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MEAT CONSUMPTION IN NIGERIA: TREND ANALYSIS AND MACROECONOMIC VARIABLES DETERMINANTS

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Abstract

The study examined consumption trends in beef, chicken meat and Chevon and provided evidence of its correlation with some macroeconomic factors in Nigeria. Secondary data were obtained from official sources and covered the years from 1991 to 2022. The Engle Granger two–step technique of cointegration and autoregressive model were used to analyze the data. The findings indicated that the consumption rates of beef and chicken experienced annual declines of -2.27% and -0.99%, respectively, whereas Chevon consumption exhibited a slight annual growth of 0.74%. The empirical analysis revealed a significant negative correlation between the inflation rate and nominal exchange rate with the consumption of Chevon, chicken meat, and beef. Conversely, the per capita GDP, credit to the agricultural sector and the capacity utilization of the meat industry have a significant positive correlation with beef, chicken meat and Chevon consumption. To increase meat consumption in the country, it is strongly recommended that the country should developed its local inputs system/machineries and introduce input subsidies to ameliorate the negative effect of inflation and exchange rate volatility in meat production. Also, the provision of sufficient incentives to boost capacity utilization of the meat industry and expanded channels to inject credit to the agricultural sector would help to increase meat consumption in the country.

Key words: *meat, consumption, macroeconomic, per capita, Nigeria*

INTRODUCTION

The Nigeria's meat industry in recent times has been challenged by several factors and its production undermined by poor processing facilities and the unregulated market system among others [16, 3]. Despite the drawbacks, the production and consumption of meats in Nigeria present tremendous potentials for both domestic and foreign investors. However, efficient and sustainable production and consumption of meat are anchored on stable and favourable economic environment among other things [2,4]. According to recent surveys, the demand for meat in Sub Saharan Africa and especially Nigeria is on the rise [19]. The increase activities in the meat industry like other agro enterprises has provided food and constitute a formidable source of livelihood to millions of Nigerians [13]. The upsurge in youthful population, improved human and social capitals, increase in personal income as well as expanding cities and towns are some of the factors that contributed to increase in demand for meats [3]. Notwithstanding the boom in demand for meat and its derivatives in the country, the supply capacity is basically small-scale with marginal annual output growth rate [15, 4].

With the country's current population of more than 200 million [4], there are enormous challenges in realizing the recommended animal protein need of citizens. In addition, most of the country's livestock producers are poor in resources and are affected by climate change, high cost of feeds resulting from poor crop yields, conflicts and economics changes among others. Furthermore, the bulk of the nation's population (being young) is fast switching to diets rich in animal protein and its derivatives [1]. As a result, there a surge in the consumption of meat and its by-products in the country. It is imperative to enhance domestic production to prioritize the minimum animal protein consumption requirement of Nigerians [6].

The per capita meat consumption index in Nigeria is much lower than most African countries [17]. Information available has shown that, the per capita meat consumption in

Nigeria in 2021 was only about 8.30kg/ person annually, which is much lower than most African countries [10]. It is also significantly less than the average consumption of 19.0kg across the continent and the minimum standard (0.830g/kg of body weight per day) consumption recommended by the World Health Organization for adults [18]. To tackle the problem of animal protein deficiency in Nigeria, policies were enunciated and implemented within the framework of livestock transformation agenda of the federal government. The livestock transformation programme was developed to boost the production of animal-based protein sources with the aim of meeting the average minimum protein requirement of most Nigerians in 2027 [3]. However, the anticipated outcome of the program lies among other factors, on a sound macroeconomic environment [8]. It is shown that agricultural production and food consumption has a strong link with macroeconomic fundamental in developing countries [13].

Though there are few pieces of literature on the relationships between per capita meat consumption and macroeconomic variables, however their submissions need to be validated and updated especially considering the fact that unexpected economic downturns had bewildered the country in recent years. From the archive, related literature provided by Baskhronet al. [7], Akpan and Udoh [1], Akpan [3], Alsarawi et al. [11], Gale and Dong [12], Akpan et al. [4] have linked meat and its bye-products production and consumptions to changes in GDP, inflation, exports, imports, size of urban areas, per capita income, exchange rate, land density, credit availability, and price index thus producing a mixed inferences. Furthermore, Whitnall and Pitts [20] found that rising household income is a key driver of increased meat consumption in developing countries. Ewa et al., [9] put forward that poultry production is sensitive to macroeconomic shocks, particularly inflation and interest rate.

The scanty literature available suggests that there is no particular focus on per capita meat consumption in Nigeria. The meat subsector therefore needs a sound policy recommendation based on empirical evidence to isolate policy instrument necessary to close the current deficit gap in animal protein consumption among Nigerians. Over the years, the government has initiated and implemented several programs, created institutions and created delicious incentives for stakeholders in this sub-sector to increase meat production [5]. However, these attempts have resulted in marginal increase and unsustainable meat production and have continually widened the deficit in animal protein consumption among Nigerians [14]. The country needs a complementary policy direction that focuses on the macroeconomic environment related to meat production [7, 3]. Furthermore, Nigeria's macroeconomic environment, which is a key driver of real sectors, has changed significantly over the last two decades, including the recent global COVID-19 pandemic and recessions, necessitating an update in trend of meat consumption in the country and its relationship with some fundamental macroeconomic variables. There is also needed to access the country’s performance in meeting the SDG of zero hunger in the future.

In order to contribute to the above directions, the study was specifically designed to examine the trends in the per capita annual consumption of beef (cattle meat), chevon (goat meat) and chicken meat in Nigeria from 1981 to 2021 and establish the relationship between the per capita meat consumptions and some key macroeconomic fundamentals.

MATERIALS AND METHODS

The study was conducted in Nigeria. The country is rich in agricultural, mineral, marine, and forest resources. The study utilized secondary data obtained from the official sources such as: World Bank, Food and Agricultural Organization and the Central Bank of Nigeria. The data/information encompassed the time span from 1981 to 2022.

Model Specification

The trends in selected meat consumption

The explicit form of an exponential trend equation for the selected meats is represented in equation 1:

$$lnBMC_t = \delta_0 + \delta_1 t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (1)$$

Note, variable "t" is the annual trend. The dependent variables are defined as:

(a) BMC_t= beef per capita consumption (kg/person) (meat from cow or bull)
(b) CMC_t= chicken meat per capita consumption (kg/person)
(c) GMC_t= chevron per capita consumption (kg/person) (meat from goat)

Therefore, the exponential growth rate is expressed in equation 2:

$$\text{Exponential growth rate} = \left(e^{\delta_1} - 1\right) * 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

To determine whether the specified per capita meat consumption growth rate suggests an accelerating or decelerating trend in an increase time period, an exponential equation in quadratic form was explicitly used as in equation 3:

$$Log_e BMC_t = \Psi_o + \Psi_1 t_1 + \Psi_2 t_1^2 + \varepsilon_t \ldots.(3)$$

If the estimated coefficient Ψ2 is found to be significant and possesses a positive sign, this indicates persistent growth in per capita meat consumption. Conversely, if Ψ2 is significant with a negative sign, it suggests a consistent deceleration in the growth of per capita meat consumption. However, if Ψ2 is not significant, it denotes stagnation in the growth of per capita meat consumption over time.

The factors influencing per capita meat consumption

The association between per capita meat consumption and some exogenous factors (i.e. macroeconomic fundamentals) was implicitly stated in a double -log form and is stated as:

$$BMC_t = f(FLT_t, INC_t, RET_t, CRD_t\ CAU_t) \ldots..(4)$$

where:

BMC_t = as defined previously in equation 1

FLT_t= Annual inflation rate (%) as a proxy for agricultural input price movement.

INC_t = Annual GDP per capita (Naira Person-1) as a proxy for household income.

RET_t= Annual nominal exchange rate (Naira per Dollar) (%) as a proxy for external influence (meat import) on meat consumption in Nigeria.

CRD_t = Annual domestic credit disbursed to the agricultural sector divided by GDP (%) to represent aggregate agricultural production.

CAU_t= Capacity utilization of the meat industry (%) as a proxy for substitutes.

An explicit form of equation 4 (representing the long run equation for cointegration meat equation) was specified and is expressed as shown in equation 5.

$$LnBMC_t = \partial_0 + +\partial_1 LnFLT_t + \partial_2 LnINC_t + \partial_3 LnRET_t + \partial_4 LnCRD_t + +\partial_5 LnCAU_t + U_t \ldots\ldots..(5)$$

Where U_t= error term defined as IID (0, δ^2_U)

To test for cointegration or a long run stable equilibrium link between the per capita meat consumption variable and some macroeconomic variables, the study used the Engle and Granger two-step technique. The conditions for using the method required that, all variables involved must be integrated in the same level. Following the confirmation of cointegration, the error correction model (ECM) was also estimated. The estimated ECM is shown explicitly in equation 6.

$$\Delta \text{LnBMC}_t = \theta_0 + \theta_1 \Delta LnBMC_{t-1} + \theta_2 \Delta LnFLT_t + \theta_3 \Delta LnINC_t + \theta_4 \Delta LnRET_t + \theta_5 \Delta LnCRD_t + \theta_6 \Delta LnCAU_t + \theta_7 ECM_{t-1} + U_t \ldots\ldots\ldots(6)$$

The coefficients (θ_7) capture the short run adjustment speed towards the long-run stability. The rest of the coefficients measure the short-run elasticity or impacts. The ECM stability and reliability was tested using the estimates of RESET test, serial correlation, normality and heteroscedasticity tests.

However, for the non-cointegrated equations of the per capita meat consumption, an autoregressive equation was specified to identify their plausible relationships with some key macroeconomic variables [11].

$$CMC_t = \partial_0 + +\partial_1 LnFLT_t + \partial_2 LnINC_t + \partial_3 LnRET_t + \partial_4 LnCRD_t + +\delta_5 LnCAU_t + \delta_6 LnCMC_{t-1} + U_t \ldots..(7)$$

Note, the dependent and explanatory variables specified in the model are defined in equation 4.

RESULTS AND DISCUSSIONS

The descriptive statistics of variables are shown in Table 1. The coefficient of variability is 39.40% in beef consumption; 14.56% in chicken meat and 21.15% in Chevon.
The results indicate that the country experienced only minor variations in annual per capita consumption of beef, chicken, and goat meat during the specified period. The findings suggest that the annual per capita meat consumption of beef, goat, and chicken remained largely stable throughout this timeframe. The indices of skewness are relatively low, further confirming that the annual per capita consumption of beef, goat, and chicken meat exhibited only marginal changes during the specified period.

Table 1. Descriptive tests

Variable	Mean	Minimum	Maximum	Std. dev.	CV	Skewness
Beef/capita (BMC_t)	2.5368	1.5165	5.2369	0.9994	0.3940	1.7110
Chicken meat/capita (CMC_t)	1.4921	1.0946	1.8275	0.2172	0.1456	-0.4930
Chevon/capita (GMC_t)	1.4263	0.8531	1.8915	0.3016	0.2115	0.1407
Inflation rate (FLT_t)	18.9490	5.3880	72.836	16.659	0.8792	1.8542
GDP/capita (INC_t)	1683.60	270.03	4471.10	1025.0	0.6088	0.3422
Exchange rate (RET_t)	108.170	0.6177	403.58	110.14	1.0182	0.9842
Domestic credit (CRD_t)	9.2506	4.9575	19.626	3.4678	0.3749	1.1862
Capacity utilization (CAU_t)	45.9710	12.700	75.750	14.450	0.3143	0.1553

Source: Computed by authors.

The mean for individual meat consumption is reported as 2.54kg/person for beef, 1.49kg/ person for chicken meat and 1.43kg/person for Chevon. These statistics revealed the country's gross deficiency in individual meat consumption when compared with other countries in Africa. For instance, poultry per capita consumption in Africa was reported as 5.77kg/person and beef as 3.68kg/person in 2020. Furthermore, the descriptive analyses performed on the macroeconomic variables indicated considerable fluctuations in the nominal exchange rate (RET), suggesting a degree of instability during the designated timeframe. The inflation rate similarly exhibited considerable variability, with an annual average of 87.92%. In contrast, the coefficient of variation was found to be minimal for both the capacity utilization variable within the meat industry and the credit disbursed to the agricultural sector. This suggests that the country's agricultural sector financing and meat industry capacity utilization rate only witnessed marginal changes during the study period. The skewness indices of the macroeconomic fundamentals all carried positive signs, which suggest that they exhibited a positive increment throughout the period of interest.

The patterns of meat consumption per capita in Nigeria

The findings displayed in Table 2 illustrate the parameters associated with the exponential and quadratic trend equations for the consumption of beef, chicken, and Chevon in Nigeria. The analysis indicated that the per capita consumption of both beef and chicken exhibits a negative correlation with time, implying that the consumption of these meat types diminishes as time progresses. The finding showed a negative exponential growth rate of -2.27% for beef and -0.99% for chicken from 1981 to 2022. However, Chevon consumption had a positive correlation with time, with an annual exponential growth rate of 0.74%. The finding aligned with the assertions of Baskhron*et al.,*[7] and Akpan [3]. The quadratic trend estimates for each meat equation showed that the consumption of these meats is significantly influenced by a longer period. For example, the negative coefficient of time-squared variable found in the chicken and Chevon equations imply that their consumptions decline as time increases. The

result also shows a significant increase in beef consumption over longer period.

The results of the analyzes suggest that the policies and programs adopted and implemented by the government to increase beef, chicken meat and Chevon in Nigeria have failed to achieve the desired objective in both the immediate and longer term. Although the result showed a slightly accelerated exponential growth rate in beef consumption, however this growth was not replicated in the square time-variable. In accordance with the result, several studies such as Baskhron et al. [7] and Akpan [3] have found similar relationship between some agricultural commodities and time variables in Nigeria.

Figure 1 shows a graphical illustration of the trend lines for beef, chicken meat and Chevon from 1981 to 2022 in Nigeria. The beef consumption followed a downward trend from 1981 to 1991. Thereafter, it assumed a progressive wave-like pattern until 2012. From 2013 to 2022, the beef consumption declines persistently. The trend in chicken meat showed a large fluctuation with distinct peaks and troughs.

Table 2. The exponential and quadratic trend equations for Beef, chicken and Chevon

	BEEF	**CHICKEN**	**CHEVON**
Variable	**Coefficient/t-test**	**Coefficient/t-test**	**Coefficient/t-test**
Constant	1.35(23.06)***	0.60(19.21)***	0.18(2.80)***
Time	−0.023(-9.54)***	−0.01(-7.71)***	0.007(2.81)***
R-square	0.69(88.63)***	0.60(59.45)***	0.17(0.74)
Exp. Gr (%)	**-2.268**	**-0.991**	**0.743**
F-cal.(1, 39)	88.634***	59.453***	0.7425
	Quadratic estimates		
Constant	1.50(17.31)***	0.51(11.32)***	−0.25(-6.15)***
Time	−0.04(4.63)***	0.003(0.56)	0.07(15.03)***
Time square	0.001(2.28)**	−0.0003(-2.67)**	−0.001(-13.79)***
R-squared	0.731***	0.667	0.861
F-cal.(2, 38)	51.689***	37.943***	118.116***

Source**:** computed by authors. The symbols ***, **, and * represent different levels of statistical significance.

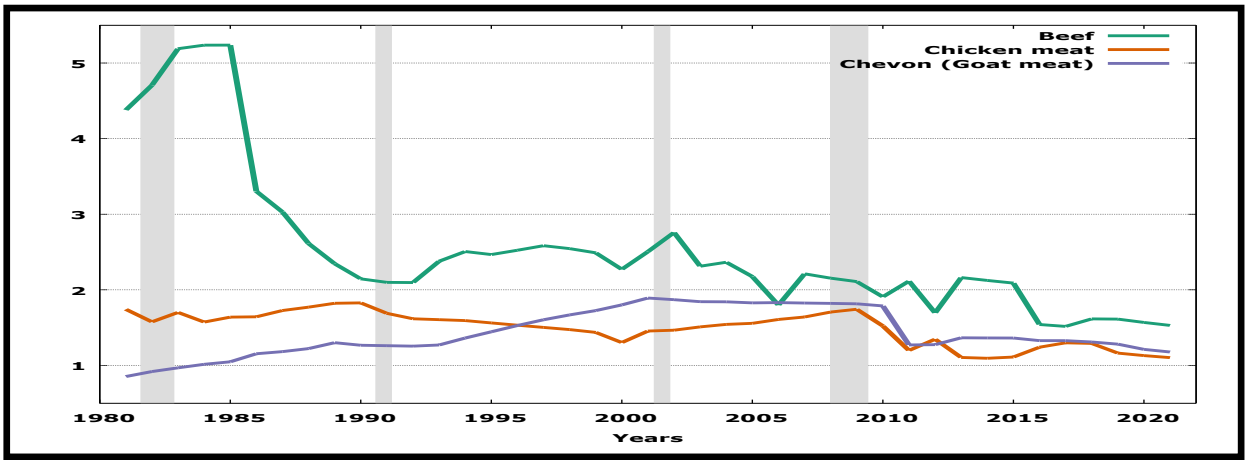

Fig. 1. Trends in per capita meat production in Nigeria (1981 to 2021*)*
Source: Own design based on the data from FAO.

The trend increased steadily from 1.74 kg per person in 1981 to 1.83 kg per person in 1990 and then worsened to 1.30 kg per person in 2000. From 2002 to 2021, the trend in chicken meat showed an average declining trend. The trend in Chevon consumption shows a gradual progressive growth from 1981 to 2001. From 2002 onwards, the trend steadily decreased, with a sharp decline in 2011 and minimal acceleration thereafter until 2021.

Stationarity test

The ADF unit root test was conducted at a 1% probability level. The results as shown in Table 3, confirms that the series were not stationary at their levels, but they were at their first difference.

Table 3. ADF estimates

Variables	ADF unit root (without constant)				
	Level	**Lag**	**1st Diff.**	**Lag**	**Decision**
Beef/capita (BMCt)	-1.7808	0	-6.5105***	0	1(1)
Chicken meat/capita (CMCt)	-1.3211	0	-6.9699***	0	1(1)
Chevon/capita (GMCt)	-0.5139	0	-4.9621***	0	1(1)
Inflation rate (FLTt)	-0.8074	0	-6.2809***	0	1(1)
GDP/capita (INCt)	-0.1086	0	-6.0466***	0	1(1)
Exchange rate (RETt)	1.9705	0	-4.3109***	0	1(1)
Domestic credit (CRDt)	0.2469	0	-5.7867***	0	1(1)
Capacity utilization (CUTt)	-0.4462	0	-6.5973***	0	1(1)
Critical values					
1%	-2.6241		-2.6256		

Source: Own results.
Note: Asterisks *** indicates 1% significance level. Variables in log.

This unit root results suggest that the appropriateness of the two-step Engle methodused to verify the presence of co-integration among variables. However, to use this method, it is required that all specified variables must be stationary at the same level.

Test of cointegration

The Engle Granger two-step method was employed to examine whether there is cointegration among the stated variables. The test results are presented in table 4. To confirm the presence of co-integration, it is required that the residuals from the long run equation must be stationary at level. The findings indicate that out of the three specified equations (beef, chicken meat and Chevon), only beef equation demonstrated evidence of co-integration. That is, the residuals of the beef long run model did not have unit root. Hence the null hypothesis was not accepted and this implies that the variable or residuals was stationary at level. This result suggests that there is a stable long-run correlation between the beef consumption and some macroeconomic variables.

Table 4. Co-integration test of variables

Equation residual	ADF test (without constant)	Order of integration	Remark
Beef/capita BMCt)	-3.7055***	1(0)	Co-integration
Chicken meat/capita (CMCt)	-1.9939	-	No co-integration
Chevon/capita (GMCt)	-1.8977	-	No co-integration
Critical value at 1%	-2.6241		

Source: Own results.
Note: Asterisks *** indicates 1% significance level. Variables in log.

The short and the long run determinants beef consumption

Following the confirmation of the co-integration in the beef equation, the short and the long run models were estimated and analyzed in the next sub-sections.

Long run determinants of the per capita beef consumption

The results in Table 5 shows the long-run estimates of beef consumption. The regression estimates divulged that the beef consumption has a positive association with per capita GDP, agricultural sector credit, and meat industry capacity utilization. This implies that a unit increase in the per capita GDP, agricultural sector credit, and meat industry capacity utilization would result in a corresponding increase in beef consumption in the long run.

By implication, an increase in per capita GDP means an increase in the citizens' disposable income, which in turn entails an increase in demand capacity of the population. Therefore, an increase in the demand potential or capacity of the population will correspondingly trigger an increase in effective demand for a beef which is considered a normal good. This finding is consistent with the reports of Akpan and Udo [1], and Whitnall and Pitts [20].

Likewise, an increase in total credit to agricultural sector increases the beef consumption. A unit increase in the total credit to the agricultural sector would lead to about 0.17467 unit increase in per capita beef consumption. By implication, increase in total credit to agricultural sector would lead to increase in beef production, since farm credit is known to enhance farm production. The finding is consistent with the submission by Whitnall and Pitts [20].

Table 5. Determinants of Beef/capita consumption in Nigeria

Variable	Coefficient	Std. Error	t-ratio	p-value
Constant	0.90932	0.47834	1.901*	0.0656
LogInflation rate	−0.03220	0.01075	−2.995***	0.0021
logGDP/capita	0.06157	0.02978	2.068**	0.0461
logExchange rate	−0.17394	0.01539	−11.29***	<0.0001
logCredit disbursed	0.17467	0.08519	2.050**	0.0479
logCapacity utilized	0.19581	0.08325	2.352**	0.0244
R^2	0.846			
F- cal. (5,35)	33.8479***			

Source: Own results.
Note**:** The asterisks ***, **, and * represent 1%, 5%, and 10% level of significance respectively. Variables in log.

In addition, higher capacity utilization rate of the meat industry will increase the absorption capacity of the industry and thus boost production at the farm level. An increase in production would likely expand demand capacity of consumers. In another dimension, the increase in the meat industry's capacity utilization rate would lead to increase in production of processed beef and its derivatives. This will equally create wider opportunities for consumers to purchase or consumed diversified beef products. The finding is similar to the empirical reports of Whitnall and Pitts [20], Akpan [3.

Conversely, the exchange rate (₦/$) and the inflation rate have a significant negative association with per capita beef consumption in the long run. The results meet *a priori* expectations. An increase in the Naira exchange rate means a depreciation of the domestic currency against the US dollar. Therefore, a high exchange rate of the domestic currency restricts imports and indirectly limits domestic production. The Nigerian meat industry is still developing and relies heavily on imported capital from developed countries and live animals from neighboring Niger, Chad, Benin Republic, Sudan, Mali and Cameroon. When production is hindered, total supply decreases, resulting in a higher price of beef per unit. As household disposable income deteriorates in the country, the increase in the exchange rate indirectly leads to a decline in per capita beef consumption. The results are consistent with the conclusions of Akpan [3]. Similarly, an increase in inflation rate would result to an increase in the real prices of the factor of production and the total cost of production for beef producers, thereby reducing production. For consumers, increase in inflation reduces the real value of household income and their demand capacities. Akpan [3] have reported similar results.

Short run estimates (beef equation)

The estimates of the short run model is presented in Table 6. The coefficient of ECM is negative and statistically significant, confirming the presence of co-integration between the beef consumption and specified macroeconomic variables. The ECM parameter indicates the speed of adjustment and convergence to long-run equilibrium from the short run disturbance. A convergence rate of about 72.17% to long-term equilibrium was found. The diagnostic tests showed that the short-run estimates are not biased, but they are efficient and sufficient. The diagnostic tests of the ECM suggest that the model estimates are stable, unbiased, and free of fundamental econometric problems.

Table 6. Short run determinants of Beef/capita consumption in Nigeria

Variables	Coefficient	Std. error	t-value	Probability
Constant	0.00379	0.01827	0.208	0.8370
ΔlogBeef(-1)	0.06876	0.12344	0.557	0.5821
ΔlogInflation rate	−0.06724	0.02782	−2.417**	0.0227
ΔlogInflation rate(-1)	0.01540	0.02725	0.565	0.5765
ΔlogGDP/capita	0.09021	0.03259	2.768**	0.0101
ΔlogGDP/capita(-1)	0.06752	0.03679	1.835*	0.0775
ΔlogExchange rate	−0.16705	0.07263	−2.300**	0.0294
ΔlogCredit disbursed.	0.04048	0.05918	0.684	0.4999
ΔlogCredit disbursed(-1)	0.09176	0.07769	1.181	0.2479
ΔlogCapacity utilized	0.13654	0.04782	2.856***	0.0082
ΔlogCapacity utilized(-1)	−0.00267	0.04984	−0.054	0.9577
ECM(-1)	−0.72174	0.15673	−4.605***	<0.0001
R^2	0.493895			
F(11, 27)	8.117340 (0.000)			

Source: Own results.

Note: The asterisks ***, **, and * signify probability levels at 1%, 5%, and 1%, respectively. The variables incorporated in the error correction model (ECM) are represented in logarithmic differences. The Akaike Information Criterion was employed to establish the suitable lag length.

The findings indicated a significant negative correlation between the rate of inflation and nominal exchange rates (N/$) with per capita beef consumption during the short run. A comparable outcome was observed in the long run. This means that as inflation and exchange rates rise, beef consumption falls. The increase in the inflation rate is typically accompanied by increases in prices and a decrease in real household income. As a result, a rise in inflation would diminish real household income, subsequently leading to a decrease in per capita beef consumption. Similarly, an escalation in the exchange rate will constrain domestic production, culminating in a supply shortfall and a decreased capacity for household demand. These findings were corroborated in the long-run model. Ewa et al. [9] reported analogous results.

Moreover, an increase in the exchange rate decreases the purchasing power of the domestic currency on the international stage, consequently limiting the import of live animals and their derivatives in the short term. Conversely, per capita income (GDP) exhibits a positive relationship with per capita beef consumption in the short term. This finding indicates that an increase in per capita income is likely to result in a corresponding rise in beef consumption.

The result aligned with *a priori* expectation since beef is considered a normal commodity whose consumption increase as household income increases. The results confirm Akpan [3] submissions.

Furthermore, the findings indicate a significant positive correlation between beef consumption and per capita income in the short run. It was observed that current per capita income (GDP) and its lagged value exhibited a positive association with beef consumption during this period. Additionally, a comparable relationship emerged between per capita beef consumption and the utilization of meat industry capacity. This association suggests that an increase in the meat industry's capacity utilization rate corresponds with a rise in per capita beef consumption in the short run. The underlying reasons for these relationships are consistent with those previously discussed in the context of long-run dynamics. These results are further supported by the work of Akpan and Udo [1] and Whitnall and Pitts [20].

Diagnostic assessment of the short-run model

The diagnostic tests concerning the ECM estimates are outlined in Table 7. The Breusch-Godfrey Serial Correlation (LM Test) result of 0.0006 indicates that serial correlation is not significant.

The result of the RESET test suggests that the ECM has structural rigidity.

The Breusch-Pagan test showed insignificant effect of heteroscedasticity while the normality

test confirms the normal distribution of the estimated residuals.

Table 7. Validity tests of ECM

Required Tests	Value	Probability
Ramsey RESET	3.487	0.073
Normality	0.223	0.895
Breusch-Pagan-Godfrey	5.445	0.908
Breusch-Godfry Serial Correlation LM test	0.0006	0.980

Note: composed by the authors.

Determinants of Chevon and Chicken Meat Consumption

After rejecting cointegration in chevon and chicken meat per capita consumption models, an autoregressive model was specified to examine the empirical relationships between these meat consumption indices and selected macroeconomic variables.

The results of the autoregressive model for chicken meat and chevon are presented in Table 8 and Table 9 respectively.

Table 8. Autoregressive estimates of chicken meat in Nigeria

Variables	Coefficient	Std. Error	t-ratio	p-value
Constant	-0.1151	0.1654	-0.6963	0.4914
LogInflation rate	-0.0236	0.0127	-1.8584*	0.0726
logGDP/capita	0.0118	0.0017	6.8395***	0.4991
logExchange rate	-0.0210	0.0115	-1.8231*	0.0835
logCredit disbursed	0.0396	0.0522	0.7579	0.4542
logCapacity utilized	0.0519	0.0271	1.9136*	0.0649
logChicken meat(-1)	0.7803	0.1758	4.4385***	0.0001
logChicken meat(-2)	0.0314	0.2130	0.1472	0.8839
R^2	0.812265			
F(7, 31)	31.97076			

Source: Own results.

Note: The asterisks ***, **, and * signify probability levels at 1%, 5%, and 1%, respectively. Variables used in the error correction model (ECM) are expressed in log differences. Akaike criterion was used to determine the appropriate lag length.

Table 9. Autoregressive estimates of Chevon estimates

Variables	Coefficient	Std. Error	t-ratio	p-value
Constant	0.1415	0.1612	0.8780	0.3872
LogInflation rate	-0.0703	0.0143	-4.9274***	0.0001
logGDP/capita	0.0265	0.0124	2.1414**	0.0430
logExchange rate	-0.0141	0.0048	-2.9441***	0.0063
logCredit disbursed	0.0250	0.0263	0.9495	0.3502
logCapacity utilized	0.0164	0.0341	0.4820	0.6334
logChicken meat(-1)	1.0081	0.1588	6.3480**	<0.0001
logChicken meat(-2)	0.2268	0.0810	2.8016***	0.0090
logChicken meat(-2)	0.1407	0.0584	2.4082**	0.0206
R^2	0.899951			
F(8, 29)	99.59958			

Source: Own results.

Note**:** The asterisks ***, **, and * signify probability levels at 1%, 5%, and 1%, respectively. Variables used in the error correction model (ECM) are expressed in log differences. Akaike criterion was used to determine the appropriate lag length.

The use of an autoregressive model was necessary to reduce the effect of autocorrelation on the models. The appropriatelag length was determined based on decision criteria. The Breusch-Godfry Serial Correlation coefficient (as shown in Table 10) indicates that, autocorrelation was not significant in the two models. This justifies the use of the autoregressive model.

Other diagnostic statistics revealed that the estimated model has structural stability, which is confirmed by the value of the RESET tests. The estimated models do not exhibit significant heteroscedasticity (Breush-Pagan test); while the model stability (CUSUMSQ tests) and the normality tests of the residuals met conventional requirements.

Table 10. Diagnostic Statistics of AR models

Test	Chicken meat	Chevon
Ramsey RESET Test	0.80 (0.46)	0.42(0.66)
Normality test	6.12(0.046)	1.68(0.21)
Heteroscedasticity (Breusch-Pagan-Godfrey)	11.04(0.136)	4.44(0.33)
Breusch-Godfry Serial Correlation LM Test	0.09(0.76)	0.79(0.38)
CUSUM test	-1.65(0.11)	-0.94(0.36)

Source: prepared by authors.

The findings indicate that the inflation rate, per capita GDP or income, and the capacity utilization rate within the meat industry significantly affect per capita chicken meat consumption in Nigeria. Notably, both the inflation rate and the exchange rate exhibit a negative correlation with per capita chicken meat consumption. For example, an increase of one unit in the inflation rate corresponds to a reduction of 0.0236 units in per capita chicken consumption in the country. Furthermore, a one-unit rise in the exchange rate (N/$) is expected to lead to a decrease in per capita chicken consumption by 0.0210 units. However, the result is consistent with the reports of Ewa et al. [9]. Likewise, a change in per capita GDP and capacity utilization of the meat industry were found to have a positive association with per capita chicken meat consumption. Consequently, an increase of one unit in both the per capita GDP and the capacity utilization rate of the meat industry would result in an increase of 0.0118 units and 0.0519 units in the per capita consumption of chicken meat within the country, respectively. The estimation of the Chevon model indicated that both the inflation rate and the exchange rate exhibit a negative correlation with per capita consumption of Chevon. Conversely, there exists a positive relationship between per capita GDP and prior levels of per capita consumption of Chevon. These findings align with the conclusions drawn by Akpan [3].

CONCLUSIONS

The research indicates that meat consumption per capita in Nigeria is significantly insufficient. The analyses found that the average per capita consumption of beef, goat meat, and chicken in Nigeria is below the average reported for Africa in 2021. The study estimated negative annual growth rates for beef and chicken meat per capita consumption and a marginal positive annual growth rate in Chevon consumption. The findings imply that the country consumed far less of animal protein compared to the recommended standard and most of the African countries. This has posed a serious challenge considering the fact the country is ranked among the top in poverty, malnutrition, and insecurity.

Secondly, the current meat consumption situation in Nigeria presents numerous opportunities for both domestic and foreign investments in the meat industry, taking advantage of the large population of over 200 million.

The results suggest that changes in per capita GDP, credit to the agricultural sector, inflation rate, nominal exchange rate and the meat industry's capacity utilization rates have significant impacts on meat consumption in Nigeria. These highlights the important role of macroeconomic environment in agricultural commodity consumption. Following the results obtained, it is recommended that the country effectively implement economic policies that will control inflation rate growth; improve per capita income; stabilize the exchange rate; enhance agricultural credit disbursement and increase capacity utilization in the meat industry as complementary strategies to improve meat consumption in the country.

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