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TIME SERIES ANALYSIS OF NIGERIAN GROSS DOMESTIC PRODUCTS USING THE METHOD OF PRINCIPAL COMPONENT

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ABSTRACT
The genuine (expansion changed) gross domestic product of Nigeria is concentrated here by Principal Component Method. An acknowledgment of the arrangement from the main quarter of 2018 to the second from last quarter of 2019 is analyzed using Minitab 12 programming. Both the correlation matrix and the covariance matrix are used. Eigen analysis of both matrices suggest that the first three principal components are enough to explain variation in the data set. The correlation principal components involved all the items. The covariance principal components did not involve all the items which is a deficiency. For instance, animals, ranger service, fishing, strong minerals, development, transport, utilities, convenience and food administrations, account and protection, proficient logical and specialized administrations, regulatory and support administrations and business administrations, policy management, human wellbeing and social administrations and expressions, amusement and entertainment are not included. This makes the technique substandard.
Keywords: Gross, Domestic, Product, Correlation, Covariance

INTRODUCTION
The gross domestic product (GDP) is a measure of national income and output for the given economy of the nation. Services transport, information & Communication, Utilities, Accommodation and food services, Finance & Insurance, Real Estate, Professional Scientific & Technical services, Administrative and Support Services & Business Services, Public Administration, Education, Human Health & Social Services, Arts, Entertainment & Recreation, Other services. Charles Davenant developed the method further in 1695. The modern concept of **GDP** was first developed by Simon Kuznets for a US Congress report in 1934. ... After the Bretton Woods conference in 1944, **GDP** became the main tool for measuring a country's economy.

Gross Domestic Products developed by Charles Davenant 1695 is one of the concept used in the history of the statistical and econometric analysis in terms of research findings. The modern concept of GDP which was first developed by Simon Kuznets for a US Congress report in 1934. After the Bretton Woods

conference in 1944, GDP became the main tool for measuring a country's economy. In Nigeria, oil sector contributes to about nine percent of the country's GDP. For instance, between July and September 2020, the oil industry contributed to 8.73 percent of the total real GDP, a decrease by one percentage point compared to the same period of 2019. Nigeria as a Sub Saharan Africa's largest economy rely heavily on oil as its main source of foreign exchange earnings and government revenues. Nigeria has proven reserves equivalent to 237.3 times its annual consumption. This means that, without Net Exports, there would be about 237 years of oil left (at current consumption levels and excluding unproven reserves). The Gross Domestic Product (GDP) in Nigeria was worth 448.10 billion US dollars in 2019, according to official data from the World Bank and projections from Trading Economics. The GDP value of Nigeria represents 0.37 percent of the world economy. Source: World Bank

This study is a further analysis of the GDP of Nigeria by the use of Principal Components. Gross Domestic Products developed by Charles Davenant 1695 is one of the concept used in the history of the statistical and econometric analysis in terms of research findings. The modern concept of GDP which was first developed by Simon Kuznets for a US Congress report in 1934. After the Bretton Woods conference in 1944, GDP became the main tool for measuring a country's economy. In Nigeria, oil sector contributes to about nine percent of the country's GDP. For instance, between July and September 2020, the oil industry contributed to 8.73 percent of the total real GDP, a decrease by one percentage point compared to the same period of 2019. Nigeria as a Sub Saharan Africa's largest economy rely heavily on oil as its main source of foreign exchange earnings and government revenues. Nigeria has proven reserves equivalent to 237.3 times its annual consumption. This means that, without Net Exports, there would be about 237 years of oil left (at current consumption levels and excluding unproven reserves). The Gross Domestic Product (GDP) in Nigeria was worth 448.10 billion US dollars in 2019, according to official data from the World Bank and projections from Trading Economics according to GDP value of Nigeria which represents 0.37 percent of the world economy. Source: World Bank

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MATERIALS AND METHODS

Data

The data used in this work are quarterly Gross Domestic Product values from the first quarter of 2018 to the third quarter of 2019 having 22 variables. They are from the website of the Central Bank of Nigeria cbn.gov.ng and are given in the appendix.

Methods

The Principal Component Analysis PCA) is a technique whereby the variance of a linear combination of a set of variables is maximized (Rencher, zool). Let X $[X_1 X_2 \ldots X_p]$ be multivariate normal with mean μ_p and covariance matrix Σ_p. Solution of the determine equation $|\Sigma - \lambda 1| = 0$ is called an eigenvalue of Σ. Let$\lambda_1, \lambda_2, \ldots \lambda_p$ be the eigen values of Σ in descending order of magnitude with the respective eigen vectors as $e_1, e_2, \ldots e_p$.

Suppose $e_1 = (e_{i1}, e_{i2} \ldots, e_{ip})$ a vector of constants.

Consider the linear combinations

$Y_1 = e_{11}X_1 + e_{12}X_2 + \ldots e_{ip}X_p$, i =, 2, … p

Then the first principal component is

$Y_1 = e_{11}X_1 + e_{12}X_2 + \ldots + e_{1p}X_p$

chosen such that its variance $V(Y_1) = e_1$ is maximum, $\Sigma e_1'e_1 = 1$, the second principal component is such that

$Y_2 = e_{21}X_1 + e_{22}X_2 + \ldots + e_{2p}X_p$

Chosen such that its variance is the maximum of the remaining variance of the data and $\Sigma e_2'e_2 = 1$ and Y_2 and Y_1 are uncorrelated. Higher principal components are similarly defined.

The same argument may be applied by replacing Σ with the matrix of correlations.

Computer Software: Minitab 17 was used for all computations.

RESULTS

Essentially, two methods like the correlation matrix and the covariance matrix were used while the eigen analysis of the correlation matrix gives the results in table 1

Summary:

Table 1: Correlation of Eigen Analysis

Eigen Value	Proportion	Cumulative Proportion
9.9566	0.332	0.332
5.8425	0.255	0.817
5.0505	0.220	0.817
.8751	0.030	0.078
0.2313	0.021	0.889
0.0440	0.003	1.000

The Principal Components are summarized in Table 2.

Table 2: Correlation principal components

Activity sector	Principal Component 1	Principal Component 2	Principal components 3
Crop production	0.230	-0.036	-0.118
Livestock	0.163	-0.146	0.110
Forestry	0.156	0.131	0.378
Fishing	-0.141	-0.127	0.2760
Crude petroleum & natural gas	0.020	0.013	-0.310
Solid minerals	0.282	0.117	0.071
Manufacturing	0.150	-0.244	0.019
Construction	-0.015	0.166	0.351
Trade	0.231	-0.118	0.130
Transport	0.002	-0331	0.088
Information & communication	0.036	0.131	0.332
Utilities	0.246	0.166	0.147
Accommodation and food services	0.000	-0.308	-0.059
Finance & insurance	-0.101	0.022	0.210
Real estate	0.303	0.071	0.023
Professional scientific & Technical services	0.307	-0.086	-0.038
Administrative and support services Business services	0.267	-0.102	-0169
Public administration	0.240	0.027	0.170
Education	0.216	-0.177	0.015
Human health & social services	0.265	0.121	0.168
Arts, entertainment & recreation	-0.170	-0.140	0.123
Other services	-0.011	-0.270	0.240

The adoption of the covariance matrix yielded the following eigenvalues as Summarized in Table 3.

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Table 3: Covariance Eigen analysis

Eigenvalues	Proportion	Cumulative proportion
644235000000	0.677	0.677
50776287740	0.061	0.848
15243864684	0.020	0.880
6777173238	0.008	0.888
467411351	0.001	1.000
144301199	0	1.000

The resultant principal components are summarized in Table below.

Table 4: Covariance principal components

Activity sector	Principal component 1	Principal component 2	Principal component 3
Crop production	0.861	-0.023	0.030
Livestock	0.006	-0.046	-0.067
Forestry	0.001	-0.011	0.010
Fishing	-0.010	-0.006	0.064
Crude petroleum & natural gas	0.086	0.474	0.223
Solid minerals	0.005	-0.018	0.010
Manufacturing	0.028	-0.065	-0.232
Construction	-0.062	-0.164	0.171
Trade	0.083	-0.370	-0.378
Transport	0.001	-0.021	-0.073
Information & communication	-0.054	-0.553	0.410
Utilities	0.013	-0.062	0.043
Accommodation and food services	0.006	0.016	-0.170
Finance & Insurance	-0.035	-0.031	-0.027
Real estate	0.115	-0.270	0.154
Professional Scientific & Technical Services	0.047	-0.075	-0.035
Administrative and support services Business service	0.000	-0.000	-0.000
Public administration	0.018	-0.095	-0.010
Education	0.048	-0.095	0.239

Human health & Social services	0.002	-0.013	0.007
Arts, entertainment & recreation	-0.006	0.004	-0.016
Other services	-0.067	-0.163	-0.461

DISCUSSION

Eigen analysis of the correlation matrix in Table 1 reveals that the first three eigen values account for more than 94% of the total variation in the data. On this basis, it is enough to consider the first three principal components. In table 2, with a benchmark of 0.23 the first principal component is a function of crop production, solid minerals, trade, utilities, real estate, professional scientific and technical services, administrative and support services and business services public administration, human health and social services and negatively arts, entertainment and recreation. The second principal component is a negative function of Livestock, fishing, manufacturing, transport, accommodation and food services education and other services. The third principal component involves forestry, construction, information and communication, finance & insurance and other services, and negatively, crude petroleum and natural gas. Some corroborative publications include Aderemi Ojekunle (2019), Oluwadamilare (2010), Vanguard (2020), Nigerian Bureau of Statistics (2019) and Njekwe Henry (2019). The covariance eigen analysis of table shows that the first three eigenvalue account for 99% of the total variation in the data. That means that the first three principal components are enough to explain the data. According to table 4, the first principal component has just crop production as the component. The second has just crude petroleum & natural gas as the positive component. The negative ones are trade, information and communication and real estate. The third has as the only positive component crude petroleum and natural gas and information and communication. The negatives are manufacturing, trade, education and other services.

CONCLUSION

Summarily, comparing the correlation analysis results from the contribution of crop production like, solid minerals, trade, utilities, teal estate, professional scientific & technical services, administrative and support services and business services, public administration, human health services and arts, entertainment and recreation) livestock, fishing, manufacturing,

transportation, accommodation and food services, education and other services) forestry, crude production, construction, information and communication, finance and other services, with covariance analysis involving crop production, crude petroleum, trade, information and communication, real estate, manufacturing, trade, information and communication, education and other services, we noticed that the correlation method is the more inclusive and therefore better for specification of real gross domestic products of Nigeria using principal component method.

AUTHORS' CONTRIBUTION

This work was carried out in collaboration among all authors. "**Robinson Amos Ibuchi**" designed and performed the statistical analysis, wrote the protocol, and drafted the manuscript. **While "Chinyem Uzoamaka Esther"** drafted the literature r'esearch, methodology with the referencing.. All authors read and approved the final manuscript.

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