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Double shocks: Russia-Ukraine conflict and COVID-19 impacts on the rice value chain, trade and fertilizer use in Africa

Rachidi Aboudou^{1,2}, Martin Paul Jr. Tabe-Ojong³, Aminou Arouna¹, Jacob Afouda Yabi²

¹AfricaRice Center (AfricaRice), 01 BP: 2551 Bouaké 01, Côte d'Ivoire.

²University of Parakou, Lab. of Analysis and Research on the Economic and Social Dynamics, Benin

³World Bank Group, United States

*Corresponding author: rachidiaboudou@gmail.com; r.aboudou@cgiar.org

1. Introduction

In 2020, the world witnessed the emergence of one of the most damaging pandemics in recent times, which has been associated with food and nutrition insecurity. When things were somewhat improving two years later, the Russia-Ukraine conflict showed its face in February 2022 with further implications for food and nutrition security. These double shocks impose serious constraints on various staple value chains including rice, which is heavily consumed in many parts of Africa. With global markets already disrupted by the COVID-19 pandemic, the crisis in the Black Sea region and climate shocks have further strained supply chains and raised prices, intensifying concerns for African countries that rely heavily on food and fertilizer imports. Many African countries depend on Russia and Ukraine for food import in many aspects. The dependence of African countries on fertilizer imports from conflict zones is also high. Overall, more than half of the African countries import fertilizer from either Russia or Ukraine (Badiane et al., 2022).

Rice, a crucial staple food in Africa's agriculture sector, provides around 9% of the continent's caloric intake and serves as a primary energy source, especially in West Africa (Fig 1). In this study, we examine how the rice value chain was fairing during the COVID-19 pandemic and the Russia-Ukraine conflict in Africa. We look at various aspects such as prices, production, yields, consumption, and trade. Previous studies have examined the impact of the COVID-19 and Russia-Ukraine conflict on food and nutrition security (Arndt et al., 2023; Tabe-Ojong et al., 2023; Mottaleb et al., 2022), but there is limited research on the impact of both crisis and fertilizer use, particularly on the rice value chain. Our paper answers this research question: What are the impacts of the COVID-19 pandemic and the Russia-Ukraine conflict on the rice value chain and fertilizer use in Africa?

The remainder of this paper is organized as follows. First, we present the methodology, including the data used and impact identification strategies. Second, we report various findings of the study along with discussions, and the last section presents concluding remarks.

2. Material and Methods

Study area and data: Our analysis relies on different databases to understand the implications of the COVID-19 shock and Russian-Ukraine war on the rice value chain. We used publicly

available yearly data from different sources and databases such as the Food and Agriculture Organization of the United Nations (FAO)¹, the World Bank, and the United States Department of Agriculture (USDA)² to analyze changes before the COVID-19 pandemic, during COVID-19, and during the Russia-Ukraine war to gather data on different outcomes on cereals, trade, and fertilizer use (Fig 2).

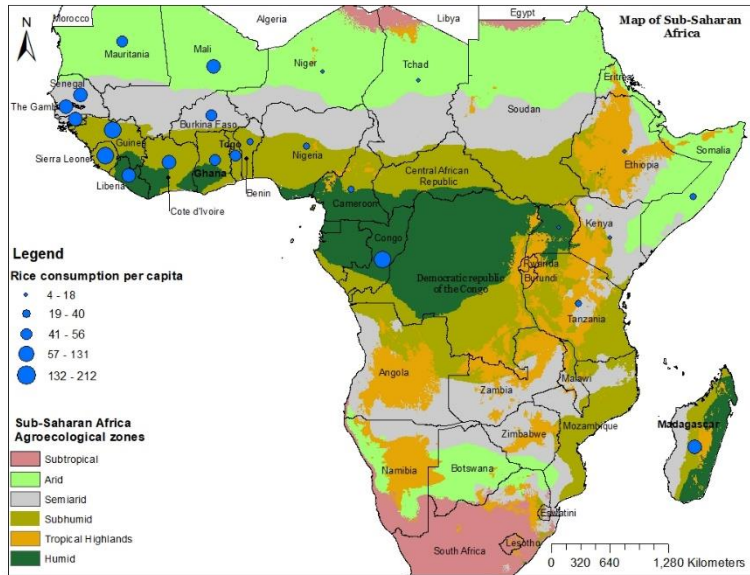


Fig 1. Study area and rice consumption in Africa

- Conditional (recursive) mixed-process estimator with multilevel random effects was used to assess the determinants of rice consumption during crises in Africa. We hypothesize that the consumption of rice in sub-Saharan Africa (SSA) was influenced by the rise in international prices of this commodity and fertilizers due to these recent crises.

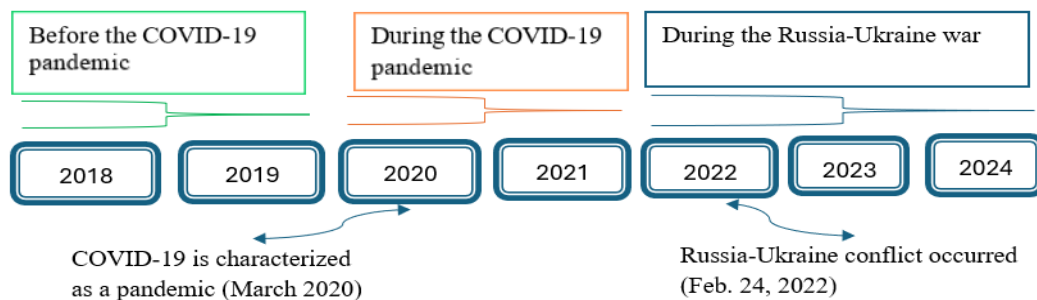


Fig 2. Timeline of the COVID-19 pandemic and the Russia-Ukraine war

3. Results and Discussion

Our investigation of the consequences of the recent crises on fertilizers and cereals in Africa yielded several interesting findings. The COVID-19 pandemic and the Russia-Ukraine conflict have had considerable and widespread consequences on the rice value chain, trade, and fertilizer utilization in Africa. Both COVID-19 and the Russian-Ukraine war were negatively associated with rice production and yield. The COVID-19 pandemic has had a profound impact on rice production systems in sub-Saharan Africa (SSA). Two years after the COVID-19 pandemic, the

¹ <http://www.fao.org/faostat/en/#data/QV>

² <https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery>

Data Analysis: We use two econometric models.

- Fixed effects regression model
The model is expressed as follows:

$$Y_{ct} = \alpha + \beta S_{ct} + \theta + u_c + v_{ct}$$

Where Y_{ct} refers to the outcomes of interest such as fertilizer and rice prices, S_{ct} refers to COVID-19 and the Russian-Ukraine war. X_{ct} is a vector of additional controls added to improve the precision of the regression estimates. v_{ct} refers to stochastic error term. β is the parameter estimate.

rice production system in SSA was negatively impacted by the pandemic, which was exacerbated by the ongoing Russia-Ukraine armed conflict (Fig 3 and 4 and Tables 1 and 2). Both shocks were positively correlated with an increase in fertilizer prices (urea and DAP) and an increase in cereal prices and global food prices (Fig 4) (Mottaleb et al., 2022).

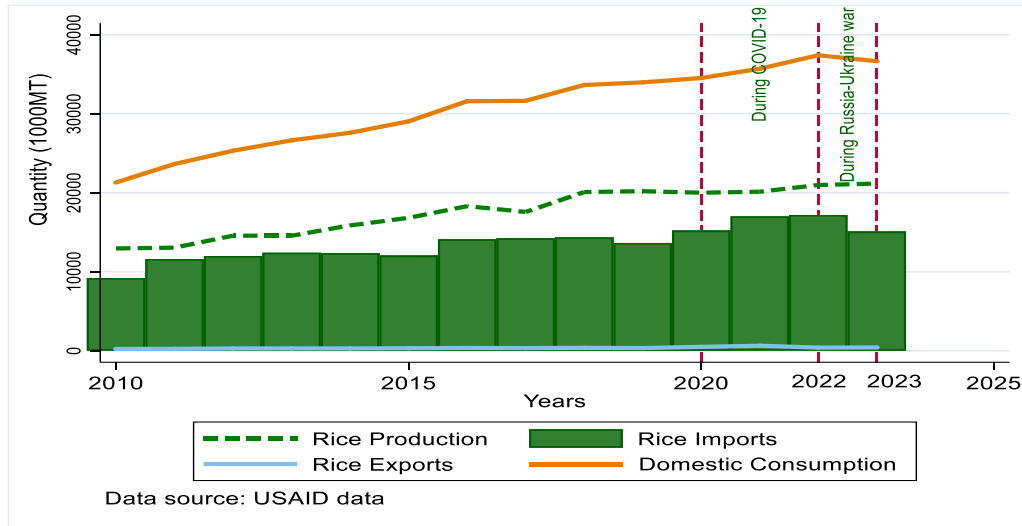


Fig 3. Rice production, exports, imports, and domestic consumption in Sub-Saharan Africa

The Russian-Ukraine war seems to have a more pronounced association with all these outcomes than the COVID-19 pandemic (Fig 4).

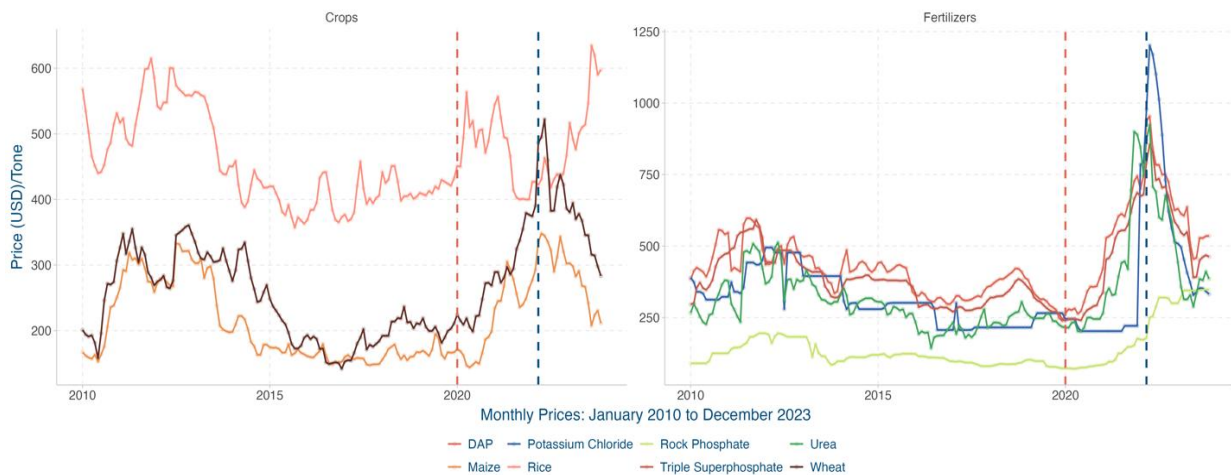


Fig 4. Monthly price trends of crops and fertilizers

Tables 1 and 2 show that the models are globally significant at the 1% level. We observed a positive association between COVID-19 and increases in urea, DAP, phosphate, and superphosphate prices. The empirical results show that during the COVID-19 pandemic, the prices of urea and DAP increased significantly by \$US 232 and \$US 240, respectively. We find evidence that during crises, rice, wheat, and maize prices increased by \$US 39, \$US 108, and US\$ 92, respectively (Table 1).

The results from the conditional (recursive) mixed-process estimator show that the rise in domestic prices of rice in Africa negatively influences rice consumption in SSA (Table 2).

Table 1. Crises and rice, maize, and wheat prices using the fixed-effect regression model

Variables	Rice price (\$US)	Wheat price (\$US)	Maize price (\$US)
COVID-19	39.08*** (2.03)	107.82*** (4.33)	91.82*** (5.01)
Russia-Ukraine war	76.52*** (8.41)	179.43*** (6.85)	117.73*** (4.66)
Constant	400.85*** (131.70)	197.61 (286.50)	209.43 (321.58)
Additional controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Number of countries	24	24	24
Number of observations	96	96	96

Table 2. Determinants of rice consumption during crises

Variables	ln (Rice consumption (kg/capita/ yearly))
Domestic price of rice (US\$/ton)	-0.15*** (0.05)
Rice importation (ton)	0.00*** (0.00)
Wheat importation (ton)	-0.00** (0.00)
ln (Rice Production)	0.28*** (0.02)
ln (Millet Production)	-0.08*** (0.02)
Constant	20.60*** (4.55)
No. of observations	144.00
Wald chi2(51)	5999.53
Prob > chi2	0.00
Log pseudolikelihood	-690.43

4. Conclusions and recommendations

The COVID-19 pandemic and Russia-Ukraine conflict have significantly impacted global food and nutrition security, particularly in SSA, where rice is a staple food. These crises have created a storm of challenges. The Russian-Ukraine war seems to have a more pronounced association with the increase in cereal prices and fertilizer, which are important for agricultural productivity. Policymakers in Africa must prioritize investments in building resilience in agri-food systems to mitigate the impact of future crises and encourage the development of regional fertilizer manufacturing plants to reduce reliance on imports.

References

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