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MULTIVARIATE ANALYSIS OF SECTORAL INFLUENCES ON HOUSEHOLD FOOD CONSUMPTION EXPENDITURE USING PRINCIPAL COMPONENT AND REGRESSION MODELING

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ABSTRACT

In this study, the principal component analysis (PCA) and multiple regression were adopted to examine the sectoral determinants of household food consumption expenditure (as proxy to food security) in Nigeria. Annual data from the Central Bank of Nigeria Statistical Bulletin spanning 1996 to 2021 were used. The results showed that the correlation analysis revealed strong positive relationships among the sectoral variables, implying the presence of multi-collinearity. The outcomes of PCA indicate that the first principal component (PC1) represents 93.58% of the total variance, whereas the second and third components are 3.96 and 1.56, and this fact confirms the fact that the data is characterized by only one underlying economic structure. The PCA loadings show that all sectors have a positive contribution to PC1 with average contribution of approximately 13%, which implies that sectors have a balanced and interconnected influence in household's consumption. Nevertheless, the energy sector pushes the second major element by nearly 60%, which shows a structural role. The individuals plot also indicates three different clusters, showing the difference in time on sectoral performance. The regression findings demonstrate that the relationship between agriculture and household consumption expenditure is positive and statistically significant (β = 0.5886, p < 0.05) and water supply and ICT are not significant. The model describes 94.98% of the change in household consumption expenditure (R^2 = 0.9498), which shows a great fit in the model. This result shows the sectoral interactions, especially agriculture, strongly influence household consumption, supporting policies that enhance welfare and food security.

Keywords: Household Consumption Expenditure, Principal Component Analysis, Food Security, Sectoral Interdependence, Modeling

INTRODUCTION

Food security has been one of the most major development issues facing many developing nations especially the Sub-Saharan African countries. In spite of the tremendous efforts by governments and global bodies, a big percentage of families living in the developing economies continue to experience the challenge of having inadequate and nutritious foods. The concept of food security is widely understood as a state when people have physical, social, and economic access to sufficient, safe, and healthy food needed to live a healthy and active life (Food and Agriculture Organization [FAO], 2022). Household food consumption in the country has been well known as a good measure of food security due to its ability to indicate the purchasing power and access to food. Households in most developing economies use a high share of their income to purchase food items; therefore, changes in income level, prices of food commodities, and the output of agriculture have a direct impact on the welfare of households and their nutritional outcomes (Danmaigoro & Gona, 2022). Therefore, to develop effective policies that can be used to enhance food security, it is imperative to determine the factors that determine food consumption expenditure. Nigeria is the most populated nation in Africa; it is a nation that faces serious food security predicaments despite the large agricultural bases. Rapid population increase, macroeconomic lack of stability, increased inflation, changes in climate and agricultural market structural inefficiency have been associated with variations in food availability and affordability.

Empirical researches note that the rise in food prices and exchange rate fluctuations impact dramatically on the purchasing power and consumption behavior of households (Mafolasire et al., 2023). These obstacles are more pronounced within rural households where the major economic activity is agriculture and informal economic activities. The spending in the food sector is affected by many related aspects that cut across economic, agricultural, and social-demographic sectors. The variables (income levels, agricultural levels, the size of households, education, and access to markets) are mutually related in complicated ways to decide the level of food intake. Nevertheless, the conventional econometric techniques tend to have challenges of modelling such relations as a result of the existence of multi-collinearity among the explanatory variables. Principal Component Analysis (PCA) is a multivariate statistical method that offers a good solution to this problem by reducing the number of correlated variables into a smaller number of orthogonal components that reflect the underlying structure of the data (Adams and Bamanga, 2018). PCA can be used by a researcher to determine which factors have the highest impact on household food consumption patterns by reducing dimensionality and, more so, it isolates multi-collinearity.

The empirical literature of the recent past has pointed out that food security determinants are multidimensional. Indicatively, Awe et al., (2021) discovered that access to credit, household income, and farm size greatly impact food security of rural household in Kogi State, Nigeria. On the same note, a different study conducted by Habib (2024) established that household size, employment status, and diversification of income are significant predictors of food security among the households of the Kano State. In addition to Nigeria, there are also cross-country studies that tend to give more importance to economic stability, institutional factors, and environmental conditions in the determination of food security outcomes (Jambor and Elias, 2022; Vysochyna et al., 2020). Moreover, new studies that emerged in the recent past have underlined the importance of holistic analysis tools that can be used to understand the multidimensional

relationships between the economic and agricultural variables (Islam et al., 2025; Kegode et al., 2025). In spite of the increased literature on determinants of food security, little research has used multivariate analysis using composite tools to examine the sectoral impacts on household food consumption expenditure in Nigeria. The vast majority of the available research is based on single- equation regression model that might be insufficient to address the multidimensional relationships between the variables that impact food consumption.

Thus, the principal component analysis with regression modeling is used in this research to investigate the sectoral determinants of household food consumption expenditure. In particular, the research will attempt to extract latent factors using economic, agricultural, and demographic measures and assess their impact on the household food consumption expenditure. The results will be valuable to policy makers who want to enhance the food affordability and household welfare in Nigeria.

Food security encompasses four major dimensions that include food availability, food accessibility, food utilization and stability. All these dimensions define the capacity of the households to access sufficient and nutritious food in the long term (FAO, 2022). Household food consumption expenditure is one of the many indicators that are used to measure food security as it reflects access to food as well as diets. In developing countries, houses normally consume a large proportion of their income to buy food. Consequently, differences in income levels, prices of food, and employment opportunities can have a great impact on the behavior of food consumption. As Danmaigoro and Gona (2022) point out, the increased amount of food consumption expenditure is in general a sign of increased accessibility of food and welfare of households. The recent research works on the global level have also shown that insufficient access to food is closely linked to low dietary diversity and malnutrition. According to Islam et al. (2025), food insecurity also plays a major role in the adverse nutritional outcomes, especially in the population at risk in developing countries. Many empirical studies have been done to determine the determinants of household food security in various socio-economic settings. These researches point out the significance of income, agricultural output, education, and household demographic data to determine food security performance. Awe et al. (2021) examined the determinants of food security in Okunland, Kogi State, Nigeria, and discovered that household income, farm size, credit access, and education play a significant part in determining the status of food security among rural households. The relevance of their results is that agricultural productivity and rural livelihoods should be improved. On the same note, Habib (2024) studied food security in households within Kano State and documented that employment, income diversification, and household size have a significant effect on household-based food consumption patterns. The paper has highlighted the importance of economic empowerment interventions in enhancing household welfare. Danmaigoro and Gona (2022) examined rice farmers in Kebbi State and determined the availability of extension services, farm income, and land ownership as relevant factors that determine food security. These results indicate that the agricultural productivity is important in improving food availability and access. The nature of the food security results in the conflict-based areas is usually determined by the insecurity and displacement. According to Maisule et al. (2023), insurgency affects agricultural production and market access in the Borno State a great deal, thus, aggravating food insecurity in the affected households. Beyond Nigeria, global research has also found a number of macroeconomic and environmental factors that determine food security. According to Jambor and Elias (2022) economic growth, agricultural productivity, and institutional quality have a major impact on the food security outcome of Asian countries. In the same vein, Vysochyna et al. (2020) emphasized the importance of the environmental sustainability and economic stability in determining the national food security. The multidimensionality of determinants of food security has also been highlighted in recent research. According to Kegode et al. (2025), productivity in the farms, availability of markets, and education of the families play a significant role in the determination of food security among small hold farmers in Rwanda. Similarly, Islam et al. (2025) have shown that socio-economic disparities and the environment have a substantial impact on the access to food and nutritional outcomes.

Food prices are one of the determinants of household food consumption that is critical. The increase in the cost of foodstuffs can cause a massive decrease in the purchasing power of households and low-income earning households, who spend a sizeable percentage of their income on food, will be affected most. Mafolasire et al. (2023) examined the determinants of food price inflation in Nigeria by means of the application of PCA and ANOVA methods and arrived at the conclusion that the fluctuations of the exchange rates, inflation rates, and transportation costs are the determinants of food price dynamics. They find that macroeconomic stability is critical in making food affordable. In the same way, Dardeer and Shaheen (2022) studied the structural foods price inflation determinants with the help of the panel data of the Gulf Cooperation Council (GCC) nations, and found that supply chain shocks and economic shocks have a significant impact on the movement of food prices. Such results indicate that the food price stabilization policy is imperative in ensuring that the household food consumption level remains and enhancing food security outcomes. The multidimensional determinants of food security have made researchers to embrace the multivariate statistical methods that are able to represent concurrent relationships between a number of variables. Principal Component Analysis (PCA) is also aggressive when it comes to downsizing large datasets and retaining most of the information stored in the original variables (Adams and Bamanga, 2018). PCA is used to convert correlated variables into independent components which explain the maximum amount of variance in the data. Adams and Bamanga (2018) demonstrated the usefulness of PCA in analyzing key indicators of the Nigerian economy. Similarly, Jambor and Elias (2022) employed multivariate methods to analyze food security determinants across Asian countries and found that economic development and agricultural productivity are key drivers of food security. Despite these advantages, the application of PCA in analyzing sectoral influences on household food consumption expenditure in Nigeria remains limited. Therefore, this study employs PCA combined with regression analysis to provide a more comprehensive understanding of the determinants of household food consumption expenditure. Although numerous studies have examined determinants of food security, most of them focus primarily on socio-economic variables at the household level or macroeconomic indicators individually. Few studies integrate multiple sectoral indicators using advanced multivariate statistical techniques to identify the latent structures influencing food consumption expenditure. This study therefore fills this gap by combining Principal Component Analysis and multiple regression modeling to examine the sectoral determinants of household food consumption expenditure.

MATERIALS AND METHODS

The data utilized in this research is 1996-2021 annual data acquired in Central Bank of Nigeria Statistical Bulletin. The regression model and Principal Component Analysis (PCA) were used to analyze the relationship between Household Consumption Expenditure (a dependent variable) and the explanatory variable of Agriculture (AGR), Water Supply (WAS), Trade and Transportation (TRT), Information and Communication Technology (ICT), Financial and Insurance services (FIN), Human Health and Social services (HHS), Scientific and Technical services (SCT), and Energy (ENR).

Model Specification

To investigate the sectoral effects on household's food consumption expenditure in Nigeria, this study employed a multivariate regression framework combined with Principal Component Analysis (PCA). In which the multivariate regression model allows and create a possibility for the simultaneous estimation of the effect of several explanatory variables on a dependent variable, thereby capturing the combined influence of different sectors of the economy. Ever since the economic sector variables are often highly correlated, which in most cases lead to the problem of multi-collinearity in regression estimation. For Multi-collinearity inflates the variance of parameter estimates and makes statistical inference unreliable. So, to address this challenge, PCA was adopted for proper transformation of the correlated explanatory variables into a smaller number of orthogonal principal components.

In this study, Household Consumption Expenditure (HCE) defines the dependent variable, while the explanatory or independent variables include Agriculture (AGR), Water Supply (WAS), Trade and Transport (TRT), Information and Communication Technology (ICT), Finance and Insurance Services (FIN), Human Health and Social Services (HHS), Scientific and Technical Services (SCT), and Energy (ENR).

$$HCE_t = \beta_0 + \beta_1 AGR_t + \beta_2 WAS_t + \beta_3 TRT_t + \beta_4 ICT_t + \beta_5 FIN_t + \beta_6 HHS_t + \beta_7 SCT_t + \beta_8 ENR_t + \varepsilon_t \quad (1)$$

Where HCE_t represents household consumption expenditure at time t; AGR_t represents agricultural sector contribution; WAS_t represents water supply sector contribution; TRT_t represents transport sector contribution; ICT_t represents information and communication technology sector contribution; FIN_t represents financial sector contribution; HHS_t represents household services sector contribution; SCT_t represents social and community services sector contribution; ENR_t represents energy sector contribution; β_0 denotes the intercept; $\beta_1 - \beta_8$ are regression coefficients; and ε_t represents the stochastic error term.

Principal Component Transformation

Since there can be a high level of correlation between the explanatory variables, then the application of the regression model alone can result in unstable parameter estimates as a result of multi-collinearity. In order to address this issue, the Principal Component Analysis (PCA) was used as a dimensionality reduction method. PCA converts the original correlated variables to a fewer number of uncorrelated variables referred to as principal components.

$$PC_j = a_{1j}AGR + a_{2j}WAS + a_{3j}TRT + a_{4j}ICT + a_{5j}FIN + a_{6j}HHS + a_{7j}SCT + a_{8j}ENR \quad (2)$$

Where PC_j represents the jth principal component and a_{ij} represents the loading of the ith variable on the jth principal component.

Eigenvalue and Eigenvector Decomposition

The principal components were obtained through eigenvalue decomposition of the correlation matrix of the standardized variables.

$$|R - \lambda I| = 0 \quad (3)$$

Where R represents the correlation matrix, λ represents the eigenvalues, and I represent the identity matrix. The eigenvalues measure the amount of variance explained by each principal component, while the corresponding eigenvectors provide the loadings used to construct the principal components.

$$PC_k = a_{1k}Z_1 + a_{2k}Z_2 + a_{3k}Z_3 + \cdots + a_{pk}Z_p \quad (4)$$

Variance Explained by Components

The proportion of total variance explained by each principal component was calculated using the following expression.

$$Proportion\ of\ Variance = \lambda_k / \Sigma\lambda_k \quad (5)$$

The overall proportion of variance was also calculated so as to know the number of principal components to be retained. Components were retained until a large enough percentage of the total variance was accounted.

Therefore, multivariate regression and PCA will offer a strong model to assess the impact of the economic variables of the sector on the household consumption expenditure besides dealing with the multi-collinearity issue among the factors explaining the relationship.

RESULTS AND DISCUSSION

In this study, the multivariate statistical and econometric model were adopted to investigate the relationship bewteen household consumption expenditure and some selected sectoral factors using annual data from Nigeria.

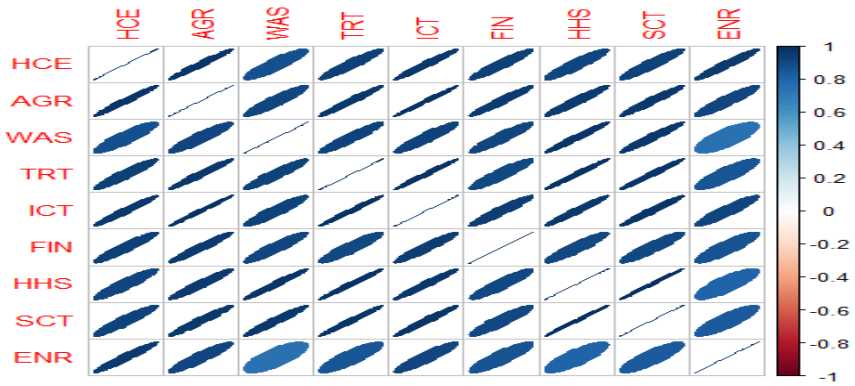

Figure 1: Correlation Plot

The correlation Plot in figure 1, indicates that there were strong positive relationships between the sector variables (HCE, AGR, WAS, TRT, ICT, FIN, HHS, SCT, and ENR). The sharp ellipses that lead to the right and above to the left point to high positive correlations indicating that development in one area is likely to be accompanied by development in the other areas as well. The deep blue color also supports the fact that majority of the correlation coefficients are near to +1 which implies a strong linear relationship among the variables. This trend is a sign of multi-collinearity of the dataset, i.e. the variables have a lot of shared information. This means that the use of Principal Component Analysis is suitable because it minimizes the dimensions of the variables representing the most valuable facts represented by the correlated variables.

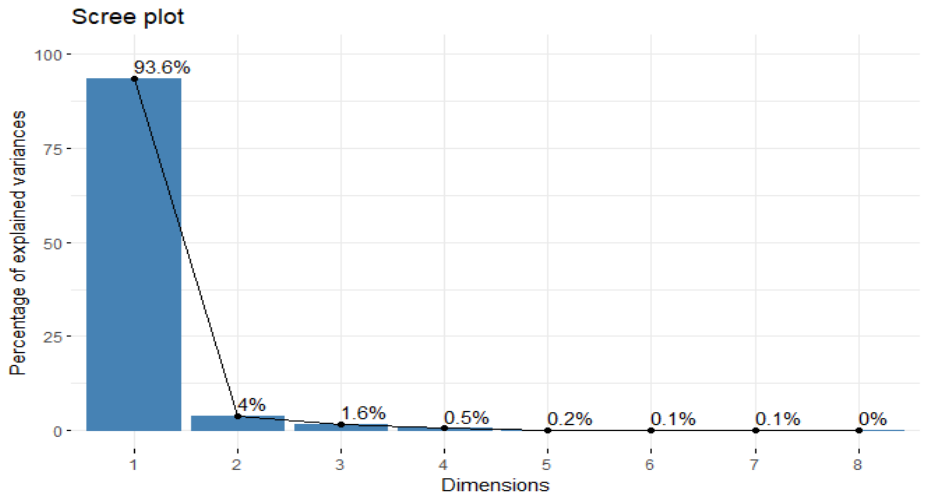

Figure 2: Screen Plot

The scree plot presented in figure 2 estimated the share of total variance that is attributed to each principal component. The findings have demonstrated that the first principal component (PC1) represents a significant portion of the total variance of 93.6, which means that the largest portion of the data stored in the data set lies in one of the dominant components. The second and third components are only explaining 4.0% and 1.6, respectively and the rest of the components are negligible contributors. The drastic reduction of variance following PC1 creates an obvious elbow in the scree plot, which indicates that add-on components do not add much explanatory value. This trend shows that the sectoral variables have a high correlation and are affected by a similar underlying economic set-up. Thus, the first principal component will be enough to summarize the variability of the dataset without much information loss.

Table 1: Eigenvalues and Variance Explained by Principal Components

Principal Component	Eigenvalue	Standard Deviation	Proportion of Variance	Cumulative Proportion
PC1	7.4865	2.7362	0.9358 (93.58%)	0.9358 (93.58%)
PC2	0.3167	0.5628	0.0396 (3.96%)	0.9754 (97.54%)
PC3	0.1244	0.3527	0.0156 (1.56%)	0.9910 (99.10%)
PC4	0.0430	0.2073	0.0054 (0.54%)	0.9963 (99.63%)
PC5	0.0131	0.1146	0.0016 (0.16%)	0.9980 (99.80%)
PC6	0.0103	0.1014	0.0013 (0.13%)	0.9993 (99.93%)
PC7	0.0046	0.0678	0.0006 (0.06%)	0.9998 (99.98%)
PC8	0.0014	0.0370	0.0002 (0.02%)	1.0000 (100.00%)

Source: Rstudio Computational Output

The principal component analysis (PCA) outcomes in table 1, show that the first principal component (PC1) is dominant, and it has an eigenvalue of 7.49 and the total variance of 93.58 that relates to the fact that most of the information, as represented by the eight variables, can be summarized on a single underlying dimension. The second major component (PC2) adds a rather small portion of the variance (3.96%), raising the cumulative explained variance to 97.54 with PC3 contributing a 1.56 portion, making the cumulative variance explained 99.10. Other elements (PC4 - PC8) all contribute an insignificant amount and explain less than 1 percent of the total variance, implying that they represent only small fluctuations or noise in the data.

Table 2: PCA Loadings of Variables on Principal Components

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
AGR	0.3618	-0.1614	-0.0247	0.2145	0.8450	-0.1267	0.1603	0.2014
WAS	0.3483	0.4525	-0.3199	-0.5106	0.0307	-0.5265	-0.0599	-0.1707
TRT	0.3592	0.1082	0.3720	0.4886	-0.1374	-0.2637	-0.6128	-0.1353
ICT	0.3632	-0.1002	0.1457	0.2492	-0.2813	-0.1301	0.6980	-0.4375

Variable	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
FIN	0.3496	-0.1047	-0.7817	0.3014	-0.1984	0.3216	-0.1468	0.0232
HHS	0.3583	0.3135	0.2105	-0.0301	-0.2850	0.1185	0.2129	0.7665
SCT	0.3595	0.2081	0.2630	-0.3174	0.1831	0.7007	-0.1119	-0.3470
ENR	0.3270	-0.7713	0.1134	-0.4471	-0.1811	-0.1088	-0.1690	0.1104

Source: Rstudio Computational Output

The table 2 Principal Component Analysis (PCA) loadings, illustrate how much each variable contributes to each of the eight principal components. The first principal component (PC1) has consistently high positive loadings on all variables (0.327 - 0.363) indicating that PC 1 is a general underlying factor that characterizes a common increase or decrease among the variables of AGR, WAS, TRT, ICT, FIN, HHS, SCT and ENR. Conversely, PC2 separates the variables, WAS (0.452), HHS (0.314), SCT (0.208), and TRT (0.108) are positively loaded, whereas ENR (-0.771) is heavily loaded meaning that ENR works in the opposite direction compared to the variables in this component. The other elements are more specific in their influences PC3 is heavily led by FIN (-0.782), PC5 by AGR (0.845), PC6 by SCT (0.701), PC7 by ICT (0.698) and TRT (-0.613), and PC8 by HHS (0.766). In general, the loading structure indicates that PC1 is overriding the common element in the dataset, and the following components reflect the specific differences present between particular sectoral variables with less generalized sources of variations in the data.

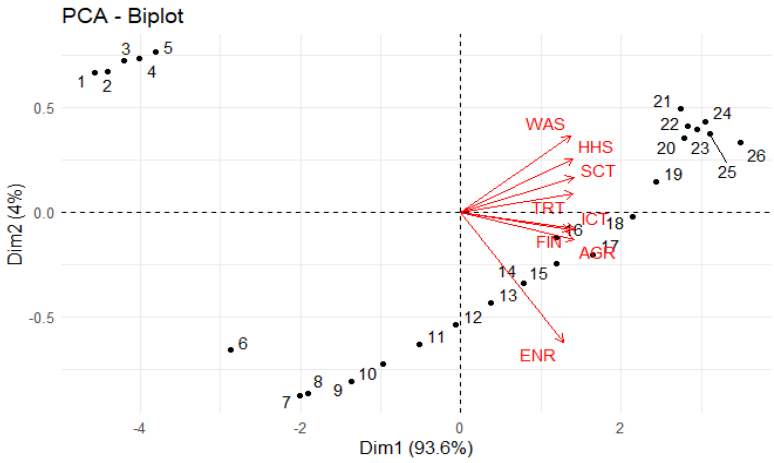

Figure 3: PCA Biplot

Figure 3 shows the PCA biplot, which depicts the interrelations between the primary components and the sectoral variables

The primary axis of difference in the data is the first (Dim1) which explains 93.6% of the total variance and the second (Dim2) explains only 4%. The orientation and the size of the variable vectors show their contributions to the principal components. The similarities in variables like WAS, HHS, SCT, TRT, FIN, ICT, and AGR, demonstrate the existence of strong positive correlations and significant contributions to Dim1. This implies that an aggregate of these sectors add up to cause the significant change in household consumption expenditure. By contrast, ENR demonstrates that Dim2 is more loaded to the downward with its orientation, and the energy sector takes a slightly different structural pattern than the rest of the sectors. On the whole, the preeminence of Dim1 underscores the high degree of interrelations among the sectoral variables in the elucidation of the seen economic structure.

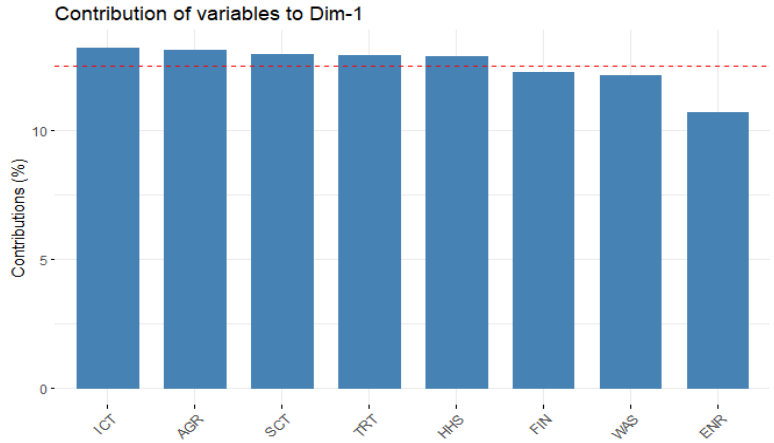

Figure 4: Contribution of Variables to Dimension 1 (PC1)

In figure 4, the contribution plot illustrates the percentage contribution made by each variable towards the first principal component. The dotted reference line is the expected contribution in the event that all variables made the same contribution. ICT, AGR, SCI, TRF and HHS are slightly higher than this threshold since the sectors have their respective contributions at about 13 percent, which denotes that these sectors have a relatively stronger role in defining the first dimension. There is also a minor contribution of FIN and WMS, the values are not far below the reference line, which implies that the contribution is meaningful but not dominant. ENR has the least contribution meaning that it is a relatively less contributing factor in explaining the variation that is exhibited by Dim1. On the whole, the comparably even distribution of the variables suggests that PC1 represents a general composite effect of several industries instead of being controlled by only one variable.

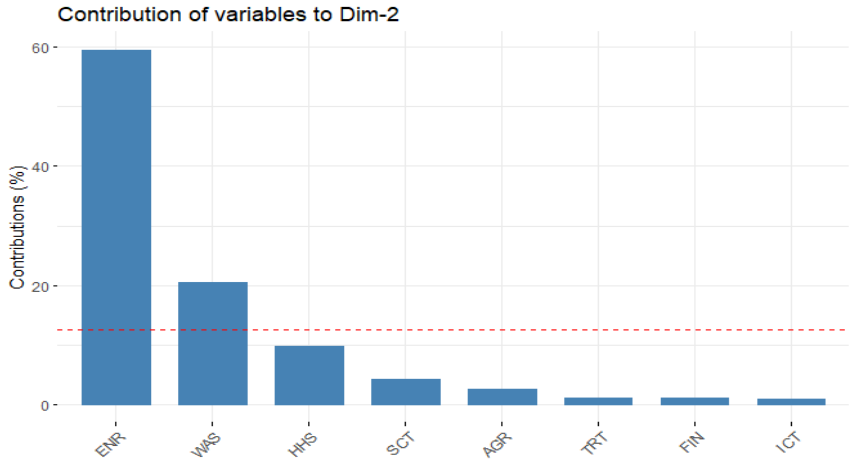

Figure 5: Contribution of Variables to Dimension 2 (PC2)

The deduction of the contribution plot of the second principal component, in figure 5, shows that the influence across variables is highly uneven. ENR easily outweighs Dim2 by a significant margin of nearly 60% of total variance, which is much more than average. It means that variations observed in the energy sector are mostly captured by Dim2. WMS has a contribution of approximately 21 which implies a secondary impact in the second dimension. HHS gives approximately 10% as well as SCT, AGR, TRT, FIN, and ICT give less than 5% and hence have limited effect on Dim2. This finding indicates that the second major component is a structural change that was majorly contributed by the fluctuations in the energy sector.

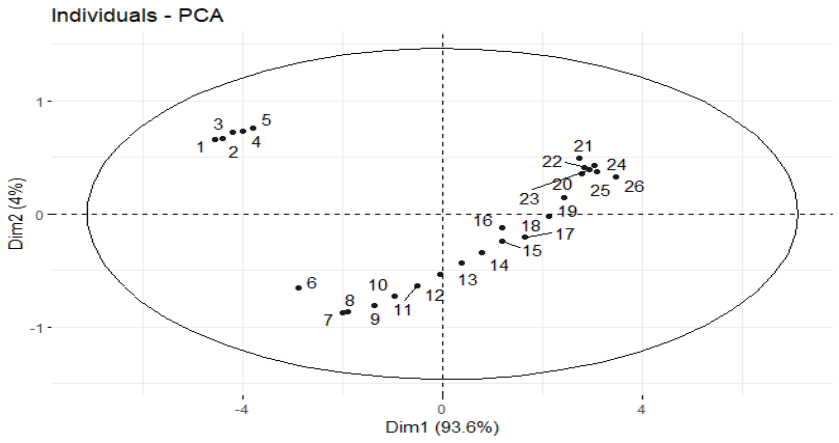

Figure 6: Individuals Plot

Figure 6 shows the plot of the people, which shows how the observations are spread in the first two main components. Dim1 has an explanation of 93.6% and Dim2 has the remaining 4.0, and this means that most of the variation in the data is explained along the first axis. The observations are observed to cluster into three clusters in the Dim1. The negative side of the first dimension has observations 1 -5 with fairly positive Dim2 scores, the lower-central area has observations 6 -15 with negative Dim2 scores, and 16 - 26 with almost zero or a bit positive scores. Such clustering implies both time-like and structural differences in the performance of the sectors and structural difference during the period of the study. The distinct separation of clusters shows the capability of PCA to represent latent heterogeneity in the data.

Table 3: Multiple Linear Regression Results for Household Consumption Expenditure (HCE)

Variable	Estimate	Std. Error	t-value	p-value	Significance
Intercept	1.7478	0.6910	2.529	0.0191	*
AGR	0.5886	0.2639	2.230	0.0363	*
WAS	-0.0713	0.0697	-1.023	0.3174	*Not significant*
ICT	0.1374	0.1137	1.209	0.2395	*Not significant*

Source: Rstudio Computational Output
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.04494 on 22 degrees of freedom
Multiple R-squared: 0.9498, Adjusted R-squared: 0.943
F-statistic: 138.8 on 3 and 22 DF, p-value: 1.925e-14

Table 3 shows the multiple linear regression analysis to determine the effect of AGR, WAS, and ICT on Household Consumption Expenditure (HCE). The findings suggest that the model has a very high level of significance in general (F = 138.8, $p < 0.001$) which implies that the explanatory variables collectively offer a good forecast of household consumption expenditure. The coefficient of determination (R^2 = 0.9498) indicates that 94.98 percent of the change in household consumption expenditure is explained by the predictors that have been included in the model and the adjusted R^2 (0.943) also indicates that this model fits the data very well even after having adjusted the number of the predictors. AGR is one of the positive and statistically significant explanatory variables of HCE (β = 0.5886, p = 0.036), which implies that an increase in the variables of agricultural-related factors would lead to an increase in household consumption expenditure. On the contrary, WAS (β = -0.0713, p = 0.317) and ICT (β = 0.1374, p = 0.239) do not have significant values at the 5% level, indicating that their impacts on household consumption expenditure are not very strong in this model. The standard error of the residual (0.0449) is also relatively small thus further showing that the predicted values are close to the observed values. Consequently, these findings show that the first principal component accounts over 93 percent of the overall variance and this is an indication of the high interdependence of the sectoral variables that affect household consumption expenditure. Besides, the research establishes that economic sectors like agriculture, finance, infrastructure and household services are likely to shift in the same direction and act in unison to stimulate consumption trends. The fact that the first principal component dominated and the correlation between the two variables are high as seen in the correlation matrix diagram also supports the application of Principal Component Analysis as a dimensionality reduction method to take care of the multi-collinearity among the indicators of sectors. The same trends have been observed in past research where the economic indicators which were highly correlated were summarized with PCA. Nonetheless, the results of the research are in agreement to the recent empirical researches on food security, and sectoral interdependence. The meaningfulness of agriculture as seen in this study is consistent with the results of Abolade et al. (2025) who have found the agricultural funding has a high effect on food security among the smallholders. Likewise, the Nigerian studies on climate-smart agriculture (Omenka et al., 2025) have found out that agricultural productivity directly increases the welfare and food security of the household. The high interdependence of variables in the sector as shown by the high share of the first principal component (93.58%), is also supported by Umeh et al. (2025) who determined that infrastructure / sectoral investments have a joint impact on food security in Nigeria. Moreover, the negligible impact of ICT and water supply on the regression model has been observed to be in line with the findings of Bello (2025), who contended that the non-agricultural sectors tend to have an indirect or conditional influence on food security. Moreover, macroeconomic research like Israel and Charity (2024) shows that the macroeconomic inflation of food is a major cause of a decrease in consumption power of the household, which supports the notion of multi-sectoral approach in the study of consumption patterns. Therefore, the empirical literature reviewed allows concluding that the aggregate effect of agricultural, economic, and structural factors on household food consumption expenditure has become apparent in Nigeria due to the interplay of these factors instead of the influence of sectoral factors exclusively.

CONCLUSION

This study examined industry conditioning factors of household consumption spending in Nigeria through the Principal Component Analysis (PCA) and multiple regression. The findings indicated that the sectoral variables are highly interdependent since the first principal component can account 93.58% of the entire variance, which means that household consumption expenditure is mostly motivated by a unified economic system motivated by various sectors. The regression findings also indicated that the explanatory power (R^2 = 0.9498) was high, which demonstrates that the chosen sectoral indicators explain the household consumption expenditure changes significantly. In the group of explanatory variables, agriculture was the only statistically significant factor, which explains the significant role of this phenomenon in determining the welfare of households and the patterns of food consumption. Other industries like water supply and ICT even though relevant, were in fact not statistically significant in the model implying that their impacts might be indirect or have to be supplemented with other sectoral impacts to have full impacts on the household consumption. Therefore, the results indicate that the relationship between the household consumption processes in Nigeria is predetermined by the performance of various sectors of the economy which are bound and help each other. This paper also verifies the usefulness of PCA in combating multi-collinearity and dimensionality reduction, which results in a more efficient framework of the analysis of the complex economic relationships. With the establishment of a prevailing underlying element that accounts the majority of the variance in the collection, the study presents solid empirical evidence of why integrated methods should be adopted in the process of economic planning and policy formulation. Government therefore should focus more on the policies that will increase agricultural production by enhancing access to modern farming inputs, mechanization, irrigation facilities, and extension services. This will directly enhance household earnings and food consumption, credit facilities and subsidies to farmers should be increased to encourage agricultural growth and productivity, there should be an increase in the

access to electricity and encourage sustainable power sources to enhance production and household living standards. Even though ICT was not statistically significant, its indirect contribution to the enhancement of market access, financial inclusion, and dissemination of information should be reinforced by investing in digital infrastructure. The measures need to be implemented to ensure that the household purchasing power is maintained by policies to control inflation, stabilize exchange rates, and enhance supply chains.

REFERENCES

Abolade, A. P., Lawal, I. O., Akanbi, K. L., & Salami, A. O. (2025). Unlocking the future of food security through access to finance for sustainable agribusiness performance. *Management and Entrepreneurship: Trends of Development*, 5(1), 45–60. doi: https://doi.org/10.26661/2522-1566/2025-1/05

Adams, S. O., & Bamanga, M. A. (2018). Principal component analysis of Nigerian economy from 2006 –2017. *Journal of Statistical Studies, 12*(2), 45–58.

Awe, F., Azeez, F. A., & Kabir, G. B. (2021). Determinants of food security status among rural households in Okunland of Kogi State, Nigeria. *Journal of Agricultural Development Studies*, *15*(1), 78–90.

Bello, L. O. (2025). Rural non-agricultural employment and food security in Nigeria. *Frontiers in Sustainable Food Systems*, 9, 1691586. doi: https://doi.org/10.3389/fsufs.2025.1691586

Bizimana, J., Karuaihe, S., Fitawek, W., & Jourdain, D. (2025). An empirical analysis of the determinants of food insecurity among smallholder farmers in Eastern Rwanda. *Agriculture & Food Security, 14*, 37.

Danmaigoro, A., & Gona, A. (2022). Determinants of food security status and coping strategies among rice farmers in Kebbi State, Nigeria. *African Journal of Agricultural Economics*, *8*(3), 112–124.

Dardeer, M., & Shaheen, R. (2022). Structural determinants of food price inflation and food security implications: Evidence from GCC panel data. *Economic Research Journal*, *35*(4), 567–589.

Habib, S. B. (2024). Determinants of food security among households in Kano State, Nigeria. *International Journal of Agricultural Economics and Statistics*, *10*(5), 67 – 79.

Islam, B., Ibrahim, T., Wang, T., Wu, M., & Qin, J. (2025). Current trends in household food insecurity, dietary diversity, and stunting among children under five in Asia. *Journal of Global Health*.

Israel, K. E., & Charity, G. (2024). Food inflation and the Nigerian economy: An empirical investigation. International *Journal of Research and Innovation in Social Science*, 8(4), 1023–1035. doi: https://doi.org/10.47772/IJRISS.2024.8041023

Jambor, A., & Elias, B. A. (2022). Determinants of food security across East, South, and Southeast Asia. *Food Policy*, *109*, 102118.

Kegode, H., Karuaihe, S., Fitawek, W., & Jourdain, D. (2025). Determinants of food insecurity among smallholder farmers in Eastern Rwanda. *Agriculture & Food Security*.

Mafolasire, S., Mephors, J. O., Mbah, J. J., Henry, M. U., Mikaeel, F. H., Ayorinde, J. O., & Nnaji, A. H. (2023). Determinants of food price inflation in Nigeria: Evidence from PCA and ANOVA. *Nigerian Journal of Economic Analysis*, *9*(1), 101 – 115.

Maisule, S. A., Fadiji, T. O., Barnabas, T. M., Aluko, O., & Sennuga, S. O. (2023). Insurgency and food security in Borno State, Nigeria. *Journal of Rural Development Studies*, *14*(2), 34 – 49.

Omenka, L. C., Osabuohien, E. S., & Urhie, E. (2025). Climate dynamics and food security in Nigeria. *Discover Sustainability*, 6(1), 118. doi: https://doi.org/10.1007/s43621-025-01518-w

Umeh, J. C., & Mensah-Bonsu, A. (2025). Infrastructure and food security in Nigeria. *Review of Agricultural and Applied Economics*, 28(1), 35–50. doi: https://doi.org/10.15414/raae.2025.28.01.35-50

Vysochyna, A., Stoyanets, N., Mentel, G., & Olejarz, T. (2020). Environmental determinants of a country's food security in short-term and long-term perspectives. *Sustainability*, *12*(10), 4098.