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TRANSMISSION OF FERTILIZER PRICE SHOCKS TO FOOD INFLATION IN SERBIA

Abstract: Over the past five years, the global economy has faced a series of major shocks and crises that have led to periods of exceptionally high inflation across both advanced and developing economies. Rising costs of energy, raw materials, and agricultural inputs have placed additional pressure on production chains, ultimately affecting consumer prices. In Serbia, food prices play a particularly important role in overall inflation dynamics due to their significant weight in the Consumer Price Index (CPI), 31.6% according to the COICOP classification. Additionally, the two indicators, the overall CPI and the Food Consumer Price Index in Serbia, exhibit positive linear relationship. Within this context, this study analyzes if shocks originating from agricultural input markets, specifically fertilizer prices, transmit through the production chain and are significantly affecting food prices in Serbia. Using a Vector Autoregression (VAR) framework, the analysis explores the relationship between Fertilizer Price Index, Agricultural Producer Price Index, and Food Consumer Price Index in Serbia, over the past twelve years. The findings suggest a transmission of fertilizer price shocks to agricultural PPI and indicate an indirect but economically meaningful effect on food inflation over the medium term.

Keywords: Fertilizer Prices, Food Inflation, Agricultural PPI, Vector Autoregression (VAR), Serbia

1. INTRODUCTION

Fertilizers represent an irreplaceable input in modern agriculture, contributing to plant health and enabling intensive farming on limited land. The large-scale application of ammonia-based fertilizers has increased global crop yields by 30-50%, especially for nitrogen-demanding staples such as corn, wheat, and rice, as well as for crops cultivated in nitrogen-poor soils (MIT Sloan, 2025), making them essential for global food security. This strong dependence on fertilizers also links agricultural productivity to developments in the energy sector.

Fertilizer production is closely tied to energy prices, as natural gas and coal are key inputs in the production of ammonia. Moreover, countries that are major exporters of crude oil and gas are often significant producers and exporters of fertilizers, since production costs are lower for them. As a result, the two markets share similar dynamics, with price fluctuations and supply and demand disruptions in the energy sector often reflected in the fertilizer market. As a global industry, the energy sector has frequently experienced major shocks and price volatility driven by such disruptions. Over the past decade, energy prices have been highly volatile, with two major shocks shaping the market. In 2020, the world faced the global COVID-19 pandemic, which led countries to close borders and impose quarantines in an effort to slow the spread of the virus. The sharp decline in travel, daily commuting, production, and industrial activity created a significant imbalance in the energy sector. The pandemic caused a sudden drop in demand for crude oil, increasing uncertainty and triggering a major economic recession in both developed and developing economies. Oil

prices reached record lows during this period, leaving oil-exporting countries with reduced revenues. As a result, the energy sector faced serious challenges, including layoffs and reduced investment in research and development.
The recovery of the energy sector that began as COVID-19 restrictions were eased was interrupted in early 2022, when Russia invaded Ukraine. In response, many countries, including the European Union and G7 nations, imposed sanctions on Russian crude oil and gas, among other products. This created demand-side pressures, contributing to high inflation and slowing economic growth, with Europe being particularly affected. Before the crisis, the European Union imported more than 150 bcm of gas per year from Russia. Between 2021 and 2023, these imports fell by over 70%, to approximately 43 bcm per year. Although imports increased slightly in 2024, they remained well below pre-war levels. Despite ongoing efforts to diversify supply, Russian gas is still expected to account for around 13% of the EU's total gas imports in 2025, highlighting the region's continued, though reduced, dependence on Russian energy sources (European Parliament, 2025).
Global shocks like these have a major impact on fertilizer prices, not only due to their close link with gas prices, but also because of the nature of the fertilizer industry. Similar to energy sector, the global fertilizer industry is characterized by a high degree of concentration, both geographically and at the company level. Production capacity for major fertilizer products is largely concentrated in a limited number of countries, reflecting the uneven distribution of key raw materials as well as the capital-intensive nature of fertilizer production (Hernandez and Torero, 2013). According to FAO Fertilizer Trade data, the top six exporting countries of nitrogen accounted for 53% of global nitrogen trade, with the Russian Federation as the largest exporter, holding 18.4% of total trade, followed by China and Qatar (details in Table 1). Figures for phosphate and potash are even higher, with the six largest exporters accounting for 67.3% of total phosphate trade, with Morocco leading at 18.9% of total trade. The six largest exporters of potash accounted for 79.3% of global potash trade, with the two largest players contributing almost 54% of total trade in 2023.
In many cases, only a few producers account for a substantial share of national production capacity, indicating the oligopolistic structure of the sector. At the same time, the fertilizer market has become increasingly globalized, with international trade expanding significantly, which has led to price formation becoming increasingly influenced by global market conditions. The integration of supply chains has also encouraged the adoption of "just-in-time" supply practices aimed at reducing inventory costs, which are particularly high for fertilizer products. However, relatively low stock levels make the industry highly vulnerable to unexpected disruptions (Ott, 2012).

Table 1: Export quantities and global trade share

A) Nitrogen Exports

Country	Export quantity (t) - Nitrogen	% in total Nitrogen trade
Russian Federation	8,234,299.99	18.73%
China	6,681,534.64	15.20%
Qatar	2,226,358.04	5.06%
Saudi Arabia	2,205,119.72	5.02%
United States of America	2,037,576.49	4.63%
Algeria	1,932,566.58	4.40%

Source: FAOSTAT, 2023

B) Phosphate Exports

Country	Export quantity (t) - Phosphate	% in total Phosphate trade
Morocco	4,670,279.38	18.91%
China	4,228,345.42	17.12%
Russian Federation	3,733,773.27	15.12%
Saudi Arabia	1,857,238.94	7.52%
United States of America	1,654,369.60	6.70%
Israel	466,428.31	1.89%

Source: FAOSTAT, 2023

C) Potash Exports

Country	Export quantity (t) - Potash	% in total Potash trade
Canada	13,705,612.16	34.77%
Russian Federation	7,561,333.59	19.18%
Belarus	2,930,829.51	7.43%
Jordan	2,675,788.06	6.79%
Israel	2,370,193.96	6.01%
Germany	2,014,131.94	5.11%

Source: FAOSTAT, 2023

With global markets facing two major shocks within a short time span, these events had significant consequences for both developed and developing economies. Prices of both energy and fertilizers increased sharply in 2022 and remained volatile in the following years. In 2022, after Russo-Ukrainian conflict started in late February, the price of crude oil increased by over 44% compared to January same year (World Bank, 2025). Fertilizers, most notably potassium chloride, also known as muriate of potash (MOP), followed this trend. In April 2022, the price of MOP, which is mainly

exported by Russia and Belarus, was 53% higher than in January of the same year (U.S. Department of Agriculture, 2023). These shocks were transmitted to final prices, contributing to a surge in overall inflation. In the European Union, annual inflation reached a record high of 9.2% in 2022, more than tripling from 2.9% in 2021 (Eurostat, 2023). However, inflation was even higher for essential consumer goods. According to Eurostat, among the twelve main consumption categories, prices for housing, water, electricity, gas, and other fuels recorded the largest increase in 2022, rising by an average of 18.0%. Transport followed with an average increase of 12.1%, while food and non-alcoholic beverages increased by 11.9% on average, indicating that the cost of living rose prominently during this period.

Smaller and developing countries were the most affected, with inflation rates often surpassing those in developed economies. A key reason for this discrepancy is their strong reliance on imported fertilizer as well as food imports, in some cases. When faced with significant increases in fertilizer prices, fertilizer use tends to decline, leading to lower agricultural production. This reduction in domestic supply drives up both food prices and food imports. As a result, fertilizer price shocks put pressure on food prices not only in the short term but also over subsequent harvest cycles. In the case of Serbia, the estimated annual inflation rate reached 15.1% in 2022, following an already high rate of 7.8% in 2021 (Statistical Office of the Republic of Serbia [SORS], 2022). By 2025, annual inflation stabilized at an estimated 2.8%, while real GDP recorded annual growth of 2%. Although macroeconomic conditions improved, agricultural production saw a slight decline, with physical volume falling by 0.3% in 2025 compared to 2024 (Statistical Office of the Republic of Serbia, 2025a).

Focusing specifically on food, its role in both inflation and household budgets in Serbia is important. In 2025, food made up 34.3% of the total Consumer Price Index (CPI), reflecting its large weight in overall price developments. Over the years, food price inflation has consistently outpaced headline inflation, as shown in Figure 1, with the gap becoming especially noticeable from 2022 crisis when food prices rose more sharply than the general price level. Between January 2020 and December 2025, overall inflation grew at a compound annual rate (CAGR) of 6.3%, while food prices rose faster, at 7.5% per year. Looking at specific categories, some food items became noticeably more expensive: fruit prices recorded a CAGR of 10.14% between 2020 and 2025, followed by oils and fats at 9.3%, and milk, cheese, and eggs at 8.4% (SORS, 2024b). This matters even more given that, in Serbia, food represents a substantial share of household spending, averaging around 21% between 2020 and 2024 (SORS, 2024a), well above the EU average of 13.2% (Eurostat, 2026). During this period, household expenditure on food grew at a CAGR of 9.6%, SORS, 2024b). Altogether, these trends suggest that rising food prices have placed a growing strain on household budgets.

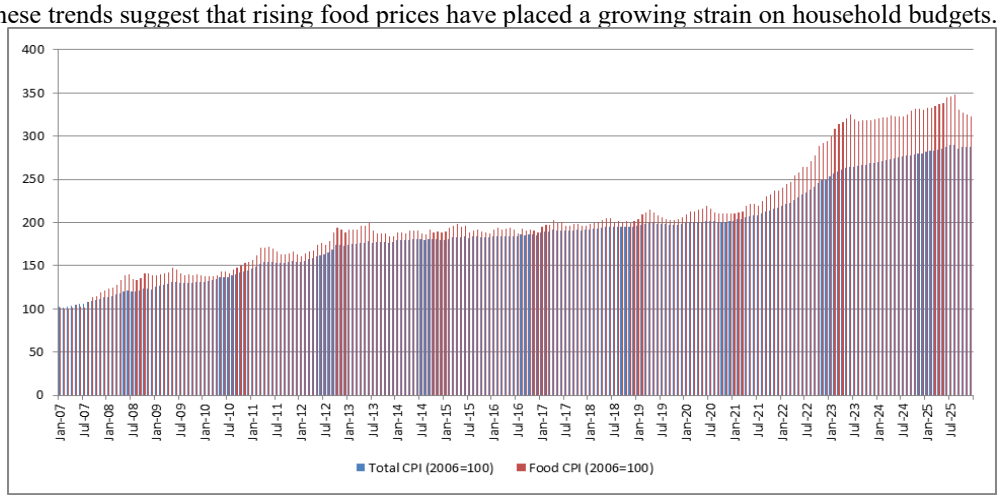

Figure 1: Consumer Price Index and Food Consumer Price Index from 2007 - 2025
Source: Statistical Office of the Republic of Serbia, 2025

To meet its domestic agricultural needs, Serbia relies on fertilizer imports. Serbia's total fertilizer imports in 2025 amounted to 832,900 tons (excluding raw fertilizers), equivalent to USD 363.6 million, along with 657,799.8 tons of raw fertilizers, valued at USD 75.4 million. At the same time, Serbia exported a significant amount of fertilizer, reaching 539,230.8 tons (excluding raw fertilizers) in 2025, valued at USD 272.7 million (SORS, 2025b). The largest suppliers of raw fertilizers are Jordan, Romania, and Egypt, together accounting for 79.3% of Serbia's total raw fertilizer imports. For other types of fertilizers, the Russian Federation presents the main supplier, accounting for 63% of total imports. Together with Hungary and Austria, these three countries represent 77% of total fertilizer imports in Serbia.

Considering Serbia's dependence on imported fertilizer, the republic is exposed to all global market shocks, emphasizing the importance of discovering how these shocks affect food prices. The aim of this study is to analyze whether shocks originating from agricultural input markets, specifically fertilizer prices, are transmitted through the production chain and significantly affect food prices in Serbia. The paper is organized as follows: after the introduction, the literature overview presents global and regional-focused studies related to fertilizer and energy markets and food prices. The next section describes the data and empirical methodology. Based on data spanning 2014–2025, the model includes consumer food, agricultural producer, and fertilizer prices within a VAR framework. The results illustrate the responses of food inflation and agricultural producer prices to fertilizer shocks supported by Granger causality and

forecast error variance decomposition. The final section provides concluding remarks and discusses the main implications of the results.

2. LITERATURE OVERVIEW

Analyzing correlation between fertilizer and energy prices with core and food inflation is subject of many authors works over the years (e.g. Alexander et al. (2023); Clark & Terry (2010); Hamilton (2009); Kilian (2008a)). This relationship is important due to its vast implications on business cycles, government policies, social dynamics, and in worst cases even world hunger. With two major crises over the last two decades, including 2008 world crisis and 2020-2022 turbulences, there has been a rising literature covering these correlations.

Ott (2012) analyzed the interaction between fertilizer, food, and energy prices in the EU, utilizing monthly price indices from the World Bank (1960-2012) for fertilizers, energy, and grains. Using VAR models and Granger causality tests, the paper analyzed price interdependencies, together with unit root tests to identify if speculative bubbles exist in the physical market. The research established a "triangular interdependency", where energy prices trigger nitrogen cost spikes, but study found food prices in EU Granger-cause fertilizer price movements more than vice-versa. A speculative bubble in 2008 was revealed to be driven by low global inventory levels and uncertainty rather than the derivatives market, according to authors' findings.

Corsello and Tagliabracci (2023) researched the transmission of energy price shocks to inflation dynamics using Monthly Eurostat data for HICP (Headline, Food, Core), negotiated wages, and unemployment in the Euro area, covering period from 2002-2022. Data was analyzed by applying a Bayesian VAR model with Choleski decomposition to identify exogenous energy shocks. Their empirical results indicated that the pass-through from energy prices to core and food inflation, while historically modest, becomes considerably more pronounced during periods of shocks. Accordingly, the study found that during 2022 energy crisis, energy shocks accounted for over 60% of euro-area headline inflation. Authors discovered that the sensitivity of food prices to these shocks is three times higher than that of core inflation

Another study on the recent surge in global fertilizer prices and its implications for food prices and food security was done by Hebebrand and Laborde Debucquet (2023). With emphasis on the underlying supply and demand drivers, using IFPRI and FAOSTAT data, this study highlighted that 75% of countries were dependent on imports for over 50% of their fertilizer use. It identified extreme supply concentration: Russia and Belarus controlled 41% of global potash trade, while Russia alone accounted for 15% of nitrogenous fertilizer exports in 2022. The study put an emphasis on how this low concentration makes the global food supply chain vulnerable to regional conflicts and trade sanctions.

Focusing on the most recent and fertilizer-oriented studies, Vos et al. (2025) investigated the effects of global fertilizer price shocks, exploring the mechanisms through which these shocks transmit to agricultural markets in recent years. Researchers analyzed weekly price data for European and US natural gas and international fertilizer benchmarks from 2019 to 2024. The authors showed that fertilizer prices are strongly linked to energy markets: the estimated pass-through elasticity of European natural gas prices to nitrogen fertilizer was 0.43 for every 1% gas price increase. The pass-through from US gas was shown to be significantly higher at 0.89. The study noted that, while global demand fell only 4.5% in 2022 and higher crop prices mitigated the impact of rising fertilizer costs for many commercial producers, smallholder farmers in import-dependent regions faced severe profitability losses.

Morão (2025) focused the analysis of fertilizer-related shocks by explaining their broader macroeconomic consequences focused on relatively smaller economy. Morão developed a novel "Fertilizer Supply Index" (FSI) using text-mining analysis of news from over 30 countries (1974–2023) to capture disruptions, including export bans and sanctions. Employing a structural Bayesian VAR, the study found that fertilizer supply shocks because an immediate and significant increase in food industry output prices in Portugal. Author revealed that, due to inelastic food demand, companies successfully pass the majority of these input costs to consumers. Notably, labor market responses, presented in wages and hours, are delayed, rising several months after the initial shock.

Focusing specifically on Serbia, Brankov and Puškarić (2023) analyzed the effects of the Ukraine conflict on Serbia's agricultural sector, using the trade data from WITS and price indices from the Statistical Office of the Republic of Serbia (SORS) for the period from 2020 to 2023. In this study, Serbia is identified as the most fertilizer-dependent country in the Western Balkans, relying on imports for 70% of its needs. Crucially, it sourced 75.9% of its NPK requirements from Russia. The authors reported that mineral fertilizer costs in Serbia surged by 177% year-on-year in Q2 2022. This shock, combined with energy price hikes, drastically reduced yields for wheat and corn, hence threatening exports, but more importantly, food security.

Mladenović and Milošević (2025) examined the role of energy prices and food inflation dynamics in Serbia. Covering period from 2007-2022, the study utilized ARDL Bounds Testing for cointegration and Structural VAR to analyze food prices (FCPI), core prices, oil, and a custom macroeconomic uncertainty index. Long-run elasticity showed that a 1% increase in oil prices leads to a 0.1% increase in food prices in Serbia. While uncertainty shocks peak within six months, oil price shocks become the dominant factor in food price variability after 18 months, eventually explaining 51% of fluctuations.

While existing literature offers valuable insights into inflation dynamics in Serbia, especially the role of energy prices and broader input costs, fertilizer prices and their interaction with other price categories received less direct attention. This paper researches that channel by focusing on how fertilizer prices are linked to food inflation in Serbia. Using a

VAR framework, the aim is to contribute to a better understanding of cost-push pressures in an import-dependent economy, where global shocks can have wider effects on overall price movements and food stability.

3. DATA AND EMPIRYCAL ANALYSIS

Given that the analysis is focused on prices in the Republic of Serbia, data was obtained from the Statistical Office of the Republic of Serbia. Analyzed indices include mineral fertilizer price index (SORS, 2025d), the producer price index for agricultural products (agricultural PPI) (SORS, 2025e), and the consumer price index for food (food CPI) (SORS, 2025c). The CPI and PPI series were available at a monthly frequency, while the fertilizer price index was reported at a quarterly frequency. Indices are expressed as year-on-year indices, defined as the percentage change relative to the same month or quarter of the previous year. Data was available for period from January 2014 and first quarter of 2024 to December 2025, for monthly series, and fourth quarter of 2025, for the fertilizer index. Monthly variables were transformed to quarterly values by taking simple averages within each quarter, while the fertilizer index is used in its original form. The final dataset comprises 48 quarterly observations and is analyzed using the R software.
Analyzed indices are presented in Figure 2, each graph showing inflation over the analyzed period. Fertilizer inflation increased sharply during 2021 and reached its peak in mid-2022, while agricultural PPI peaked shortly after, in third quarter of 2022. Food inflation peaked with a slight delay in the first quarter of 2023. Food inflation presents relatively stable series when compared to the other two, with its values ranging roughly from 0.5% to 16%, indicating that there are no extreme values in this dataset. Given that its mean (4.2%) exceeds the median (2.5%), there is mild right-skewness indicating a high inflation period. Agricultural PPI is considerably more volatile, with values ranging from -26.7% to 34%, which confirms its cyclical nature and strong reaction to market shocks. Its average value is also higher than median. Fertilizer price inflation displays the highest volatility, with extreme movements between -39.5% and 177%, and the large gap between the mean (around 9.2%) and the median (-0.2%) value.

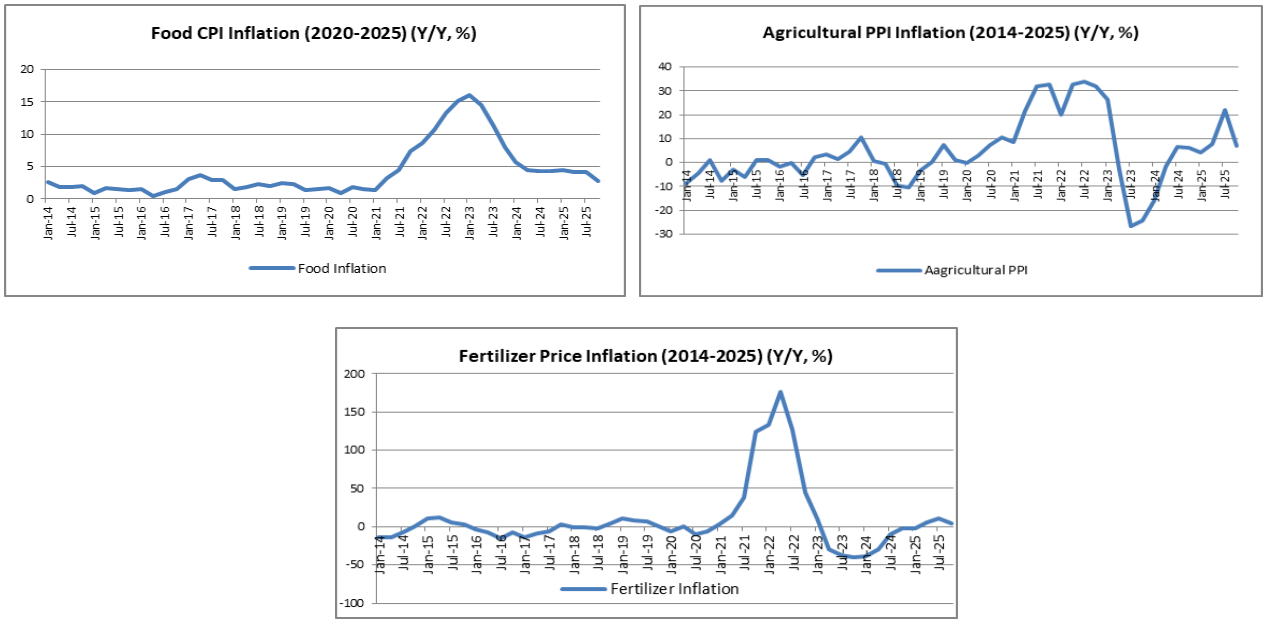

Figure 2: Year on year quarterly inflation for food prices, agricultural PPI, and fertilizer prices for period from Q1/2014 to Q4/2025
Source: Statistical Office of the Republic of Serbia, 2025

The analysis employs a Vector Autoregression (VAR) model, which treats all variables as endogenous and allows for the examination of dynamic interactions and feedback effects among them. Following Sims (1980), a VAR(p) model can be written as:

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t \quad (1)$$

Where Y_t is a vector of endogenous variables, c is a vector of constants, A_i are matrices of coefficients capturing lagged relationships between variables, and ε_t is a vector of innovations with zero mean and covariance matrix $\sum$.
Stationarity of the variables was tested using the Augmented Dickey-Fuller (ADF) test, which indicated that food inflation and PPI inflation are non-stationary, while fertilizer inflation is borderline stationary. As argued by Kilian et al. (2020), unit root tests have low power in short samples and often fail to clearly distinguish between I(0) process and I(1) process, which is particularly relevant for this paper, given the limited sample size (T = 48). In addition, Sims (1980) emphasized that in macroeconomic applications with persistent data, strict reliance on such pre-tests may be misleading, as variables may appear non-stationary in finite samples even when their long-run behavior is more stable.

Since the variables are already expressed as year-over-year inflation rates, further differencing would risk removing economically meaningful variation. Given that the aim of the study is to capture the transmission from fertilizer prices to food and producer prices, the VAR was estimated in levels, in order to preserve these relationships. The results should therefore be interpreted with due caution.
Structural shocks are identified using a recursive scheme based on the Choleski decomposition of the variance-covariance matrix of residuals (Lütkepohl, 2005). Following previous studies, specifically the seminar paper by (Kilian, 2008b) where energy prices are treated as exogenous within the system, fertilizer price inflation is ordered first, assuming that it is contemporaneously exogenous to other variables. This implies that fertilizer price inflation is affected only by its own structural shocks, while agricultural producer prices and food inflation can respond to fertilizer price changes. This assumption was considered appropriate, given the largely exogenous and internationally determined nature of fertilizer prices. The lag length was selected based on standard information criteria (AIC, HQ, SC, and FPE). With AIC and FPE indicating an optimal lag length of three, a VAR (3) model was estimated.

4. RESULTS

Initial model evaluation showed that the model is stable and statistically strong across all three equations, including fertilizer equation, PPI equation, and CPI equation. Food inflation is the most inertial, PPI responds to fertilizer shocks with a one to two quarter lag, while fertilizer prices are largely driven by their own dynamics. Diagnostic assessments indicate that the model demonstrates robust performance concerning autocorrelation and heteroskedasticity, given that the residuals do not display serial correlation or ARCH effects. Conversely, the normality assumption is not upheld, as evidenced by skewness and excess kurtosis. This is likely attributable to significant inflationary shocks experienced during the crisis period, especially in 2022.
Impulse response function reveals the impact of a one standard deviation shock in fertilizer price inflation, and is illustrated in Figure 3. The findings are as follows:

- A one standard deviation shock in fertilizer price inflation leads to a rapid and pronounced increase in agricultural PPI. The effect emerges almost immediately, peaks around the 3rd and 4th quarter (approximately 4%), and then gradually declines, approaching zero by the 6th-7th period and turning slightly negative at longer horizon. The confidence interval is above zero in the early horizons, confirming a statistically significant short-run effect.
- A one standard deviation shock in fertilizer price inflation precipitates a gradual increase in food inflation. Initially, the effect is modest, however, it subsequently intensifies, peaking around the 5th and 6th quarter (approximately 1.25%), before slowly declining and losing significance in later periods. The confidence interval stays above zero in the initial periods, suggesting a statistically significant effect, but gradually moves closer to zero over time, indicating that the impact fades in the medium term.

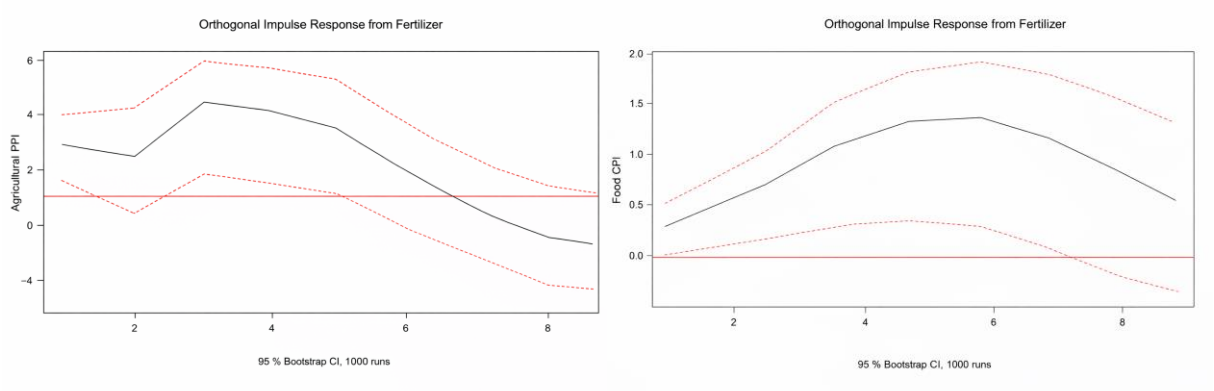

Figure 3: Orthogonal Impulse Response Function: Reaction of agricultural producer prices and food prices to shock in fertilizer
Source: Author's calculation output from R, based on the SORS' data, 2025

Following the impulse response analysis, Granger causality is used to assess the relationships that were analyzed and identified above. Results are presented in Table 2 The null hypothesis that fertilizer price inflation does not Granger-cause agricultural PPI and food inflation is rejected:

- The F-test ($p = 0.0067 < 0.05$) indicates that, within the system, fertilizer price inflation Granger-causes both agricultural PPI and food inflation, confirming the relationships suggested by the IRF results.
- The instant causality test ($p = 0.028 < 0.05$) suggests the presence of instantaneous linkages.

To complement these results, Wald test provided more detailed evidence on the significance of lagged effects in each equation.

- The result confirms that past changes in fertilizer prices have a statistically significant effect on agricultural PPI ($p = 0.0089 < 0.01$), the effect on food inflation is also significant but weaker ($p = 0.032 < 0.05$).

Table 2: Granger Causality and Wald Test

Test	Statistic (F)	p-value	Interpretation
Granger causality	3.1697	0.0067	H0 Rejected
Instant causality	–	0.0280	Instant linkage
Wald test – PPI	4.5092	0.0089	H0 Rejected
Wald test – CPI	3.2754	0.0324	H0 Rejected

Source: Author's calculation based on the SORS data, 2025

The Forecast Error Variance Decomposition (FEVD) shows the share of unexpected or unexplained variations in agricultural PPI and food CPI that are tied to shocks in fertilizer prices. After eight quarters, 60.3% of the variance is explained by its own shocks, while the feedback from food inflation remains relatively small (6.3%), and the contribution of agricultural PPI is more substantial (about 33.4% after two years). In the case of agricultural PPI, 35.9% of its variance is explained by fertilizer shocks after eight quarters, whereas the role of food inflation is negligible (around 2%). Approximately 49.7% of food inflation variance is driven by fertilizer price shocks, with 30.7% explained by shocks in PPI, after eight quarters. At the same time, the importance of its own dynamics declines markedly, from about 79% in the first period to around 20% after eight quarters.

5. CONCLUSION

World economy was faced with several shocks in recent years, starting from 2020 and continuing through 2026. After the global slowdown in 2020, Europe experienced exceptionally high prices, caused by geopolitical instabilities. Prices of energy and fertilizers surged, disturbing national economies and drawing attention to how energy supply is strongly influenced by political relationships and global events. As such, this period amplified the need for countries to diversify their energy and fertilizer supply channels. High inflation also hit Serbia, similar to many smaller economies, more strongly than EU and other developed economies, which makes this topic especially relevant.

The empirical results point to a consistent pattern. The impulse response functions show that fertilizer price shocks have a strong and immediate impact on agricultural PPI, with the peak in the third quarter after the shock. The response of food inflation is more gradual, reaching its peak after six quarters. These results indicate that the transmission from fertilizer prices to consumer prices is not instantaneous, but rather takes place through the production chain, affecting producer prices first and then passing on to consumers. Confirming that fertilizers play the primary role within the system, study showed that, at the 5% significance level, fertilizer price inflation Granger-causes both agricultural PPI and food inflation, though the effect is stronger at the producer level. Finally, the variance decomposition indicated that fertilizer shocks explain around 36% of the variation in PPI and nearly 50% of food inflation after eight quarters. It should be noted that this effect increases over time, from 12% after one quarter to almost 50% after eight quarters for food prices, while the effect of its own dynamics gradually decreases.

Considered together, the results point to a significant transmission of fertilizer price shocks through the production chain, indicating that producers are able to pass increased fertilizer costs to final consumers over time. The findings are in line with previous researches, suggesting that such expenses can be passed on consumers due to non-elasticity of food (Morão, 2025; Vos et al., 2025). These results suggest that policymakers should pay closer attention to developments in input markets and monitor the changes in them, as the delay in transmission offers a window for early action. Stabilizing fertilizer prices, whether through larger reserves or direct subsidies for fertilizer purchases by farmers, could help limit future inflationary pressures on food. Finally, strengthening supply chains and reducing reliance on a narrow set of external suppliers could improve resilience to external shocks and support more stable price dynamics over time.

On the other hand, the analysis has certain limitations. First, these findings should be viewed in light of the short sample period and the non-stationary nature of the data. Second, the use of quarterly data might limit the ability to capture more complex dynamics. Additionally, inclusion of additional variables, specifically energy prices, could provide additional context. The constraints outlined above call for cautious interpretation of the results, while also offering ideas for future research.

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