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# Russia-Ukraine War and Food Prices in Low-and Middle-income Countries

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This study examines the impact of the Russia-Ukraine war on food prices in 12 low-and middle-income countries (L&MICs) using Mean Group and Pooled Mean Group techniques on monthly data from January 2021 to April 2023. The study confirms the long run positive and significant impact and the short run negative and insignificant influence of the war. It thus recommends economic diversification by L&MICs to substitute the imported food products from the war zone.

## I. Introduction

The Russia-Ukraine war, which broke out on 24th February 2022, emerged when the world was still struggling to recover from the devastating consequences of the COVID-19 pandemic and appears to have imposed severe threats to mankind's survival. Apart from conflicting findings in the literature about the war's impact (e.g., Arndt et al., 2023; Lopes & Martin-Moreno, 2022), we are motivated by the recent World Bank (2022) report about the renewed upsurge in global food prices. Low-and middle-income countries (L&MICs) constitute about 86% of the total population of the world's economically vulnerable group, implying that the largest global share of the market is also from these countries (World Bank, 2022).

Russia and Ukraine are prominent players in the global cereal export market; they contribute about 20% of the total barley production and rank as the third and fourth largest exporters, respectively. Together, they respectively represented 50% and 25% of the global sunflower oil exports from 2016 to 2021 (United Nations, 2022). Ukraine is the third largest global exporter of rapeseed and soybean to the Americas, whereas Russia is consistently ranked as the second and third leading supplier of potassic and phosphorous fertilizers, respectively, accounting for over 15% of global fertilizer exports in 2020. Interestingly, both countries are also net importers of animal products (United Nations, 2022).

Considering the pivotal role of Russia and Ukraine in the global agricultural input markets, the ongoing war and its associated political responses are expected to have far-reaching consequences for producers and consumers. Existing research on the war primarily relies on descriptive statistics and predominantly focuses on developed economies (Sohag et al., 2023; Tank, 2022). The prominent channels of transmission identified in the literature include import price hike and financial factors (Arndt et al., 2023). There is a notable empirical gap as no previous study, to the best of the researchers' knowledge, has explored the quantitative impact of the conflict on food prices in L&MICs, which are particularly more fragile and vulnerable to external shocks due to their persistent reliance on food imports. Consequently, we contribute to the literature by employing the second generation of panel data techniques, specifically the Mean Group (MG) and Pooled Mean Group (PMG), to investigate the phenomenon in L&MICs. Unlike the static traditional panel data methods, these techniques are capable of accounting for heterogeneity among the individual countries. Thus, we restructure the remaining part of the study as follows: After the introduction in section I, we present the data and methodology in section II, results and discussion in section III, and the conclusion in section IV.

## II. Data and Methodology

### A. Data

Monthly data from January 2021 to April 2023 (28 months) regarding key variables were obtained from 12 selected L&MICs. The start period was chosen to avoid the overlapping influence of the COVID-19 pandemic, which had over 75% of its restrictions lifted in December 2020, signaling the gradual recovery of the global economy (World Bank, 2022). The sampled countries include Burkina Faso, Burundi, Cameroun, Central African Republic (CAR), Chad, Congo DRC, Congo Republic, Lao PDR, Niger, Nigeria, South Sudan, and Yemen. These countries were strictly selected based on data availability. Details of the data used in this study are presented in Table 1.

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**Table 1. Data Description**

| S/N | Variable | Description | Source |
|---|---|---|---|
| 1 | INF | Food price inflation (month-on-month % change) | World Bank WDI |
| 2 | EXR | Nominal exchange rate (monthly values in US $) | IMF |
| 3 | RINTR | Real interest rate (%) | IMF |
| 4 | GDP | Gross domestic product (at current prices in billions of US $) | World Bank WDI |

Table 1 reveals the details of all the variables used in this study. It shows the detailed description of the variables and their respective sources of data, including the units of measurements.

## B. Model specification

This study is anchored in the structuralist theory of inflation which could be attributed to the works of Pinto (1947), Noyola (1956) and Sunkel (1958). The theory ascribes inflationary pressure in the developing countries (particularly the L&MICs) to structural rigidities occasioned by factors such as persistent war, which often fuels supply gaps, thus necessitating persistent food importation. Based on this theory, we conceptualized the baseline and alternative models to explain the impact of the war on food prices. We began by specifying the reduced form of the baseline model, which accounted for the traditional determinants of food prices (inflation) and is represented as follows:

$$INF = f(EXR, RINTR, GDP, TEW) \tag{1}$$

Where *TEW* stands for time effect of the war dummy, *INF* is food price inflation, *EXR* represents nominal exchange rate, *RINTR* is real interest rate and *GDP* is gross domestic product. Equation 1 could be explicitly captured to reflect the country-specific and time-varying effect of the variables in a stochastic form as follows:

$$\begin{aligned} INF_{it} = \alpha_i + \delta_t + \beta_1 INF_{i,t-1} + \beta_2 EXR_{it} \\ + \beta_3 RINTR + \beta_4 GDP_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

Where $\beta_1 - \beta_4$ are the structural parameters to be estimated, $\alpha_i$ and $\delta_t$ represent the country-specific and time effect intercepts, and $\varepsilon_{it}$ stands for the idiosyncratic white noise disturbance. In model 2 (the alternative model), war impact is isolated and captured as a dummy variable ( 0 for pre-war period effect ranging from January 2021 to February 2022 and 1 for the post-war period effect from March 2022 to April 2023). Google Trends was used, as it has the capacity to directly measure returns from news as opposed to other similar methods (Salisu & Vo, 2020). The model is stated as follows:

$$INF = f(TEW) \tag{3}$$

## C. Estimation Techniques

This study utilizes both the MG and PMG methods for estimation, given the heterogeneous and dynamic nature of the panel series under consideration (N=12 and T=28). Additionally, the result of the Hausman test points to the adoption of the PMG for model 1 (the multivariate) and MG for model 2 (the bivariate model). Under the null hypothesis, PMG is by default the preferred (restricted model) which constrains the long-run parameters but allows short-run coefficients to vary across panel groups, while the MG is the unrestricted estimator. The null hypothesis is that PMG is the preferred estimator.

## III. Results and Discussions

First, the descriptive statistical tests reveal that food prices rose by 18.3% on average, while the mean exchange rate stands at 1,838.97 units, with a high spread. The results further indicate that only food price inflation achieved stationarity at levels for the Levin-Lin-Chu test. The remaining variables were integrated at first difference for the unit root test with common, individual process, cross-sectional dependence, or no unit root process. Thus, the series has a mixed order of integration, and there is no evidence of cross-sectional dependence among the panels. Also, there is a long-run cointegration among the variables based on Kao (1999), Pedroni (2004) and Westerlund (2005) test results. Table 2 presents the estimated results of the MG and PMG models.

The PMG estimator was preferred for model 1 and the MG estimator for model 2 according to the Hausman test result. The PMG short-run estimates reveal that the error correction (EC) factor which shows the speed of adjustment towards the long-run equilibrium is negative and significant for some countries. Table 2 also reveals that exchange rate positively varied with food inflation in the short-run for Cameroun, CAR, and Yemen Republic but negatively for Lao PDR, though with a positive and significant long-run impact. This could be due to structural variations or rigidities in terms of the type of exchange rate regime adopted, degree of trade openness or innovation experienced. Exchange rate depreciation/devaluation is expected to increase food prices by 0.00364 units in the long-run, which conforms with Tank's (2022) finding. Given the import dependent nature of these economies, depreciation may raise prices in their domestic economies perhaps due to supply disruptions from the war zone. In the long run, policy adjustments in the form of export diversification, import substitution, and trade restrictions may boost the value of domestic currencies, accounting for the positive relationship.

Further analysis from Table 2 shows that the time effect of the war accounts for significant positive changes in food prices in the long run but is only significant in the short run for Burkina-Faso, Lao PDR, and Yemen Republic. This implies that the war has triggered higher food prices in these countries, which aligns with the findings of Sohag et al. (2023) but partially contrasts with Lopes & Martin-Moreno's (2022) results. However, negative results were ob-

**Table 2. Impact of the War on Food Prices**

| Variables | Long-run Estimates | Burkina Faso | Burundi | Cameroon | Central African Republic (CAR) | Chad | Congo, DRC | Congo, Rep. | Lao PDR | Niger | Nigeria | Soutd Sudan | Yemen, Rep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Multiple Regression Model Results (PMG Results): Hausman Test (Chi-Square) =5.76 | | | | | | | | | | | | | |
| Ec | | -0.0402 | -0.140 | 0.0774 | -0.369** | -0.136 | -0.600*** | -0.365** | -0.645*** | -0.0640 | -0.0359* | -0.143*** | -0.0496 |
| | | (0.0636) | (0.117) | (0.0780) | (0.170) | (0.136) | (0.138) | (0.149) | (0.125) | (0.0603) | (0.0204) | (0.0431) | (0.0461) |
| D.IINF | | 0.703*** | 0.0785 | -0.0514 | 0.169 | 0.492** | 0.316** | 0.189 | 0.355*** | 0.411** | 0.306** | 0.388*** | 0.552*** |
| | | (0.164) | (0.212) | (0.222) | (0.232) | (0.229) | (0.153) | (0.205) | (0.129) | (0.193) | (0.142) | (0.137) | (0.172) |
| D.EXR | | 0.0729 | -2.893 | 0.0471** | 0.112* | 0.0275 | -0.181 | 0.0167 | -0.00154** | 0.000787 | 0.0548 | 0.0734 | 0.0261*** |
| | | (0.0783) | (2.177) | (0.0198) | (0.0658) | (0.037) | (0.312) | (0.0645) | (0.00072) | (0.0284) | (0.0872) | (0.0487) | (0.00927) |
| D.TEW | | 11.51*** | -1.967 | -1.089 | -0.246 | 1.525 | -4.603* | -2.411 | -3.448*** | 0.447 | -2.288 | -3.586 | 10.25** |
| | | (3.793) | (2.615) | (1.122) | (3.641) | (1.902) | (2.657) | (4.232) | (1.094) | (1.555) | (2.902) | (7.249) | (4.964) |
| D.RINTR | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| D.GDP | | -15.11 | -24.26 | -0.203 | 22.34 | 89.09 | 193.8** | 24.97 | -1.522 | -13.74 | 1.412 | -27.21* | 9.056 |
| | | (12.54) | (28.05) | (0.974) | (42.09) | (171.7) | (85.30) | (188.4) | (6.038) | (9.057) | (4.174) | (14.36) | (5.789) |
| EXR | 0.00364*** | | | | | | | | | | | | |
| | (0.00041) | | | | | | | | | | | | |
| TEW | 4.751*** | | | | | | | | | | | | |
| | (1.652) | | | | | | | | | | | | |
| RINTR | 0.0457 | | | | | | | | | | | | |
| | (0.200) | | | | | | | | | | | | |
| GDP | 1.663*** | | | | | | | | | | | | |
| | (0.391) | | | | | | | | | | | | |
| Constant | | -0.577 | 15.38 | 5.788 | -1.839 | -2.803 | -168.1*** | -9.072 | -37.67*** | -1.030 | -33.73 | 2.200 | -2.133* |
| | | (1.202) | (10.95) | (5.735) | (1.426) | (1.882) | (46.56) | (6.761) | (10.58) | (1.336) | (26.07) | (2.189) | (1.155) |
| Observations | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 |
| Bivariate Regression Model Results (MG Results): Hausman Test (Chi-Square)=5.44** | | | | | | | | | | | | | |
| Short Run Estimates | | | | | | | | | | | | | |
| Ec | | -0.0799 | -0.158 | -0.216 | -0.385* | -0.162 | -0.277** | -0.446*** | -0.188*** | -0.119 | -0.0701 | -0.160*** | -0.0689 |
| | | (0.0710) | (0.120) | (0.164) | (0.198) | (0.144) | (0.113) | (0.157) | (0.0418) | (0.0790) | (0.0480) | (0.0481) | (0.0555) |
| D.IINF | | 0.820*** | 0.292 | 0.347 | 0.322 | 0.550** | 0.272 | 0.241 | 0.320** | 0.416** | 0.325** | 0.357** | 0.401** |
| | | (0.162) | (0.233) | (0.250) | (0.251) | (0.241) | (0.192) | (0.216) | (0.155) | (0.205) | (0.162) | (0.153) | (0.196) |
| D.TEW | | 12.06*** | -1.924 | -0.218 | 1.375 | 1.873 | -3.684 | -2.262 | -4.215*** | 0.857 | -3.132 | -6.324 | 14.97** |

| Variables | Long-run Estimates | Burkina Faso | Burundi | Cameroon | Central African Republic (CAR) | Chad | Congo, DRC | Congo, Rep. | Lao PDR | Niger | Nigeria | Soutd Sudan | Yemen, Rep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (4.179) | (3.240) | (1.240) | (4.142) | (2.099) | (3.349) | (4.336) | (1.400) | (1.663) | (3.167) | (8.116) | (5.991) |
| **Long Run Estimates** | | | | | | | | | | | | | |
| TEW | | -3.610 | 22.78*** | 2.589 | 5.565 | 2.441 | 25.39*** | 2.707 | 24.36*** | -10.03 | 4.034 | 48.37* | -82.42 |
| | | (30.83) | (7.105) | (2.644) | (3.884) | (6.537) | (4.108) | (3.223) | (2.832) | (6.701) | (36.28) | (27.70) | (80.17) |
| Constant | | 1.767 | 1.745* | 1.166 | 1.152 | 1.209 | -0.0731 | 1.054 | 1.134*** | 0.796 | -0.130 | 1.729 | 4.207 |
| | | (2.044) | (0.976) | (0.789) | (1.480) | (1.122) | (0.868) | (1.177) | (0.409) | (0.709) | (2.509) | (3.548) | (2.651) |
| Observations | | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 | 312 |

Note: Table 2 contains the summary of the multivariate (PMG) and the bivariate (MG) models in the short run and long run for all the selected countries, presented in the upper and lower panels respectively. For the PMG model, only the short run results are presented across the panels, whereas the long run results are restricted or pooled together. As for the MG model, we have results across all the individual countries for both the short run and long run periods. Standard errors are in parentheses while ***, ** and * stand for statistical significance at 1%, 5% and 10% respectively.

tained for Burundi, Cameroun, CAR, Congo DRC, Congo Republic, Lao PDR, Nigeria, and South Sudan. This may be attributed to the geographical distance of those countries from the war zone since they have limited direct trade and economic ties as compared to their neighbouring countries with whom they have closer economic relationships. Moreover, these countries may have produced a significant portion of their food domestically and may be less reliant on food imports from the countries affected by the war.

GDP remains positive and significant in the long run, though predominantly negative and insignificant for most countries in the short run. This suggests that national income is a driver of food prices, which corroborates Sohag et al.'s (2023) finding that output imposed asymmetric shocks in Eastern and Western Europe via geographical risk threat. Initial increase in GDP may gradually lead to increased aggregate spending on foodstuff which accelerates prices. Real interest rate appears to produce a rather sterile effect in all the countries. Most of these economies are characterized by a huge size of the informal sector and are largely non-monetized, rendering monetary policy impotent. In the long run, however, apart from real interest rate, all the other predictor variables significantly explain food inflation.

In model 2, the study regresses only the time effect of war on food inflation in order to clearly ascertain their mutual interactive effect. The results are also contained in Table 2. The speed of adjustment is negative for all the countries. The short-run war effect is still positive for Burkina Faso, Chad, and Niger, though insignificant for other countries. In the long run, it became positive and significant in Burundi, Congo DRC, Lao DPR and South Sudan, which conforms with Arndt et al.'s (2023) finding. The insignificant impact for some countries may indicate that they may not be direct trading partners with Russia and Ukraine or that the volume of their imports may not be too strong to have a significant positive impact.

## IV. Conclusion

Motivated by the persistence of the Russia-Ukraine war, amidst conflicting submissions about its global economic impact, this study investigates the time effect of the war on food prices in 12 L&MICs, using the MG and PMG methods, given their ability to capture heterogeneity across the panels more efficiently than other methods. In sum, this study submits that the war has a long-run positive and significant impact, though with a negative but insignificant short-run influence on food prices for most of the countries. We therefore recommend that L&MICs diversify their economies by investing in locally-produced commodities rather than those initially imported from the war zone to be insulated from the negative price shock imposed by the war.

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