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A Comparative Analysis of the Contributions of the Agricltural Sector and Industrial Sector towards the Development/Growth of the Nigerian Economy

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I. Introduction

In most developing countries, agriculture is the main traditional pursuit and the key to sustain the growth of the modern economy. Economic growth has gone hand in hand with agriculture and stagnation in agriculture is the principal explanation for poor economic performance in any developed country like Nigeria.

Economic growth is the increase per capital GDP or other measures of aggregate income, typically reported as the annual rate of change in real GDP. Economic growth is referred to the value of goods and services produced and does not account for working conditions such as education, politics, social, environmental degradation etc.

Agriculture is the backbone of the Nigerian economy and the growth of the economy is primarily driven by improvements in productivity which involves producing goods and services with fewer inputs of labour, energy and material per unit of growth. Population growth contributes to economic growth on a national level but population growth itself does not improve the standard of living.

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Nigerian manufacturing industry has suffered neglects, since the country's economy has depended on the petroleum sector since 1970's. As the government tries to diversify the economy, it is working to revive the manufacturing sector so as to increase its contribution to the Nigerian prosperity. Lagos and its surroundings are about 60% of the Nigerian industrial base. Other key industrial base or centers are Kano, Ibadan, and Kaduna. The Nigerian most manufacturing industries are Beverages, Cement, Cigarettes, Food Processing, Textiles and Detergent. The manufacturing industry contributed 3.6% GDP in 2008 and 4.2% in 2009. The contribution to GDP has changed little over decade. Industries like cement and Beverages attracts investment from home and abroad while other industries are closing up shop. Between 2000 and 2012 more than 850 manufacturing companies either shutdown or temporarily halted production. Capacity utilization in the manufacturing industry is about 53%. Imports of manufactured goods have constituted the biggest category of import since 1980's, but the governments are working to revitalize the ailing sector.

In 2010, the Nigerian government announced a USD 1.3 billion fund to help banks extend credit to the manufacturing sector, following the decline in availability of finance after the onset of the global economic crisis.

Nigeria as a country has an urgent need to increase the supply of capital; there is usually no shortage of labour, though there may be a shortage of particular skill. An increase in capital can increase the total output and average income. If people are transferred to a place where their marginal productivity is low to a developing industry where their marginal productivity is high, the labour force may be unsuited for industrial work. Therefore, it is necessary to improve the level of literacy of the population as a whole and to develop technical and managerial skills at all levels.

Another problem is that a movement of labour from agricultural sector to industrial sector may result in a downfall of the production of food with consequent food shortage in the expanding urban centers of production. A necessary industrialization may be agricultural reforms and modernization such as change in ownership of land. So that the economic growth may involve a radical change of social and political customs.

The problem of industrial sector over decade has been inadequate infrastructure and lack of power supply. The country set a target of generating 6000 MW of electricity by the end of 2009, but estimated national demand is 25000MW. Manufacturers mainly installed their own generator to compensate for spotty supply from the state and the industry as a whole generated around 72% of its own energy needs. But operating these generator increases the cost of manufacturing goods and the cost is passed on the consumer, making it difficult for Nigerian goods to compete with cheaper imports.

II. Methodology

In realizing the objective or purpose of this work, a method of data analysis was employed namely multivariate analysis. Multivariate analysis was used to study and compare the contributions of agricultural sector and industrial sector towards the growth of the Nigerian economy. Multivariate analysis is a major area in statistics where p-correlated variables must be analyzed jointly and large part of the analysis is concerned with inference on the basis of sample information. The multivariate method for this work follows the Hotelling' s T^2distribution with v-degree of freedom. Hotelling's T^2 distribution is obtained from $X^I \Sigma X$ by replacing Σ with its unbiased estimate D which is independently distributed with x.

Notes

Notes

Hotelling's T^2 distribution is a multivariate generalization of Student t-distribution. It is useful in many problems where one will use the t-statistics in the univariate analysis. It can also be used in some situations for which there is no univariate counterpart. The distribution of $\mu = 0$ is called the null distribution of T, while $\mu \neq 0$ is called the non null distribution of T.

Let $x \sim N_p(\mu, \Sigma)$ and, $D \sim W_p(\Sigma, v)$, $D > 0$ then X, D are independent.

Hence,

$$T^2 = VX^I D^{-1} X.$$

Consider

$H_0: \mu = \mu_0$ *vs* $H_1: \mu \neq \mu_0$, and a random sample $\{x_1\ x_2, \ldots, x_n\}$ from $N_p(\mu, \Sigma)$.

Let $\bar{X}$ and S be the sample mean and variance, then

$$s^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^I (X_i - \bar{X})}{n-1}$$

or

$$(n - 1)\, s^2 = \sum_{i=1}^{n}(X_i - \bar{X})^I (X_i - \bar{X})$$

According to Mahalanobis D^2- statistics, the deviation of Hotelling's T^2 for one sample case is as follows

$$\text{Let, Let } t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}}, \quad \text{but } \bar{X} - \mu_0 = d. \text{ Hence, } t = \frac{d}{s/\sqrt{n}}; \quad t^2 = \frac{d^2}{s^2/n}.$$

$$\text{Let } D = \frac{d}{s} \text{ and } D^2 = \frac{d^2}{s^2} \Longrightarrow d^2 = D^2 s^2; \text{ then, } t^2 = \frac{D^2 s^2}{s^2/n} = nD^2 = nD^I s^{-1} D$$

$$T^2 = n(\bar{X} - \mu_0)^I s^{-1} (\bar{X} - \mu_0);$$

where s^{-1} is the inverse of the sample covariance matrix, $\bar{X}$ is the mean vector of sample of size n from multivariate normal distribution with mean vector μ_0 and dispersion matrix Σ.

To test the null hypothesis, we compare T^2 with $T^2_{\alpha/2,p,n-p}$ If, $T^2 > T^2_{\alpha/2,p,n-p}$, we reject H_0 and accept if otherwise.

$$\text{Where } T^2_{\alpha/2,p,n-p} \cong \frac{p(n-p)}{n-p} F_{\alpha/2,p,n-p}.$$

For two sample case, let two independent sample $X_i, i = 1,2, \ldots, n_1$ and $Y_j, j = 1,2, \ldots, n_2$ be from $N_p(\mu_1, \Sigma)$ and $N_p(\mu_2, \Sigma)$ respectively. We may wish to test the hypothesis that both samples came from the same distribution; that is $H_0: \mu_1 = \mu_2$ vs $H_1: \mu_1 \neq \mu_2$.

$$s_1 = \frac{\sum_{i=1}^{n_1}(x_i - \bar{x})^I (x_i - \bar{x})}{n_1 - 1}; \quad (n_1 - 1)s_1 = \sum_{i=1}^{n_1}(x_i - \bar{x})^I (x_i - \bar{x})$$

Also,

$$s_2 = \frac{\sum_{j=1}^{n_2}(y_j - \bar{y})^I (y_j - \bar{y})}{n_2 - 1}; \quad (n_2 - 1)s_2 = \sum_{j=1}^{n_2}(y_j - \bar{y})^I (y_j - \bar{y})$$

The pooled estimate S of Σ is $s_p = \frac{(n_1 - 1)s_1 + (n_2 - 1)s_2}{n_1 + n_2 - 2}$

Therefore, the derivation of T^2 for two sample case is as follows ($Mahalanobis\ D^2 - statistic$)

$$t = \frac{\bar{x}-\bar{y}}{s_p\Big/\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}, \text{ let } \bar{x}-\bar{y} = d;\ t = \frac{d}{s_p\Big/\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}};\ t^2 = \frac{d^2}{s_p^2\Big/\frac{1}{n_1}+\frac{1}{n_2}}$$

Let $D = \frac{d}{s_p}$. and $D^2 = \frac{d^2}{s_p^2}$; then, $t^2 = \frac{D^2 s^2}{s_p^2\Big/\frac{1}{n_1}+\frac{1}{n_2}} = \frac{D^2 s_p^2}{s_p^2\left(\frac{n_1+n_2}{n_1 n_2}\right)}$.

Therefore, $T^2 = \frac{n_1 n_2}{n_1+n_2} D^2 = \frac{n_1 n_2}{n_1+n_2} D^I s^{-1} D$

$$= \frac{n_1 n_2}{n_1+n_2} (\bar{x}-\bar{y})^I s_p^{-1} (\bar{x}-\bar{y});$$

The null hypothesis is rejected if $T^2 > T^2_{\alpha/2,p,n_1+n_2-p-1}$ and accepted if otherwise.

Where $T^2_{\alpha/2,p,n_1+n_2-p-1} \cong \frac{p(n_1+n_2-2)}{n_1+n_2-p-1} F_{\alpha/2,p,n_1+n_2-p-1}$.

We can also employ F–statistic given by

$F = \frac{n_1+n_2-p-1}{p(n_1+n_2-2)} T^2$ and compare it with $F_{\alpha/2,p,n_1+n_2-p-1}$.

III. Data Presentation and Analysis

Table 3.1 : The contributions of each sector and their corresponding item (N billion) between 2005 – 2014. Source: National Bureau of Statistics (NBS)

Year	Agricultural Sector				Industrial Sector			
	Crop Production	Live Stock	Forestry	Fishing	Quarrying & Other Mineral	Oil Refining	Cement	Other Manufacturing
2005	192.5	13.7	2.8	7.2	1.4	0.6	0.4	18.5
2006	206.2	14.6	3.0	7.6	1.5	0.7	0.4	20.2
2007	221.6	15.7	3.2	8.1	1.7	0.8	0.4	22.1
2008	237.7	16.7	3.4	8.7	1.9	0.8	0.5	24.2
2009	252.5	17.9	3.6	9.2	2.1	0.9	0.6	26.3
2010	267.2	19.0	3.8	9.8	2.4	1.0	0.6	28.4
2011	282.6	20.3	4.0	10.4	2.7	1.0	0.7	30.5
2012	298.4	21.5	4.2	11.0	3.0	1.1	0.8	32.8
2013	309.6	22.7	4.5	11.7	3.4	1.2	0.8	35.3
2014	324.3	24.0	4.7	12.3	3.8	1.3	1.0	38.0

$$\bar{X} = \begin{bmatrix} 256.26 \\ 18.61 \\ 3.72 \\ 9.60 \end{bmatrix},\ \bar{Y} = \begin{bmatrix} 2.39 \\ 0.94 \\ 0.62 \\ 27.63 \end{bmatrix};\ (\bar{X}-\bar{Y}) = \left(\begin{bmatrix} 256.26 \\ 18.61 \\ 3.72 \\ 9.60 \end{bmatrix} - \begin{bmatrix} 2.39 \\ 0.94 \\ 0.62 \\ 27.63 \end{bmatrix} \right) = \begin{bmatrix} 253.87 \\ 17.67 \\ 3.10 \\ -18.03 \end{bmatrix}$$

$$S_1 = \begin{bmatrix} 18105.124 & 1408.244 & 255.878 & 701.32 \\ 1408.244 & 109.949 & 19.978 & 2711.590 \\ 255.878 & 19.978 & 3.636 & 9.690 \\ 701.320 & 2711.590 & 9.960 & 27.320 \end{bmatrix}$$

Notes

Notes

$$S_2 = \begin{bmatrix} 6.049 & 1.614 & 1.482 & 47.953 \\ 1.614 & 0.444 & 0.392 & 12.968 \\ 1.482 & 0.392 & 0.376 & 11.764 \\ 47.953 & 12.968 & 11.764 & 384.601 \end{bmatrix}$$

$$S_1 = \begin{bmatrix} 1006.1763 & 78.3254 & 14.2978 & 41.62632 \\ 78.3254 & 6.1329 & 1.1317 & 151.3643 \\ 14.2978 & 1.1317 & 0.2289 & 1.2069 \\ 41.6263 & 151.3643 & 1.2069 & 22.8845 \end{bmatrix}$$

$$s_p^{-1} = \begin{bmatrix} 0.0085 & 0.0020 & -0.5429 & -0.0005 \\ 0.0020 & -0.0003 & -0.1618 & 0.0068 \\ -0.5429 & -0.1618 & 39.1031 & -0.0049 \\ -0.0005 & 0.0068 & -0.0049 & -0.0001 \end{bmatrix}$$

$$T^2 = \frac{n_1 n_2}{n_1 + n_2}(\bar{x} - \bar{y})^I s_p^{-1}(\bar{x} - \bar{y})$$

$$= \frac{100}{20}\begin{bmatrix} 253.87 \\ 17.67 \\ 3.10 \\ -18.03 \end{bmatrix}^I \begin{bmatrix} 0.0085 & 0.0020 & -0.5429 & -0.0005 \\ 0.0020 & -0.0003 & -0.1618 & 0.0068 \\ -0.5429 & -0.1618 & 39.1031 & -0.0049 \\ -0.0005 & 0.0068 & -0.0049 & -0.0001 \end{bmatrix}\begin{bmatrix} 253.87 \\ 17.67 \\ 3.10 \\ -18.03 \end{bmatrix} = 688.90$$

Hypothesis:

H_0: their contributions towards the Nigerian economy are the same

H_1: their contributions towards the Nigerian economy are not the same

$$F = \frac{n_1 + n_2 - p - 1}{p(n_1 + n_2 - 2)}T^2 = \frac{10 + 10 - 2 - 1_1}{2(10 + 10 - 2)}(688.9) = 325.31$$

$$F_{\alpha/2,p,n_1+n_2-p-1} = F_{0.05/2,2,17.} = 3.59$$

Decision Rule: Since $F_{calculated}(325.314) > F_{tabulated}(3.59)$, we reject H_0 and conclude that their contributions are not the same.

a) To Test For Their Level Of Contribution

$t = \frac{\bar{x} - \bar{y}}{s_p \Big/ \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$, which follows Students' t-distribution with $v = n_1 + n_2 - 2$ degree of freedom, where $s_p = \frac{(n_1 - 1)s_1 + (n_2 - 1)s_2}{n_1 + n_2 - 2}$.

Hypothesis

H_0: Agricultural sector contributes more to the Nigerian economy than the industrial sector.

H_1: Industrial sector contributes more to the Nigerian economy than the Agricultural sector

$$s_p = \frac{(10 - 1)(2654.3104) + (10 - 1)(42.7716)}{10 + 10 - 2} = 1348.541$$

$$t = \frac{259.61}{1348.541\Big/\sqrt{\left(\frac{1}{10}+\frac{1}{10}\right)}} = 0.0861$$

$$t_{\alpha,n_1+n_2-2} = t_{0.05,18} = 1.734$$

Decision Rule: Since $t_{calculated}(0.0861) < t_{tabulated}(1.734)$, tcal (0.43047) <ttab (1.734), we do not reject H_0 and conclude that Agricultural sector contributes more to the Nigerian economy than industrial sector.

Notes

IV. Conclusion

Based on the above analysis, it was discovered that the growth of the Nigerian economy is moving on the positive side. It shows that the Agricultural and the Industrial sectors had contributed significantly to the GDP of this nation for the years under study. Also, the Agricultural sector is contributing more to the Nigerian economy than industrial sector.

We therefore recommend that since Agriculture is the major and most certain path to economic growth/development and sustainability, Nigeria Government should give it a priority by developing and exploiting the sector for the upkeep of her teeming populations through the earnings of revenue for development purpose as well as employment for the youths.

The Government should create enabling environment for the industries to succeed and market its industrial produce to the developed and developing countries by maintaining a high level of standard in their industrial products.

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