SN Bus Econ (2023) 3:188
https://doi.org/10.1007/s43546-023-00569-3

ORIGINAL ARTICLE

# Global food price volatility and inflationary pressures among developing economies

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Received: 11 April 2023 / Accepted: 11 September 2023 / Published online: 2 October 2023


## Abstract

The study evaluates the impact of volatility in global commodity (food) prices on domestic inflationary conditions among economies in sub-Saharan Africa. Data for the analyses were compiled from relevant sources for 27 economies from the sub-region from 1996 to 2019. Empirical results from the two-step system generalized method of moments estimation technique suggest that volatility in the global price of traded commodities, such as corn, rice, and beef (staple food items among most economies in the sub-region), tends to worsen inflationary conditions among economies in the sub-region, all other things being equal. Further empirical estimates show that global inflationary conditions exacerbate domestic inflationary conditions, while appreciable global economic growth or performance helps to assuage the extent of inflationary conditions among economies in the sub-region. Additionally, further results suggest that institutional quality helps negate some of the adverse effects of volatility in the global price of rice and global inflationary conditions on domestic inflationary conditions among economies in the sub-region.

**Keywords** Global commodity price volatility · Inflationary conditions · Institutional quality · Two-step system generalized method of moment

**JEL Classification** C33 · C36 · F 18 · F62

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## Introduction

The Russo-Ukrainian War and the resulting economic impact on economies around the globe have been significant according to emerging studies (see Liadze et al. 2022; Umar et al. 2022; Orhan 2022; Ahmed et al. 2022; Jagtap et al. 2022; Chortane and Pandey 2022). Evolving evidence points to significant distortions in global stock market performance, volatile crude oil prices, which have led to price hikes in global fuel prices, and upward pressure on the general price of goods due to the constrained supply of critical global commodities. Although the Russo-Ukrainian War has undoubtedly had a pervasive negative impact on the global economy already reeling from the effect of the COVID-19 pandemic, there is a growing consensus that the war is having a relatively more devastating impact on less developed and emerging economies such as those in sub-Sahara Africa than developed economies. Proponents of this consensus, for instance, point to the dire impact of the on-and-off export blockage of critical commodities, such as maize and wheat (the main nutrition intake for most developing economies), as a result of the war. These on-and-off grain export conditions due to the war have led to food shortages, high grain and wheat prices, and growing hunger among economies in the sub-region. World bodies, such as the World Bank and the International Monetary Fund (IMF), for instance, continue to envisage a significant devastating impact of the war on food shortages among most developing, and less developed economies such as those in sub-Sahara Africa. The full impact of the war on the global economy as a whole also continues to be assessed and may be fully appreciated in the near future. However, there is enough evidence in recent times to suggest that the Russo-Ukrainian War continues to have a significant negative effect on global food commodity prices, leading to inflationary pressures across the globe. Advanced economies with relatively strong economic structures and policies, such as the US and the European Union, have had to grapple with soaring fuel prices and general heightened price levels at the retail shops since the onset of the war. The war-induced inflationary pressures as it has come to be known, have, for instance, given rise to policy initiatives among most economies, all designed to minimize the impact of souring inflationary conditions. For most emerging economies such as those in sub-Sahara Africa, the inimical impact of the war being felt across the globe has been worsened by pre-existing macroeconomic constraints and institutional challenges. Challenging economic conditions in most parts of the sub-Sahara region brought about by the COVID-19 pandemic (see Teachout and Zipfel 2020; Danquah et al. 2020; Amewu et al. 2020; Agyei et al. 2021) continue to deteriorate further since the onset of the war.

Economies in SSA are mostly characterized by heavy dependence and exposure to some of the extremes of the global economy, relatively high inflationary conditions, constrained economic growth, and weak or ineffective institutional structures. For instance, on average, the sub-region is characterized by 6.5% inflation—a condition that is significantly higher than the global average according to Table 1. These pre-existing conditions continue to make the sub-region more susceptible to external shocks such as volatile food prices. Global supply chain

**Table 1** Descriptive statistics

| Variables | Obs | Mean | Std. Dev | Min | Max | p1 | p99 | Skew | Kurt |
|---|---|---|---|---|---|---|---|---|---|
| CPI | 666 | 0.065 | 0.07 | −0.096 | 0.466 | −0.032 | 0.329 | 2.024 | 9.57 |
| Vcorn | 672 | 0.048 | 0.026 | 0.022 | 0.136 | 0.022 | 0.136 | 1.611 | 6.202 |
| Vbeef | 672 | 0.012 | 0.004 | 0.005 | 0.024 | 0.005 | 0.024 | 1.466 | 5.091 |
| Vrice | 672 | 0.056 | 0.027 | 0.006 | 0.104 | 0.006 | 0.1 | −0.184 | 1.746 |
| Vwheat | 672 | 0.042 | 0.001 | 0.041 | 0.044 | 0.041 | 0.044 | 0.036 | 1.965 |
| Vfish | 672 | 0.026 | 0.005 | 0.015 | 0.037 | 0.015 | 0.037 | 0.384 | 3.197 |
| Ginfl | 672 | −0.005 | 0.313 | −0.672 | 0.859 | −0.672 | 0.859 | 0.457 | 3.887 |
| GGDPg | 672 | 0.045 | 0.051 | −0.057 | 0.127 | −0.057 | 0.127 | −0.086 | 2.275 |
| FL | 632 | 0.29 | 0.208 | 0.051 | 1.153 | 0.059 | 1.014 | 1.983 | 6.7 |
| TL | 608 | 0.669 | 0.298 | 0.207 | 1.619 | 0.235 | 1.478 | 0.873 | 3.085 |
| FDI | 667 | 0.004 | 0.003 | −0.009 | 0.016 | −0.006 | 0.01 | -0.169 | 5.204 |
| IQ | 635 | −0.42 | 0.682 | −3.751 | 1.332 | −2.305 | 1.073 | −0.601 | 5.106 |

*CPI* consumer price inflation, *Vcorn* corn price volatility, *Vbeef* beef price volatility, *Vrice* rice price volatility, *Vwheat* wheat price volatility, *Vfish* fish price volatility, *Ginfl* global inflation, *GGDPg* global GDP growth rate, *FL* financial liberalization, *TL* trade liberalization, *FDI* foreign direct investment, *IQ* institutional quality

constraints, a lingering impact of the COVID-19 pandemic, are further exacerbated by the on-and-off food export blockage due to the war. This condition further aggravates the already-dire macroeconomic conditions among economies in the sub-region. These pre-existing conditions coupled with the ongoing ramifications of the war have energized the discussion on how fluctuations in global food supply and prices influenced food price inflation, food shortage, and hunger among economies in Africa. This empirical inquiry is thus motivated by the evolving symptoms of the war coupled with inherent macroeconomic features associated with economies in the sub-region. We review specific empirical questions designed to gage and evaluate how global food price fluctuations, FDI, GDP growth, etc. ultimately influence inflationary dynamics among economies in sub-Saharan Africa. For instance, this study examines the extent to which variability in inflationary pressures among economies in sub-Sahara Africa may be attributed to price volatility associated with specific global food prices (core global food items, such as rice, corn, wheat, beef, and fish). The analysis performed further examines how the institutional quality characterizing economies in the sub-region may influence the dynamic interaction between various global commodity price volatilities and inflationary pressures. In order words, apart from a review of the nature of interactions between global food prices and inflationary conditions among economies in the sub-region, further attempts are made to evaluate the extent to which quality of institutions charged with the responsibility to ensure economic resilience and growth may influence externally induced inflationary pressures. These analyses among others reflect the core objectives of the study. Specifically, this study examines the dynamic interactions between inflationary pressures among emerging economies in sub-Sahara Africa and

volatilities associated with global food prices, and the role effective governance and institutional quality may play in such dynamic relationships.

The focus of the study and the interactions examined have been motivated mostly by expert opinions and the consensus of most policymakers to the effect that the on-and-off economic blockade as a result of the war will continue to promote severe food shortages, high prices, and dire economic conditions for most developing economies including those in sub-Sahara Africa. Following this consensus, we theorize that such conjecture is only plausible if a significant relationship exists between global food commodity prices and consumer price index among the developing economies in question. This study is thus designed on the presumption that globalization and the growing dependence of most emerging economies such as those in sub-Sahara Africa on global food trade make the prevailing notion about the impact of the war plausible. Consequently, we argue that the implications of the on-and-off economic blockade depend on the nature of the underlying link between global food prices and inflationary conditions among emerging economies in the sub-region. The strength of such relationships based on key global food items, such as rice, corn, and wheat, among others, however, is yet to be fully understood according to our review. Hence, this empirical inquiry. Compared to allied studies that have examined the potential impact of global commodity prices on inflationary conditions (see Abaidoo and Agyapong 2022), this study has a different focus. We rather focus specifically on dominant food items and the volatility associated with prices of such commodities (not the impact of the actual prices), and how such price fluctuations ultimately influence inflationary pressures among economies in the sub-region. The assessment of the role of institutional quality or effectiveness (a PCA-generated index) in the underlying interactions further augments the literature with a different perspective on the nexus being examined.

## Review of related literature

### Theoretical literature

The fundamental relationship between how adverse external economic conditions (global food price volatility) may ultimately influence inflationary conditions within other economies (developing economies in the case of this study) is theoretically explained by the concept of economic contagion. Ait-Sahalia et al. (2015), Allen and Gale (2000), and Martinez-Jaramillo et al. (2010), among others, have reviewed the theoretical underpinnings of the economic contagion concept. These studies analyzed the theoretical basis through which economic crises (financial crises) can become a contagion spreading to other allied or integrated economies. This study's reference to the economic contagion phenomenon follows the concept of the uncertainty channel of contagion by Kannan and Kohler-Geib (2009). The concept of economic contagion, as employed in this study, posits that integrated markets and economic interdependence increase the likelihood that macroeconomic conditions prevailing in an economy or among economic blocs may be transmitted to others depending on the degree of macroeconomic or policy vulnerability. According to the

concept, economies or economic blocs can 'contract' adverse or favorable macroeconomic conditions emanating from economies or regional economic blocs far beyond their immediate environment because there exists an underlying transmission mechanism through the behaviors of economic agents, and how such agents process information far beyond their locality. This view that macroeconomic "events" or adverse macroeconomic conditions tend to have some measure of cross-economy impact is not new to the macroeconomic literature. Studies, such as Kamau (2010) and Naveh et al. (2012), have verified the economic contagion phenomenon on how economic integration affects economic activities of engaged economies. Conclusions from these studies suggest that macroeconomic "events" or adverse macroeconomic conditions in one economy tend to have a significant impact on economic activities in others due to growing economic integration. Following this concept of economic contagion, the present study surmises that food price inflation, shortages, and potential for hunger for most economies in the sub-region may be a contagion symptom from global food price fluctuations due to the Russo-Ukrainian War, all other things being equal.

## Empirical literature

Empirical works in the extant literature have identified various factors influencing inflationary conditions among various economies around the world. For instance, Lim and Sek (2015) submitted that factors influencing inflation for both high-inflation and low-inflation economies include GDP growth, import of goods and services, money supply, and national expenditure. Again, for the Pakistani economy, Khan and Gill (2010) found exchange rate depreciation and an increase in the value of imports as significant conditions influencing the rate of inflation. Nguyen et al. (2012) similarly found the factors that influence inflation include money supply, oil price, and price of rice in Vietnam. For the Ghanaian economy, Adu and Marbuah (2011) identified factors that play an influential role in inflationary pressures including real output, broad money supply, nominal interest rate, nominal exchange rate, and fiscal deficit. For the Nigerian economy as well, Iya and Aminu (2014) found that the rate of inflation is mostly influenced by money supply, interest rate, government expenditure, and exchange rate. Again, for the Nigerian economy, Alexander et al. (2015) found the exchange rate, fiscal deficit, importation of goods and services, agricultural output, and money supply to have a significant influence on inflation in the long run. Madito and Odhiambo (2018) also found the price of imports, inflation expectations, labor cost, and government expenditure to positively impact inflation, while GDP and exchange rates were found to negatively affect inflation for the South African economy. Jakšić (2022) concluded from global vector autoregressive analysis that the globalization process has resulted in the increasing importance of international dynamics in influencing domestic inflation for post-communist countries that became members of the European Union. This conclusion specifically highlights the importance of the current study, where we specifically evaluate the global economic trend on inflation among economies in SSA with a focus on volatility associated with food products on the global market.

The literature also features studies that specifically evaluate the impact of commodity prices on inflation among economies around the globe. In earlier work, Cecchetti and Moessner (2008) found that higher commodity prices do not generally result in a higher rate of inflation for emerging and advanced economies. For the Indian economy, however, Joshi and Acharya (2011) found that domestic prices are significantly influenced by the price of internationally traded commodities. The conclusion by Joshi and Acharya (2011) is further confirmed by Gospodinov and Ng (2013) for G-7 countries. From a construct that uses the price of 23 commodities, the study revealed that inflation is significantly impacted by fluctuations in commodity prices. Again, for the Lithuanian economy, Miecinskiene and Lapinskaite (2014) concluded that changes in the price of key commodities, such as cocoa, coal, oil, and aluminum, significantly affect the rate of inflation. Similarly, according to Davidson et al. (2016), the global price of food products, oil prices, and exchange rate exerts significant influence on food price inflation. Gelos and Ustyugova (2017), the subject matter in question, found that commodity price shocks exert significant and sustained inflationary pressures for economies that are characterized by a higher proportion of food products in the CPI basket, higher state of inflation, and fuel intensity. Further inquiries from the study revealed that good governance and independent central banks are attributes that assist countries to withstand commodity price shocks. Lapinskaite and Miecinskiene (2019), on the other hand, found that there exists no significant nexus between global commodity prices and inflation for European Union (EU) economies in the long run. From a panel of 72 developing and advanced economies, Choi et al. (2018) studied the impact of global oil prices on domestic inflation over the period starting from 1970 to 2015. Results from the empirical estimates revealed that global oil price relates positively to domestic inflation. The impact was observed to have declined over time as a result of good monetary measures, confirming the possible significance of the moderating role of institutional structures theorized in this study.

Further review of the literature shows the existence of related studies that focus on the African continent. For instance, in a recent study, Abaidoo and Agyapong (2022) examined the effect of changes in the price of commodities on inflation for a sample of 32 countries in SSA. Results from the study showed that the price of crude oil, gold, and cocoa positively influences inflationary conditions among economies in the sub-region. Further results from the study showed that improved regulatory structures help in stabilizing inflation during periods of rising prices of non-food commodities on the international market. For the Nigerian economy, Tule et al. (2019) found that prices of agricultural products individually exert a significant impact on the rate of inflation. Again, for the Nigerian economy, Okorie and Ohakwe (2018) employed 5 most popular Archimedean copulas to assess the impact of agricultural export commodities on inflation. Results from the study revealed that lower prices of major agricultural products on the global market reduce inflation in the Nigerian economy. Again, for both the Nigerian and South African economies, Fasanya and Awodimila (2020) concluded that commodity price indexes significantly affect core and headline inflation. In Kenya, Misati et al. (2013) also found food prices and oil prices to significantly affect non-food and non-fuel inflation.

Reviewed theoretical and empirical literature suggests that significant attention and review of the subject matter from various perspectives using varied methodologies. Our review, however, failed to identify any study focusing on how institutional quality, or lack thereof, may influence the interactions between global food price volatility and inflationary conditions among developing economies. The current study is designed to augment existing literature by specifically focusing on the effect of volatility in global food items on inflationary pressures among economies in the sub-region of SSA, especially following concerns about the potential impact of the Russo-Ukrainian War on emerging and developing economies. Empirical inquiry reviewed in the study further examines the degree to which the extent of institutional quality characterizing these economies may influence the fundamental relationships examined.

## Methodology and data

The study adopts a panel estimation technique for the analysis of the data. The generalized method of moments (GMM) panel estimation procedure is specifically employed to carry out the various estimations based on the objectives of the study. Panel data is noted for often being characterized by features such as heteroscedasticity, with its associated problems. Wooldridge (2001) therefore recommends the application of the GMM estimator because the technique overcomes such problems, compared to other techniques, such as the two-stage least squares and ordinary least squares. Because of its robustness in panel data estimations, the GMM estimation methodology has received significant application in the extant literature (see Fiordelisi and Molyneux, (2010); Sarpong-Kumankoma et al., (2018); Abaidoo et al. (2021); Ofoeda et al., (2022)). Ofoeda et al. (2022), for instance, identify two types of GMM estimators—the system GMM and the difference GMM. Ofoeda et al. (2022) identify the system estimator as superior since it is not significantly biased compared to the difference estimator. The difference estimator is biased because it employs the lagged levels of the independent variables as the instruments. Country-specific effects are eliminated by the difference estimator, (Ofoeda et al., (2022)). Roodman (2009) further argues for the superiority of the system estimator technique compared to the difference estimator.

Two variants of the system GMM estimator exist—the two-step GMM estimator and the one-step GMM estimator. This study opts for the two-step estimator because according to Hwang and Sun (2018), it is associated with smaller asymptotic variance, and therefore considered asymptomatically robust when compared to the one-step estimator. Again, the number of countries examined in the study (27) is greater than the number of years (24), and according to Ofoeda et al. (2022), the two-step variant is efficient and robust for panel data that has fewer periods than the number of groups. Additionally, according to Sarpong-Kumankoma et al. (2018), the system GMM estimator is comparatively more robust because it controls endogeneity, fixed effects, and heteroscedasticity and allows for the addition of lagged dependent variables as explanatory variables with no loss of efficiency. These characteristics greatly informed the rationale for using the two-step systems GMM estimation technique.

Following the submissions of the economic contagion model (that is, macroeconomic conditions prevailing in an economy are ultimately transmitted to other economies in an integrated macroeconomic environment), this study conceptualizes that inflationary pressures among economies in the sub-region of SSA could be expressed as a function of fluctuations associated with global prices of food items, global inflationary trend, and global economic activities. In this regard, the choice and the inclusion of specific variables in our inquiry are determined by the objectives of the study, which are duly noted in the introduction section. The objective of the study is presented functionally in Eq. (1) as follows:

$$\text{CPI} = f(\text{VGFP}, \text{GET}, \text{Ctls}). \tag{1}$$

From Eq. (1), CPI is defined as consumer price inflation, VGFP is a vector of variables made up of volatility in the price of global food prices, GET denotes global economic trend (represented by global inflation pressures and global productivity or GDP growth), and Ctls represents a set of control variables. In its expanded form, the model can be presented in Eq. (2) below:

$$\text{CPI}_{it} = \lambda_0 + \lambda_1 \text{VGFP}_{q,it} + \lambda_2 \text{Ginfl}_{it} + \lambda_3 \text{GGDPg}_{it} + \lambda_4 \text{FL}_{it} + \lambda_5 \text{TL}_{it} + \lambda_6 \text{FDI}_{it} + \lambda_7 \text{IQ}_{it} + \varepsilon_{it} \tag{2}$$

From the equation, CPI denotes consumer price inflation, $i$ and $t$ represent country and year, respectively, and $\varepsilon_{it}$ denotes composite error term. $\text{VGFP}_q$ denotes volatility of the global price of food item $q$ ($q$ is given by either corn, beef, rice, wheat, or fish), Ginfl represents global inflation rate, and GGDPg denotes global GDP growth. The control variables are given by FL, TL, FDI, and IQ, and denote financial liberalization, trade liberalization, foreign direct investment, and institutional quality, respectively. $\lambda_0$, $\lambda_1$, $\lambda_2$, $\lambda_3$, $\lambda_4$, $\lambda_5$, $\lambda_6$, and $\lambda_7$ are the intercept and coefficients of the explanatory variables, respectively. The control variables, comprising financial liberalization, trade liberalization, foreign direct investment, and institutional quality, have been employed in the model consistent with conclusions from the following studies (Adam (1995), Kurihara (2013), Sayek (2009), and Agoba et al. (2017)), who have respectively concluded that these factors or conditions have a significant influence on inflationary pressures around the globe. The study proceeds to verify the potential moderating influence of institutional quality on the surmised relationships of focus using the model presented in Eq. (3) below:

$$\begin{aligned}\text{CPI}_{it} = {} & \lambda_0 + \lambda_1 \text{VGFP}_{q,it} + \lambda_2 \text{Ginfl}_{it} + \lambda_3 \text{GGDPg}_{it} + \lambda_4 \text{FL}_{it} \\ & + \lambda_5 \text{TL}_{it} + \lambda_6 \text{FDI}_{it} + \lambda_7 \text{IQ}_{it} + \lambda_k (\text{IQ}_{it} \times \text{Var}_{k,it}) + \varepsilon_{it}.\end{aligned} \tag{3}$$

According to Eq. (3), $\text{Var}_k$ denotes variable of focus $k$ ($k$ is either corn price volatility, beef price volatility, rice price volatility, wheat price volatility, fish price volatility, and global inflation rate or global GDP growth rate), $\lambda_k$ is the coefficient of interaction variable between institutional quality and variable $k$, while the remaining variables and the symbols are denoted by the definitions per Eq. (2).

The data for the study were compiled from different sources for 27 countries from the sub-region of SSA from 1996 to 2019, based on the availability of data points for the key variables examined in the study. The sources include Federal Reserve Bank

(FRED), World Development Indicators (WDI), and World Governance Indicators (WGI) databases. Global prices for five key food items, namely corn, beef, rice, wheat, and fish, and the global rate of inflation and global GDP growth rate were compiled on an annual basis from the FRED database. From the WDI, we collected data for consumer price inflation, broad money (in local currency), GDP (in local currency), net inflow of foreign direct investment (FDI), and trade, while data for six governance variables, namely government effectiveness, control of corruption, political stability, voice and accountability, and regulatory quality and rule of law, were compiled from the WGI database. The study represents financial liberalization by the ratio of broad money (in local currency) to GDP (in local currency), and trade liberalization by the ratio of imports plus exports to GDP.

Data for the prices of food items were collected in USD per unit of measurement. However, the study assesses the impact of volatility associated with the price of these food items on inflationary conditions in the sub-region. As a result, volatility data has to be generated using an econometric procedure, following a similar approach by Abaidoo et al. (2021). The econometric procedure employed is the generalized autoregressive conditional heteroscedasticity (GARCH) methodology. The theory explaining this econometric procedure asserts that volatility associated with the price of these food prices generates a significant degree of uncertainty or risk, which when acted upon by economic agents could influence inflationary pressures among economies in SSA. The GARCH process postulates that the volatility associated with a variable (the global price of food products in this study) is a function of its lags. Due to its advantages, compared to other techniques for deriving uncertainty or fluctuations in data such as standard deviation, the GARCH approach has been employed extensively in the literature (see Abaidoo and Anyigba, (2020); Abaidoo and Agyapong, (2021); Asamoah et al. (2016); Gökbulut and Pekkaya, (2014). Following Reschenhofer (2013) and Hansen and Lunde (2003), who identify the GARCH (1,1) model as sufficient for the derivation of volatility data, we present Eq. (4) below for deriving volatility data on the global price of noted food items.

$$h_{q,t}^2 = \omega + \gamma \varepsilon_{q,t-1}^2 + \delta h_{q,t-1}^2. \tag{4}$$

From Eq. (4), the subscripts $q$ and $t$ represent the global price of food items and year, respectively, while $\omega$ is the intercept of the GARCH model. $h^2$ denotes the volatility associated with the food price in question. In the subsequent terms after the intercept ($\omega$), the first term is the coefficient $\gamma$ multiplied by the lag square return $\varepsilon^2_{q,\,t\text{-}1}$; plus, the coefficient $\delta$ multiplied by the lag variance $h^2_{q,\,t\text{-}1}$. The coefficients of the ARCH and GARCH terms are denoted by $\gamma$ and $\delta$, respectively.

Institutional quality examined in the study is a composite index that employs six governance variables computed by the World Bank. These variables are political stability, government effectiveness, rule of law, voice and accountability, control of corruption, and regulatory quality. They are indexes computed to illustrate the extent of development of institutional and governance frameworks among economies around the globe. We employ the principal component analysis (PCA) technique for the construction of the institutional quality index. The PCA process generates weights for each of the six governance variables. The weights are denoted by

the eigenvectors that explain the significant proportion of the variance of each of the variables used for the construction of the index (Ahamed and Mallick, (2019)). By this process, and as explained by Abdi and Williams (2010), the redundant component of the variance of the interconnected variables is discarded, while the significant proportions are retained to derive the weights. Among the other techniques for the derivation of weights for the construction of composite indexes include the use of expert opinion, assignment of equal weights, conjoint analysis, budget allocation process, correlation analysis, and analytical hierarchy process, among others. However, as argued by Sendhil et al. (2018) and Basel et al. (2020), these approaches are significantly biased compared to the PCA methodology, hence their adoption in this study. We proceed with the presentation of Eq. (5) for the model that constructs the composite institutional quality index. The base variables (the six governance variables) are indexes of equal scale; hence, we do not need to normalize the data (a technique employed when the variables for the index computation are presented in differing scale or unit of measurement).

$$IQ_{it} = \sum_{p}^{n}((Y_{p,it} * \text{ш}_{p,i})/\sum_{p}^{n}\text{ш}_{p,i}) \tag{5}$$

According to Eq. (5), the subscripts $i$, $t$, and $p$ represent country, year, and governance variables respectively. IQ denotes institutional quality, $Y$ represents the data point for the governance variable in question, and ш denotes weight derived from PCA. The computed index denotes the quality of institutional and governance framework in an economy, where a higher index represents improved institutions and vice versa.

## Empirical estimation and analysis

Results of the descriptive statistics for the various variables examined in this study are presented in Table 1. The results indicate that over the study period, for the sampled countries in the sub-region, an average of 6.5% rate of inflation was recorded, significantly higher than the global average rate of inflation (−0.5%). The average rate of the volatility of the price of the food products is significantly higher than their standard deviations; this implies that over the years, there has been insignificant difference in the rate of volatility of the price of these food items from one year to the other. The results further indicate that over the study period, an average rate of 4.5% was recorded for the growth in global GDP, with a standard deviation of 5.1% (illustrates significant differences in the pace of growth globally from one year to the other). The statistics reveal further that an average of 29% of GDP was recorded as money in circulation (financial liberalization), an average of 66.9% of the value of GDP was reported as imports and exports, and an average of 4% of GDP was recorded as inflow of funds from foreign investors over the study period for sampled economies in the sub-region. Again, an average negative index (−0.42) was reported for the quality of institutions for sampled countries over the study period; this attests to the conventional knowledge concerning the poor nature of institutions and governance framework for the sub-region.

**Table 2** Multicollinearity test

| | VIF | SQRT VIF | Tolerance | R-Squared |
|---|---|---|---|---|
| Vcorn | 1.84 | 1.36 | 0.5443 | 0.4557 |
| Vbeef | 1.47 | 1.21 | 0.6806 | 0.3194 |
| Vrice | 2.23 | 1.49 | 0.4481 | 0.5519 |
| Vwheat | 1.10 | 1.05 | 0.9085 | 0.0915 |
| Vfish | 1.36 | 1.16 | 0.7374 | 0.2626 |
| Ginfl | 2.13 | 1.46 | 0.4695 | 0.5305 |
| GGDPg | 2.18 | 1.48 | 0.4593 | 0.5407 |
| FL | 1.40 | 1.19 | 0.7121 | 0.2879 |
| TL | 1.20 | 1.09 | 0.8351 | 0.1649 |
| FDI | 1.02 | 1.01 | 0.9822 | 0.0178 |
| IQ | 1.24 | 1.11 | 0.8088 | 0.1912 |

*Vcorn* corn price volatility, *Vbeef* beef price volatility, *Vrice* rice price volatility, *Vwheat* wheat price volatility, *Vfish* fish price volatility, *Ginfl* global inflation, *GGDPg* global GDP growth rate, *FL* financial liberalization, *TL* trade liberalization, *FDI* foreign direct investment, *IQ* institutional quality

The section performs a test for multicollinearity, with the results presented in Table 2. The table shows the variance inflation factor (VIF) for the various explanatory variables examined in the study. To ensure that there are no problems emanating from multicollinearity in our model estimates, the explanatory variables should satisfy the acceptability threshold. Reference is made to Liao and Valliant (2012), who argue that the independent variable for a model estimate meets the acceptability threshold if the VIF is less than 10. As reported in Table 2, none of the explanatory variables has a VIF above 10. All the variables per the model estimates are consistent with the acceptable VIF threshold. This conclusion is confirmed by the results of the pairwise correlation matrix presented in Table 3. The table further shows the correlation coefficient of the various pairs of variables examined in this study. Elith et al. (2006) recommend that variables with a correlation coefficient that exceeds 0.85 should be deemed not acceptable for a model estimate since it could have significant multicollinearity repercussions. Results from Table 3 indicate that none of the correlation coefficients exceed 0.85. The study, therefore, proceeds with the examination of surmise interactions without the threat of analyzing spurious results due to multicollinearity.

## Empirical findings and discussion

Table 4 presents the results of empirical estimates examining dynamic interactions between volatility associated with key global food prices and inflationary pressures among economies in sub-Saharan Africa. Column 1 of the table reports coefficient estimates of the direct interactions between the volatility associated with the price of five major global food products and the control variables on inflationary pressures among economies in the sub-region. The results show that volatility in the price of

**Table 3** Pairwise correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) CPI | 1.000 | | | | | | | | | | | |
| (2) Vcorn | 0.024 | 1.000 | | | | | | | | | | |
| (3) Vbeef | 0.000 | −0.100 | 1.000 | | | | | | | | | |
| (4) Vrice | 0.079 | −0.547 | −0.185 | 1.000 | | | | | | | | |
| (5) Vwheat | −0.086 | −0.103 | 0.165 | −0.018 | 1.000 | | | | | | | |
| (6) Vfish | −0.032 | −0.153 | −0.247 | −0.068 | −0.091 | 1.000 | | | | | | |
| (7) Ginfl | 0.056 | −0.242 | 0.149 | 0.353 | −0.149 | 0.145 | 1.000 | | | | | |
| (8) GGDPg | −0.001 | −0.330 | 0.100 | 0.423 | 0.001 | 0.161 | 0.674 | 1.000 | | | | |
| (9) FL | −0.099 | 0.061 | 0.035 | −0.121 | 0.014 | 0.031 | 0.024 | 0.000 | 1.000 | | | |
| (10) TL | −0.112 | 0.073 | 0.021 | −0.046 | 0.026 | 0.013 | 0.043 | 0.044 | 0.383 | 1.000 | | |
| (11) FDI | 0.091 | 0.028 | 0.022 | −0.067 | −0.006 | 0.006 | −0.017 | 0.009 | 0.072 | −0.030 | 1.000 | |
| (12) IQ | 0.060 | 0.090 | 0.010 | −0.083 | −0.012 | 0.003 | −0.023 | −0.087 | 0.400 | 0.183 | 0.111 | 1.000 |

*CPI* consumer price inflation, *Vcorn* corn price volatility, *Vbeef* beef price volatility, *Vrice* rice price volatility, *Vwheat* wheat price volatility, *Vfish* fish price volatility, *Ginfl* global inflation, *GGDPg* global GDP growth rate, *FL* financial liberalization, *TL* trade liberalization, *FDI* foreign direct investment, *IQ* institutional quality

**Table 4** Global food price volatility and inflationary pressures in sub-Saharan Africa

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | GMM | 2SLS | GMM | GMM | GMM | GMM | GMM | GMM | GMM |
| Lag1-CPI | 0.409*** | 0.265*** | 0.470*** | 0.429*** | 0.232*** | 0.409*** | 0.239*** | 0.268*** | 0.329*** |
| | (7.69) | (6.53) | (8.26) | (7.11) | (2.98) | (4.43) | (3.63) | (5.49) | (5.45) |
| Vcorn | 0.178** | 0.246** | 0.346*** | 0.276*** | 0.118 | 0.227*** | 0.231** | 0.125* | 0.170* |
| | (2.46) | (2.25) | (2.90) | (2.86) | (1.23) | (3.10) | (2.65) | (1.87) | (1.90) |
| Vbeef | 1.004*** | 1.362*** | 1.314*** | 0.688 | 0.833* | 1.349*** | 1.331*** | 0.960*** | 1.123*** |
| | (4.12) | (2.61) | (3.50) | (0.48) | (2.02) | (3.93) | (3.58) | (3.57) | (3.10) |
| Vrice | 0.138** | 0.658*** | 0.184* | 0.183** | −0.728 | 0.263** | 0.258** | 0.153** | 0.188*** |
| | (2.73) | (4.15) | (1.98) | (2.12) | (−1.56) | (2.73) | (2.68) | (2.68) | (3.45) |
| Vwheat | −1.794 | 0.524 | −0.344 | −0.964 | 0.543 | 6.073 | −3.133 | 0.223 | −2.079 |
| | (−1.56) | (0.17) | (−0.30) | (−0.84) | (0.32) | (1.14) | (−1.50) | (0.11) | (−1.64) |
| Vfish | 0.307 | 0.622 | 0.508* | 0.416* | 0.387 | 0.583** | 0.0444 | 0.574** | 0.548** |
| | (1.50) | (1.21) | (2.03) | (1.85) | (1.27) | (2.41) | (0.05) | (2.24) | (2.21) |
| Ginfl | 0.0433*** | 0.0757** | 0.0439*** | 0.0463*** | 0.0431*** | 0.0415*** | 0.0359*** | 0.00746 | 0.0344*** |
| | (6.24) | (2.28) | (5.24) | (6.06) | (4.82) | (8.05) | (3.98) | (0.37) | (4.69) |
| GGDPg | −0.204*** | −0.670* | −0.210*** | −0.195*** | −0.259*** | −0.224*** | −0.213*** | −0.282*** | −0.315*** |
| | (−6.04) | (−1.89) | (−5.06) | (−5.43) | (−3.78) | (−7.01) | (−3.35) | (−5.12) | (−3.30) |
| FL | −0.235*** | 0.0270 | −0.240*** | −0.207*** | −0.245*** | −0.125 | −0.152** | −0.174*** | −0.245*** |
| | (−3.76) | (0.84) | (−3.48) | (−3.61) | (−3.24) | (−1.60) | (−2.26) | (−2.92) | (-4.48) |
| TL | 0.106*** | 0.0718*** | 0.0755* | 0.0712** | 0.195*** | 0.135*** | 0.190*** | 0.169*** | 0.155*** |
| | (2.97) | (3.20) | (1.87) | (2.17) | (3.21) | (3.28) | (3.29) | (3.64) | (3.52) |
| FDI | 0.00928 | −0.230 | −0.0236 | −0.00703 | −0.101** | −0.0598* | −0.0645 | −0.126** | −0.0356 |
| | (0.33) | (−0.33) | (−0.92) | (−0.38) | (−2.66) | (−1.98) | (−1.69) | (−2.61) | (−1.04) |
| IQ | −0.00900 | −0.00431 | −0.0211 | 0.00338 | 0.151* | −0.654 | 0.01000 | −0.00757 | −0.000553 |
| | (−1.52) | (−0.74) | (−1.19) | (0.11) | (1.98) | (−1.41) | (0.17) | (−0.95) | (−0.07) |
| IQ×Vcorn | | | 0.169 | | | | | | |
| | | | (0.47) | | | | | | |

**Table 4** (continued)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| IQ×Vbeef | | | | −1.366 | | | | | |
| | | | | (−0.56) | | | | | |
| IQ×Vrice | | | | | −2.132* | | | | |
| | | | | | (−2.03) | | | | |
| IQ×Vwheat | | | | | | 15.42 | | | |
| | | | | | | (1.40) | | | |
| IQ×Vfish | | | | | | | −0.543 | | |
| | | | | | | | (−0.22) | | |
| IQ×Ginfl | | | | | | | | −0.0907* | |
| | | | | | | | | (−1.88) | |
| IQ×GGDPg | | | | | | | | | −0.193 |
| | | | | | | | | | (−0.98) |
| Constant | 0.0812* | −0.0865 | 0.0187 | 0.0496 | 0.0334 | −0.302 | 0.0873 | −0.0221 | 0.0655 |
| | (1.90) | (−0.48) | (0.36) | (0.99) | (0.45) | (−1.25) | (0.96) | (−0.26) | (1.26) |
| Obs | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 |
| Countries | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| F-Stats | 264.4 | 110.2 | 523.8 | 384.0 | 214.0 | 126.7 | 109.6 | 98.06 | 376.8 |
| *p* value | 5.56e−24 | 5.59e−18 | 5.29e−28 | 2.92e−26 | 5.44e−23 | 4.41e−20 | 2.76e−19 | 1.13e−18 | 3.72e−26 |
| R-squared | – | 0.1064 | – | – | – | – | – | – | – |
| Instruments | 24 | – | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| AR(1) p | 0.000437 | – | 0.000249 | 0.000539 | 0.00240 | 0.000472 | 0.000808 | 0.000538 | 0.000854 |
| AR(2) p | 0.357 | – | 0.236 | 0.211 | 0.163 | 0.143 | 0.154 | 0.175 | 0.103 |
| Hansen p | 0.314 | – | 0.383 | 0.395 | 0.309 | 0.389 | 0.392 | 0.397 | 0.395 |

*t* statistics in parentheses

*CPI* consumer price inflation, *Vcorn* corn price volatility, *Vbeef* beef price volatility, *Vrice* rice price volatility, *Vwheat* wheat price volatility, *Vfish* fish price volatility, *Ginfl* global inflation, *GGDPg* global GDP growth rate, *FL* financial liberalization, *TL* trade liberalization, *FDI* foreign direct investment, *IQ* institutional quality

*$p<0.1$, **$p<0.05$, ***$p<0.01$

three out of the five globally traded food items examined is significant in influencing variability in inflationary pressures among economies in the sub-region. We find that volatility associated with the global price of corn, rice, and beef tends to have a significant positive impact on inflationary pressures among economies in SSA, all other things being equal. These positive coefficient estimates suggest that volatility in the price of these three dominant globally traded food commodities foment or worsen prices of goods and services (inflationary pressures on imported food products) among economies in the sub-region, consistent with the presumed impact of the Russo-Ukrainian War on food price hikes and shortages among inhabitants of the sub-region. With rice and corn being among some of the highly imported food commodities into the sub-region, extreme price volatilities due to constraints such as the Russo-Ukrainian War blockade, and disruption of the critical supply chains fueling the supply of such products due to the war, heighten inflationary pressures on such vital source of choleric intake among economies in the sub-region. These findings are consistent with submissions by Joshi and Acharya (2011), Gospodinov and Ng (2013), and Miecinskiene and Lapinskaite (2014), who found that global commodity prices significantly influence inflationary conditions. However, the results contrast with the findings by Lapinskaite and Miecinskiene (2019) who found an insignificant nexus between global commodity prices and inflation in European Union countries. The impact of these three commodities notwithstanding reported results further suggests that volatility associated with wheat and fish prices has no statistically significant influence on inflationary pressures, at least over the period examined in the study.

Coefficient estimates presented in column 1 of Table 4 further indicate that inflationary pressures among economies in the sub-region may be inherited or symptoms of much broader global inflationary conditions. In column 1, we find that global inflationary conditions tend to engender significant inflationary pressures for economies in the sub-region. In order words, a rising tide of global inflationary conditions tends to have a contagious impact on inflationary conditions among economies in the sub-region. This outcome is consistent with the economic contagion phenomenon where macroeconomic happenings or conditions are transmitted or 'contracted' by other economies or economic blocs. Global GDP growth is also shown to have a significant negative influence on inflationary pressures among economies in SSA. This outcome indicates that upswings in global macroeconomic performance, all other things being equal, help in alleviating inflationary conditions among economies in the sub-region. The result suggests that appreciable global economic performance has the potential to ultimately curtail inflationary pressures among regional economies such as SSA. Empirical estimates reported in column 1 further show that financial liberalization among economies in the sub-region tends to have a negative impact on inflationary conditions in the sub-region. This outcome may be explained by how most financial liberalization policies are implemented among economies in the sub-region. More often than not, such liberalization policies are accompanied by modalities for strengthening core sectors of the economy. Such conditions have the potential to contain or minimize inflationary pressures, all other things being equal. Our results further indicate that trade liberalization worsens inflationary pressures among economies in the sub-region. Liberalized economic systems are often

exposed to external price shocks and other macroeconomic conditions, which may constrain efforts at managing inflationary conditions at the domestic level, hence the observed outcome. Foreign direct investments and institutional quality are, however, found to be insignificant in influencing inflationary conditions among economies in the region. For robustness checks, we present empirical estimates for two-stage least squares (2SLS) in column (2) of Table 4. Results from column (2) (2SLS estimates) are significantly aligned to column (1) (GMM estimates), in terms of the magnitude and the direction of influence.

In columns (3) to (9) of Table 4, the potential moderating impact of institutional quality on the extent to which volatility associated with core global food commodities influences inflationary dynamics among economies in the sub-region is examined. The results suggest that institutional quality only moderates the relationship between volatility in the global price of rice and inflationary pressures among economies in the sub-region, and the relationship between global inflationary conditions and domestic inflationary pressures. In the first instance, the results show that institutional quality reduces the positive impact of volatility in the global price of rice on inflationary pressures among economies in the sub-region. This outcome suggests that all other factors held constant, effective domestic institutions with the mandate to ensure economic stability could negate the adverse impact of volatility in the global price of rice on inflationary conditions among economies in the sub-region, and the potential for regional hunger. Additionally, we also find that effective domestic or regional institutions (institutional quality) have a negative moderating influence on the relationship between global inflationary conditions and inflationary pressures among economies in the sub-region. This outcome indicates that potential contagion interaction between global inflationary pressures and domestic or regional inflationary conditions can be minimized or curtailed by effective regional structures and institutions tasked with the mandate of minimizing the domestic economy's exposure to such external shocks. In other words, effective domestic or regional institutions have the potential to minimize economies in the sub-regions exposure to external price shocks or vulnerabilities to such global inflationary conditions. Such institutional policies are initiated with the prime object of curtailing the possible adverse outcome to key economic indicators such as domestic inflation, as a result of rising prices of food items and general increases in goods and services on the global market, hence the observed outcomes.

## Post-estimation and robustness checks

This section reviews the results of post-estimation checks associated with empirical estimates displayed in Table 4 to validate the robustness of the results and the interpretations thereof. First, to ensure the validity of the results for the GMM estimate, it is fundamental that the number of instruments should be less than the number of groups (countries in this instance). As shown in all eight columns of Table 4, for each estimate, the number of countries is greater than the number of instruments, hence satisfying this requirement. Again, the F-statistics and the corresponding *p* values for each of the estimates indicate the overall fitness of the models (that is,

the explanatory variables significantly explain variation in the inflation rate). The validity of the instruments used is also confirmed by the Hansen test (the estimations show the $p$ values of the Hansen test). The $p$ value for each of the estimations is greater than 0.05. We, therefore, fail to reject the null hypothesis that the instruments used are valid for the various estimations. The existence of serial correlation or otherwise is also checked using the AR(2) test. The null hypothesis of the test states that the estimations are not characterized by serial correlation, as against the alternative that there exists serial correlation in the error terms. According to Table 4, the $p$ value for all the estimates is greater than 0.05, signifying that we fail to reject the null hypothesis and conclude that the estimations are devoid of serial correlation. Appropriate inferences can therefore be made from the estimations following validation of the results through the post-estimation analysis.

## Summary, conclusion, and policy recommendations

The economic impact of the Russo-Ukrainian War has been significant for most economies around the world. For most developing and emerging economies, however, the impact has been devastating (See Duho et al. 2022; Kammer et al. 2022; Mwansa 2022). The current study infers from the possible devastating impact of the war, examines how volatility associates with global food prices, specific global economic conditions influence inflationary pressures among economies in SSA, and the degree to which institutional quality may influence such dynamic interactions. The study employs data from FRED and other various sources for 27 countries in the sub-region of SSA from 1996 to 2019. Empirical analyses in the study were performed using the two-step system generalized method of moments (TS-GMM) estimation methodology due to its robustness and significant advantage in controlling for most fundamental assumptions of regression analysis.

Reviewed results from the study suggest that volatility in major global food prices tends to have a significant positive impact on inflationary pressures among economies in the sub-region. For instance, among the five major global food items examined, empirical estimates show that volatility in the global price of corn, rice, and beef tends to worsen inflationary conditions among economies in the sub-region, all other things being equal. In other words, growing dependence on the global market for food products exposes the sub-region to inflationary conditions during times of significant price fluctuations in major global food items. Reported empirical estimates further show that trade liberalization and global inflationary conditions also exacerbate inflationary pressures among economies in the sub-region. On the contrary, we find that appreciable global economic performance and financial liberalization tend to help assuage the extent of inflationary conditions among economies in the sub-region. Finally, institutional quality is found to exert a significant moderating influence on the interaction between volatility in the price of rice and inflationary conditions in SSA. The results suggest that effective regional or domestic institutions help negate the adverse effects of volatility in the price of rice on inflationary conditions among economies in the sub-region. We further find that institutional

quality can also help in minimizing how global inflationary conditions ultimately influence regional inflationary pressures.

This study augments existing literature on factors and conditions influencing inflationary conditions among developing economies by highlighting the role of volatility associated with the price of key global food products. The conclusions, to a greater extent, support the theoretical position of the economic contagion theory, adding to theoretical knowledge and providing an opportunity for further research on the subject. It also prompts further empirical inquiry into how vulnerability thresholds exhibited by different economies in the sub-region may play a role in how global food price volatility ultimately influences inflationary conditions domestically. Various conclusions of this study can also inform policies designed to minimize the ultimate impact of inflationary pressures among domestic economies in the sub-region. For instance, following the conclusion that institutional quality has the potential to assuage adverse effects of global food (corn, rice, etc.), price volatility, and global inflationary conditions on domestic inflationary conditions, policymakers can take a cue to promote and ensure the efficiency of such institutions tasked with the mandate to ensure the stability of economies within the sub-region. This outcome suggests that effective and well-functioning institutions can implement policies with the potential to counter the adverse effects of global food price volatility. Policies, such as increases in domestic output of such food products, government rebates through budgetary support, etc. have the potential to minimize domestic inflationary pressures due to volatile global food prices. It is also recommended that the growing trend toward liberalized trade policies should be measured to ensure that it does not make the sub-region vulnerable to external price shocks that may engender further inflationary conditions. This study's empirical inquiry focuses primarily on economies in sub-Saharan Africa. Consequently, the report may not reflect conditions in other emerging economies and other regional blocs. We propose further empirical inquiries focusing on other emerging economic blocs around the globe.

**Acknowledgements** The manuscript was developed solely by the authors and we have no other person/s to acknowledge in the development of the manuscript.

**Author contributions** The concept for the manuscript was developed, and designed by RA. RA also wrote the introduction of the manuscript and developed the various components of the manuscript. He is also involved in the results interpretations and fine-tuning of the final manuscript. EKA is responsible for the literature review, and empirical estimations, and wrote the sub-sections following the literature review section as well.

**Funding** No external funding was sourced or used in the development of this manuscript that needs to be reported.

**Data availability statement** The datasets generated during and/or analyzed during the current study are all publicly available and noted in the data section of the manuscript.

## Declarations

**Conflict of interest** We, the authors of the above manuscript, declare that the current manuscript has not been sent to any other journal for review and publication. We also wish to declare that there is no conflict of interest in any shape or form in the development of this manuscript. We further wish to declare that no

funding was sourced in the development of this manuscript and that both developers of this manuscript consent to its presentation for review and possible publication. This manuscript is an original work from the two authors (Prof. Rexford Abaidoo and Mr. Elvis Kwame Agyapong as acknowledged in the manuscript).

**Ethical approval** This study does not require any form of ethical approval because no human or animal subjects were used or engaged in any form in the development of the manuscript.

**Informed consent** This article does not contain any studies with human participants performed by any of the authors.

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