

The Relationship Between Food Security and Educational Outcomes in Nigeria

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Abstract

This study examined the relationship between food security and educational outcomes among Nigerian households between 1999 to 2022. It adopted econometric tools of analysis and found that there was a feedback effect from the longrun relationship to the shortrun dynamics of the model, though at a very sluggish rate. Similarly, it was found that food insecurity was one of the major obstacles to households' educational pursuit during the period examined. This conclusion was reached on the background that, most Nigerian families, being peasants, produce so little that their output often is too inconsequential to generate the needed funds which should have served as impetus for enhancing the learning outcomes of their offspring. In the same vein, it was found that several households faced the challenge of food insecurity, given the drastic fall in their purchasing power, hence their quest for adequate and recommended nutrition was grossly undermined, with the potential to further downgrade their learning capability and hence the outcomes. This is also given the fact that families bedevilled by such low-level nutritional needs suffer acute deficiency in learning, as they exhibit low intelligence quotient and thus their educational performance is undermined. These findings are bolstered by the views of Woolf (2016) who opined that, "one cannot think clearly, reason well, love well, or sleep well until one has dined properly." Hence to this connection; the study concluded that learning outcomes among Nigerian households was grossly impeded due to food insecurity and other sundry factors like low income during the referenced periods and therefore recommended that, the Nigerian government should evolve policies that will assist intending farmers to increase their productivity and maximise the gains of farming as feedback mechanism to education; secondly, creating formal employment opportunities and income-generating activities for all qualified Nigerians holds the potential for improved income that would enhance households' access to adequate and nutritious food, with consequential effect on their capacity for absorption in schools for enhanced learning outcomes.

Keywords: Food Security, Educational Outcomes, VECM, Nigeria

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Background to the Study

The United Nations Food and Agriculture Organization, views food security as a condition or a state in which every person (families, community(s), local government, state and the nation) have unhindered and unobstructed physical, social, and economic access to enough, safe, and nutritionally inclined food, that guarantees their dietary requirements for an active, energetic and productive life. The opposite is a situation of food insecurity where there is the absence or lack of access to enough, safe, and nutritionally inclined food for an active, healthy and productive life (FAO, 2002; Barrett, 2002). Food security is commonly understood to comprise four important components: food availability, food access, food consumption (usage), as well as constant and sustained assurance of access to it. Food, being a necessary component of human existence, has and will always be a source of contention among scholars. To operate efficiently, the human body requires certain vital nutrients, and these minerals, which are critical for disease prevention and growth, are according to the World Health Organization (WHO-FAO, 2003) obtainable from food.

An individual or household becomes food insecure when it is incapable, or otherwise unable to purchase or maintain constant access to the food required for a healthy and productive life. Food insecurity is also viewed as a severe kind of poverty, a situation in which a household, a state, or a country lacks basic human needs (Obayelu et al, –2015). Food insecurity is expected to intensify as the number of persons whose livelihoods still depends on less than two dollars per day is said to have risen from 292 million in 1981 to around 555 million in 2005 and 689 million in 2020, with children, youth, and women accounting for a significant portion of the world's poor (World Bank, 2020)

Accordingly, the United Nation's Food and Agriculture Organization (FAO, 2021) estimates between 828 million people globally were malnourished as of 2021, higher than it was in the preceding year (2020) when it was 702 persons This implies that hunger affected 126 million more people in 2021 compared to 2020; 98% of these victims of food insecurity live in developing countries. Out of this figure, one out of every five people or an estimated 278 million Africans were faced with hunger in 2021, while more than half (425) of the people affected by hunger in 2021 live in Asia; 205 million food insecure people are distributed across Latin American countries and the Caribbean, while 88 million of these hungry people are in North America and Europe, with 5.9 million in the Oceania. Put succinctly, the vast majority of the world's hungry people are largely residents of poor countries, which as it were, accounts for 12.9 percent of the global population of the malnourished, daily in search of and yearning for the true definition of food to be actualised in their lifetimes (FAO, IFAD, UNICEF, WFP & WHO (2021).

An increasing number of studies have documented a high prevalence of food insecurity, or a lack of 'access, at all times, to enough food for an active, healthy life' on primary, secondary and tertiary education across Nigeria. This study is conscious of the numerous poor health outcomes that results from inadequate calorie intake with concomitant effect on learning outcomes, thus it is argued that food insecurity may hinder student achievement and undermine the potential for increased educational access in Nigeria. Given the paucity of

literatures in this regard, this research is intended to fill the knowledge gap and through the findings provide robust suggestions changing the narrative.

Consequently, this study which covers the period 1999 to 2021 seeks examine the impact of food security on households' educational attainment in Nigeria. The specific objectives are as follows: (i) to evaluate the effect of aggregate food output on households' food security and educational attainment in Nigeria (ii) to examine the impact of households' income vis-à-vis their food choices and overall households' learning outcomes (iii) to determine the impact of calorie intake on the academic performance of Nigerian households (iv) to examine the effect of poverty on Nigerian households' food security and hence learning outcomes.

Literature Review

Conceptual Clarification

Education in Nigeria

Education, according to Ikiyei, Donkemezuo, Precious & Seribofa (2022) is the bedrock of development of any nation. The realization that education is the engine room to the advancement of both industrial and technological growth of nations has propelled the leadership and citizens of many nations to consider the training of their younger generations with seriousness. The school is a formal institution vested with the responsibility to ensure that children are properly trained in the methods, ways and means for the future progress of the society. In Nigeria, there are educational policies put in place in line with other international institutions to ensure that all children at least acquire the basic level of education. Presently, there are millions of children that lack access to basic education.

To this connection, Ikiyei (2009) contended that in a bid to enhance access to education, the Nigerian government has devoted huge resources in a series of policy initiatives and other interventions to revitalize its system of education for sustainability and the attainment of positive outcomes. The National Policy on Education (NPE) introduced the Universal Basic Education (UBE) through the Free Universal Basic Education Act, 2004, providing a policy framework to enforce section 18(3) (a) of the 1999 Constitution (as amended) which was not enforceable like all other rights provided for in Chapter 2 of the 1999 Constitution. By the combined effect of section 18(3) (a) of the Constitution and section 2(1) of the Compulsory Free Universal Basic Education Act 2004, the right to free and compulsory primary education and free junior secondary education for all qualified Nigerian citizens are enforceable rights in Nigeria. Meanwhile, the Universal Basic Education Commission (UBEC) has an enforceable mechanism both at the federal and state levels.

Food Security

According to (IFPRI, 2004), the term "food security" referred solely to a country's ability to produce enough food to feed its population. As nutrition security was added to food security in the 1990s and risk management and risk coping became more important in the 2000s, the concepts of food and nutrition security were blended with these other concepts. According to the World Food Summit Report (1996), food security is achieved when all people have continuous economic and physical access to appropriate, safe, and healthy food combinations

that meet their nutritional requirements for an active and healthy lifestyle, while also maintaining their cultural traditions. Moreover, in 2001's *The State of Food Insecurity*, this concept was redefined to mean a situation in which all people have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and provides them with food options for leading an active and healthy lifestyle (FAO, 2002).

Four fundamental pillars underpin food security: food availability, food access, food consumption, and food stability, which imply removing the potential that any shock may cause any of the first three dimensions or pillars to be disrupted in any way. While food availability is required, it is not a sufficient condition for food accessibility, just as food accessibility alone cannot suffice without consumption. Food security is mostly determined by two variables. These include guaranteeing enough food supply and, secondly, ensuring that households suffering from undernutrition or malnutrition have the opportunity to access food, either via self-production or by the ability to purchase it. As a result of the disagreements and divergent views expressed by various scholars regarding the definition of food security, this study adopts, as its working definition and hence views food security as a fundamental human right, and the ability and / or capacity of all people, to have unfettered access to a sufficient, safe, and nutritious food combination that satisfies, guarantees, and meets their food preferences and dietary needs for an active and productive life at all times, regardless of their financial means, as they could fall back on food aid. It should be noted that where food insecurity becomes the norm, children are mostly the victims. This is given the fact that an insufficient or inadequate intake of nutritious food increases the rate of malnutrition among families, with consequences for their educational pursuit.

Theoretical Framework

Income-based approach to Food Security

The long-held belief about food security as a problem of food availability has undergone some moderate re-examination within a much better macroeconomic framework. The focus on food sector was initially only agricultural production-based, with the inclusion of trade food much later on. This method however has been criticized by economists for being too focused on one single economic sector at the detriment of the others. Knowing that the economy is composed of many interdependent segments, food security cannot be seen as a special or exclusive challenge of the agricultural or food industry.

The income-based hypothesis to food security is comparable to the one traditionally used to assess poverty. While poverty was considered or viewed as a lack of enough income needed to buy a bundle of goods to guarantee the survival and / or minimally expected standard of living of a person, food insecurity is tacitly conceived as a sub-category of poverty, referred to as “food poverty”, which include the lack of enough income needed to buy at the given conditions, the bundle of food stuff required (Sibrian, Ramasawmy and Mernies (2007) and Sibrian (2008). To be precise, the different foods are converted into calories and where the people's calorie availability falls below the threshold specified by international nutritionists, they are considered food insecure.

From a survey of households' data on income, it is hypothetically possible to measure the amount of food consumed, under the assumption that poorer households use a larger proportion of their earned income to purchase food which is then converted to calories. If however in the process it is discovered that household calorie availability is lower than the essentials, then some or all of the members of that household are considered or judged as being food insecure.

Basic Needs Approach to Food Security

The Basic Needs Approach was birth by two economists, Streeten (1981) and Stewart (1985). During the second half of 1970s, it was the proposition of the International Labour Organization (ILO) that a new model of development known as the 'basic needs approach' be considered with the intention of incorporating other non-economic dimensions of development (ILO, 1976). The reason behind this thinking in policy shift was due to the challenges of poverty, under-employment and unemployment recorded in periods of rising economic growth. These two, in their contention saw development as a process aiming to ensure that all the people attain the satisfaction of their basic needs, as according to Streeten and Stewart, the attainment of these basic needs was a precondition for a “full life” which of course composed of material and nonmaterial elements.

Owing to the importance of this approach, it was important and essential to give a minimal and modest interpretation to the idea of 'a full life', by spelling out basic needs that government and other development partners could ensure. Even though several authors came out with conflicting views on this list, in most instances it included food, shelter and clothing (Denton, 1990). This much was corroborated by Magrabi and Yang, (1991) who argued that food indisputably is a basic need – and in all likelihood the most basic needs of all. In the same vein, the definition of “basic rights” as those rights required for the enjoyment and attainment of all other rights given by Henry Shue (1996) has led many scholars to include primarily the “human right to adequate food” (Kent 2005) as one vital component of rights. This dialogue in economic literature has immensely affected the debate on food security, giving birth to the so-called 'food first' view of Maxwell and Smith (1992) and Maxwell (1996) respectively. The crux of this approach is directly on whether people eat enough food and contributed to make a further step in shifting the analysis from the macro level to the household front.

Food, of a necessity is view as the priority and most probably the only element of food security. This is the main thinking behind the view of food security as consumption of less than 80% of the World Health Organisation's average required daily caloric intake (Reardon and Matlon, 1989) as well as the ability to satisfy adequately, the food consumption needs of an individual at all times for a normal healthy life (Sarris 1989). The income-based approach to food security draws attention to short-term food security just as it tells us if households have access to enough food to feed all its members at any given time, though it does not offer any further explanation for food deprivations in the future.

Methodology

Model Estimation Techniques

The study adopts various econometric techniques of analysis to answer the objectives earlier stated in section one. The model was estimated using Econometric Software, E-view 10.

Augmented Dickey Fuller Stationarity Test

For the purpose of avoiding the situation of generating spurious results as unit root is normally associated with majority of time series data, the study started by conducting the unit root test on the annual data for the variables (gross domestic product, domestic debt, debt servicing and external reserve) The Augmented Dickey Fuller (ADF) test of stationarity is adopted to determine the underlying properties of the process that generated the time series, that is, whether the variables of interest have unit root or not.

Cointegration Test

In the words of Gujarati (2004), a cointegration test is an established econometric procedure for establishing the presence or absence of such a long-term relationship. Economically speaking, two or more variables will be cointegrated if they have a long-run or an equilibrium relationship between or among them. The Johansen cointegration test approach is employed to test for cointegration among the series used in the model.

Framework of the Study

This research model is based on the Income-based approach and Basic Needs Approach to food security as propounded by Reutlinger and Selowsky (1976); Haq (1976) and Griffin and Khan (1977) and Streeten (1981) and Stewart (1985) respectively. These two models viewed food insecurity as being triggered by the loss of income (poverty) or a combination of unemployment and underemployment as a consequence for impeding household food security. An increasing number of studies have documented a high prevalence of food insecurity, or a lack of 'access, at all times, to enough food for an active, healthy life' on learning outcomes in some countries. Concomitant with numerous poor health and academic outcomes, food insecurity may hinder student achievement and thus undermine the potential for increased educational attainment.

Model Specification

Consequently, the theoretical modelling for this study is as follows:

$$EDUC = f(FS) \quad \dots \quad (Eqn \ 1)$$

But

$$FS = f(Agoutput, GDPPC, Calories, Pov) \quad \dots \quad (Eqn \ 2)$$

Substituting eqtn 1 into eqn 2, we have

$$EDUC = f(Agoutput, GDPPC, Calories, Pov) \quad \dots \quad (Eqn \ 3)$$

The explicit form of eqn 3 becomes.

$$EDUC = \alpha_0 + \beta_1 Agoutput + \beta_2 GDPPC + \beta_3 Calories + \beta_4 Pov + \mu_t \quad \dots \dots (Eqn \ 4)$$

Given that poverty is one of the greatest determinants of households' food security, it was included in this study as a control variable.

Where:

- EDUC = Educational attainment, proxied by government expenditure on education. This covers the expenditure of government on the various tiers of education, including primary, secondary and tertiary education. It is included in this model as the dependent variable.
- Agoutput = This is the aggregate food output from the various food production activities in the country. It is proxied by food production index and served as the indicator for food availability in the model.
- GDPPC = Gross domestic product (GDP) per capita is a financial metric that breaks down a country's economic output per person and is calculated by dividing the GDP . Per capita income measures the average income earned per person in a given area in a specified year. It is also used to determine the average per-person income for an area and to evaluate the standard of living and quality of life of the population. It is used as a representative measure of food accessibility per household.
- Calorie = It is employed as a proxy for food utilization / consumption in this study. Calorie intake is a unit of measurement for the amount of food or drink consumed (i.e., the quality and quantity) or the amount required to maintain a healthy lifestyle. The amount of energy required is often determined by an individual's age, lifestyle and size.
- Pov = Poverty is a multifaceted term that presents itself in a variety of ways. A poor person is helpless, hopeless, powerless and most times voiceless. Poverty reveals itself in a person's lack of possibilities, self-confidence, which results in low self-esteem (ODI, 2009). Though these manifestations are hard to measure, thus an identification of the type of poverty or better still, its measure was adopted for this study. Consequently, the poverty measure utilized in this study is the poverty headcount ratio which pegs poverty at \$1.90 a day, which is the ratio of the population whose livelihoods depends on less than \$1.90 per day, expressed in 2011 international prices. Poverty rate, which is representative of a household's resilience in is the food security discourse is included in the model as a control variable.
- μ_t = Stochastic error term / time trend, while α_0 , β_1 , β_2 , β_3 , β_4 , are parameters estimates respectively.

Vector Error Correction Model (VECM)

The Vector Error Correction Model (VECM), a test for short run and long run relationships or dynamics between variables is also conducted. The Vector error correction model is specified as in equation the below:

$$\Delta EDUC_t = \mu_t + \alpha_1 \Delta EDUC_{t-1} + \sum_{j=1}^{m-1} \pi_1 \Delta Agoutput_{t-j} + \sum_{j=1}^{m-1} \phi_1 \Delta GDPPC_{t-1} + \sum_{j=1}^{m-1} \delta_1 \Delta Calories_{t-1} + \sum_{j=1}^{m-1} \delta_1 \Delta POV_{t-1} + \varphi_{t-1} + \mu_t \quad \dots Eqtn (1)$$

Where Δ is the first difference operator, α_1 , and $\pi_1, \delta_1, \partial_1$, and \emptyset_1 and are the coefficients estimated from the equation; while φ represents the speed or rate of adjustment, The Vector error correction mechanism will indicate how much of deviation from the long run is being corrected. In order to confirm the robustness and validity of regression model, some post-estimation tests were conducted. The next section of this study shows the findings of the evaluation, as presented and discussed after preliminary analysis of the data.

Econometric Analysis
Results and Discussions
Unit Root Test

The ADF is carried out using E-views software package and the results from the test are tabulated below:

Table 1: Augmented Dickey-Fuller Unit Root Test at 1st Difference

Variable	Level	1 st Difference	5% Critical Value	Order of Integration
Log(EDATT)	Non-Stationary	-9.591906	-2.892536	I(1)
Log(Agoutput)	Non-Stationary	-2.271925	-1.944445	I(1)
Log(Calo_Def)	Non-Stationary	-6.518733	-2.893956	I(1)
Log(GDFPC)	Non-Stationary	-2.084821	-1.944445	I(1)
Log(POV)	Non-Stationary	-3.714316	-2.895512	I(1)

Source: Author's Computation using E-views

The Augmented Dickey-Fuller (ADF) unit root test in the above table showed that all the variables were non-stationary at levels but became stationary after first difference, thus they were all integrated of order one I(1). Prior to the estimation of the Johansen cointegration test, Akaike Information criterion was employed to select a lag selection criterion of eight (8).

Cointegration Test

Having determined the order of integration (i.e. all the series are I(1), the Johansen cointegration test was applied on the series to examine their cointegrating properties. Consequently, a test for the number of co-integrating vectors under the assumption that the series have linear deterministic trend was employed. The outcome of the co-integration is presented below:

Table 2: Johansen Cointegration Test Output

No. of cointegrating equations	Trace statistic	Critical Values		Max-Eigen statistic	Critical Values	
		Trace	P-value (%)		Trace	P-value (%)
None *	72.40867	47.85613	0.0001	34.23793	27.58434	0.0060
At most 1*	38.17074	29.79707	0.0043	28.72876	21.13162	0.0035
Result:	<i>Trace test indicates 2 cointegrating eqn(s) at the 0.05 level</i>			<i>Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level</i>		

Source: Author's Computation using E-views

From (1) above, it is observed that Trace test statistic and the Max-Eigenvalue tests indicated two cointegrating equations at 5% level of significance respectively. Based on the evidence above, the null hypothesis (H_0) of no cointegrating vectors can be safely rejected leading to the acceptance of the alternative hypothesis of the presence of cointegrating vectors. Thus, it is concluded that there exists a unique longrun relationship between the dependent variable (educational attainment) and the explanatory variables in the model (agricultural output, calorie intake, per capita GDP and poverty) within the period examined. That is to infer that the series possess the characteristics that would cause them to converge in the long-run. Consequently, the study proceeded with the Error correction model (ECM) to determine the speed of convergence (short-run dynamics) of series in the model.

Extracted ECM Output

Table 3: ECM output

Description	Coefficient Value	P-Value
Error Correction Term:	-0.000731	0.000112

Source: Author's Computation using E-views

The above extract from the VECM output indicated the error correction model (ECM) to equilibrate at an adjustment speed of $(0.000731 * 100) = 0.0731\%$ between the short-run dynamics and long-run equilibrium. It equally revealed the error correction term to be negative and significant. This implied that there is a feedback effect from the long run relationship to the short run dynamics of the model, though at a very sluggish rate. Specifically, the ECM coefficient implies that a little less than one percent of any disequilibrium in the system is corrected every year. Even this convergence rate is contingent upon government's commitment to implementing laid down policies that will impact on the agricultural sector that will ultimately crystallize to every household's food security status and thus their learning outcomes.

Granger Causality / Block Exogeneity Test

The direction of causality cannot be precisely established through the Johansen cointegration test; hence Granger causality test based on the vector error correction model was applied. The study adopts blockexogeneityGranger/causality analysis to examine the causal relationship between food security and educational outcomes in Nigeria. Empirical evidence revealed that a unidirectional (one-way) causality existed among the variables captured in the model. Specifically, the study adopted the coefficient value for agricultural output as proxy for food security to conclude that food insecurity was among the major obstacles to households' educational pursuit during the period examined. This is given the fact that most Nigerian families are peasants; hence their production often is too inconsequential to generate the needed funds that should have served as impetus for educating the children from such households.

Table 3: Granger Causality / Block Exogeneity Test for Selected Series

Variable	Nature of causation	P-value	Decision
AGOUTPUT does not granger cause EDATT	Unidirectional	0.0813	Reject**
GDPPC does not granger cause EDATT	Unidirectional	0.0047	Reject**
GDPPC does not granger cause CALO_DEF	Unidirectional	0.0002	Reject**

Source: Author's Computation using E-views

Furthermore, it was revealed that per capita income (GDPPC) does not granger cause educational outcomes during the referenced period. The implication of this finding is to the effect that income available to majority of households in Nigeria within the referenced period was quite infinitesimal and insignificant to accord their children the needed academic attention. For instance, it was shown that every one dollar decrease in household's income, accentuates their misery index and thus impedes the ability to give their wards/children the needed access to quality education.

Additionally, it was shown that per capita income does not granger cause calories intake. That is, for every one dollar decrease in household's income, there was a corresponding decline in households' ability to access their required food needs for enhanced welfare. In other words, several households faced the challenge of food insecurity, as their purchasing power dipped, perhaps as a consequence economic dire strait, thus grossly undermining their access to the required food needs for enhanced welfare. This further translates to low learning outcomes, given that families bedevilled by such low-level nutritional needs suffer acute deficiency in learning and thus their educational performance would be undermined.

Robustness Checks

Some robustness / diagnostic tests were performed to ensure that the models yield robust estimates. These results are presented in the Appendix section. Based on the diagnostic tests, we can conclude that the modelling and results, including the VECM are robust and as such, we can make inference with greater certainty. The residual stability and autocorrelation test are presented hereunder.

Residual Stability Test

The inverse roots of Auto-Regressive characteristic Polynomial in appendix I suggests that the residuals of the models are stable. This is because the residual values do not fall outside the acceptance region. Based on the aforementioned, we conclude that the residuals are stable for the study period.

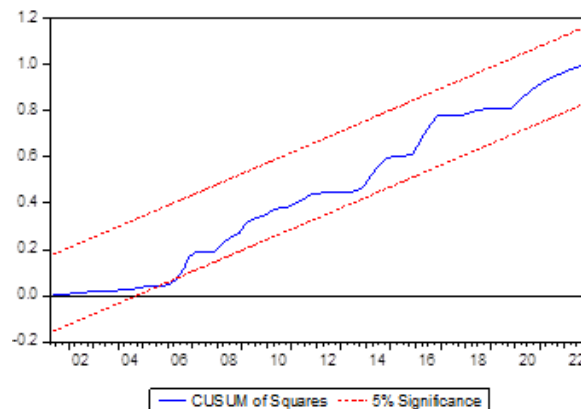
Autocorrelation Test

The VEC residual portmanteau test for autocorrelation was used to test for autocorrelation of the residuals. The result as contained in appendix II accepts the null hypothesis of no residual autocorrelation up to lag h (lag maximum of 3). The decision was reached based on the insignificant values of the probability values.

Testing for Structural Breaks in the Model

To examine the short and long-term relationships found previously are stable over the entire period of the study, the cumulative sum of squares (CUSUMSQ) tests proposed by Brown et al. (1975) was adopted. The CUSUMSQ test uses the recursive residuals squared and follows the same procedure. Figures 3 below present the of cumulative sum of squares tests. The visual inspection of this graph shows no evidence of instability in the regression parameters over the study period, since the sum of squared residuals lie within the critical limits of the 5 per cent level of significance.

Fig. 3



The straight lines represent critical bounds at 5% significance level

Source: Author's Computation using E-Views 10.0

Consequently, the null hypothesis that all the coefficients are stable cannot be rejected, hence we conclude that the short and long-term relationships found previously are stable over the study period.

Concluding Remarks

This study aimed at examining the impact of food security on educational outcomes among Nigerian households between 1999 to 2022. The study adopted econometric tools of analysis and found that there is a feedback effect from the long run relationship to the short run dynamics of the model, though at a very sluggish rate. That is, the convergence rate would be contingent upon government's commitment to implementing laid down policies that will impact on the agricultural sector which will ultimately improve households' food security status and thus their learning outcomes.

Similarly, the study adopted the coefficient value for agricultural output as proxy for food security and found that food insecurity was one of the major obstacles to households' educational pursuit during the period examined. This conclusion was reached on the background that, most Nigerian families, being peasants, produce so little that their output is often too inconsequential to generate the needed funds which should have served as impetus for enhancing the learning outcomes of their offspring.

The study also found that, the income available to majority of households in Nigeria was too infinitesimal to accord their children the required academic attention. In the same vein, it was also found that several households faced the challenge of food insecurity, given the drastic fall in their purchasing power, hence their quest for adequate and recommended nutrition was grossly undermined, with the potential to further downgrade their learning capability and hence the outcomes. This is also given the fact that families bedevilled by such low-level nutritional needs suffer acute deficiency in learning, as they exhibit low intelligence quotient and thus their educational performance is undermined. These findings are bolstered by the views of Woolf (2016) who opined that, "one cannot think clearly, reason well, love well, or sleep well until one has dined properly." This remark further underscores the imperativeness of food to man, hence to this connection; the study concludes that within the referenced period, learning outcomes among Nigerian households was grossly undermined due to food insecurity and other sundry factors like low income.

Consequently, it was recommended that: the Nigerian government should evolve policies that will assist intending farmers increase their productivity and maximise the gains of farming as feedback mechanism to education; secondly, creating formal employment opportunities and income-generating activities for all qualified Nigerians holds the potential for improved income that would enhance households' access to adequate and nutritious food, with consequential effect on learning outcomes. Finally, to ameliorate or reduce the incidence of calorie deficiency among Nigerian households, it is recommended that households should reorder their eating habits by consuming more nutritious food combinations with consequential effect on their capacity for absorption in schools for enhanced learning outcomes.

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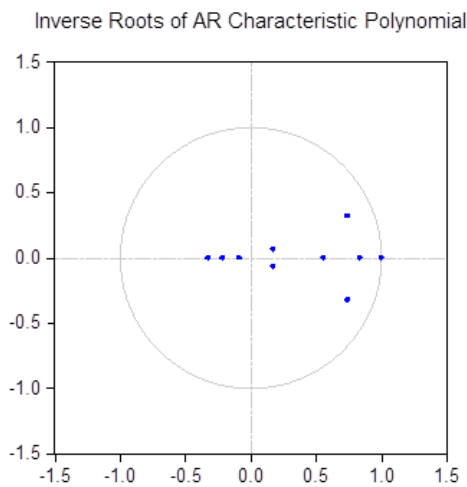
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APPENDIX I:



APPENDIX II:

VEC Residual Portmanteau Tests for Autocorrelations

Null Hypothesis: no residual autocorrelations up to lag

h

Date: 08/11/23 Time: 20:19

Sample: 1999Q1 2022Q4

Included observations: 93

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	0.760556	NA*	0.768823	NA*	NA*
2	4.957356	NA*	5.057861	NA*	NA*
3	13.44464	1.0000	13.82806	1.0000	45

*The test is valid only for lags larger than the VAR lag order.

df is degrees of freedom for (approximate) chisquare distribution