Food Prices and Food Production in Selected West African Countries: The Moderating Effect of Fragility

Naomi O. DOKI[1]
Bridget Ngodoo MILE[2]
Victor Ushahemba IJIRSHAR[3]
Ashifa TERSUGH [4]

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ABSTRACT
The relationship between food prices and production significantly shapes consumer affordability and producer income in low-to-middle-income nations. While increased prices can stimulate production, excessive fluctuations pose threats to financial stability and food security, especially in regions like West Africa prone to conflicts and disruptions. This study investigated the impact of food prices on food production in selected West African countries, exploring the moderating effect of fragility on this connection. Employing non-stationary heterogeneous panel models, including Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE) estimators based on Hausman test results, the study revealed that agricultural lands and fertiliser application drive food production in the long run. Positive links are found between food prices, agricultural employment, and food production, with fragility moderating these relationships in some instances. The study also found that fragility negatively affects food production, showing its adverse influence in several West African nations. The study recommends that governments address fragility by focusing on conflict resolution, institution strengthening, and political stability. Additionally, it suggests promoting land management policies facilitating farmer access, encouraging fertiliser use, and implementing market-driven incentives to enhance price stability and market access for fair farmer compensation.

KEYWORDS: *fragility, food prices, food production, West Africa*

JEL CLASSIFICATION: *E31, L66, P22, P42, Q11*

1. INTRODUCTION

Food production is the process of transforming raw agricultural commodities into edible food products that are suitable for human consumption. In other words, it is a comprehensive process of growing, harvesting, processing, and manufacturing various food items to meet the dietary needs of a population. Food production begins with agricultural activities such as planting and tending to crops, as well as raising livestock. It is a critical component of the food supply chain necessary to address food security, nutrition, and the well-being of society. It is also a complex network of activities subject to various factors such as technology, climate, security threats, regulations, and market dynamics, particularly food prices.

[1] Centre for Food Technology and Research (CEFTER), Department of Economics, Benue State University, Makurdi, Nigeria. onyeje80@yahoo.com
[2] Centre for Food Technology and Research (CEFTER), Department of Economics, Benue State University, Makurdi, Nigeria. milengodoo@gmail.com
[3] Centre for Food Technology and Research (CEFTER), Department of Economics, Benue State University, Makurdi, Nigeria. ijirsharvictor@gmail.com, corresponding Author
[4] Centre for Food Technology and Research (CEFTER), Department of Economics, Benue State University, Makurdi, Nigeria. ashifatersugh@gmail.com

Food prices refer to the average price level of food commodities across countries, regions, and globally. These prices affect and matter to consumers and producers, as they influence consumer affordability and the income of producers. In low-to-middle-income countries, food prices have a strong influence on food availability, food affordability, hunger, undernourishment, and dietary quality (Ritchie et al., 2023). Rising food prices can have both positive and negative short-term impacts and long-term consequences (Gustafson, 2013). For instance, high food prices since 2007 have led to increased food production in some regions, including West Africa, Latin America, and the Caribbean (World Bank, 2012). However, rising food prices can also lead to decreased food consumption, especially among poor people in developing countries (Green et al., 2013).

The relationship between food prices and food production is a fundamental aspect of the global economy and food security. Higher food prices can incentivise increased production as producers seek to capitalise on better returns. They influence crop choices, with favourable prices leading to shifts in what farmers choose to grow. Elevated prices can drive investment in agricultural technology and risk management strategies, improving productivity and reducing post-harvest losses.

However, excessive price fluctuations can impact financial stability and food security, particularly for vulnerable populations such as West Africa. But it is always important to balance between fair prices for producers and affordable access to food for consumers while promoting sustainable and efficient food production practices to meet global demands. This relationship is also affected by the fragility of an economy.

Fragility refers to the vulnerability of a country or region to conflict, violence, or other shocks that can disrupt food production and distribution systems; which distorts food prices (World Bank, 2021). It reduces food production by disrupting agricultural activities, thus, changing food prices and access to food, especially for vulnerable populations. In regions with fragile or unstable environments, the relationship between food prices and food production becomes more complex.

Although higher prices can provide an incentive for increased production, fragility can hinder the ability of producers to respond effectively. Factors such as conflict, political instability, and weak infrastructure can disrupt food supply chains, making it challenging for farmers to capitalise on favorable prices. Therefore, fragile regions such as Africa and particularly West Africa struggle to invest in food technology as a means to reduce postharvest losses, and risk management, potentially limiting their ability to respond to market signals.

West Africa is facing a severe food crisis, with food prices increasing by 20-30 percent between 2017 and 2021, and food reserves dwindling in the Sahel. Cereal production has declined in the region, and the global crisis in Ukraine and other security threats in West Africa are making the situation dangerously worse. In view of this, it is imperative to examine the nexus between food prices and food production in West Africa, as well as the moderating effect of fragility.

The significance of this study lies in its ability to inform targeted policies and interventions about the most effective strategies to manage food price fluctuations and improve food production in both stable and fragile regions, thus supporting sustainable development and poverty reduction efforts. In other words, it helps policymakers address food security, economic stability, and resilience to fragility in West Africa. Additionally, it can contribute to

conflict prevention by tackling food-related issues that often exacerbate social unrest in fragile regions.

2. LITERATURE REVIEW

2.1 Theoretical review

There are several economic theories that explain the impact of food prices on food production, viz supply and demand theory, price stabilisation theory, cost-push theory, and economic growth theory. The Supply and demand theory states that food prices are determined by the interaction of supply and demand in the market. The theory further asserts that when demand for food increases, prices rise, and this incentivises producers to increase food production to meet the demand.

Conversely, when demand for food decreases, prices fall, and this can lead to a decrease in food production (Adjemian et al., 2023; Newbery, 1989). The theory, however, was criticised for oversimplifying the complexity of food price determination. It often ignores market imperfections, government interventions, and non-price factors like climate change and technological advancements. Additionally, it may not adequately address income disparities and access to food, overlooking the impact of food prices on vulnerable populations.

The price stabilisation theory suggests that governments can stabilise food prices by intervening in the market. The theory states that governments can use policies such as price floors and price ceilings to ensure that food prices remain stable and predictable. This can help to incentivise food production and ensure that consumers have access to affordable food (Newbery, 1989). But the price instability theory suggests that fragility can lead to price instability in the food market, which can affect food production. Fragile regions, such as West Africa, are more susceptible to price shocks, which can lead to higher food prices and reduced food production. This can result in food insecurity and malnutrition, especially for vulnerable populations (Ben-Abdallah et al., 2021; Puma et al., 2015).

In a bid to respond to the shocks, the agricultural supply response theory states that fragility can affect the agricultural supply response, which can lead to changes in food prices. Fragile regions may have limited access to inputs such as seeds, fertilisers, and irrigation, which can limit agricultural productivity and food production. This can lead to increased food prices and reduced food security (Headey & Hirvonen, 2023; Puma et al., 2015).

The economic growth theory also suggests that higher food prices can stimulate economic growth by inducing increased food production. When food prices rise, farmers have an increased incentive to invest in their farms and increase production. This can lead to increased economic growth and development in rural areas (Headey & Hirvonen, 2023).

2.2 Empirical Review

Using data that ranged from 1991 to 2017, Toriola (2022) investigated the impact of commodity prices on agricultural output in Nigeria. In Nigeria, maize and soya bean prices have a beneficial impact on agricultural output, but wheat and oil prices have a negative impact. This was discovered using the fully modified OLS (FMOLS) technique. According to this, agricultural output increases when the price of agricultural commodities rises and decreases when the price of oil increases. The study urges the government to work directly with farmers to increase agricultural productivity by providing them with loans, technology, and professional knowledge.

Mbah et al. (2022) investigated whether agricultural production had an effect on food costs and whether this impact was contagious to inflation. The vector autoregressive model (SVAR) technique was used in the investigation, which used time series data for Nigeria between 1981 and 2021. The findings showed that Nigeria's agricultural productivity and inflation are both long-term phenomena. A rise in food prices causes a positive improvement in agricultural production, while a long-term decline in inflation is accompanied by an increase in food costs. The report suggests policies such as agricultural input subsidies or laws to keep input costs low in order to minimise the rise in food prices that is anticipated to happen as a result of greater agricultural output due to increased production costs.

Agricultural productivity growth was examined by OCE (2020) along with its influences on Gross Domestic Product (GDP), commodity prices, retail food prices, and domestic and foreign consumer food expenditures. The study uses descriptive methods from 1929 and 2017 to demonstrate how, in the short run, a significant shock to the economy and the agricultural sector, in particular, the coronavirus COVID-19 pandemic, affects food prices and expenditures. It demonstrates that despite a simultaneous 9% decline in crop field area, consistent productivity development in the US was mirrored by an increase in the production of basic goods of almost 400 percent. Food costs have decreased as output has increased, despite rising demand and a shortage of farmland acres.

Agriculture's productivity rise has contributed to GDP growth and other economic sectors' expansion. Americans spend less on food as a percentage of household spending than people in other nations do as a result of GDP growth, growing incomes, and declining food prices. Despite the significant economic shock to the overall economy caused by the COVID-19 outbreak and the significant increase in the proportion of total food expenditures that go to home consumption, the agricultural sector has shown resilience in the face of the outbreak. This is evidenced by the relatively muted inflation in the prices of food for domestic consumption.

A study conducted by Headey and Martin (2016) on the impact of food prices on poverty and food security, reviewed literature on the impacts of changes in food prices on household poverty and food security, a literature which expanded rapidly with the food price crisis of 2007–2008, when the international prices of major staple foods doubled in the space of a few years. Early estimates of the impacts of higher food prices use the net-benefit ratio, which suggests that most of the poor are net consumers of food who would lose from higher prices. Inadequate attention is paid to the challenge of accurately measuring the net-benefit ratio given that recent World Bank studies suggest there could be serious errors in estimates of both food consumption and food production.

A more recent literature also focuses on how households and economies adjust to higher food prices over the longer term, with substantial emphasis on agricultural supply responses and the impacts of these responses on the demand for unskilled labour. Both simulation and econometric evidence on the longer-term impacts of higher food prices suggests that higher food prices often benefit the poor through these mechanisms. Despite increased consensus on the longer-term impacts of high food prices, there remain many knowledge gaps, and there is a particular need for better data on food consumption and production.

In Ethiopia, Loening et al., (2009) employed an error correction model to study the dynamics of inflation and food prices in an agricultural economy using monthly data from 1999 to 2009.

The findings showed that the exchange rate and global food and products prices ultimately influenced domestic food and non-food costs. Agribusiness supply shocks and inflation inertia have a significant short-term impact on domestic inflation, leading to significant departures from long-term pricing patterns. Results indicated that Ethiopia will face difficult times in the future and that fighting inflation would require a multifaceted strategy.

Fasanya and Odudu (2020) model the return and volatility spillovers among food prices in Nigeria. The Using monthly data from January 1980 to June 2017, the author specifically examined the spillovers across wheat, rice, soybeans, groundnuts, and palm oil in terms of returns and volatility. It used the VAR and spillover approaches from Diebold and Yilmaz (2012). They conduct the rolling sample analysis, which complements the spillover results, in an effort to capture the innate secular and cyclical dynamics in the Nigerian agricultural commodities market.

Given the spillover indicators, research revealed indications of interconnectedness across Nigeria's primary agricultural commodities. Both trends and bursts can be seen in the return and volatility spillovers, respectively. Additionally, it acknowledged the times of crisis that appeared to be responsible for the recorded variations in returns and volatility of the Nigerian agricultural commodities market.

The movement of relative food prices and inflation rate trends in Nigeria under different agricultural strategies were assessed by Akpan and Udoh in 2009. The data utilised by the researchers were collected between 1961 and 2009, and they were analysed using the GARCH (1,1) model and an ANOVA based on the OLS estimation approach. The research found that there was a positive and significant impact of inflation on the relative price variability of food.

Giordani et al. (2012) used panel regression to examine the relationship between export policy and food prices using a dataset that includes monthly data on trade measures across 125 countries and 29 food goods for the years 2008 to 2010. The likelihood of putting a new export restriction on a product is positively connected with its global restrictions (i.e., the percentage of global trade covered by export restrictions), especially for staple foods. Large exporters are observed to be more responsive to restrictive policies, indicating that this group is primarily responsible for the multiplier effect.

Last but not least, we predict that between 2008 and 2010, an increase in worldwide limitations raised international food prices. These findings contribute to the larger discussion on how export policy should be regulated under the multilateral trading system. From the above literature, there is dearth information on the influence of food prices on food production in West Africa where agriculture is the major occupation among many of the countries.

3. METHODOLOGY

The study employs a quasi-experimental technique to investigate cause-effect relationships between food prices and food production among selected West African countries while x-raying the interactive effect of fragility on the nexus, utilising a positivist research approach and deductive research approach. Secondary data sources and specific indicators are used for the analysis. The data were sourced on food production, food prices, employment in agriculture, and fragility from World Bank, The Fund for Peace, and Food and Agricultural Organisation (FAO).

3.1 Model specification

Food prices can have both direct and indirect effects on food production. Higher food prices can incentivise farmers to increase production to meet market demands. This relationship is often positive, indicating that as food prices increase, food production tends to increase. Following the supply and demand theory and the work of Green, et al. (2013) who modelled that the changes in maize price, wheat price, soybeans price, and oil price affect the agricultural output, changes in food prices and food production can be expressed in a functional form as:

$$fdpr = f(rfp) \tag{1}$$

Where $fdpr$ = food production and rfp =food prices

Food prices can affect the demand for food and the profitability of food production because high food prices can lead to increased production, while low food prices can lead to decreased production (Sexton, 2022). More so, the availability of arable land is a fundamental driver of food production. It allows for increased cultivation and diversification of crops, leading to higher food production. This relationship is typically positive theoretically, suggesting that expanding agricultural lands leads to increased food production.

The availability and quality of agricultural lands can affect food production since the expansion of agricultural lands can increase food production, while the degradation of agricultural lands can decrease food production (Fanzo & Davis, 2021). Furthermore, a larger agricultural workforce can lead to enhanced farming practices, improved crop management, and increased production. Labour-intensive agriculture depends on the availability of a skilled workforce, which has a positive influence on food production.

A shortage of labour can decrease food production, while an abundance of labour can increase food production. The use of fertilisers also enriches the soil with essential nutrients, promoting healthier crop growth and higher yields. Increased fertiliser application is associated with higher food production.

However, the relationship can vary depending on local conditions and practices. The use of fertilisers can increase crop yields and food production. However, excessive use of fertilisers can lead to environmental degradation and decreased food production in the long run (Anastasiou et al., 2023). But fragility that refers to the vulnerability of food systems to shocks and stresses, such as natural disasters, conflicts, and economic crises and includes factors like political instability, conflict, and weak institutions, can disrupt farming activities, reduce investment in agriculture, and hinder infrastructure development. It has a negative influence on food production, and the magnitude of this impact can vary between countries and regions. (Fanzo & Davis, 2021).

These drivers of food production are can have complex and non-linear effects on food production. Thus, by transforming equation (1) by taking the natural logarithm, it can be restated as:

$$lfdpr = f(lrfp, lagrls, lfert, lempc, lfra) \tag{2}$$

Where *lfdpr* is log of food production, *lrfp* is log of food prices, *lempc* is the log of agriculture raw material imports, *lagrls* is the log of employment in agriculture, *lfert* is log of fertiliser application, *lfra* is the log of fragility. The stochastic form of the mode can be presented as:

$$lfdpr_{it} = \beta_0 + \beta_1 lrfp_{it} + \beta_2 lagrls_{it} + \beta_3 lfert_{it} + \beta_4 lempc_{it} + \beta_5 lfra_{it} + \varepsilon_{it} \quad (3)$$

β_0 and $\beta_1 - \beta_5$ =parameters to be estimated, and ε_{it} =mutually independent idiosyncratic error

These objectives examine the causality among the variables and the effects of food prices on food production in the selected West African countries. The study also interacts the fragility and food prices using equation (3) as follows:

$$lfdpr_{it} = \beta_0 + \beta_1 lrfp_{it} + \beta_2 lrfpvfra_{it} + \beta_3 lagrls_{it} + \beta_4 lfert_{it} + \beta_5 lempc_{it} + \beta_6 lfra_{it} + \varepsilon_{it} \quad (4)$$

This study used the model with the interactive effect of fragility and food prices as captured in equation (4) to achieve objective two. The objective examines the interactive effect of effect of fragility and food prices on food production in the selected West African countries.

3.2 Method of data analysis

Before conducting the primary analysis, the study performed panel unit root tests using various methodologies, including Levin, Lin, and Chu (LLC), Hadri, Pesaran, and Maddala and Wu, with different assumptions about parameter homogeneity/heterogeneity. This process is crucial for enhancing the reliability of estimations in panel data. The study assessed cross-sectional dependency and highlighted the importance of employing second-generation unit root tests when analysing variables with such dependencies.

The study used various econometric techniques, including the Dumitrescu and Hurlin causality test, the Westerlund and Edgerton LM bootstrap cointegration test, and the conventional panel cointegration test, to explore the relationships between food prices and food production between selected West African countries while x-raying the interactive effect of fragility on the nexus. These tests helped assess causality and cointegration among the variables.

The study used a range of panel data techniques, including Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effects (DFE) estimators, to investigate relationships between food prices and food production among selected West African countries while x-raying the interactive effect of fragility on the nexus. Due to the larger number of time series (T) compared to cross sections (N), nonstationary heterogeneous panel estimators were used to analyse the long-run effects and speed of adjustment. These estimators are crucial due to West Africa's diverse economic dynamics, capturing time-series and cross-sectional variations, addressing nonstationarity, investigating cointegration, and offering insights for policy-making and forecasting.

Pooled Mean Group (PMG) allows intercepts, short-run coefficients, and error variances to differ among groups while constraining long-run coefficients to be similar across groups. The MG estimator estimates separate regressions for each country and averages country-specific coefficients, imposing no restrictions on parameter heterogeneity. The Dynamic Fixed Effects (DFE) estimator controls for country-specific effects, with equal long-run coefficients and a constant speed of adjustment. The Hausman-type test determined the most suitable estimator.

A linear panel data model methods was applied to analyse country-specific effects of food prices and fragility on food production in selected West African countries. This approach aimed to assess homogeneity or heterogeneity and ensure robust results by addressing the bias associated with country-specific effects on the dynamic relationship.

4. RESULTS AND DISCUSSIONS

4.1 Panel unit root test results

Panel unit root tests, including Levin-Lin-Chu, Im-Pesaran-Shin, and Fisher-type augmented Dickey-Fuller tests, were employed to determine the stationarity of variables. The study used a 5% significance level to assess stationarity. The results are presented in Table 1.

Table 1. Panel Unit Root Test Results

Panel Unit Root Tests	lfdpr	d.lfdpr	lrfp	d. rfp	lagrls	d.lagrls
Harris-Tsavalis (rho)	0.9658	-0.3126***b	0.911	0.0311***b	0.9282	0.1119***b
Breitung (lambda)	7.1697	-10.1569***b	-0.0697	-11.5212***b	5.1233	-4.8545***b
Levin-Lin Chu (Adjusted t)	0.4968	-8.1152***b	0.5744	-5.3588***b	-3.008***a	-1.6e+02***b
Im-Pesaran-Shin (z-t-title-bar)	2.9721	-12.1948***b	2.3465	-8.5502***b	-1.1901	-8.6089***b
Fisher-type (Choi, 1997)	-2.1424	2.4344***b	-2.8959	-0.756	-1.6829**a	5.9371**b
Pesaran (2007) CSD Test (t-bar)	-1.415	-1.599	2.61	2.61	-2.164*	-1.897
Hadri LM (z statistic)	58.1647***	-1.7336b	38.5287***	-1.6214b	53.9822***	2.345***
Panel Unit Root Tests	**lfert**	**d. lfert**	**lempc**	**d.lempc**	**lfra**	**d.lfra**
Harris-Tsavalis (rho)	0.8158***a	-0.3062***b	1.0251	0.2253***b	0.9591	0.2496***b
Breitung (lambda)	-1.4547*	-11.9702***b	9.5789	-5.2986***b	2.0206	-8.6934***b
Levin-Lin Chu (Adjusted t)	1.3258	-7.4984***b	2.0326	-6.5094***b	-1.6153*	-4.5789***b
Im-Pesaran-Shin (z-t-title-bar)	-0.4672	-11.0799***b	9.8321	-6.371***b	0.9345	-6.6265***b
Fisher-type (Choi, 1997)	-1.807	-2.395**b	-1.891	-1.712	-0.477	-1.439

Panel Unit Root Tests	lfdpr	d.lfdpr	lrfp	d. rfp	lagrls	d.lagrls
Pesaran (2007) CSD Test (t-bar)	0.949	-0.425	1.092	-1.221	-1.234	-0.552
Hadri LM (z statistic)	28.3101***	-0.8955b	57.7693***	3.1712***	53.5281***	5.2877***

Source: Extracts from STATA 15 Output.

Note: The asterisk (*** ** and *) denotes rejection of the null hypothesis at 1%, 5% and 10 percent level of significance, while a and b indicate stationarity at level and first difference respectively. CSD Test means Cross-Sectional dependence test

The results in Table 1 indicate that some variables were initially stationary in their original form, with no apparent trends. However, after applying the first difference transformation, all variables became stationary. This transformation involves calculating differences between consecutive observations to remove underlying patterns or trends.

4.2 Correlation test for multicollinearity

The study examined predictor variable correlations to assess multicollinearity, cautioning that correlation does not imply causation, and further diagnostics are needed.

Table 2. Results of Correlation Test for Multicollinearity

Economic Growth Model	ind	Pat	lntrd	rad	lnexpt	lnimpt	
Ind	1						
Pat	0.4342	1					
lntrd	0.4954	0.4639	1				
Rad	0.337	0.4036	0.2674	1			
lnexpt	0.3886	0.4702	0.5305	0.3583	1		
lnimpt	0.4159	0.5032	0.5582	0.4379	0.9745	1	

Source: Extracts from STATA 15 Output.

The correlation test result in Table 2 reveals weak associations among explanatory variables in the model suggesting the absence of substantial multicollinearity.

4.3 Results of the Cointegration Analysis

The panel cointegration analysis in this study, as shown in Table 3, revealed that all models exhibited cointegration among their variables. This implies the presence of long-term relationships within each model. The use of multiple tests (Kao, Predoni, and Westerlund) enhanced the study's findings' robustness and credibility by offering complementary evidence.

4.4 Impact of Food Prices on Food Production in West Africa

The study examined the impact of food prices on food production and the results are presented in Table 4.

Table 3. Panel Cointegration Results

Statistics/Probabilities	Statistic	p-value
Kao (1999) Test of Cointegration Results		
Modified Dickey-Fuller t	0.1879	0.4255
Dickey-Fuller t	-0.0592	0.4764

Statistics/Probabilities	Statistic	p-value
Augmented Dickey-Fuller t	1.5118*	0.0653
Unadjusted modified Dickey-Fuller	-3.7915***	0.0001
Unadjusted Dickey-Fuller t	-2.4690***	0.0068
Predoni (1999, 2004) Test of No Cointegration		
Modified Phillips-Perron t	0.6593	0.2549
Phillips-Perron t	-4.4789***	0.0000
Augmented Dickey-Fuller t	-4.5339***	0.0000
Westerlund (2005) Test of No Cointegration [Alternative hypothesis: cointegration in some panels]		
Variance ratio	-0.7778	0.2183
Westerlund (2005) Test of No Cointegration [Alternative hypothesis: All panels are cointegrated]		
Variance ratio	-0.6006	0.2741

Source: Extracts from STATA 15 Output.

Table 4. Impact of Food Prices on Food Production in West Africa (Without Interactive Effect)

VARIABLES	Benin	Burkina Faso	Cote d'Ivoire	Gambia	Ghana	Guinea	Mali	Niger	Nigeria	Senegal	Togo
ec	-0.641***	-0.849***	-0.334	-0.0149	-0.198**	-0.416***	-0.361**	-0.988***	-0.693***	-1.211***	-0.721***
	(0.248)	(0.254)	(0.205)	(0.149)	(0.084)	(0.141)	(0.146)	(0.235)	(0.166)	(0.219)	(0.254)
D.lrfp	0.0731	0.0602	-0.11	-0.227	0.116**	0.0934	0.352**	-0.104	0.151	-0.133	-0.129
	(0.144)	(0.158)	(0.530)	(0.145)	(0.050)	(0.108)	(0.147)	(0.348)	(0.109)	(0.308)	(0.137)
D.lagrls	0.576	-0.279	2.039*	-0.858	1.878	-1.584	0.978	-1.023	-3.932	0.068	-0.218
	(0.743)	(0.639)	(1.068)	(1.093)	(1.825)	(1.316)	(0.857)	(1.187)	(8.676)	(1.163)	(1.284)
D.lfert	0.0124	-0.0787	-0.305**	0.00516	-0.00657	-0.0294	-0.129*	0.571	0.181***	-0.24	-0.0214
	(0.023)	(0.063)	(0.143)	(0.044)	(0.030)	(0.048)	(0.077)	(0.790)	(0.046)	(0.153)	(0.040)
D.lempc	-0.285	-0.425	-4.807	0.186	0.961	0.391	1.271***	-0.119	0.791	0.795*	1.193**
	(1.178)	(4.097)	(4.031)	(0.268)	(0.624)	(0.629)	(0.463)	(5.066)	(1.157)	(0.464)	(0.589)
D.lfra	-0.193	-1.710*	3.531	0.494	-0.580*	1.163	0.59	0.0449	-0.918	-2.4	0.72
	(0.980)	(1.036)	(4.430)	(1.001)	(0.307)	(0.863)	(0.558)	(1.726)	(0.780)	(2.108)	(1.214)
lrfp	0.0909	-0.166	-1.055	9.192	-0.189	-0.254	1.256***	0.13	-0.266**	0.168	0.0404
	(0.238)	(0.155)	(1.289)	(98.760)	(0.205)	(0.268)	(0.443)	(0.375)	(0.114)	(0.251)	(0.190)
lagrls	1.181***	2.895**	0.146	-14.45	5.483	4.598*	1.431**	2.353***	1.955	4.080***	3.273***
	(0.392)	(1.269)	(2.665)	(168.500)	(6.734)	(2.400)	(0.663)	(0.461)	(4.807)	(0.764)	(1.006)
lfert	0.0395	0.0958	0.514	-1.173	0.0683	0.147	0.22	-1.402	0.223**	0.298***	-0.0367
	(0.036)	(0.090)	(0.498)	(16.250)	(0.185)	(0.135)	(0.254)	(0.939)	(0.095)	(0.101)	(0.053)
lempc	0.536**	-2.197	-1.425	-4.184	3.428**	-1.371	-2.956	4.710***	2.040**	0.995***	-0.145
	(0.230)	(1.993)	(10.800)	(43.190)	(1.415)	(0.957)	(2.265)	(1.177)	(0.866)	(0.174)	(0.275)
lfra	0.812	-3.706**	0.912	-17.56	-2.786***	-0.813	-1.469*	-0.689	-1.272	-0.118	0.625
	(1.017)	(1.656)	(2.728)	(200.300)	(0.978)	(0.869)	(0.757)	(1.296)	(0.922)	(0.411)	(1.592)
Constant	-6.429***	-2.287	2.767	3.4	-11.55	-17.52	-5.245	-0.446	-4.517	-47.95***	-23.28**
	(2.421)	(13.740)	(20.400)	(10.620)	(15.480)	(15.270)	(6.428)	(13.790)	(48.920)	(13.910)	(9.835)
Observations	330	330	330	330	330	330	330	330	330	330	330

Source: Extracts from STATA 15 Output.

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From the results in Table 4, the study found a positive and significant effect of lagged food production on current food production in Ghana and Mali at a 10% level of significance, and a 5% level of significance respectively. This means that there is strong evidence to suggest that past food production levels have a significant impact on the current food production in the country. This indicates that the agricultural practices and conditions in Ghana tend to be persistent over time. This may be due to factors such as soil quality, climate, or traditional farming methods that continue to influence current production. More so, farmers often allocate resources based on their previous experiences and production levels.

The study also revealed positive and significant effect of agricultural lands on current food production in Cote d'Ivoire at10% level of significance. This means that the availability of arable land has a significant influence on the current food production. This is because Cote d'Ivoire's economy heavily relies on agriculture, with a focus on crops like cocoa, coffee, and oil palm. The positive effect suggests that a larger expanse of agricultural land contributes significantly to current food production. As food production is closely tied to agricultural lands, the positive effect signifies a strong foundation for improving food security and reducing dependence on imports.

The findings from this study shed light on the impact of fertiliser application on current food production in Nigeria, Cote d'Ivoire, and Mali. In the case of Nigeria, the results indicated a positive and significant effect of fertiliser application on food production, explaining the vital role of fertilisers in enhancing agricultural productivity and increasing food production. This positive effect can be attributed to the fact that fertilisers enrich the soil with essential nutrients, which, in turn, promotes healthier crop growth.

The higher crop yields associated with fertiliser application in Nigeria contribute to increased food production, which is crucial for food security and agricultural sustainability. Conversely, the study revealed a different trend for Cote d'Ivoire and Mali, where fertiliser application exhibited a negative influence on food production. This suggests that in these two countries, increased fertiliser use did not necessarily lead to higher food yields. These contrasting outcomes imply that the impact of fertiliser application on food production is context-dependent and may be influenced by various factors, such as soil quality, crop types, or agricultural practices specific to each country.

The study also found a positive and significant impact of employment in agriculture on current food production in Mali and Togo. This signifies that a larger agricultural workforce is contributing substantially to increased food production. This effect is justified by the labour intensive nature of agriculture, where a well-employed workforce can lead to enhanced farming practices, improved crop management, and increased production. In Mali and Togo, a larger agricultural workforce is crucial in meeting the demand for food production, which subsequently ensures greater food availability, food security, and economic well-being for these nations.

The results revealed negative and significant impact of fragility on food production in Burkina Faso and Ghana in the short-run at 10% level of significance. This suggests that unstable and fragile conditions impede agricultural productivity. This effect is justified by the fact that fragility, often associated with conflict, political instability, and weak institutions, disrupts

farming activities, reduces investment in agriculture, and hampers infrastructure development. Such adverse conditions hinder farmers' ability to produce food efficiently and, consequently, lead to decreased food production, posing significant challenges to food security and economic stability in these countries.

In the long-run, the positive and significant impact of food prices on food production in Mali and Nigeria highlights the responsiveness of these countries' agricultural sectors to market dynamics. This effect is justified by the fact that higher food prices create economic incentives for farmers, leading to increased investment in agriculture, adoption of advanced technologies, and expansion of agricultural activities.

Over the long term, these actions enhance the overall food production capacity, contributing to food security and economic stability. It signifies that market-driven price signals play a pivotal role in fostering sustainable food production and ensuring a consistent food supply in Mali and Nigeria.

From the results, there is positive and significant impact of agricultural lands on food production in Benin, Burkina Faso, Guinea, Mali, Niger, Senegal, and Togo in the long-run. This reflects the crucial role of arable land in determining the agricultural output of these nations. The justification is that agriculture is a cornerstone of their economies, and an expansion of available agricultural lands allows for increased crop cultivation and diversification. In the long run, this not only increases food production but also supports economic growth, employment opportunities, and improved food security.
These countries exhibit a specific behaviour rooted in the recognition that the availability of arable land plays a fundamental role in their sustained agricultural development and overall well-being.

The study also showed negative and significant impact of agricultural employment on food production in Benin, Ghana, Niger, Nigeria, and Senegal in the long run. This implies the country-specific shift away from labour-intensive agriculture. The justification of this finding lies in the transition towards more mechanised and technology-driven farming, as well as economic diversification efforts. As these nations evolve, the dependency on manual labour in agriculture declines, with implications for long-term production trends. This specific behaviour explains the changing dynamics in agricultural practices and workforce allocation in these countries.

The result also reveals the positive and significant effect of fertiliser application/consumption on food production in Nigeria and Senegal in the long-run. This explains the role of this agricultural practice in enhancing crop yields and overall food output. This is because fertiliser use enriches the soil, providing essential nutrients that lead to healthier and more productive crops, thereby increasing food production. This positive impact is justified by the modernised farming practices and improved resource utilisation associated with fertiliser application.

Additionally, it contributes to food security and economic growth, reducing the reliance on food imports and supporting overall economic stability in these countries.
However, the study found a negative and significant impact of fragility on food production in Burkina Faso, Ghana, and Mali in the long run. This denotes a country-specific pattern where political instability, conflict, and weak institutions hinder sustained agricultural productivity.

The justification lies in the disruption of resource allocation, limited institutional support, security concerns, and damage to critical agricultural infrastructure.

These factors collectively contribute to a decrease in long-term food production, explaining the specific challenges these nations face in ensuring a stable and growing food supply in the face of fragility.

4.5 The moderating effects of fragility on the relationship between food prices and food production among West African Countries

The results from the mean group (mg) estimator preferred based on the results of the Hausman test are presented in Table 5.

Table 5. Impact of Food Prices on Food Production in West Africa (Without Interactive Effect)

Variables	Benin	Burkina Faso	Cote d'Ivoire	Gambia	Ghana	Guinea	Mali	Niger	Nigeria	Senegal	Togo
ec	-0.644**	-0.975***	-0.33	-0.0696	-0.203*	-0.424***	-0.474***	-1.145***	-0.773***	-1.217***	-0.900***
	(0.267)	(0.271)	(0.221)	(0.152)	(0.107)	(0.149)	(0.142)	(0.293)	(0.196)	(0.224)	(0.228)
D.lrfp	4.097	65.2	-1.177	-9.987	-3.862	4.048	20.92	-25.98	-3.282	-0.886	-80.64***
	(7.084)	(59.110)	(24.420)	(9.721)	(7.232)	(21.340)	(16.770)	(43.850)	(26.180)	(15.120)	(26.770)
D.lrfpvlfra	-0.927	-14.52	0.252	2.348	0.864	-0.844	-4.868	5.676	0.751	0.167	18.04***
	(1.668)	(13.170)	(5.651)	(2.348)	(1.571)	(4.576)	(3.870)	(9.668)	(5.730)	(3.566)	(5.999)
D.lagrls	1.184	-0.165	1.918	-0.875	1.64	-1.462	0.622	-1.453	-1.51	-0.0987	1.83
	(0.774)	(0.640)	(1.219)	(1.110)	(1.978)	(1.474)	(0.791)	(1.260)	(9.651)	(1.191)	(1.284)
D.lfert	0.0488**	-0.0386	-0.309*	0.0101	-0.00792	-0.0314	-0.243***	0.543	0.162***	-0.302*	-0.0273
	(0.024)	(0.069)	(0.160)	(0.045)	(0.032)	(0.050)	(0.084)	(1.023)	(0.056)	(0.164)	(0.035)
D.lempc	1.721	-8.183	-4.918	0.223	0.904	0.258	1.254	-1.967	-0.0333	0.802*	-0.875*
	(1.287)	(6.718)	(4.383)	(0.298)	(0.667)	(0.763)	(0.772)	(7.197)	(1.558)	(0.476)	(0.510)
D.lfra	3.537	67.97	2.62	-10.22	-4.45	5.472	22.75	-24.3	-4.689	-2.44	-82.12***
	(7.713)	(60.300)	(26.970)	(10.900)	(7.074)	(21.140)	(17.680)	(42.930)	(26.330)	(16.640)	(27.510)
lrfp	-28.01**	-110.4	19.93	185.1	7.934	-21.16	-12.8	-13.67	29.52	13.21	70.20**
	(14.020)	(71.100)	(85.830)	(395.800)	(39.130)	(46.650)	(35.090)	(32.550)	(32.600)	(11.640)	(35.370)
lrfpvlfra	6.573**	24.6	-4.877	-44.23	-1.763	4.483	3.124	3.027	-6.513	-3.059	-15.74**
	(3.271)	(15.850)	(19.980)	(94.290)	(8.485)	(10.010)	(8.100)	(7.212)	(7.134)	(2.736)	(7.928)
lagrls	1.494***	2.156**	0.643	-7.689	6.554	3.926	1.649***	2.217***	4.398	4.125***	1.903**
	(0.381)	(1.072)	(3.464)	(22.300)	(7.721)	(2.785)	(0.465)	(0.510)	(5.391)	(0.785)	(1.034)

Variables	Benin	Burkina Faso	Cote d'Ivoire	Gambia	Ghana	Guinea	Mali	Niger	Nigeria	Senegal	Togo
lfert	-0.0336	0.0526	0.505	-0.391	0.0983	0.153	0.596**	-1.315	0.175*	0.177***	-0.024
	(0.046)	(0.079)	(0.548)	(1.825)	(0.195)	(0.142)	(0.232)	(1.039)	(0.099)	(0.027)	(0.042)
lempc	-0.827***	-3.743**	-1.744	-1.779	-3.137*	-1.377	0.45	-5.234***	-1.455	-0.903***	-0.421**
	(0.230)	(1.746)	(11.900)	(4.936)	(1.782)	(1.054)	(1.534)	(1.237)	(1.033)	(0.193)	(0.212)
lfra	-29.11**	-114.6	22.55	197.9	10.62	-21.65	-12.93	-14.58	28.96	13.7	73.29**
	(14.820)	(71.860)	(88.610)	(417.600)	(38.060)	(45.780)	(37.060)	(32.630)	(32.980)	(12.430)	(36.840)
Constant	74.68**	497.3	-28.94	-50.39	-22.05	26.81	15.12	76.37	-139.1	-121.1*	-306.6**
	(30.100)	(342.100)	(128.500)	(37.930)	(52.150)	(98.430)	(77.420)	(187.200)	(158.000)	(66.190)	(149.200)
Observations	330	330	330	330	330	330	330	330	330	330	330

Source: Extracts from STATA 15 Output.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The findings of the study examine the relationship between food prices and food production in several West African countries using two different statistical models, one without and the other with the interactive effect of fragility and food prices, to assess the relationship. In the model without interactive effect of fragility and food prices, the variable "fragility" is not considered as an influencing factor. The results revealed a negative and significant speed of adjustment for the selected West African countries. The speed of adjustment refers to how quickly a system or relationship corrects itself when there are initial imbalances or distortions.

Therefore, the negative and significant speed of adjustment indicates that, in the absence of the interactive effect of fragility and food prices, these countries are capable of correcting any deviations from a long-run equilibrium in their food production when food prices change. The correction process is relatively efficient.

Similarly, in the model with interactive effects of fragility and food prices, fragility is taken into account as an influencing factor on the relationship between food prices and food production. The results also showed a negative and significant speed of adjustment for the same West African countries. This suggests that, even when fragility is considered, the countries still exhibit a negative and significant speed of adjustment. This implies that the presence of fragility does not change the fundamental behaviour of these countries in terms of correcting any initial imbalances in food production in response to changes in food prices.

In both models, the negative and significant speed of adjustment indicates that these West African countries have the capacity to correct any initial distortions in food production when food prices change, whether fragility is considered or not. This suggests an inherent resilience in these countries' agricultural systems, allowing them to adapt to changing market conditions and return to a long-term equilibrium in their food production.

The study also found a positive and significant effect of food prices on food production in Ghana and Mali at 10% level of significance and 5% level of significance, respectively, in the short-run from the model without interactive effect of fragility and food prices. The result indicates that there is a statistically significant and positive relationship between food prices and food production in the short-term (short-run) in Ghana and Mali. In other words, when food prices go up, food production also increases in these two countries. The significance levels (10% and 5%) explains that this relationship is stronger and more significant in Mali (5% significance level) compared to Ghana (10% significance level).

This part of the study seems to have examined the connection between food prices and food production in multiple West African countries, excluding the influence of fragility as a variable in the analysis.

However, the results from the model with the interactive effect of fragility and food prices on the relationship between food prices and food production in several West African countries showed a positive and significant effect of food prices on food production in Togo in the short-run at1% level of significance. This part of the study introduces the concept of fragility as an interactive factor in the analysis. It found that, when considering the interactive effect of fragility and food prices in several West African countries, there is still a positive and significant relationship between food prices and food production in the short-run, but this time specifically in Togo at 1% significance level.

The study suggests that, in the short-run, higher food prices are positively associated with increased food production in Ghana, Mali, and Togo. The strength and statistical significance of this relationship vary between the countries, with Togo having a stronger relationship followed by Mali and Ghana exhibiting weaker but still statistically significant connections. Additionally, the study indicates that the influence of fragility has an interactive effect in Togo, where it also positively affects the relationship between food prices and food production.

The study revealed a strong and statistically significant impact of food prices on food production in Ghana and Mali at 5% level of significance in the short term. This finding signifies a strong and positive connection between food prices and food production in both Ghana and Mali. In simple terms, as food prices rise, so does food production in these two countries.

The portion of the study that scrutinised the model without accounting for the interactive effect of fragility and food prices on the relationship between food prices and food production in the selected West African countries focused on this link, excluding the influence of fragility as a factor. However, the findings from the model that incorporated the interactive effect of fragility and food prices found a positive and significant relationship between food prices and food production in Togo at 1% level of significance. This indicates that when considering the interplay with fragility, there is only a substantial and optimistic relationship between food prices and food production in the short term within Togo alone.

Therefore, the study suggests that, in the short run, higher food prices are linked to increased food production in Ghana and Mali at 5% level of significance. Furthermore, when taking fragility into account, the connection between food prices and food production remains substantial, but only in the case of Togo. This suggests that fragility plays a crucial role in determining how food prices impact food production, particularly in Togo.

The results of the model with the interactive effect of fragility and food prices on the relationship between food prices and food production in the selected West African countries showed a positive and significant interactive effect of fragility and food prices and food prices on food production in Togo in the short-run at 1% level of significance. This implies that when considering the interactive effect of fragility and food prices in the selected West African countries, there is a positive and significant relationship between fragility, food prices, and food production in the short-run, specifically in Togo.

This interaction is highly significant, indicating a very strong statistical relationship. The study suggests that in the short-run, there is an interactive effect between fragility, food prices, and food production in Togo. This means that the relationship between food prices and food production is influenced by the level of fragility in Togo. This implies that fragility has a significant impact on how food prices and food production interact in Togo.

The findings from the study further provide crucial insights into the relationship between fertiliser application and food production in West African countries. Initially, without considering the interactive effect of fragility and food prices, the results revealed that fertiliser application had a negative and significant impact on food production in Cote d'Ivoire and Mali, indicating that increased fertiliser use did not necessarily lead to higher food yields in these nations. Surprisingly, in Nigeria, the study found a positive and significant effect of fertiliser application on food production at 5% significance level, implying that fertiliser use indeed contributed to increased food production in the short run.

However, when fragility was introduced into the analysis, the picture became more intricate. In Benin and Nigeria, the positive and significant effect of fertiliser application on food production was confirmed, suggesting its effectiveness even in fragile contexts. In contrast, Cote d'Ivoire, Mali, and Senegal experienced a negative and significant effect of fertiliser application on food production in the presence of fragility. These results explain the importance of considering fragility when implementing agricultural policies, as its impact on the relationship between fertiliser use and food production varies across West African countries.

The study also investigated the impact of agricultural employment on food production within a group of West African countries, while also considering the role of fragility in this relationship. In the short run, when the model did not account for the interactive effect of fragility and food prices, the findings revealed a positive and significant effect of agricultural employment on food production in Mali, Senegal, and Togo, at a 5% level of significance. This indicated that an increase in agricultural employment had a strong and beneficial impact on food production in these nations.

However, when the study incorporated the interactive effect of fragility and food prices, the results continued to demonstrate a positive and significant effect of agricultural employment on food production in Senegal and Togo in the short run. This suggests that fragility did not alter the positive relationship between agricultural employment and food production in these countries, except Mali. Importantly, while the effects remained significant at the 5% level of significance, they were relatively less pronounced in terms of their magnitude, indicating that the presence of fragility may moderate the strength of this relationship.

These findings explain the importance of considering fragility in the context of agricultural employment and food production, showcasing the continued positive impact of agricultural employment in Senegal and Togo, although with somewhat diminished effects when fragility is taken into account.

The study further explored the influence of fragility on food production in the selected West African countries, with and without considering the interactive effect of fragility and food prices. In the short run, without accounting for the interactive effect, the findings indicated a negative and significant effect of fragility on food production in Burkina Faso and Ghana at 5% level of significance. This suggested that these two countries experienced reduced food production in the presence of higher fragility, highlighting the adverse impact of instability and vulnerability on their agricultural output.

More so, when the study included the interactive effect of fragility and food prices and food prices, it unveiled a different dynamic. In Togo, there was a negative and significant effect of fragility on food production in the short run at 5% level of significance. This implies that fragility, when considered alongside food prices and food production, continued to exert a detrimental influence on food production in Togo, aligning with the findings from Burkina Faso and Ghana.

These results explain the importance of recognising the negative impact of fragility on food production, particularly in Togo, and suggest that instability can hinder agricultural output across different West African countries, even when accounting for other factors such as food prices.

The study also explored the correlation between food prices and food production in the selected West African countries, while taking into account both fragility and food prices in the long term. When the model did not incorporate the interactive effect of fragility and food prices, it uncovered a statistically significant positive relationship between food prices and food production in Mali and Nigeria at 5% significance level. This indicated that elevated food prices were linked to increased food production in these two nations, potentially acting as an incentive for farmers to enhance their output. However, when the study integrated the interactive effect of fragility into the analysis, the dynamics shifted. In Benin and Togo, there emerged a positive and significant association between food prices and food production in the long run. This implies that, when accounting for the impact of fragility, higher food prices still exerted a beneficial influence on food production in these countries in the long-run. These findings explain the notion that the impact of food prices can fluctuate based on the presence of fragility, with favorable effects observed in Benin and Togo.

The study also revealed the influence of agricultural lands on food production in the selected West African countries in the long run. When considering the model without the interactive effect of fragility, it revealed a positive and statistically significant effect of agricultural lands on food production in Benin, Burkina Faso, Guinea, Mali, Niger, Senegal, and Togo. This implies that over time, an increase in agricultural land was associated with higher food production in these nations, showcasing the significance of land availability for agricultural output.

When the study integrated the interactive effect of fragility into the analysis, the results remained consistent except for Guinea. It showed a positive and significant effect of agricultural land on food production in Benin, Burkina Faso, Mali, Niger, Senegal, and Togo in the long run. Fragility did not alter the positive relationship between agricultural land and food production, emphasising the enduring importance of land resources in sustaining and promoting food production across these West African countries.

The study explored the impact of fertiliser application on food production among the selected West African countries in the long run. When the model did not consider the interactive effect of fragility, the findings revealed a positive and significant effect of fertiliser application on food production in both Nigeria and Senegal. This implied that over time, increased use of fertilisers was associated with higher food production in these countries, signifying the potential benefits of improved agricultural practices.

However, when the study introduced the interactive effect of fragility into the model, the results remained positive and significant for fertiliser application on food production in both Nigeria and Senegal in the long run. However, the magnitudes of these effects were somewhat diminished when compared to the model without the interactive term. This suggests that, while the positive relationship between fertiliser application and food production persisted when fragility was considered, the impact might be slightly less pronounced, emphasising the role of fragility in influencing the strength of this association.

The study also assessed the impact of agricultural employment on food production among the selected West African countries in the long run. Results from the model without the interactive effect of fragility showed a positive and statistically significant relationship between employment in agriculture and food production in Benin, Ghana, Niger, Nigeria, Senegal, and Togo. This indicated that, in the long-run, an increase in agricultural employment was linked to higher food production, explaining the pivotal role of the workforce in sustaining and boosting food output in these countries.

Interestingly, when the study introduced the interactive effect of fragility into the analysis, the positive and significant effect of agricultural employment on food production persisted. It was observed in Benin, Burkina Faso, Ghana, Niger, Senegal, and Togo. This finding indicates that fragility did not diminish the favourable connection between agricultural employment and food production, emphasising the enduring importance of a strong agricultural workforce in promoting food production in this diverse group of West African nations. These findings underscore the resilience of the relationship between agricultural employment and food production, irrespective of the presence of fragility, offering valuable insights for policymakers and stakeholders seeking to enhance food security in the region.

The study also delved into the impact of fragility on food production across several West African countries in the long run. The study found a positive and significant influence of fragility on food production in Burkina Faso, Ghana, and Mali when the model did not incorporate the interactive effect of fragility. This implies that higher levels of fragility were associated with reduced food production, highlighting the adverse effects of instability and vulnerability on agriculture and food security.

However, when the study introduced the interactive effect of fragility into the analysis, the negative and significant impact of fragility on food production persisted, but was also observed in Benin and Togo in the long run. These findings emphasise that fragility, when considered in conjunction with food prices and food production, continued to have a detrimental effect on food production in these West African countries, explaining the importance of addressing fragility as a crucial factor in promoting agricultural sustainability.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The study concludes that agricultural lands and fertiliser application are drivers of food production among some selected West African countries in the long-run. The study also infers that food prices and employment in agriculture positively influence food production, with fragility moderating its strength in some cases. Additionally, fragility was found to negatively affect food production, emphasising its detrimental impact in several West African nations.

Based on the study findings, several practical policy recommendations can be made to enhance food production and agricultural sustainability in West African countries:

i. To mitigate the negative impact of fragility on food production, efforts must focus on conflict resolution, strengthening institutions, and building political stability. Peace and stability are critical to ensuring a conducive environment for agriculture.
ii. Given the significant positive impact of agricultural land on food production, governments should focus on land management policies that facilitate land access for farmers. Encouragement of responsible land expansion can lead to increased crop cultivation and diversification.
iii. Fertiliser use should be encouraged, particularly in countries such as Nigeria, but with careful consideration of specific local conditions. Fertiliser subsidies and extension services can be developed to ensure efficient and judicious use.
iv. Governments should also create policies that promote agricultural employment by investing in training, mechanisation, and modern farming techniques. A well-trained and well-employed agricultural workforce can significantly boost food production.
v. Recognise the positive impact of food prices on food production, especially in Mali and Nigeria. Policymakers can create market-driven incentives for farmers by promoting price stability and access to markets, ensuring that farmers receive fair prices for their produce. More so, there should be tailored policies to the specific context of each country, as the impact of variables like fertiliser use and fragility can vary significantly. One-size-fits-all policies may not be effective in addressing the diverse challenges and opportunities in West African agriculture. More so, continuous research and data collection are crucial to monitor and adapt agricultural policies to changing conditions. Accurate and up-to-date information is essential for informed decision-making.
vi. By implementing these recommendations, West African countries can improve their food production, improve food security, and build more resilient agricultural sectors that can withstand the challenges posed by fragility and other factors.

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