# THE RUSSIAN INVASION OF UKRAINE, FERTILIZER PRICES, AND FOOD SECURITY

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ABSTRACT

This study assesses the impact of increased fertilizer prices under different scenarios on rice production, consumption, trade and prices. Using a global rice model based on a partial equilibrium framework, the simulation results show that a 30% to 100% increase in fertilizer prices would reduce rice yields by 0.45% to 1.33%, but increase world rice prices by 7% to 23% between 2022 and 2025. As the world market price for rice increases significantly, rice trade and rice consumption will decrease accordingly, estimated at 1.7% to 7.0% and 0.27% to 0.78%, respectively. The simulation results also show that retail prices for rice would increase significantly in all rice-consuming countries. The impact of higher fertilizer prices would vary widely in the major rice-producing countries.

Keywords: rice, world prices, Asia, rice trade, food security, partial equilibrium model
JEL codes: Q17, Q18, F51

## 1. Introduction

Fertilizer, especially nitrogen, is one of the primary inputs for rice production (Kousonsavath and Sacklokham 2020), especially for high-yielding rice varieties. About 16% of the world's nitrogen fertilizer is used for rice production (Heffer, Gruere, and Roberts 2017). Nitrogen is essential for plant growth (plant size, leaf width, and number of panicles). The critical period for nitrogen application in the plant life cycle is 21 days after seedling sowing. Farmers need to know the optimal nitrogen application rate because excessive use of nitrogen fertilizer could lead to excessive plant growth and provide a haven for pests. Phosphorus, another critical element in fertilizers, is essential for strong root growth. Finally, potassium, another component of fertilizer, contributes to pest resistance, plant durability and thickness, and panicle formation. Natural gas is a major input used in fertilizer production. Because of the export restrictions resulting from the Russian invasion of Ukraine, increased natural gas prices have led to higher fertilizer prices and reduced supply on the world market (FAO 2022; Glauber and Laborde 2022; World Bank Group 2022; Mottaleb, Kruseman, and Snapp 2022).

Russian forces invaded Ukraine on 24 February 2022. The Russian Federation is a major supplier of oil and natural gas to the world market. The world has imposed significant restrictions on Russian oil and natural gas exports. With no end in sight, the invasion seems to fuel the rising oil and natural gas costs. The Russian Federation is the world's largest exporter of oil and fertilizer (nitrogen) and the second largest exporter of potash and phosphorus fertilizer. Since the invasion, the Russian Federation has suspended fertilizer exports to other countries, putting upward pressure on fertilizer prices. Oil and fertilizer are critical to the global food system. In rice farming, depending

on the country in developing and emerging economies (DEEs), fertilizer expenditures account for 21% to 30% of total production costs (Chau and Ahamed 2022). The Russian invasion of Ukraine has led to severe international sanctions against the Russian Federation. As a result, the global economy is facing a significant increase in oil prices, shortages of fertilizers, and price volatility. One can argue that fertilizer markets will continue to depend on energy markets and geopolitical events.

Volatility in food prices affects consumers. On one hand, the Russian invasion of Ukraine has increased food price volatility, inflation, and logistics. Higher inflation could lead to higher prices, such as labor wages and fuel prices, and lower incomes. The linkages between food–energy and the food–stock market provide important explanations for rising costs (Serra 2011; Lahiani, Nguyen, and Vo 2013). Energy prices influence feedstock markets, especially crude oil prices (Tyner 2010; Zhang et al. 2010; Serra 2011; Vacha et al. 2013; Saghaian et al. 2018; Janda and Kristoufek 2019). Furthermore, crude oil explains post-crisis price volatility, a net transmitter of return spillovers. On the other hand, crops such as wheat and soybeans are net recipients of volatility (Hassen and El Bilali 2022; Wang et al. 2022). Indeed, farming costs have been affected by restrictions on Russian fertilizer exports (Adekoya et al. 2022; Bongou and Yatié 2022; Umar et al. 2022). A number of blog reports from the International Food Policy Research Institute (IFPRI) have documented the rise in fertilizer prices and the uncertain availability of prices for farmers in DEEs (Hebebrand and Laborde 2022a). The blogs point out that smallholder farmers will have difficulty paying for essential inputs, which could affect food

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security in many countries around the world, including Bangladesh (Mamun, Glauber, and Laborde 2022), Egypt (Abay et al. 2022),[1] Kenya (Breisinger et al. 2022), Nigeria (Balana et al. 2022), and Malawi (De Weerdt and Duchoslav 2022).

On the other hand, rising fuel costs are also problematic for fertilizer production. Natural gas is an input in the synthetic fertilizers used in many parts of the world. Agricultural production, including rice crops, consumes large amounts of fertilizers. As mentioned earlier, farmers apply large amounts of nitrogen fertilizer in rice cultivation to maximize yield. Most developing countries (India, Bangladesh, Thailand, Viet Nam, the Philippines, and the People's Republic of China [PRC]) produce rice as a staple food and rely heavily on imported fertilizers and oil. For DEEs, the problem is compounded because their budgets are stretched by fertilizer subsidies, price support, and increased inflationary pressures. For example, in DEEs with rice as a staple, policymakers have subsidized fertilizer to increase yield and food security for millions of low-income rural households. India, for example, relies on imported fertilizers and spends about $14 billion annually. As fertilizer prices rise, spending on imported fertilizer is bound to increase. Recently, Verma, Bhardwaj, and Ahmed (2022) reported that India will spend about $40 billion on food and fertilizer subsidies. About $18 billion will be spent on fertilizer subsidies. Ultimately, all of this has a significant impact on the livelihoods of farmers and rural populations and increases food insecurity for millions of people in Asia and around the world. Thus, it is of paramount importance to investigate the current and future effects of increased fertilizer prices on rice production, yields, farm-gate prices, and consumption.

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[1] According to recent data from international agencies, such as FAO et al. (2020), about 8.0% of the world's population suffers from hunger. von Grebmer et al. (2021) note that about 77 million people are severely food insecure due to wars and conflicts.