Climate-Induced Food Price Shocks and Macroeconomic Outcome in Sub-Saharan Africa

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ABSTRACT

This study explores the connections between food prices, climate anomalies, and macroeconomic outcome (GDP Growth) in 10 countries in Sub-Saharan Africa, including Nigeria, South Africa, Ethiopia, Kenya, Angola, Ghana, Côte d'Ivoire, DR Congo, Senegal and Uganda. The study explores both short- and long-run dynamics using a Panel Autoregressive Distributed Lag (Panel ARDL) model, with a specific emphasis on the effects of climate-induced food price shocks. Important factors include food imports as a percentage of merchandise imports, the Food Price Index, and climate anomalies as measured by land temperature fluctuations and their interactions. These countries' rapid susceptibility to climatic changes is highlighted by the short-run results, which show that climate anomalies severely impair GDP growth with p-value estimated at 0.0424. While food prices and climatic anomalies both contribute to economic growth over the long run, their interaction has a strong negative impact, indicating that simultaneous rises in both put downward pressure on growth with an estimated p-value of 0.0000. Furthermore, a large reliance on food imports has a negative impact on economic performance that never goes away (p-value = 0.0000). The study suggests stabilizing food prices, reducing dependency on food imports, and investing in climate-resilient agriculture. These results highlight the significance of combining climate and food policy approaches to foster sustainable growth and increase economic resilience in the face of growing environmental and food security issues in Sub-Saharan Africa.

Keywords: Climate Change, Climate anomaly, Food Prices, GDP Growth, Food Import

JEL Classification Codes: Q54, Q11, O55, O44, C33, F43, Q17

BACKGROUND

Threats to the agricultural systems of Sub-Saharan Africa (SSA) are unprecedented, and the region remains highly vulnerable to the escalating consequences of climate change (Bellemare, 2015; Serdeczny *et al*., 2017). Agriculture in SSA is primarily rain-fed and highly climate-dependent, making it particularly vulnerable to temperature changes, fluctuations in precipitation, and the growing occurrence of extreme weather events including storms, floods, and droughts (Serdeczny *et al*., 2017; Intergovernmental Panel on Climate Change IPCC, 2022). Sharp drops in food output are frequently the result of these climate shocks, which causes a great deal of volatility in food prices (Sultan & Gaetani, 2016). Because food makes up a significant portion of household spending and agriculture provides a significant amount of employment and national income, climate-induced food price shocks have significant effects that go beyond food security and affect macroeconomic stability and development outcomes more broadly (Food and Agriculture Organization FAO, 2018; Dell *et al*. 2014).

Climate-induced increases in food costs have the potential to intensify social inequality, accelerate inflation, reduce real incomes, and deepen poverty (Ivanic & Martin, 2008; Brown *et al*., 2021). According to Cevik and Jinjarak (2020), these shocks have the potential to put a strain on public finances, undermine growth prospects, upset exchange rate dynamics, and degrade overall economic resilience in nations with limited fiscal headroom and less effective monetary policy tools. The macroeconomic consequences of climate-driven fluctuations in food prices are especially severe in Sub-Saharan Africa (SSA), where structural vulnerabilities, including limited social protection mechanisms, weak institutions, and low economic diversification, amplify the impact of both internal and external shocks (Collier & Dercon, 2014).

The literature is still dispersed, even though the connections between macroeconomic outcomes, food price variation, and climate variability are becoming more widely recognized. While macroeconomic studies tend to consider food price shocks as independent occurrences, ignoring their meteorological origins, studies on food security frequently focus on microeconomic or household-level implications (Wheeler & von Braun; World Bank, 2023). Moreover, a large portion of empirical studies on the macroeconomic effects of climate shocks have focused on high- and middle-income nations, where more robust institutional frameworks lessen the impact of these shocks (Hallegatte *et al*., 2016). Understanding how changes in food prices brought on by climate change contribute to macroeconomic instability, particularly in the distinct institutional and structural contexts of Sub-Saharan Africa, is thus critically lacking. In the absence of a thorough framework that takes into account these connections, policy initiatives run the danger of being inadequately focused or insufficiently strong to address the region's exacerbated vulnerabilities.

In light of this, this study explores the connection between macroeconomic outcome in Sub-Saharan Africa and shocks to food prices brought on by climate change. It looks for ways that climatic variability influences food markets and, in turn, macroeconomic metrics including inflation, exchange rates, and fiscal balance. By filling this significant research vacuum, the study hopes to provide a more comprehensive knowledge of the connections between the economy and climate change and offer evidence-based suggestions for developing climate-resilient economic systems in Sub-Saharan Africa.

LITERATURE REVIEW

Numerous scholarly works emphasize the clear connection between SSA's climate and agricultural output. Schlenker and Lobell (2010) offer convincing proof that the yields of important staple crops including millet, groundnuts, sorghum, and maize are suffering due to rising temperatures throughout the continent. Given that many farming systems in SSA lack access to irrigation and contemporary technologies that could reduce the hazards associated with weather, the susceptibility is especially high.

Similarly, in their investigation of the relationship between climate funding and food prices in Sub-Saharan Africa, Nelson and Phiri (2023) discover that nations that receive more climate finance, enhance their anti-corruption policies, and invest in dependable irrigation systems for water supply have more stable or lower food prices. This emphasizes how crucial targeted investments and sound governance are to improving food security.

Along with rising temperatures, there are also significant risks from altered rainfall patterns. Sultan and Gaetani (2016) show how crop maturation and production are impacted by either an early or delayed beginning of rainfall, which shorten growing seasons. Reduced food production has been linked to droughts, which are frequently repeated in areas like the Horn of Africa and the Sahel. In SSA economies, agricultural losses might amount to almost 4% of GDP with just a 1°C increase in temperature, according to Mideksa (2010), indicating the extreme economic sensitivity to climate conditions.

Due to the structural flaws in the food markets throughout SSA, such as inadequate transport networks, low market integration, and subpar storage capacity, output shocks swiftly result in notable fluctuations in food prices. Gilbert (2010) contends that localized supply shocks have disproportionately high impacts on consumer prices in these kinds of environments.

This is further supported by Bellemare (2015), who provides empirical evidence that weather-related supply interruptions frequently result in sudden and significant spikes in food costs. These increases are most noticeable for consumption baskets that are dominated by staple foods like millet, cassava, and maize. Moreover, SSA's susceptibility to global shocks is increased by its partial reliance on foreign food markets. Although the majority of SSA countries are protected from global price fluctuations to some extent by their small trade volumes,

Badiane and Resnick (2008) point out that their dependence on imports for commodities like wheat and rice exposes them to global price transmissions, which can worsen the effects of local production deficits. Inflation is the most obvious way that shocks to food prices caused by climate change are transferred to more general macroeconomic indices. Food accounts for a significant component of the consumer price index (CPI), occasionally surpassing 50%, in SSA economies. Increases in food prices therefore immediately result in higher headline inflation.

In low-income nations, including those in SSA, Cevik and Teksoz (2012) found that the inflation of food prices significantly contributes to the total volatility of inflation. Additionally, as explained by Moser (2014), second-round impacts may be triggered by food inflation. These situations lead to sustained, widespread inflation that makes managing monetary policy more difficult. In these cases, firms boost prices for non-food commodities, and workers seek compensation for rising living expenses, which drives up wages. Economic output and growth are also significantly impacted by changes in food prices. Higher food costs cause the poor to have lower real incomes and consume less, which in turn causes aggregate demand to decline (Ivanic & Martin, 2008). Slower economic growth and possible recessions are caused by this effect, which is exacerbated in SSA where poverty rates are still high.

Rakotoarisoa *et al*. (2011) argued that price instability on the supply side makes agricultural investment decisions less sound. Uncertainty may make producers reluctant to spend money on inputs that will increase productivity, creating a vicious cycle of low output and ongoing vulnerability. Food price shocks can skew production incentives, particularly when governments respond with ad hoc policies like price controls, which can exacerbate market inefficiencies.

Blanz (2023) highlights that the poorest quintiles are disproportionately affected by climate-induced losses in agricultural output, which exacerbate wealth inequality and raise precautionary savings, which in turn reduce labor income for all agents. According to the IMF (2023), climate shocks that result in decreased agricultural output in Niger also cause rural households' consumption to drop dramatically, capital to be eroded, and urban-rural disparities to increase.

A thorough investigation by Okou *et al*. (2025) reveals several factors that influence the inflation and volatility of food prices, such as weather variations, unfavorable occurrences, and interruptions in the global supply chain. Understanding these elements is crucial for precise inflation estimates and successful policy responses, the report emphasizes. Additionally, the IMF (2023) shows that food inflation in SSA is greatly impacted by global supply chain pressures, with a one standard deviation shock raising food inflation by 0.54 percentage points after five months. This demonstrates how vulnerable food prices are to outside shocks in the area.

According to a Reuters (2024) article, there will likely be around 55 million hungry people in West and Central Africa in the next months, which is a fourfold rise over the previous five years. Rising costs, double-digit inflation, and slack local production are some of the main causes of this problem. Furthermore, food inflation is being driven by extreme weather events brought on by climate change; if immediate action is not taken, estimates suggest that food inflation might rise by as much as 50% by 2035.

METHODOLOGY

Using a quantitative panel data research design, this study empirically investigates the relationship between climate-induced food price shocks and macroeconomic outcome in Sub-Saharan Africa (SSA). The method allows for the identification of both cross-sectional and temporal variations, which enhances the findings' reliability and generalizability. The empirical focus is on determining how climate anomalies interact with changes in food prices to affect economic indicators, more particularly GDP growth.

Scope of the Study

The macroeconomic impacts of food price shocks brought on by climate change in Sub-Saharan Africa (SSA) between 2000 and 2023 are investigated in this paper. With a focus on 10 nations leading economies of SSA (Nigeria, South Africa, Ethiopia, Kenya, Angola, Ghana, Côte d'Ivoire, DR Congo, Senegal and Uganda. Tanzania was excluded because of data unavailability), it investigates how climate anomalies, like variations in temperature affect macroeconomic outcome while exacerbating the volatility of food prices. Because SSA countries depend heavily on rain-fed agriculture, they are especially vulnerable to climate variability, which can undermine agricultural productivity and lead to wider macroeconomic instability. The study examines national-level data from sources such as the World Bank, IMF, FAO, and numerous climate databases using panel data econometric techniques.

Theoretical Framework, Model Specification and Estimation Technique

This study is based on the aggregate demand–aggregate supply (AD-AS) model and macroeconomic transmission mechanism theory. Shocks to food prices, especially those caused by climate change, have an impact on macroeconomic outcome by reducing real incomes, creating supply-side inflationary pressures, and influencing economic growth. Climate events can also increase domestic price volatility, according to research on commodity price transmission, particularly in areas where a significant portion of household consumption is food.

The core estimation model is specified as

$$Y_{it} = \alpha + \beta_1 FPI_{it} + \beta_2 CLM_{it} + \beta_3(FP_{it} \times CLM_{it}) + \curlyvee X_{it} + \mu_i + \lambda_t + \varepsilon_{it} ------1$$

Where:

Y_{it}= Macroeconomic outcome

FPI_{it}= Food Price Index

CLM_{it}= Climate anomaly variable proxied by Temperature Change on Land

$FPI_{it} \times CLM_{it}$= Interaction term that captures the climate induced price shocks

X_{it}= Control variables

μ_i, λ_t = Country and time fixed effects

ε_{it}= Stochastic error term

Transforming equation 1 into a Panel Autoregressive Distributed Lag model:

$$GGR_{it} = \phi_i + \sum_{j-1}^{p} \alpha_{ij} FPI_{i,j-1} + \sum_{j=0}^{q_1} \beta_{1j} CLM_{i,j-1} + \sum_{j=0}^{q_2} \beta_{2j} FPI \times \mathrm{CLM}_{i,j-1} + \sum_{j=0}^{q_3} \beta_{3j} FIM_{i,j-1} + \varepsilon_{it} ---- ------------------------2$$

Where:

GGR: GDP Growth Rate

FIM: Food imports % of merchandise imports (Control variable)

Utilizing the Pooled Mean Group (PMG) estimator, the study employs a Panel Autoregressive Distributed Lag (PARDL) model to examine how climate-induced food price shocks impact macroeconomic outcome in Sub-Saharan Africa. This approach accounts for variables with varying integration orders and captures changes over the short and long term (Jima & Makoni, 2023). Important factors include macroeconomic restrictions like trade openness and political stability, as well as indexes of food prices and climate. First, the model checks for cointegration and unit roots to make sure the PARDL framework is appropriate. The PMG estimate allows for country-specific short-term dynamics while assuming common long-term linkages across nations. The results are validated by robustness checks that employ variable specifications and alternative estimators.

Analysis and Interpretation of Data

Climate Anomaly, Food Price Index and GDP Growth Trends in Sub Saharan Africa

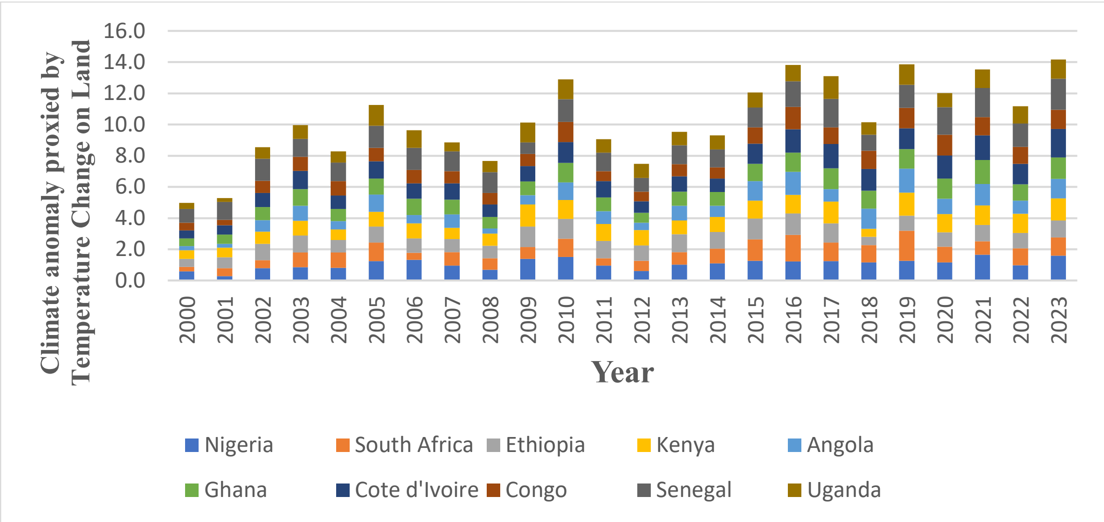

Figure 1: Trend of Temperature Change on Land in Selected Sub-Saharan African Countries, 2000-2023

Land temperature anomalies clearly and steadily increased in Sub-Saharan African nations between 2000 and 2023, mirroring a larger regional warming trend. The majority of countries had an increase in anomalies from below 1.0°C in the early 2000s to above 1.0°C after 2010, with recent years seeing the highest values. With an anomaly of 2.0°C in 2023, Senegal had the highest reading, closely followed by Nigeria and Côte d'Ivoire. Egypt, Ghana, Angola, Uganda, and other nations have shown a persistent warming trend, which indicates increasing climate vulnerability. The critical need for climate adaption and mitigation measures throughout the region is highlighted by these rising temperatures.

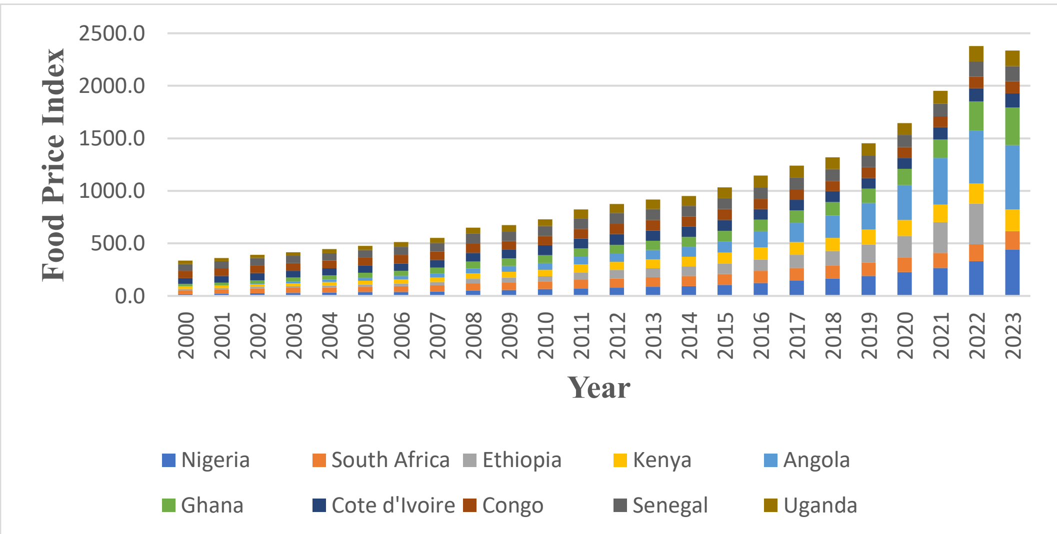

Figure 2: Trend of Food Price Index in Selected Sub-Saharan African Countries, 2000-2023

The Food Price Index (FPI) for a few Sub-Saharan African nations from 2000 to 2023 shows a gradual increase in food prices, followed by a sudden spike, as the stacked column figure illustrates. Due to their higher base values, nations like Côte d'Ivoire, Senegal, and Congo contributed the most to the regional index during the comparatively low food price period of the early 2000s. But as time went on, the effects of food inflation spread more widely. Food prices began to rise sharply in the region starting in 2015, both individually and collectively. The stacked bars' increasing height is a visible reflection of this. Countries that were facing some of the biggest increases in food prices were those like Nigeria, Angola, Ethiopia, and Ghana, which started to dominate the top parts of the stack. The sharp increase in Angola in particular was a major factor in the region's overall inflation.

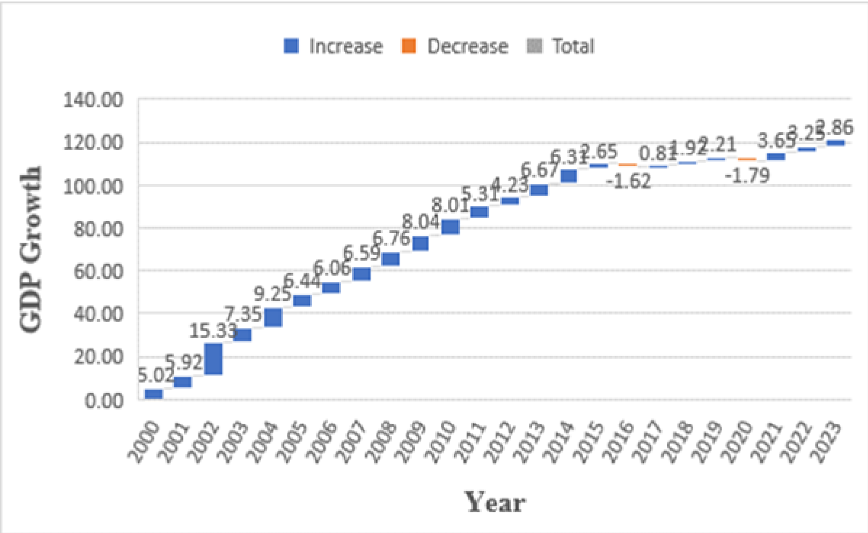

Figure 3: Trend of GDP Growth in Selected Sub-Saharan African Countries, 2000-2023

Several Sub-Saharan African nations' GDP growth between 2000 and 2023 showed a range of economic paths influenced by both internal and external factors. Ethiopia was a steady performer, often achieving double-digit growth rates, especially in the 2000s and early 2010s, because to strong agricultural and infrastructure investments. In the early 2000s, Nigeria and Angola both saw rapid economic expansion, primarily due to oil exports. However, both nations went through major downturns in 2016 and 2020, with the latter being brought on by the COVID-19 epidemic that affected regional economic activity. Throughout the period, South Africa's growth was largely slow, which was caused by recurring shocks, policy uncertainty, and structural economic restrictions. More consistent, moderate growth patterns were shown by nations like Kenya, Ghana, Côte d'Ivoire, and Uganda, with sporadic upticks that were indicative of better governance, diversified economies, and policy reforms. Although the 2020 pandemic caused severe economic contractions in all countries, the majority of them recovered to varied degrees in the years that followed. Despite being hampered by external shocks, reliance on commodities, and disparities in institutional and policy strength, the region is generally shown by the GDP trends to be resilient and promising.

Panel Stationarity Test

Testing for stationarity is crucial when dealing with panel data, which incorporates observations from various cross-sectional units (such as nations, businesses, or individuals) over a number of time periods. By making sure the data is stationary, econometric models can prevent spurious regressions, which happen when non-stationary series are mistakenly regarded as stable.

Table 1: Panel Stationarity Test: Unit Root at Level

VARIABLE	Levin, Lin & Chu (LLC) Test		ADF-Fisher Chi-square (F-CHI) tests		Conclusion
	LLC Test @ 5%	P-Value	F-CHI Test @ 5%	P-Value	
GGR	-3.242	0.0006	38.017	0.0088	Significant

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FPI	11.012	1.0000	8.381	0.9890	Insignificant
CLM	1.278	0.8993	6.123	0.9987	Insignificant
FPI*CLM	6.716	1.0000	0.375	1.0000	Insignificant
FIM	-2.215	0.0134	20.132	0.4497	Inconclusive

Source: Authors' Computation, 2025

The results of the panel unit root test at the 5% significance level show different levels of stationarity among the variables according to the ADF-Fisher Chi-square (F-CHI) test and the Levin, Lin & Chu (LLC) test. Beginning with GGR, the LLC and ADF-Fisher tests both have p-values of 0.0006 and 0.0088, respectively, which strongly reject the null hypothesis of a unit root. This shows that GGR is level and stationary, indicating that differencing is not necessary for additional investigation. The ADF-Fisher p-value of 0.9890 and the LLC test statistic of 11.0118 (p-value = 1.0000), on the other hand, demonstrate that FPI is non-stationary. The null hypothesis cannot be rejected based on these data, suggesting the existence of a unit root and the requirement for transformation or differencing in order to attain stationarity. The interaction term FPI*CLM and CLM are also non-stationary. High p-values well over the 5% cutoff are obtained from both tests for these variables, indicating that they behave like unit roots and are not level-stationary. Results for FIM are not entirely consistent. With a p-value of 0.0134 and a test statistic of -2.21491, the LLC test indicates stationarity, which is significant at the 5% level. This result is not supported by the ADF-Fisher test, which yields a p-value of 0.4497 and is unable to reject the null hypothesis. Based on these contradictory findings, the stationarity status of FIM is thus still unclear, and additional testing perhaps at the first difference may be required to elucidate its characteristics.

Table 2: Panel Stationarity Test: Unit Root at First Difference

VARIABLE	Levin, Lin & Chu (LLC) Test		ADF-Fisher Chi-square (F-CHI) tests		Conclusion
	LLC Test @ 5%	P-Value	F-CHI Test @ 5%	P-Value	
GGR	------	-------	------	-------	------
FPI	-1.791	0.0366	78.853	0.0000	Significant
CLM	-15.799	0.0000	227.845	0.0000	Significant
FPI*CLM	-12.015	0.0000	164.118	0.0000	Significant
FIM	-14.316	0.0000	193.070	0.0000	Significant

Source: Authors' Computation, 2025

Following differencing, all previously non-stationary or inconclusive variables become stationary, demonstrating that they are integrated of order one, I(1), according to the panel unit root test at first difference. At the 5% significance level, stationarity for FPI is confirmed by the ADF-Fisher test and the Levin, Lin & Chu (LLC) test. The very significant p-value of 0.0000 is obtained from the ADF-Fisher test, but the LLC test returns a statistic of -1.7910 with a p-value of 0.0366. After first differencing, this shows that the variable becomes stationary. Likewise, there is compelling evidence of stationarity at first difference in CLM. In addition to the ADF-Fisher test yielding a p-value of 0.0000, the LLC test statistic is -15.7990 and the p-value is 0.0000. These findings verify that the first-differenced form of the unit root is absent from CLM. Additionally, following first differencing, the interaction term FPI*CLM becomes stationary. Strong rejection of the null hypothesis of a unit root is indicated by the LLC test statistic of -12.0149 with a p-value of 0.0000 and the ADF-Fisher test's p-value of 0.0000. Lastly, FIM is now verified to be steady following initial differencing, despite previously displaying inconsistent findings at level. The variable becomes stationary, as supported by the ADF-Fisher p-value of 0.0000 and the LLC test statistic of -14.3155.

Panel Cointegration Test

In order to determine if two or more non-stationary time series in a panel dataset have a long-term equilibrium connection, the Panel Cointegration Test is utilized. When one time series is non-stationary (has unit roots), but a linear combination of them is stationary, cointegration takes place. That means that even while each series may drift apart over time, they ultimately move in tandem.

Table 3: Pedroni Cointegration Test

	Statistic	Prob.
Panel v-Statistic	-1.1446	0.8738
Panel rho-Statistic	-0.5128	0.3041
Panel PP-Statistic	-5.5347	0.0000
Panel ADF-Statistic	-5.5314	0.0000
Group rho-Statistic	0.4123	0.6599
Group PP-Statistic	-8.4741	0.0000
Group ADF-Statistic	-6.6513	0.0000

Source: Authors' Computation, 2025

A long-term equilibrium link between the variables in the panel is well supported by the Pedroni cointegration test results. Seven statistics make up the test, which is separated into two groups: group (between-dimension) statistics and panel (within-dimension) statistics. The Panel v-Statistic and Panel rho-Statistic, which have corresponding p-values of 0.8738 and 0.3041, are not statistically significant among the panel statistics. According to these findings, the null hypothesis that there is no cointegration is not rejected by these statistics alone. Both the more reliable Panel PP-Statistic and Panel ADF-Statistic, however, have p-values of 0.0000 and are extremely significant. From a within-dimension standpoint, this suggests the existence of cointegration and shows a strong rejection of the null hypothesis. The Group rho-Statistic is also not significant (p-value = 0.6599) in the group statistics, however the Group PP-Statistic and Group ADF-Statistic both exhibit great significance (p-values of 0.0000). These findings support the existence of a long-term bond among the panel members.

Table 4: Kao Cointegration Test

	t-Statistic	**Prob.**
ADF	-6.4235	0.0000
Residual variance	15.7746	
HAC variance	8.6819	

Source: Authors' Computation, 2025

Similarly, a long-term link between the variables in the panel is well supported by the Kao cointegration test results. Using the Augmented Dickey-Fuller (ADF) method, the test determines if the residuals of a panel regression are stationary. With -6.4235 as the ADF t-statistic, and the p-value is 0.0000; assuming no cointegration between the variables, the null hypothesis is categorically rejected by this very significant result. A stable long-term equilibrium relationship between the variables is thus shown by the results, which show that the residuals are stationary and demonstrate the existence of cointegration. All things considered, the Kao test confirms that the variables in the panel are cointegrated.

Panel ARDL Estimate

An econometric method for examining the dynamic relationship between variables in panel data is the Panel Autoregressive Distributed Lag (Panel ARDL) model. This method is especially useful when the variables have mixed orders of integration, meaning that some are stationary at level I(0) and others at first difference

I(1). By integrating short-term dynamics and long-term equilibrium relationships across several cross-sectional units (such as nations, businesses, or regions) throughout time, the Panel ARDL framework expands the ARDL model used in time series analysis to the panel setting.

Table 5: Short Run Panel ARDL Model Result

Dependent Variable: GGR Method: Panel ARDL				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
COINTEQ01	-0.3366	0.1980	-1.7004	0.0920
D(GGR(-1))	-0.2730	0.0973	-2.8049	0.0060
D(FPI)	-0.3021	0.2090	-1.4454	0.1514
D(FPI(-1))	0.0855	0.1004	0.8512	0.3966
D(CLM)	-5.8243	2.8340	-2.0551	0.0424
D(CLM(-1))	10.1089	10.8532	0.9314	0.3538
D(CLM*FPI)	0.02956	0.0307	0.9643	0.3371
D(CLM(-1)*FPI(-1))	-0.1628	0.1581	-1.0303	0.3053
D(FIM)	-0.1694	0.2271	-0.7461	0.4573
D(FIM(-1))	0.2526	0.2774	0.9108	0.3645
C	4.1724	1.6411	2.5425	0.0125

Source: Authors' Computation, 2025

A number of significant correlations between GGR and different explanatory variables are revealed by the Panel ARDL model's results, which look at the short-term dynamics of macroeconomic outcome. First, the long-run cointegration error correction has a negative coefficient of -0.3366 and a p-value of 0.0920 for the COINTEQ01 component. Although this implies that the model is trying to account for long-term disequilibrium, the outcome is not statistically significant at the 5% level, but it is nearly significant at the 10% level. This suggests a moderate rate of adaptation toward long-term equilibrium.

With a coefficient of -0.2730 and a p-value of 0.0060, lagging GDP growth significantly reduces current GDP growth in the short term. This finding points to a lagged adjustment in economic performance, suggesting that previous GDP growth has a detrimental impact on current growth.

Although there is a negative correlation between GDP growth and the Food Price Index, the effect is statistically insignificant (p-value = 0.1514). In a similar vein, the lagged Food Price Index shows a positive but negligible effect (p-value = 0.3966), suggesting that the short-term effects of changes in food prices on GDP growth are neither immediate nor substantial.

The impact of Climate Anomalies, as measured by changes in land temperature, is significant. At a 5% level, the current climatic anomalies coefficient, which is -5.8243 with a p-value of 0.0424, is statistically significant. In the short term, this implies that adverse climate conditions, exemplified by temperature fluctuations, have a highly detrimental effect on GDP growth. On the other hand, the p-value of 0.3538 indicates that the lagged effect of climate anomalies has no discernible effect on GDP growth. Although the coefficient is positive (0.02956), the p-value (0.3371) suggests that there is no statistical significance in the relationship between Climate Anomalies and Food Prices, which does not significantly impact GDP growth. By the same token, the lagged interaction term likewise has a p-value of 0.3053, which indicates that it has no significant effect. Both the current and lagged terms of food imports as a percentage of goods imports do not indicate a substantial short-term influence on GDP growth. The lagged effect is likewise not significant, with a p-value of 0.3645, while the coefficient for current food imports is -0.1694 with a p-value of 0.4573. Last but not least, the constant component (C) has a coefficient of 4.1724 and a p-value of 0.0125, indicating that there is a positive baseline level of GDP growth when all other variables are held constant.

Table 6: Long Run Panel ARDL Model Result

Dependent Variable: GGR Method: Panel ARDL				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
FPI	0.1084	0.0053	20.3385	0.0000
CLM	6.9749	0.6440	10.8303	0.0000
FPI*CLM	-0.0741	0.0036	-20.3376	0.0000
FIM	-0.9068	0.0297	-30.5035	0.0000

Source: Authors' Computation, 2025

The Panel ARDL estimation's long-term findings offer important new information about the connections between GDP growth and the following important explanatory factors: food imports as a percentage of merchandise imports, the Food Price Index, climate anomalies, and the interaction between food prices and climate anomalies. Long-term GDP growth is positively and statistically significantly impacted by the Food Price Index, according to the findings. With a p-value of 0.0000 and a coefficient of 0.1084, this finding implies that rising food costs are linked to longer-term economic growth. This could be a reflection of the financial gains from more agricultural production, higher consumer demand, or higher food industry profits that boost the overall economy. This aligns with the assertion of Ivanic and Martin (2008) that economic output and growth are also significantly impacted by changes in food prices. Higher food costs cause the poor to have lower real incomes and consume less, which in turn causes aggregate demand to decline. Likewise, with a coefficient of 6.9749 and a p-value of 0.0000, climate anomalies, as measured by temperature variations on land, likewise show a clear and substantial beneficial impact on GDP growth. This result suggests that changes in the climate are associated with economic growth over the long run. But, as it could be impacted by things like adaption tactics, advancements in technology, or regional differences in climate sensitivity, this link should be read with caution. This further elaborate of the proclamation of the IMF (2023) that asserted that climate shocks results in decreased agricultural output in Niger also cause rural households' consumption to drop dramatically, capital to be eroded, and urban-rural disparities to increase

The interaction term between food prices and climatic anomalies which is used to proxy climate-induced food price shock exhibits a negative and highly significant coefficient of -0.0741, despite the positive effects of FPI and CLM alone. This suggests that the combined impact of rising food costs and climate anomalies slows GDP growth. Essentially, even though each component by itself can promote growth, their combined rise which is seen as a shock to food prices brought on by the climate has a negative impact on the economy, most likely as a result of decreased agricultural output, increased inflation, or heightened economic instability. This result expatiated the conclusions of Blanz (2023) that the low-income populace is disproportionately affected by climate-induced losses in agricultural output, which exacerbate wealth inequality and raise precautionary savings, which in turn reduce labor income for all agents. Finally, with a coefficient of -0.9068 for food imports as a proportion of merchandise imports, GDP growth is negatively and statistically significantly impacted. This finding suggests that increased dependency on food imports typically impedes sustained economic expansion. It can be a sign of structural flaws in the country's food production or an over-reliance on outside markets, which can put a burden on foreign exchange reserves and make a country more susceptible to changes in international markets. This buttresses Badiane and Resnick (2008) that point out that dependence on imports for commodities exposes them to global price transmissions, which can worsen the effects of local production deficits.

CONCLUSION

Regarding the dynamics of macroeconomic outcome (GDP Growth) in connection to food prices, climate anomalies, their interplay, and food import dependency, numerous important conclusions may be made based on the noteworthy short- and long-term results from the Panel ARDL estimation. GDP growth is strongly impacted by its historical values in the short term, suggesting some degree of economic performance persistence. More significantly, there is a statistically significant negative impact on GDP growth from climate anomalies, as measured by variations in land temperature. This implies that abrupt or drastic changes in the environment might cause short-term disruptions to economic activity, especially in weather-sensitive industries like agricultural and food supply networks.

Long-run outcome show a more intricate relationship. The Food Price Index and climate anomalies both have a positive and considerable impact on GDP growth on their own. This suggests that rising food costs and slight climate variations may eventually be a reflection of structural or adaptive changes that promote economic growth. Nevertheless, their combined impact is noticeably negative as indicated by the interaction term (FPI*CLM). This suggests that when food prices increase in the face of unfavorable weather, the economy suffers a net loss, most likely as a result of climate-induced food price shocks that put a strain on household welfare, lower productivity, and raise inflation.

Moreover, a high dependence on food imports has a persistently detrimental effect on GDP growth over the long term. This emphasizes how import dependency can weaken the domestic economy and leave it vulnerable to outside shocks on a structural level. Summarily, connection between climate and food prices is dangerous, especially when climate variability upsets agricultural systems and raises costs. Furthermore, the ongoing harm caused by food import dependency emphasizes the necessity of bolstering indigenous agricultural capabilities.

POLICY RECOMMENDATIONS

In light of climate and food-related concerns, the findings suggest a number of crucial policy avenues for promoting economic resilience and sustainable growth. climatic anomalies have a short-term negative influence on GDP growth, and over time, rising food prices and climatic variability work together resulting into climate-induced food price shocks to further stifle economic expansion. Furthermore, a high reliance on imported food is a major hindrance to sustained growth. In order to lessen the effects of climate shocks, policymakers are advised to provide climate-resilient agricultural systems such as drought-tolerant crops and better irrigation priority funding in light of these findings. It is also essential to stabilize food prices through better market regulation and strategic reserves, especially during times of increased volatility. Enhancing domestic production and agricultural value chains will lessen dependency on food imports and contribute to increased resilience and economic self-sufficiency.

Incorporating climate adaption tactics into more comprehensive development plans, such the use of renewable energy sources and environmental preservation, will also promote sustainability over the long run. More prompt and well-informed policy responses will be possible with improved data collecting and early warning system establishment. Last but not least, encouraging regional and global collaboration on climate resilience and food security can improve coordination of policies and collective readiness.

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