Agricultural Commodities' Price Transmission From International to Local Markets in Developing Countries

Lotanna E. Emediegwu*[1] and Marco Rogna†[2]

[1]Manchester Metropolitan University

[2]European Commission Joint Research Centre–Sevilla

*l.emediegwu@mmc.ac.uk

†marco.rogna@ec.europa.eu

Abstract

The transmission of commodities prices from the international to local markets is an interesting and deeply investigated topic. A fast and strong link between the two levels of the market is seen by economists as a sign of local market efficiency, allowing actors to respond fast to signals coming from the international market. However, the empirical evidence on the topic is very mixed, ranging from a very weak linkage between the two market prices to a high-speed and almost complete transmission. The present paper aims to advance the knowledge on the topic by focusing on the price transmission of four main cereals – maize, rice, sorghum, and wheat – in 23 developing and fragile economies. Employing a recent World Bank dataset with prices for several local markets in select countries, we estimate panel vector autoregressions (PVAR) to analyze the pass-through effects of international price shocks on local food prices. We find evidence for a relatively strong price transmission elasticity for all commodities except sorghum. Furthermore, the observed transmission of shocks is almost immediate. We present the policy implications for these findings.

Keywords: commodities prices; developing countries; price transmission; panel VAR.
J.E.L. Codes: Q11; Q13; Q17; C33.

1 Introduction

The price of agricultural commodities is crucial in determining the economic and welfare conditions in developing countries. In a large household survey on the Indonesian island of Java, poor families were found to spend 75% of their budget on food products (Block and Webb, 2009), while Meyimdjui and Combes (2021), analyzing several developing countries, found income shares dedicated to food expenditures comprised between 40.1% and 56.4%. Emediegwu (2022b) observes that an average household in Nigeria spends 56.4% of its income on food whereas, an average household in the UK only 8.2% of its income. Moreover, the price of agricultural commodities affects households in developing countries not only in their role as consumers but also as producers. Agriculture absorbs a significant fraction of the workforce (Gollin et al., 2007) and may constitute a substantial portion of the household income. According to World Bank data, the share of Gross Domestic Product (GDP) coming from agriculture, forestry and fishing in several developing countries is above 25% with peeks beyond 50% for countries such as Somalia and Sierra Leone.

Agricultural commodities are traded internationally, and their price is often determined in dedicated markets such as the London Commodity Exchange (LCE). The price in local markets and the price received by farmers in developing countries are likely to be influenced by the international price of a commodity. For certain tradeable products, such as cash crops, the link between international and local prices is expected to be very strong. For staples, such as grains, the link may be weaker. On one side, several developing countries, especially in Africa, are net importers of cereals and other essential food products, raising concerns related to the diminished availability of grains due to the Russo–Ukrainian war (Behnassi and El Haiba, 2022) and most recently due to the untimely collapse of the Black Sea agreement (Emediegwu, 2023b).[1] This fact may imply a strong dependence of local prices on global food prices. However, other authors like Fjelde (2015) and Ivanic et al.

[1]On 22 July 2022, Russian and Ukrainian officials signed the Black Sea Grain Initiative in Istanbul, Turkey. This agreement was brokered by the United Nations (UN) to permit the safe passage of Ukraine's grain exports through three ports: Chornomorsk, Odesa, and Yuzhny/Pivdennyi. Unfortunately, Russia pulled out of the deal on 17 July 2023 (barely a year after its inception).

(2012) evidence that changes in international prices may not be fully transmitted to local producers and consumers as this pass-through depends on a host of local factors such as openness of the domestic markets, distance to capital, etc. Also, Gollin et al. (2007) show that low–income countries, on average, import less than 5% of their total calorie intake, with few exceptions reaching a maximum of 15%. The authors explicitly state that "it is reasonable to view most economies as closed, from the perspective of trade in food" (Gollin et al., 2007; p. 1234). These authors push the notion that the impact of international prices on local ones may be relatively modest for some agricultural commodities.

Due to the importance of agricultural commodity prices for the livelihood of billions of people in developing countries, it is naturally interesting to investigate their relationship with international prices. In the literature, several papers are going in this direction. Arnade et al. (2017) investigate the transmission mechanism between the international price of some agricultural products and the local prices in the Chinese domestic market. Baffes and Gardner (2003) consider the effect of policy reforms in developing countries on local food prices, while Baquedano and Liefert (2014) analyze the strength of the price transmission mechanism in several developing countries for major cereals. These are few examples of a larger literature. Willing to summarize the main findings, we can say that local prices respond to shocks in international prices. Still, the link is often loose, and fluctuations in international prices are generally slow in affecting local prices.

The present paper is part of the literature investigating the nexus between international and local food prices. A significant novelty characterizes the current work. First, we use a recent World Bank dataset offering local (market-level) monthly market prices for some food commodities in 23 developing and fragile economies. To our knowledge, this dataset has not yet been used for this type of analysis. Multiple local markets – all georeferenced – are considered for each covered country. Overall, we examine monthly price series consisting of four staple food products from more than 1200 markets from five developing regions of the world. This dataset allows us to use a panel setting rather than simple time series used in previous studies, thereby enriching the quantity of our observations and improving the quality of the estimation. Secondly, we estimate panel vector autoregressions (PVAR) to analyze the pass-through effects of international price fluctuations on local food prices. Our findings are partially in line with the existing literature, with the significant difference that we find, in general, a stronger and faster pass-thought of international price shocks for rice, maize, and wheat. On the other hand, we find that shocks to global sorghum price do not significantly pass-through to sorghum prices in developing economies' local markets.

Section 2 provides a synthetic review of the relevant literature, Section 3 describes the data and methodology, while Section 4 is dedicated to the results of the econometric estimation and to their discussion. The last section is devoted to the conclusion with important policy suggestions.

2 Literature Review

A fast transmission of prices across markets is generally considered positive by economists because it helps to improve market efficiency (Arnade et al., 2017). However, price stability, particularly the price stability of food and other necessary goods, is an objective pursued by several countries, particularly developing ones (Baffes and Gardner, 2003). While the liberalization programs that occurred in several low–income countries during the 80s and 90s should have increased the speed of price transmission for agricultural commodities, most of such countries have retained some degree of intervention to stabilize prices, motivated either by electoral, humanitarian, or efficiency concerns (Timmer, 1989). The level of market integration, its role in economic performance, and the effect of policy reforms on such market integration are all aspects that have received wide attention in the economic literature.

The early literature on the topic that focuses on price transmission in developing countries when liberalization programs were not yet started or were in their infancy does not provide a clear view of price transmission. Contrary to expectations, given the strong interventionism of several countries during the analyzed period (1968–78), Mundlak and Larson (1992) find a strong linkage between international and local prices. Hazell et al. (1990) partially contradict this view, sustaining that the variability in global prices is transmitted to developing countries in the dollar value of their exports but far less strongly to average producer prices. Morisset (1998), despite analyzing commodity markets in industrialized nations, also finds a far-from-perfect price transmission mechanism with significant asymmetries.

In more recent studies, findings about the strength of the price transmission mechanism in commodity markets have been equally ambiguous. Investigating the Chinese economy, Arnade et al. (2017) find a relatively strong transmission of prices for soybeans, soy meal, and chicken but a much weaker one for rice. Furthermore, they find that pass-through effect is stronger in the long than in the short run, explaining this behavior with the limited capacity of price stabilization policies to operate beyond the short run effectively. Baffes and Gardner (2003), analyzing eight developing countries, find evidence of significant price transmission only in three. Furthermore, they reject the idea that liberalization reforms have significantly increased the strength of price transmission. On their part, Baquedano and Liefert (2014) show a certain degree of price transmission for several widespread cereals in a large set of developing countries. However, the transmission and the rate of adjustment after a shock are relatively slow. Subervie (2011) points out that liberalization programs affect price transmission but mainly on the speed of convergence of price decreases. Finally, Bekkers et al. (2017) find a stronger transmission mechanism for commodities in developing rather than in industrialized countries, underlying the negative implications regarding food security for the former.

Contrary to the large variance in findings, the methods of investigation and the unit of observations have been rather homogeneous. Most empirical literature adopts time-series data and techniques such as error correction models (ECMs). Arnade et al. (2017) use an ECM for their estimation, while Balcombe et al. (2007) and Subervie (2011) use a threshold ECM. Baquedano and Liefert (2014) adopt a single equation ECM, while Esposti and Listorti (2013) utilize a vector error correction model (VCEM). Finding no evidence for cointegration in most of the examined countries, Bekkers et al. (2017) rely on a vector autoregression (VAR) model. In contrast to prior studies, we employ a new market-level, monthly database of food prices for developing regions around the world, granting us more information, variability, and efficiency than pure time series data used in previous works or cross-sectional data. Consequently, we are able to model both the common and individual behaviors of groups that affect commodity prices.

3 Data and Methods

3.1 Data sources

Our analysis focuses on developing and problematic countries. Figure 1 shows the countries included in our sample, while Table A1, in the Appendix, lists their names. Most countries fall into the UN definition of least developed countries (LDC), while others, such as Afghanistan, Syria, and Nigeria, have very problematic situations due to internal conflicts. The monthly local market food prices data have been obtained from a recent World Bank dataset (available here), that covers 1331 markets from January 2007 to July 2023[2]. In the spirit of Emediegwu and Nnadozie (2023), all food prices are collected at retail level to ensure that the pass-through of international food prices shocks to household welfare is captured.

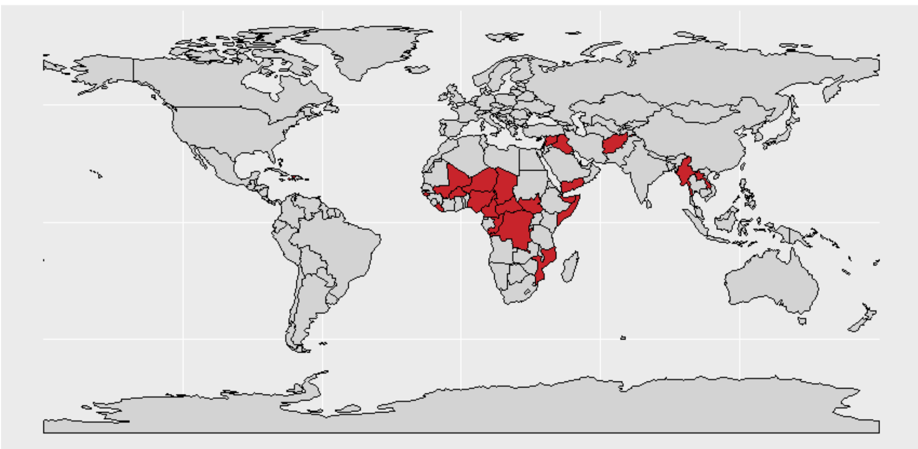


Figure 1: World map with sampled countries (in red)

[2]For our analysis, however, the time span has been reduced to Jan 2007–Dec 2021 due to missing values.

We also rely on the World Bank for international prices, using the monthly World Bank Commodity Market Data (available here). The analyzed commodities are four cereals widely used as staples, namely maize, rice, sorghum, and wheat, chosen for their importance in food security and due to data availability. For rice and wheat, various types are traded internationally. Wheat is divided into soft and hard, with the former preferred because it is more typically grown in hot climates, characterizing all countries under investigation (Posner, 2000). For rice, we have chosen the price of Thai rice 5% (Thai rice with 5% maximum of broken grains) over the other types: Thai rice 25%, A1, or Vietnam rice 5%. Broken rice is often used as animal feed, therefore, types such as 25% or A1 (100% of broken grains) may be less indicative of the price of rice for human consumption (Filgueira et al., 2014). Thai rice has been preferred to Vietnamese rice since Thailand is a greater exporter of this commodity; thus, its price should be more representative. The correlation between the two types of wheat and the various types of rice shown in Figure A1 in the Appendix is generally strong (except for rice A1), ergo, this choice is not so crucial. The discarded types are used as a robustness check of our main estimations.

Local market prices, expressed in local currencies, have been converted into PPP dollars, and, together with international prices, they have been deflated to obtain real prices. We transformed the real prices to their month-on-month (MoM) logarithmic values to ease the interpretation of the impulse-responses in percentage terms. We present the summary statistics of the main variables used in the study in Table 1.

Over the period under consideration, average real prices of maize and rice are highest in Middle East and North Africa (MENA), where they also have the lowest variation. Latin America and the Caribbean (LAC) have the least variation for most food prices, perhaps because they have the lowest number of markets sampled. Aside from West Africa, where most of the average food prices are below the general average, other regions experience higher than the total sample's average price. Table 1 also shows that most observations come from the West Africa subregion (>60%). Our sensitivity analysis shows that our results are robust to the inclusion or exclusion of the subregion.

Table 1: Summary statistics of local food prices (in US$) across regions

	Maize			**Rice**			**Sorghum**			**Wheat**		
	Mean	SD	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD	Obs
Central Africa	0.43	0.11	2,964	1.06	0.32	2,470	0.37	0.15	3,110	0.69	0.02	45
Eastern Africa	0.68	0.22	3,179	1.53	0.25	3,325	0.83	0.36	1,489	-	-	-
Southern Africa	0.48	0.70	2,780	0.99	0.54	2,665	-	-	-	-	-	-
Western Africa	0.37	0.12	15,810	0.77	0.16	18,541	0.37	0.12	18,565	0.85	0.23	207
Middle East & North Africa (MENA)	0.73	0.04	8	1.69	0.61	2,327	0.73	0.31	448	0.52	0.17	191
East Asia & Pacific	0.66	0.21	238	0.68	0.28	4,271	-	-	-	-	-	-
Latin America & Carribbean	-	-	-	1.22	0.19	535	0.43	0.09	508	-	-	-
Southern Asia	-	-	-	0.80	0.22	984	-	-	-	0.45	0.08	882
Aggregate sample	0.43	0.29	24,979	0.94	0.42	35,118	0.41	0.20	24,120	0.53	0.19	1,325

Note: The above table represents monthly observations from Jan 2007 to Dec 2021. More information regarding the number of countries and markets in each subregion is reserved in the Appendix section. SD denotes standard deviation. Observations are US$ in real terms.

3.2 Empirical strategy

We employ a panel VAR approach to investigate the impact of shocks in international food prices (P) on local food prices (p) in developing economies. The following reduced model is estimated:

$$y_{it} = \beta_i + A(L)y_{it} + \varepsilon_{it} \tag{1}$$

where y_{it} is a two-variables vector (P, p) in market i at month t, and β_i is a diagonal matrix of market-specific intercepts (fixed effects), capturing time-invariant factors that affect food prices (the Russo-Ukrainian war, for example). $A(L)$ is a matrix polynomial of lagged coefficients with $A(L) = A_1L^1 + A_2L^2 + \ldots + A_qL^q$, with q being the autoregressive order. Here, we choose q=*1* following extant empirical works as well as under the assumption that food prices are very volatile to macroeconomic shocks (see Figure A2 in the Appendix for results with alternative lags). A and B are parameters to be estimated, whereas ε_{it} is a vector of idiosyncratic errors. In subsequent analysis, we estimate equation (1) for the prices of four food commodities separately - maize, rice, sorghum, and wheat.

Love and Zicchino (2006) note that the fixed effects are likely correlated to the lags of the outcome variable due to the dynamic nature of equation (1). Hence, the standard method of eliminating fixed effects, mean-differencing, would produce biased results. To overcome this empirical challenge, we use the forward mean-differencing or orthogonal deviation (Helmert transformation) approach proposed in Arellano and Bover (1995) as an alternative elimination strategy. This "orthogonal deviation" approach eliminates the average of all future observations for each market-month rather than using deviations from historical observations. This transformation allows the use of lagged covariates as instruments since it retains the orthogonal structure between the lagged covariates and the transformed variables (Baltagi, 2008). Hence, the model coefficients can be jointly estimated using system GMM. To compute the impulse-response functions (IRFs), we apply Cholesky decomposition to the residuals to orthogonalize them. Given that the intent of our paper is to measure the pass-through impact from international prices to local prices, we allow international food prices (P) to have a contemporaneous effect on local food prices (p) in the Cholesky ordering and not the other way around. By construction, such arrangement means that the variable that appears earlier (P) is weakly exogenous with respect to the rest of the covariates in the short run.

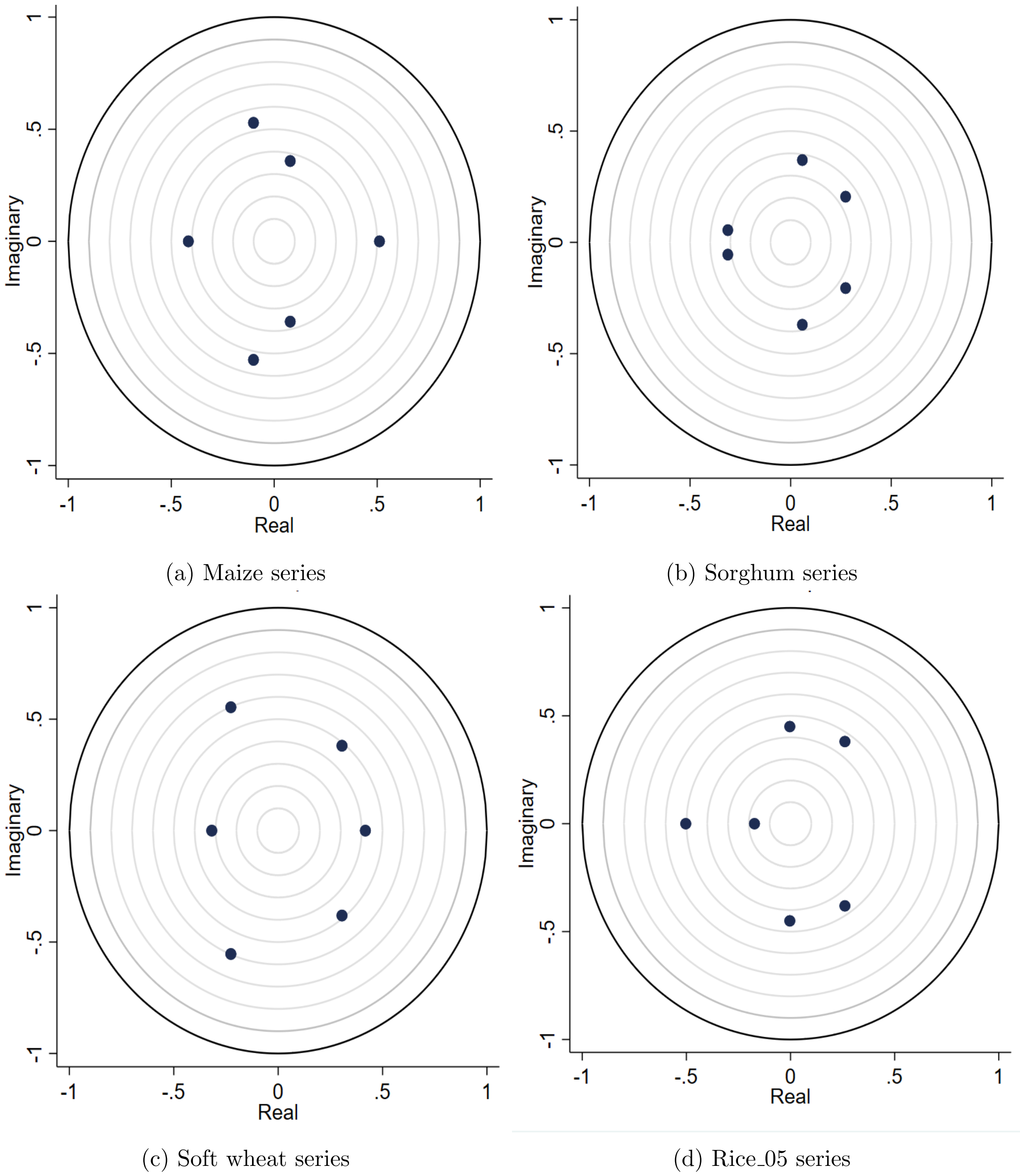
Finally, we estimate the IRFs using the method described in Love and Zicchino (2006), where the confidence intervals are estimated using Monte-Carlo simulations. These estimations were done using the *pvar* package in Stata developed by Abrigo and Love (2016). Practically, we re-estimated the IRFs by randomly building a draw of coefficients A of equation (1) using the estimated coefficients and the associated variance-covariance matrix. We repeat the entire procedure 1,000 times to construct the 5th and 95th percentiles of the distribution used as confidence intervals of IRFs. The IRFs in this paper describe the response of local food prices over time to shocks to international food prices within the system for 12 months ahead.

4 Results of the Econometric Analysis

We begin by showing that the GMM-estimated equation (1) is stable because Figure 2 reveals that the modulus of each eigenvalue of the fitted model lies inside the unit circle, implying they are strictly less than one. The stability of the estimated model suggests that shocks will eventually converge towards zero; hence, the PVAR model is invertible, making the estimated IRFs interpretable.

4.1 Impulse response functions

To appreciate the PVAR model, we turn to the interpretation of the impulse response functions (IRFs). Figure 3 presents the IRFs graphs and the associated 95% confidence intervals generated *via* Monte Carlo simulations with 1,000 repetitions. We interpret the Figure as the effect of a shock in international food prices on local food prices for 12 months after introducing the shock. With the exception of sorghum, we find that a positive shock



(a) Maize series

(b) Sorghum series

(c) Soft wheat series

(d) Rice_05 series

Figure 2: Roots of companion matrix

to international prices of maize, rice, and soft wheat is associated with a positive impact on the respective local prices in developing economies as seen in panels a, b, and d in Figure 3. These results confirm that most local staple prices are closely linked to fluctuations in their international prices. For example, Emediegwu and Nnadozie (2023) show that a positive shock following COVID-19 lockdown announcement affects maize and rice prices in India positively. However, they attribute this impact to human-driven processes, such as hoarding, rather than actual production shortages.

One possible explanation for the different behavior of sorghum price may come from its use in industrialized countries and its internationally traded quantity. Sorghum is scarcely used as food for human consumption in high- and upper-middle-income countries, except for a marginal use in gluten-free products for coeliacs. Its main use is as animal fodder in industrialized countries, whereas it is a staple food in several developing nations, where roughly 80% of world production is located (Hariprasanna and Rakshit, 2016). When comparing the percentage of internationally traded quantities (import or export) over the total production quantity of our commodities of interest, we can see that sorghum is the second lowest after rice: maize (14.3%), rice (0.3%), sorghum (12.6%), wheat (24.2%).[3] If we consider only Africa as a proxy for developing countries and examine the ratio of the sum of imported and exported quantities over domestic production, the gap between sorghum and the other crops increases: maize (26.3%), rice (0.5%), sorghum (4.1%), wheat (170.8%). Therefore, despite the percentage of internationally traded sorghum being similar to maize at the world level, it seems that the share imputable to developing countries is far lower for sorghum than for maize. Once again, this could be because the international market of sorghum deals mainly with the portion of this crop dedicated to animal feed, while the production of developing countries is mainly for local human consumption.

[3] Data obtained from FAO (FAOSTAT). The reported percentages are averages over the years 2010-2021.

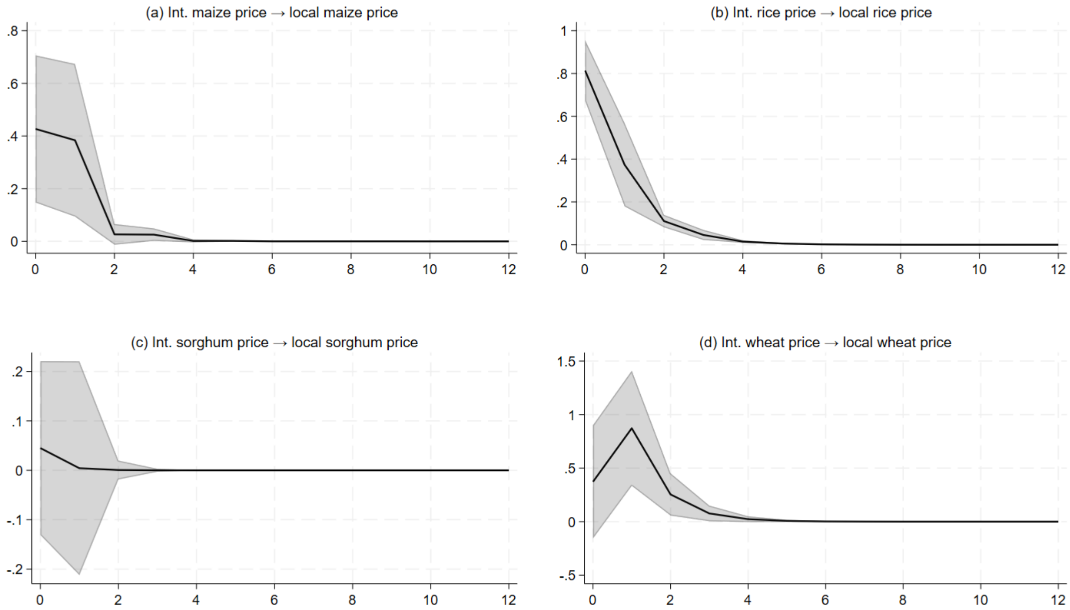


Figure 3: Impulse-response functions computed from GMM Panel VAR. The grey areas, representing the 95% confidence bounds, are generated by Monte Carlo with 1,000 repetitions.

Further, we find that most impacts peak at the inception of the shock, with exception of wheat prices that peak after one month before they start, plateauing from the fourth month. These findings imply that the pass-through effect of shocks in international food prices to local food prices is almost immediate. A 'mere' announcement or news of a macroeconomic adjustment or political actions that threaten the stability of international food prices can send an immediate signal to local food prices. For example, some commentators attribute the pre-Black Sea Grain Initiative fall in the FAO food price index to the role of expectations of a grain deal being signed (Emediegwu, 2023b).[4]

[4]Although the Black Sea Grain Initiative was signed on 22 July 2022, Emediegwu (2023b) shows that the FAO food price index had started falling following the proposition of the Initiative in April 2022.

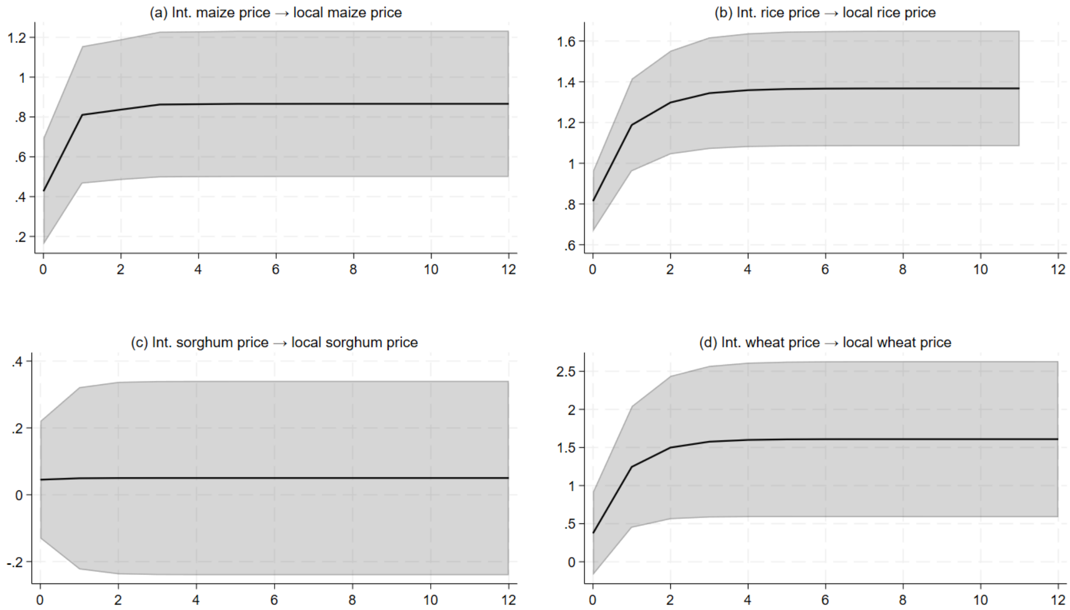


Figure 4: Cumulative IRFs computed from GMM Panel VAR. The grey areas, representing the 95% confidence bounds, are generated by Monte Carlo with 1,000 repetitions.

We present the cumulative IRF in Figure 4 to show the effects in levels rather than in log-differences. We achieve this task by aggregating the impacts over the forecast horizon (12 months). Although it appears that the form of Figure 4 differs from Figure 3, both exhibit similar interpretations. Specifically, wheat prices appear to have the highest total amount of pass-through effect from international price shocks (1.5.%), followed by rice (1.38%) and maize (0.82%). These figures are comparable but slightly higher than findings from previous studies. For example, Arnade et al. (2017) report an estimate of less than 1% for the short-run pass-through of international rice price shocks to rice price in China. Focussing on developing economies, Baffes and Gardner (2003) find short-run pass through percentages generally lower than one, with the exception of maize in Egypt and in Colombia. In like manner, Dillon and Barrett (2016) find that a marginal change in international food prices is associated with a 0.22% change in maize price in Kenya. We conjecture that our slightly higher value than most previous works could be attributed to the use of panel data in detecting and measuring statistical effects that pure time series or cross-sectional data cannot. Additionally, our focus on least developed and fragile countries may also be a reason for such higher pass-through. While several countries tend to pursue price stabilization policies for food commodities, countries with problematic financial situations may be prevented from doing so. It is also important to state that while the effects appear marginal, translating to additional cents, they may not be negligible when translated to local currencies.[5]

4.2 Robustness checks

In this subsection, we use several alterations of equation (1) to ascertain the robustness of our baseline results. Specifically, our sensitivity analysis involves re-modeling equation (1) with more aggregated panel samples, with alternative international food prices for rice and wheat, as well as with different alterations of standard error corrections.

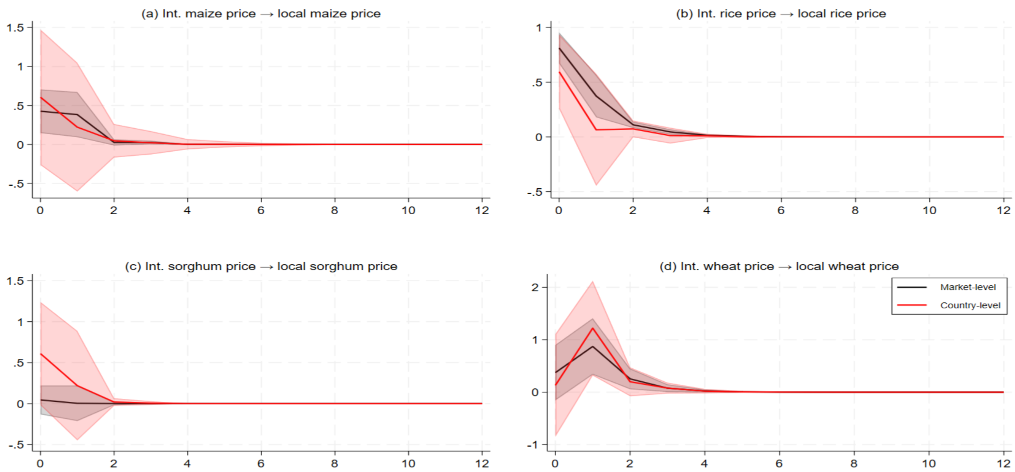


Figure 5: IRFs from country-level observations). 95% confidence bounds are represented by shaded areas.

Country-level analysis: Here, we rescaled our unit of observations from market-level to

[5] A simple back-of-the-envelope calculation reflects this point. For example, for a country that exchanges 1000 units of its currency for \$1, a 1.25% increase in food prices would translate to an additional 12.5 units of the local currency. The final price will then be 1012.5 units of the local currency.

country-level by taking the average value of food prices in all markets within a country per month. Hence, our cross-sectional units fall from 1209 markets to 23 countries as shown in Table A1 in the Appendix section. Figure 5 shows that our findings are unaffected by the choice of observational unit as the impacts follow a similar pattern as in the main result.

Different varieties of food items: In the main analysis we provided reasons for using certain classes of international food prices. For example, we show that rice (05) is preferable and more consumed in developing economies such as SSA than other varieties of rice (e.g., Vietnam rice, A1 rice, etc.). The same applies to the choice of soft wheat above hard wheat. Here, we show that our results retain their interpretation regardless of which variety of food prices we employ. Figure 6 displays the IRFs. Using other varieties of rice do not change the original findings of a positive impact, although certain varieties, like Vietnam rice and rice 25 pass-through a lower positive impact to local rice prices. On the other hand, using hard wheat or soft wheat makes no significant difference as they produce very similar IRFs.

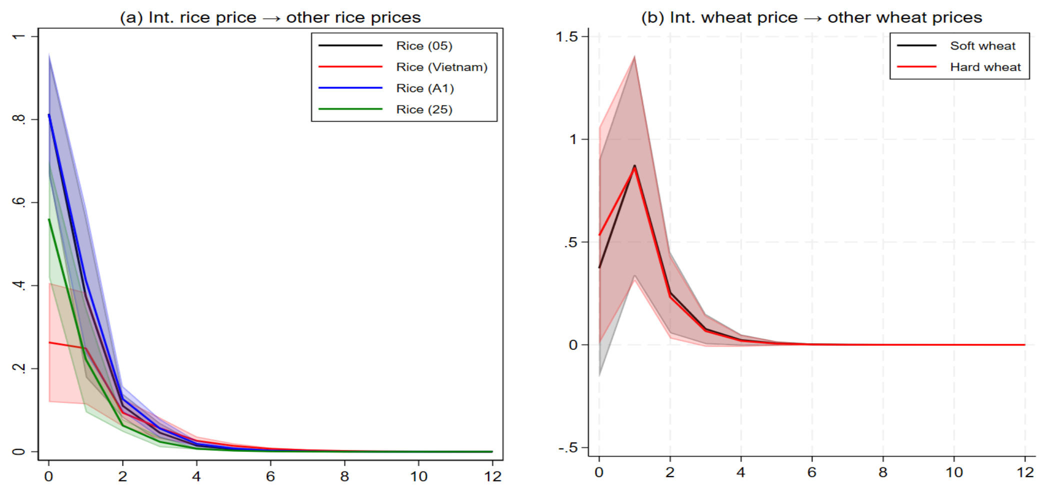


Figure 6: IRFs from food prices of alternative varieties of rice and wheat. 95% confidence bounds are represented by shaded areas.

Alternative standard error corrections: Equation (2a) is analyzed with spatially-clustered standard errors at market-level (ML). As part of the robustness tests, we re-analyze equation (1) with alternative standard errors correction: country-level (CL) clustering, clustering by year, bootstrapping, and unadjusted standard errors. The results in Figure 7 shows that, except unadjusted and by-year clustering, other corrections of standard errors produce analogous IRFs.

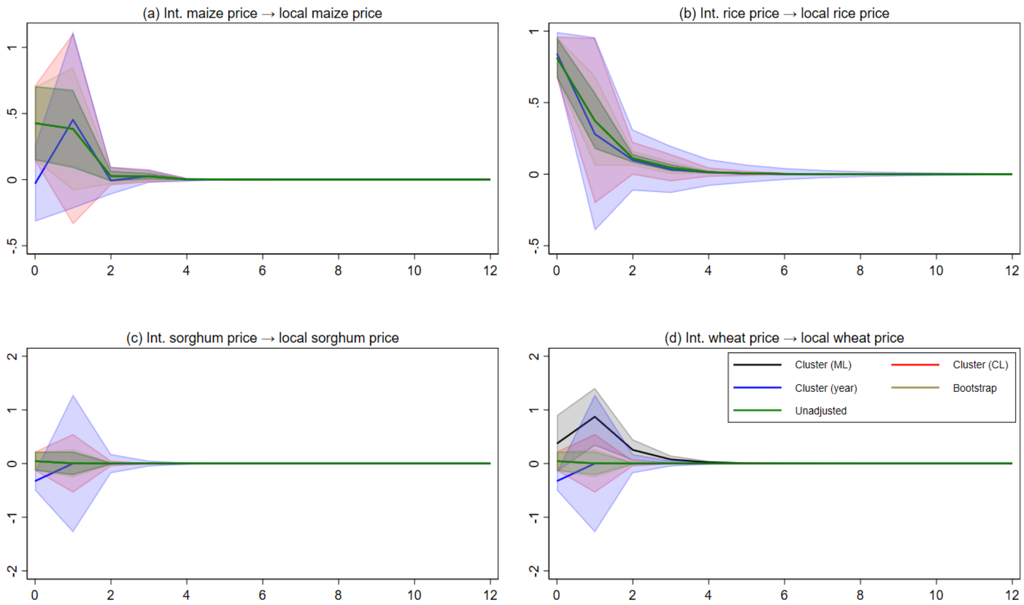


Figure 7: IRFs from alternative standard errors corrections. 95% confidence bounds are represented by shaded areas.

Summarily, the results from the various sensitivity tests show that our findings regarding the impact of global food price fluctuations are robust.

4.3 Investigating channels and sources

Next, we investigate where the impacts are coming from. Are there areas or periods where the impact of shocks to international food prices are greater? We conduct this exercise by showing the results of the estimated model specific to (i) each region (ii) West Africa (iii) non-COVID-19 era.

Figure 8 shows the IRFs from maize and rice prices. We exclude wheat and sorghum as most of the observations for the local prices of these commodities come from a single

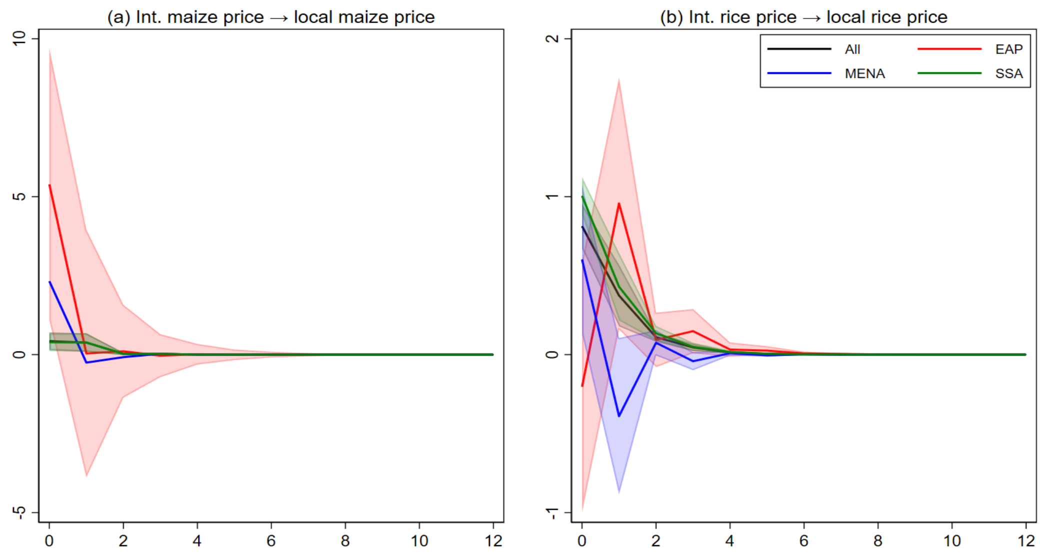


Figure 8: IRFs from Regional Analysis. 95% confidence bounds are represented by shaded areas.

region, as shown in Table A1 of the appendix, thereby making the heterogeneity analysis impossible. Figure 8 reveals that East Asia and Pacific (EAP) and Middle East and North African (MENA) are the most impacted regions in terms of global maize price fluctuations. This is easily explained by the fact that these regions are far more dependent on imports of maize than Eastern and Western sub-Sahara African (SSA) countries. In fact, if we look at the ratio of net imports (imports minus exports) over the total domestically produced quantity[6], we can observe, for maize, a value of roughly 201% for Northern African countries, lowering to 26% in South East Asia and to 14% in both South and East Asia. For Western and Eastern SSA countries, instead, this percentage is close to a mere 2%, testifying the lower dependence of this area on net imports of maize.

On the other hand, SSA countries are more affected by shocks to international rice price than the rest of the regions. Most SSA economies (even in Western African where large-scale production occurs) are yet to attain self-sufficiency in rice production (Emediegwu, 2023a).

[6]We used FAOSTAT as source of data, considering data from 2010 to 2021.

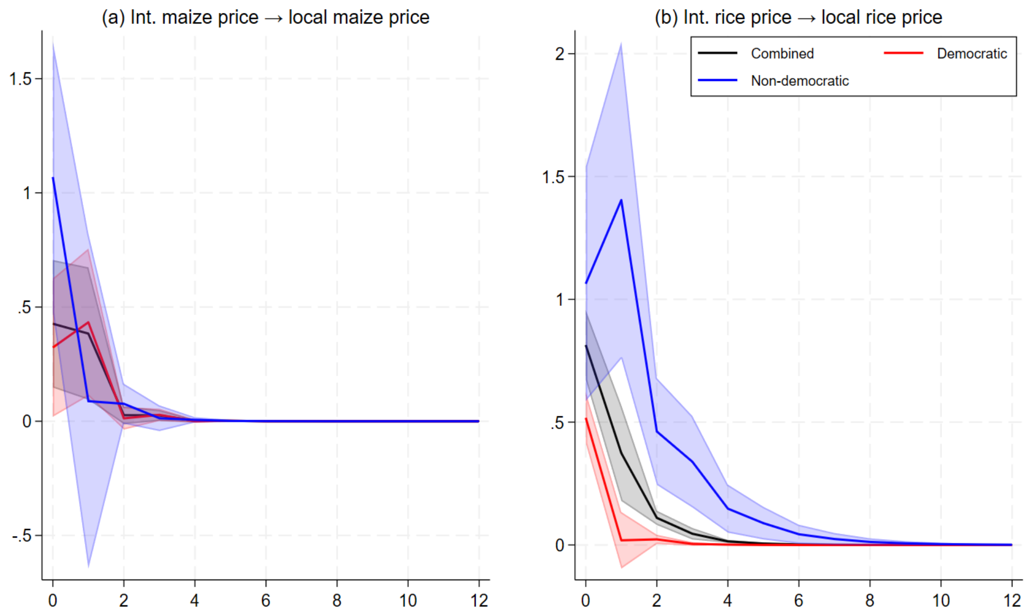


Figure 9: The impact of democracies and autocracies. The shaded areas, representing the 95% confidence bounds, are generated by Monte Carlo with 1,000 repetitions.

Therefore, to augment domestic needs, many rice-producing SSA countries import between 50% to 99% of their rice demand (FAO, IFAD, UNICEF, WFP, & WHO, 2018). We also provide further results in the Appendix (see, Figure A3) that show that the West Africa subregion is the most impacted subregion in SSA following global rice price fluctuations.

Also, we consider the influence of democracies as potential channels for the heterogeneous effects of international food price fluctuations on local food prices. We use Polity2 scores from the Polity5 database (Marshall and Gurr, 2018) to classify political regimes, which ranges from –10 (strongly autocratic) to +10 (strongly democratic).[7] Specifically, we classify a country as democratic if the average score over the sample period is positive, otherwise it is identified as autocratic. Figure 9 shows that the effect of international food prices shocks is higher in autocracies than in democracies. In this regard, we contribute

[7]Polity5 dataset, an extension of the Polity IV dataset, covers all major, independent states (i.e., nation-states with a total population of 500,000 or more in the most recent year) in the global system over the period 1800-2018. The dataset can be accessed *via* `https://www.systemicpeace.org/inscrdata.html`.

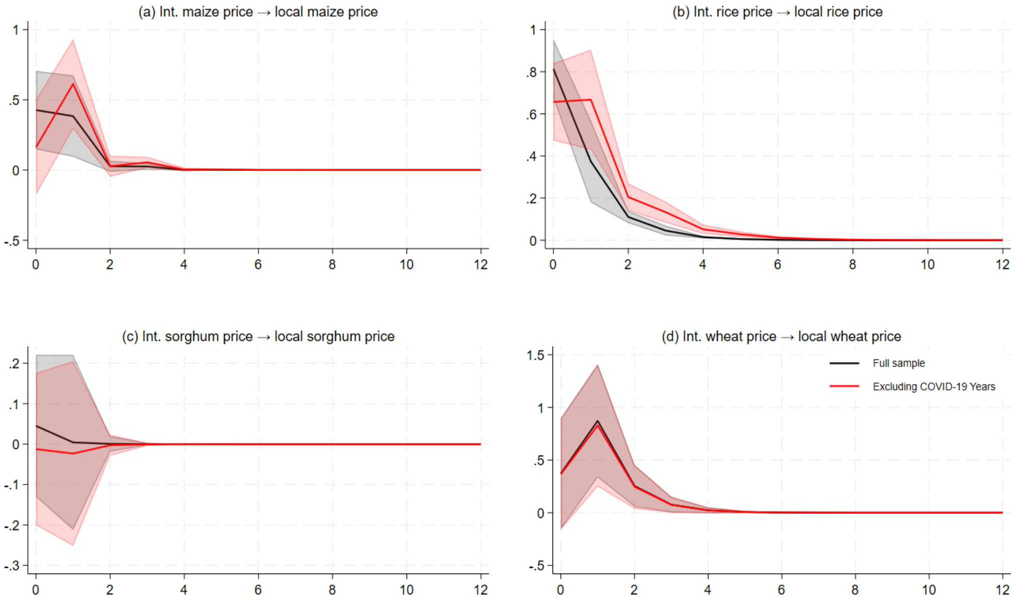


Figure 10: The impact of COVID-19. The shaded areas, representing the 95% confidence bounds, are generated by Monte Carlo with 1,000 repetitions.

to understanding the impact of political regimes (democracy vs. autocracy) on the food prices. Our results here fall in line with previous findings that suggest that systematic differences in food policy across regimes of different types moderate or amplifies the effects of global food price shocks. For example, Hendrix and Haggard (2015) show that democratic economies are more resilient to global food price shocks than autocratic systems because there is a higher possibility of price-induced civil unrest in the former than in the latter. In the same vein, Raleigh et al. (2015) evidence that commodities price fluctuations are less likely to result into violence when a state is democratic because of the positive relationship between democracy and economic growth; a view also shared by Acemoglu et al. (2019). Hence, prospered states develop safety nets and buffers to absorb shocks from global price fluctuations.

Lastly, we investigate whether our results are driven by the emergence of COVID-19 and the attendant restrictions to contain the pandemic. Several studies (e.g., Emediegwu and

Nnadozie (2023); Emediegwu (2020)) have shown that the pandemic exacerbated the food crisis in several developing economies because lockdowns and restrictions on free movement led to a decline in agricultural production and food imports. Figure 10 supports this prior findings as excluding COVID-19 years (Year 2020+) saw a slight decline in the impact on local food prices, with the exception of wheat prices. In the same vein, we suspect that the ongoing Russo-Ukrainian conflict would increase these effects significantly, although we cannot test this assumption in this present study as our data do not include the conflict years.[8]

5 Conclusion

A strong mechanism of commodities price transmission between international and local markets is generally seen as a useful feature for a country. A full and prompt transmission of movements of international prices to local markets encourages agents to direct their investments and efforts properly. Delays or a partial transmission may instead cause a misallocation of resources that may have to be subsequently corrected with costly measures. Clearly, a certain sluggishness in the transmission of prices from the international to local markets is impossible to eliminate. Besides this physiological gap between international and local prices, there may be several other reasons to slow down the transmission of movements. The desire of governments to stabilize local prices, particularly sensitive prices such as the ones of food commodities, is a reason, followed by the scarce integration of a country into the international market for political or physical reasons. These examples show some theoretically valid reasons for local prices to be rather unresponsive to movements in international prices.

How actually strong and efficient is the transmission mechanism is an empirical question that has received a consistent interest in the literature. Several authors focused on the effects of the liberalization processes undertaken by several developing countries on this

[8] While we do not have an empirical proof to this claim, our surmising is informed by an excellent piece on this subject documented in Emediegwu (2022a).

mechanism. In general, results have been very mixed, with some authors claiming that liberalizations did not have much effect and others contradicting such findings. Depending on the commodities and the group of countries analysed, authors have found, generally using VAR or ECM models, either signs of a strong transmission mechanism or a weak, when not completely absent, one. It is difficult, therefore, to find a clear pattern form the previous literature. Each country-product tuple seems to deserve an ad hoc analysis.

The present paper has analysed 23 countries among the least developed and most fragile with regard to four major staple crops: maize, rice, sorghum and wheat. By using a panel VAR model, we have found sign of significant price linkages between local and international prices for three of the mentioned crops. The only exception is sorghum, a crop that is actually used mainly as animal fodder by industrialized countries, while it is an important staple for several developing countries. On the light of its different use and considering the scarce participation of SSA countries in the international trade of this crop, it does not surprise the lack of linkage between international and local prices. Furthermore, the result obtained for this crop is consistent with the dedicated literature.

When comparing our results with the ones obtained by similar research papers, we can say that the transmission mechanism we observe is relatively strong. In fact, several papers, previously mentioned, evidence short-term pass-through values that are lower than 1% or even 0.5%, whereas our lowest fond values is 0.82% (maize). A further difference is the speed of transmissions that, in our case, appears to be fast: the international price shock is passed to local markets mostly in the first two months, then its effect vanishes. Once again, this differs from the results of other papers where shocks may keep to influence local prices for several months.

One possible explanation for such differences is the use of a panel setting that allows to better capture the transmission of price shocks. Besides this, it is also possible that the sample of analysed countries is part of the explanation. While a fast and strong transmission of prices is often seen as a signal of a responsive, efficient and well integrated markets, it may also be a sign of strong dependence from imports. Furthermore, we have mentioned that several countries adopt price stabilization policies, particularly for staples. In this case, a high value of the pass-through from shocks in international prices would signal the lack of capability to implement a price stabilization policy rather than the existence of an efficient market.

References

Abrigo, M. R. and Love, I. (2016). Estimation of panel vector autoregression in stata. *The Stata Journal*, 16(3):778–804.

Acemoglu, D., Naidu, S., Restrepo, P., and Robinson, J. A. (2019). Democracy does cause growth. *Journal of Political Economy*, 127(1):47–100.

Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1):29–51.

Arnade, C., Cooke, B., and Gale, F. (2017). Agricultural price transmission: China relationships with world commodity markets. *Journal of Commodity Markets*, 7:28–40.

Baffes, J. and Gardner, B. (2003). The transmission of world commodity prices to domestic markets under policy reforms in developing countries. *Policy Reform*, 6(3):159–180.

Balcombe, K., Bailey, A., and Brooks, J. (2007). Threshold effects in price transmission: the case of Brazilian wheat, maize, and soya prices. *American Journal of Agricultural Economics*, 89(2):308–323.

Baltagi, B. H. (2008). *Econometric analysis of panel data*, volume 4. Springer.

Baquedano, F. G. and Liefert, W. M. (2014). Market integration and price transmission in consumer markets of developing countries. *Food Policy*, 44:103–114.

Behnassi, M. and El Haiba, M. (2022). Implications of the Russia–Ukraine war for global food security. *Nature Human Behaviour*, 6(6):754–755.

Bekkers, E., Brockmeier, M., Francois, J., and Yang, F. (2017). Local food prices and international price transmission. *World Development*, 96:216–230.

Block, S. and Webb, P. (2009). Up in smoke: tobacco use, expenditure on food, and child malnutrition in developing countries. *Economic Development and Cultural Change*, 58(1):1–23.

Dillon, B. M. and Barrett, C. B. (2016). Global oil prices and local food prices: Evidence from East Africa. *American Journal of Agricultural Economics*, 98(1):154–171.

Emediegwu, L. E. (2020). How is coronavirus affecting food security in sub-Saharan Africa? https://www.economicsobservatory.com/how-coronavirus-affecting-food-security-sub-saharan-africa, (accessed November 03, 2021).

Emediegwu, L. E. (2022a). How is the war in Ukraine affecting global food prices? https://www.economicsobservatory.com/how-is-the-war-in-ukraine-affecting-global-food-prices, (accessed August 19, 2022).

Emediegwu, L. E. (2022b). How is the war in Ukraine affecting global food security? https://www.economicsobservatory.com/how-is-the-war-in-ukraine-affecting-global-food-security, (accessed September 06, 2023).

Emediegwu, L. E. (2023a). Assessing the (a) symmetric effect of global climate anomalies on food prices: Evidence from local prices. Technical report, Agricultural Economics Society-AES.

Emediegwu, L. E. (2023b). Has global food security been improved by the Black Sea Grain Initiative? https://www.economicsobservatory.com/has-global-food-security-been-improved-by-the-black-sea-grain-initiative, (accessed September 06, 2023).

Emediegwu, L. E. and Nnadozie, O. O. (2023). On the effects of COVID-19 on food prices in India: a time-varying approach. *European Review of Agricultural Economics*, 50(2):232–249.

Esposti, R. and Listorti, G. (2013). Agricultural price transmission across space and commodities during price bubbles. *Agricultural Economics*, 44(1):125–139.

FAO, IFAD, UNICEF, WFP, & WHO (2018). *The State of Food Security and Nutrition in the World 2018: Building climate resilience for food security and nutrition.* FAO Rome.

Filgueira, T., Freitas, E., Quevedo Filho, I., Fernandes, D., Watanabe, P., and De Oliveira, A. (2014). Corn replacement by broken rice in meat-type quail diets. *Brazilian Journal of Poultry Science*, 16:345–350.

Fjelde, H. (2015). Farming or fighting? Agricultural price shocks and civil war in Africa. *World Development*, 67:525–534.

Gollin, D., Parente, S. L., and Rogerson, R. (2007). The food problem and the evolution of international income levels. *Journal of Monetary Economics*, 54(4):1230–1255.

Hariprasanna, K. and Rakshit, S. (2016). Economic importance of sorghum. In *The Sorghum Genome. Compendium of Plant Genomes*, pages 1–25. Springer.

Hazell, P. B. R., Jaramillo, M., and Williamson, A. (1990). The relationship between world price instability and the prices farmers receive in developing countries. *Journal of Agricultural Economics*, 41(2):227–241.

Hendrix, C. S. and Haggard, S. (2015). Global food prices, regime type, and urban unrest in the developing world. *Journal of Peace Research*, 52(2):143–157.

Ivanic, M., Martin, W., and Zaman, H. (2012). Estimating the short-run poverty impacts of the 2010–11 surge in food prices. *World Development*, 40(11):2302–2317.

Love, I. and Zicchino, L. (2006). Financial development and dynamic investment behavior: Evidence from panel var. *The Quarterly Review of Economics and Finance*, 46(2):190–210.

Marshall, M. G. and Gurr, T. R. (2018). Polity5 Political Regime Characteristics and Transitions, 1800-2018. Dataset Users' Manual. *Center for Systemic Peace.*

Meyimdjui, C. and Combes, J.-L. (2021). *Food price shocks and household consumption in developing countries: the role of fiscal policy.* International Monetary Fund.

Morisset, J. (1998). Unfair trade? The increasing gap between world and domestic prices in commodity markets during the past 25 years. *The World Bank Economic Review*, 12(3):503–526.

Mundlak, Y. and Larson, D. F. (1992). On the transmission of world agricultural prices. *The World Bank Economic Review*, 6(3):399–422.

Posner, E. S. (2000). Wheat. In *Handbook of Cereal Science and Technology, Revised and Expanded*, pages 1–29. CRC Press.

Raleigh, C., Choi, H. J., and Kniveton, D. (2015). The devil is in the details: An investigation of the relationships between conflict, food price and climate across Africa. *Global Environmental Change*, 32:187–199.

Subervie, J. (2011). Producer price adjustment to commodity price shocks: An application of threshold cointegration. *Economic Modelling*, 28(5):2239–2246.

Timmer, C. P. (1989). Food price policy: The rationale for government intervention. *Food Policy*, 14(1):17–27.

Appendix

Figure A1: Correlation of Prices of Different Types of International Commodities

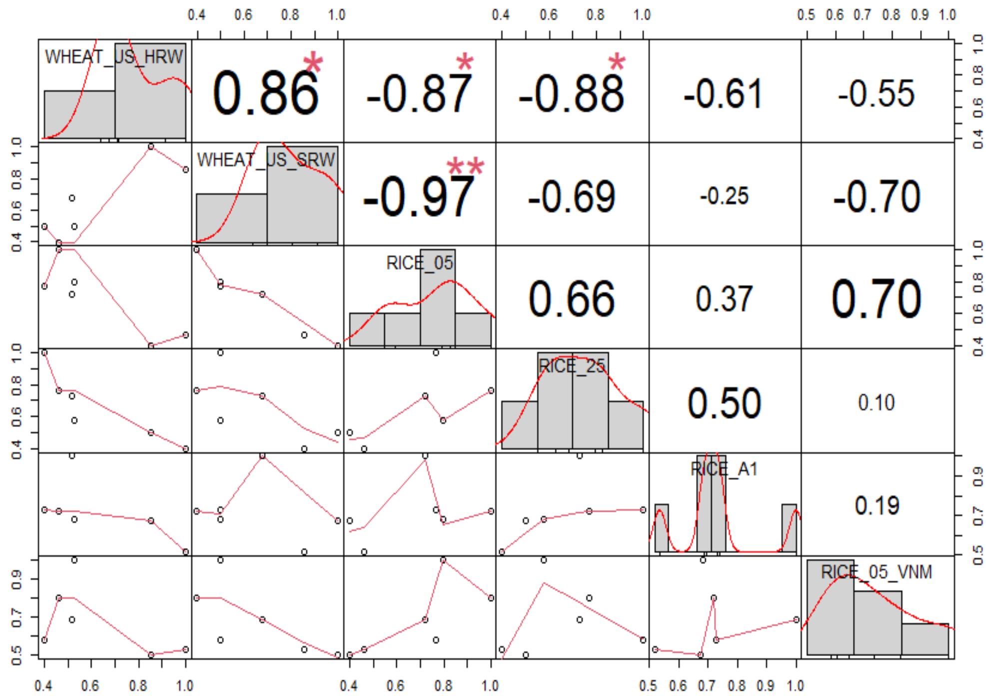


Table A1: Summary of Sampled Markets and Commodities

Country	*No of markets*	*Commodities (No)*
Central Africa		
Cameroon	81	maize, rice, sorghum
Central African Republic	42	maize, rice, sorghum
Chad	61	maize, rice, sorghum
Eastern Africa		
Congo	10	rice
Burundi	72	maize, rice, sorghum
South Sudan	28	maize, sorghum
Southern Africa		
Mozambique	98	maize, rice
Western Africa		
Burkina Faso	64	maize, rice, sorghum
Guinea-Bissau	45	maize, rice, sorghum, wheat
Gambia	28	maize, rice, sorghum
Liberia	24	rice
Mali	111	maize, rice, sorghum, wheat
Niger	68	maize, rice, sorghum, wheat
Nigeria	35	maize, rice, sorghum
Middle East & North Africa (MENA)		
Iraq	19	rice
Lebanon	26	rice
Sudan	15	sorghum, wheat
Syria	94	maize, rice
Yemen	24	wheat
East Asia & Pacific		
Lao	17	rice
Myanmar	198	maize, rice
Latin America & Caribbean		
Haiti	9	rice, sorghum
Southern Asia		
Afghanistan	40	rice, wheat
Total: 23	***1209***	

Prices are in US$ in real teams per kg of the above-listed food items.

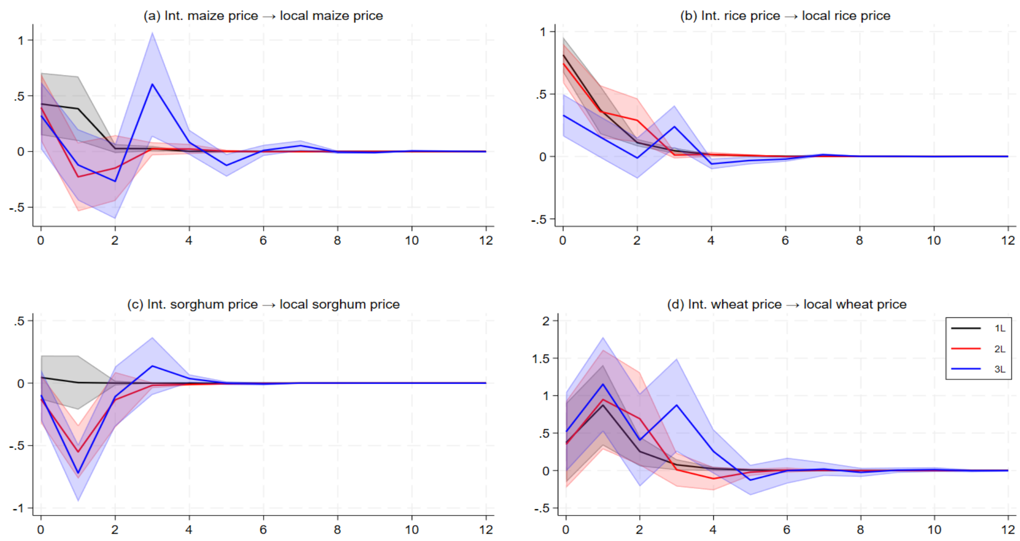


Figure A2: IRFs from lag alterations. 95% confidence bounds are represented by shaded areas.

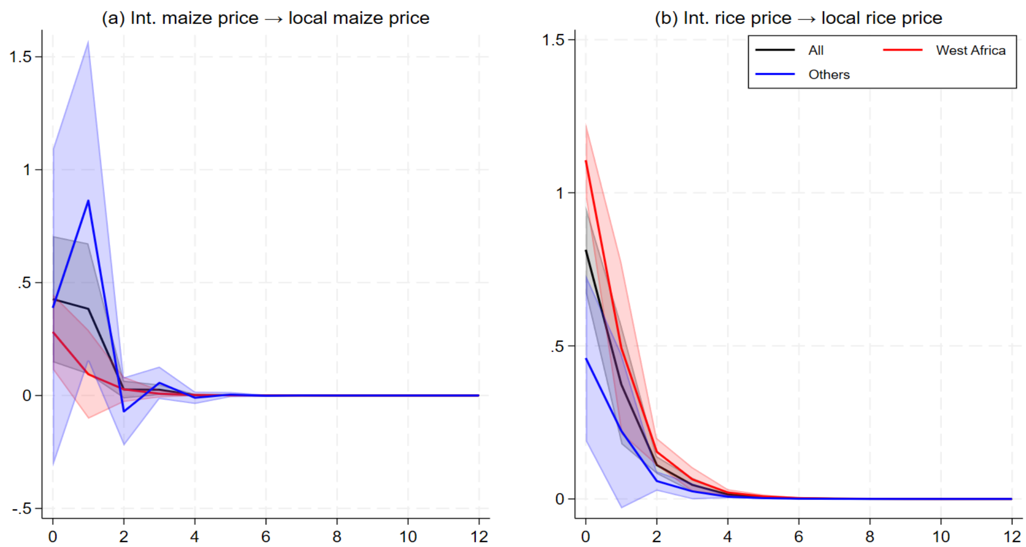


Figure A3: The impact of West Africa. Impulse-response functions computed from GMM Panel VAR. The shaded areas, representing the 95% confidence bounds, are generated by Monte Carlo with 1,000 repetitions.