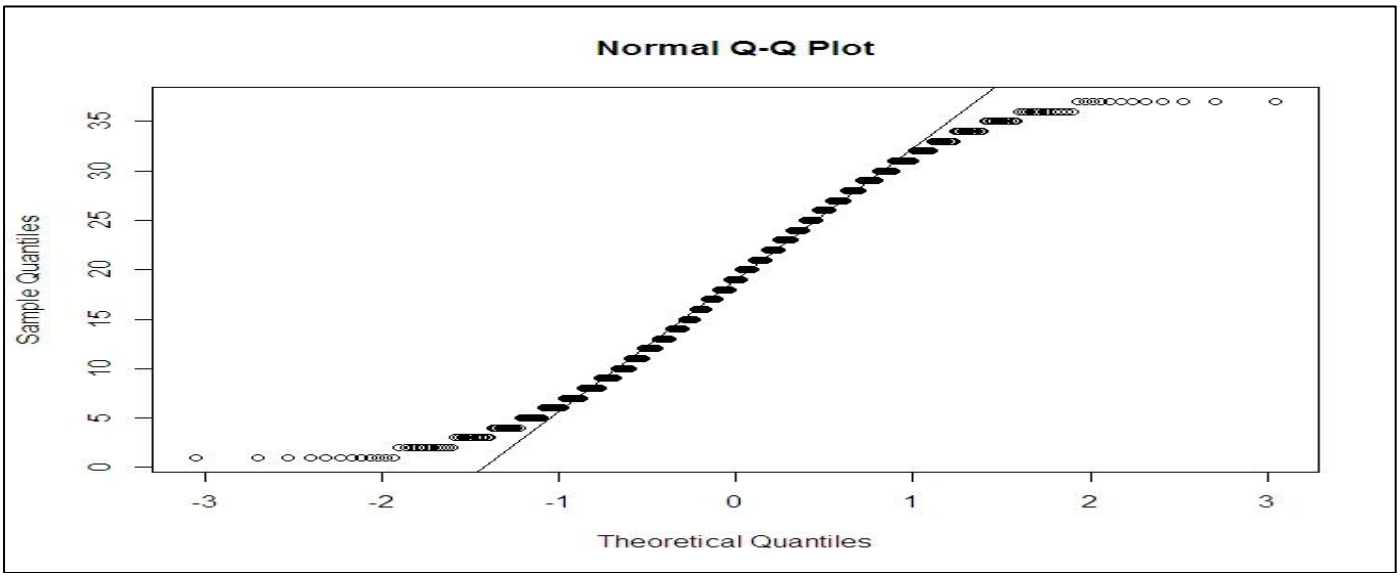

Fig 14 Q–Q (Quantile-Quantile) Plot shows the Contribution Factors are Normal q-q Plot

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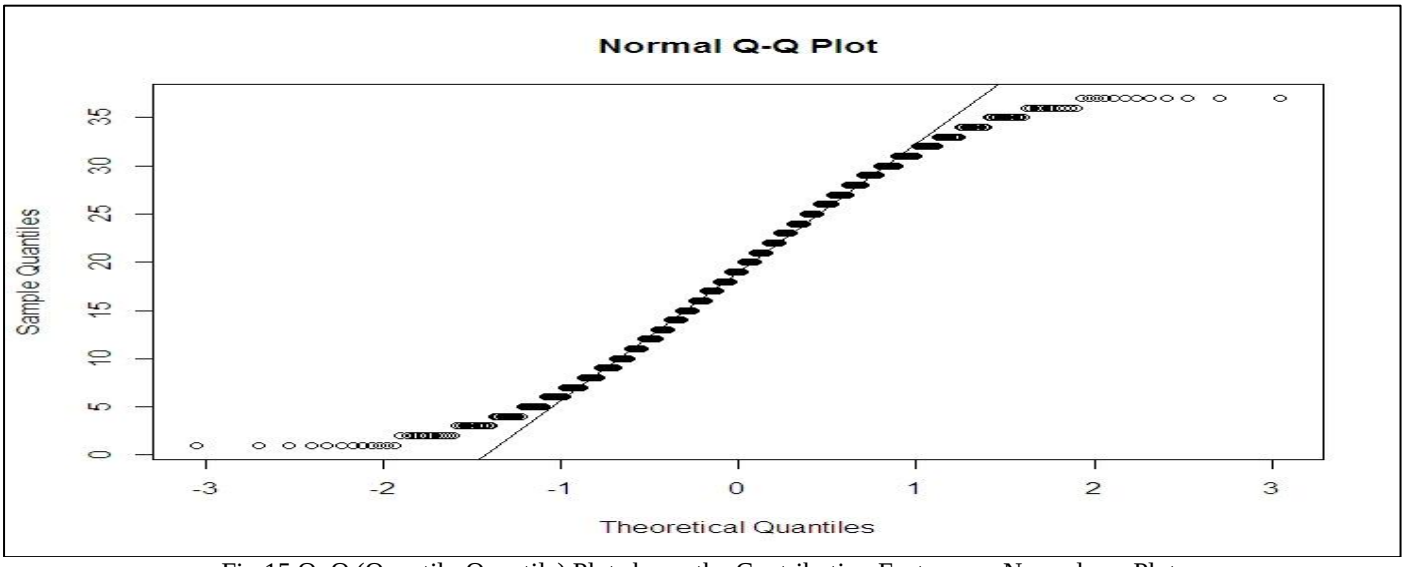

Fig 15 Q–Q (Quantile-Quantile) Plot shows the Contribution Factors are Normal q-q Plot

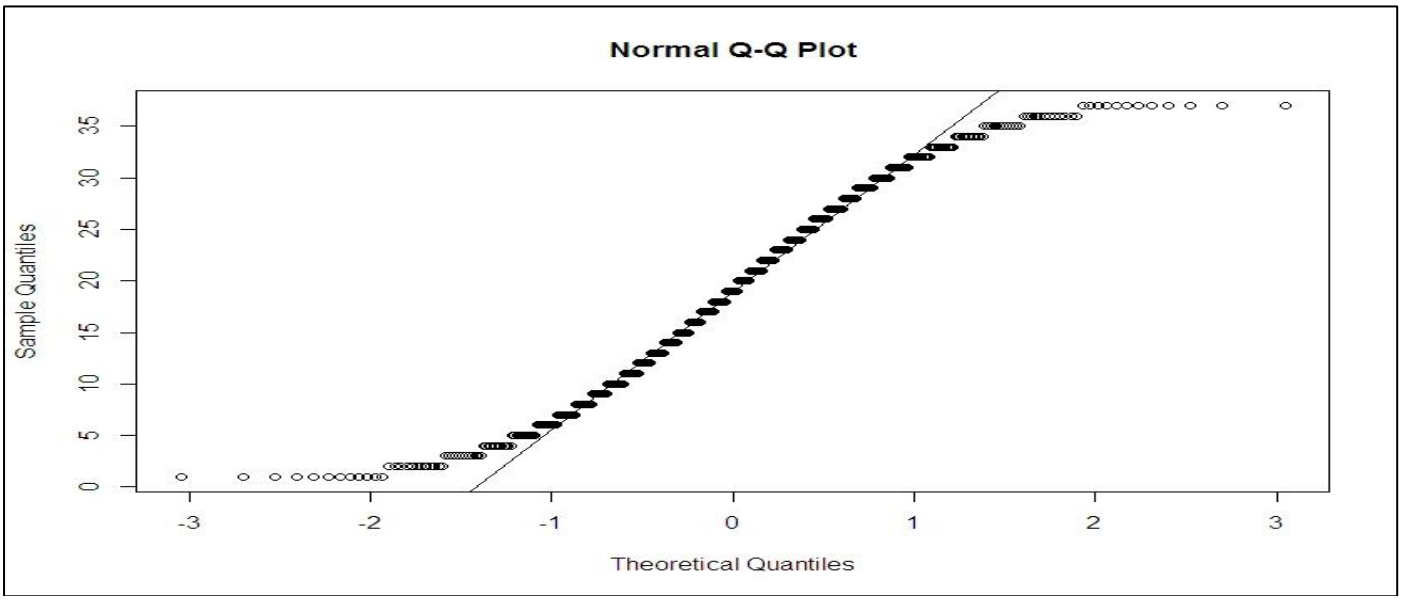

Fig 16 Q–Q (Quantile-Quantile) Plot shows the Contribution Factors are Normal q-q Plot

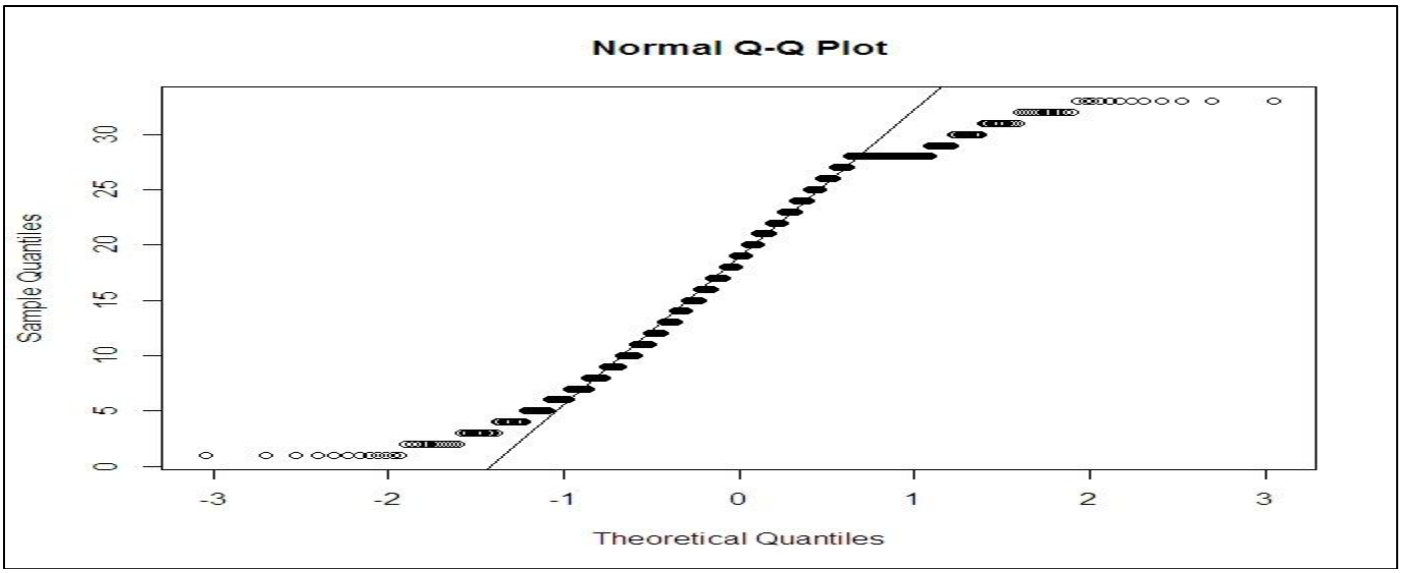

Fig 17 Q–Q (Quantile-Quantile) Plot shows the Contribution Factors are Normal q-q Plot

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP250

Agriculture had the highest number activities to this per capital income followed by Industry, Services, wholesales and building. It is to be noted that factored series are more suitable PCA than that of time series models. This factored certainty was justified by the decreasing variance of the GDP from 1981 to 2017. It connotes that the variation at the beginning of 1981 that the GDP and its contributors are lower and far apart from the immediate past one, the deviation in variation was larger. That is why all the , histograms and QQ plots maintained and suggested a single increasing flow of trend expect for services that experienced a structural break towards last three years.

➢ *Correlation Matrix and Descriptive Interpretation*

The overall accumulated variance for the GDP for the studied period is 10.7 for a 56% coefficient of variation. All the contributors (Agriculture, Industry) maintained a positive correlation all through the period of study expect for SERVICES that affect/shirk the GDP along the year. Wholesales experienced the strongest doling of taking care of the GDP with 98%, followed by BC, industry and agric with 86%, 78% and 6% respectively, and -6% shirking by Services.

➢ *Correlation Matrix:*

$$\begin{array}{c} \\ Agriculture \\ Industry \\ Building/C \\ WRT \\ Services \\ GDP \end{array} \begin{array}{c} \begin{array}{cccccc} Agriculture & industry & building & wrt & GDP \end{array} \\ \begin{pmatrix} 1.00 & 0.64 & 0.490.83 & 0..80 & 0.93 \\ 0.76 & 1.00 & 0.760.54 & -0.92 & 0.01 \\ 0.89 & 0.86 & 1.000.62 & 0.73 & 0.48 \\ 0.40 & 0.92 & 0.841.00 & 0.72 & 0.40 \\ 0.88 & 0.39 & 0.770.79 & 1.00 & -0.49 \\ 0.06 & 0.78 & 0.860.98 & -0.24 & 1.00 \end{pmatrix} \end{array}$$

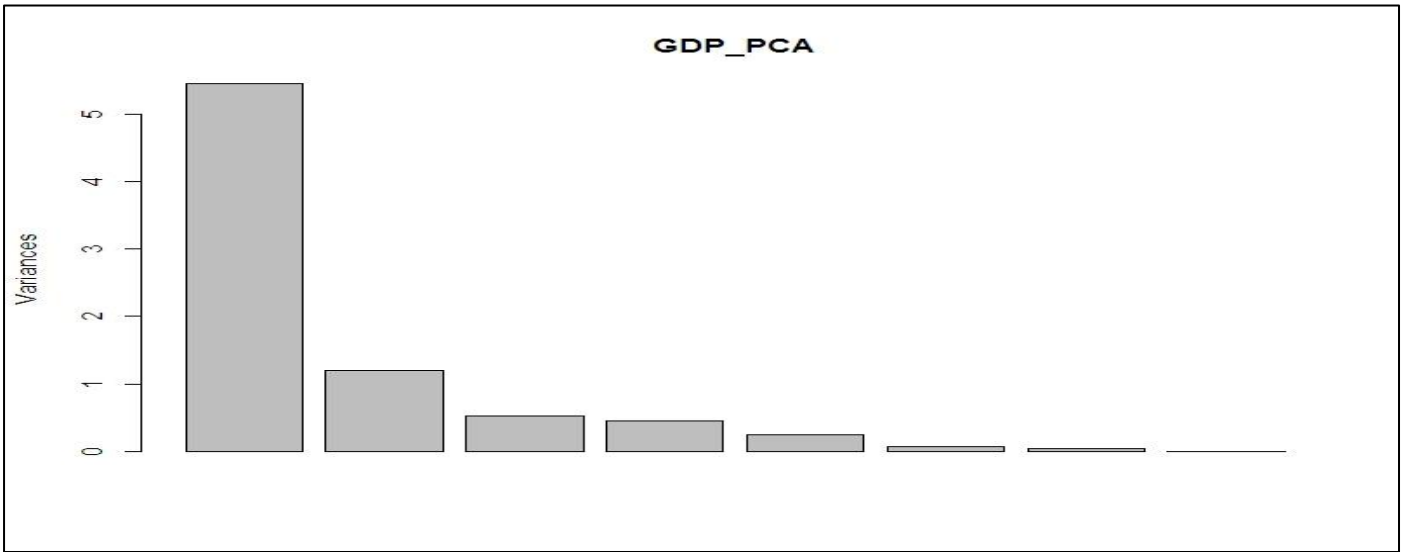

Fig 18 Correlation Matrix

Standard deviations (1, .., p=6):

2.33372393, 1.09623192, 0.72182793, 0.67615707, 0.49697892, 0.27157857

Rotation (n x k) = (5 x 5):

$$\begin{array}{c} \\ Agriculture \\ Industry \\ Building/C \\ WRT \\ Services \end{array} \begin{array}{c} \begin{array}{ccccc} PC1 & PC2 & PC3 & PC4 & PC5 \end{array} \\ \begin{pmatrix} 0.47734940 & 0.98901324 & 0.05672682 & 0.979472237 & 0.406389 \\ 0.75629982 & -0.84085003 & 0.52905782 & -0.30280380 & 0.038019 \\ 0.33224949 & 0.93018727 & 0.84671814 & 0.50898677 & 0.06782880 \\ -0.37686180 & 0.0364668 & -0.4172022 & 0.76991028 & 0.503674682 \\ 0.41792790 & -0.0630886 & -0.56024367 & 0.390190939 & 0.308588990 \end{pmatrix} \end{array}.$$

➢ *PCA Interpretation*

The factor contribution of services, and WRT with cumulative proportions of 0.98258 and 0.94754 happened to be the converging components of interest with minimum Proportion of Variances 0.06531 and 0.03504 respectively. Building/Construction and Industry are the swingy maintained components that are balance wheeling components with cumulative proportions 0.88223 and 0.8078 with reduced variation of 0.07443 and 0.1706. Whereas the diverging contributor that happened to be the wheeling contributor at the beginning of the studied period is Agric with the smallest Cumulative Proportion of 0.6372 and Proportion of Variance to be 0.6372. The linear combination (that is the eigenvalues of each of the individual components are.

Agriculture	Industry	Buiding/C	W/R Trades	Services
−0.5209391	−0.42019290	−0.410927827	−0.3028372	−0.873125

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➢ *Components of PC (%s):*

	PC1	PC2	PC3	PC4	PC5
Standard deviation	2.1119	1.0928	0.72181	0.67614	0.49524
Proportion of Variance:	0.6372	0.1706	0.07443	0.06531	0.03504
Cumulative Proportion	0.6372	0.8078	0.88223	0.94754	0.98258

- *The Linear Combination for the First Principal Component is:*

Agriculture	Industry	BC	WRT	Services
-0.5209391	-0.42019290	-0.410927827	-0.3028372	-0.873125

➢ *Prediction*

Agriculture	Industry	BC
24,465.09	8,520.11	702.99
WRT	Services	GDP
23,221.65	5,983.00	45,490.52

It is to be noted that the prediction of the in-sample of 2017 is closer to the actual recorded observation with (24,465.09 - 23,952.55) = 512.54 residue for Agriculture,

(8,520.11 - 7,927.90) = 592.21 for residue for industry,

(702.99 - 667.92) = 35.07 residue for BC,

(23,221.65 - 21,895.09) = 1,326.56 residue for WRT,

(5,983.00 - 5,129.34) = 853.66 residue for services and

(45,490.52- 44,093.09) = 1397.43 for GDP

Predict (gdp_pca) [,1]

Agriculture	Industry	Building/C	WRT	Services	GDP
24,465.09	8,520.11	702.99	23,221.65	5,983.00	45,490.52

IV. SUMMARY

In 2014, Nigeria was largest and fastest growing economy in Africa, and this is determine by year on year Gross Domestic Product (GDP), which is the major tools use by the rest of the world to determine the growth of a country's economy. Furthermore National Bureau of Statistics (NBS) releases both quarterly and yearly growth of Nigeria GDP, while the data source in this project is from NBS, starting from 1980 to 2017. Moreover the Nigeria GDP, comprises many component therefore the Principal Component Analysis (PCA) was adopted for the analysis, the major PCs use are Agriculture, Building and Construction, Industry, Wholesale and Retail Trade, and Services

V. CONCLUSION

There is yearly growth in Nigeria gross domestic products due to increase in all contributors factored components from 1980 to 2017, Agriculture had the highest number activities to this per capital income followed by Industry, Services, wholesale and retail trade, and building and construction.

Also the overall accumulated variance for the GDP for the studied period is 10.7 for a 56% coefficient of variation. All the contributors (Agriculture, Industry) maintained a positive correlation all through the period of study expect for SERVICES that affect/shirk the GDP along the year. Wholesales experienced the strongest doling of taking care of the GDP with 98%, followed by Building and Construction, industry and agriculture with 86%, 78% and 6% respectively.

RECOMMENDATION

For Nigeria to maintain the largest economy in Africa I will strongly advice the economy team should look properly on agriculture and industry if this two increases certainly wholesale and retail trade with building and construction will be affected positively while extended to services, therefore the GDP will also be stabilise

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