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The Impact of Global Food Prices on Domestic Prices in Saudi Arabia

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Abstract

This paper analyzes the symmetric and asymmetric impact of global food prices on domestic consumer prices in Saudi Arabia based on monthly data from January 1990 to November 2023. The empirical results, based on the linear ARDL model, showed that an increase in global food prices by 1 percent pushed domestic prices higher by 0.55 percent. The estimated results based on non-linear ARDL revealed that the impact of increasing global food prices is higher and significant compared to the insignificant impact of falling global food prices. In other words, a rise in global food prices by 1.0 percent leads to a significant increase in domestic prices by roughly 0.5 percent. However, falling global food prices do not have a significant impact on domestic prices.

Keywords: Food prices, consumer prices, ARDL, NARDL, Saudi Arabia

JEL Codes : C13, C32, E31, Q02, Q10.

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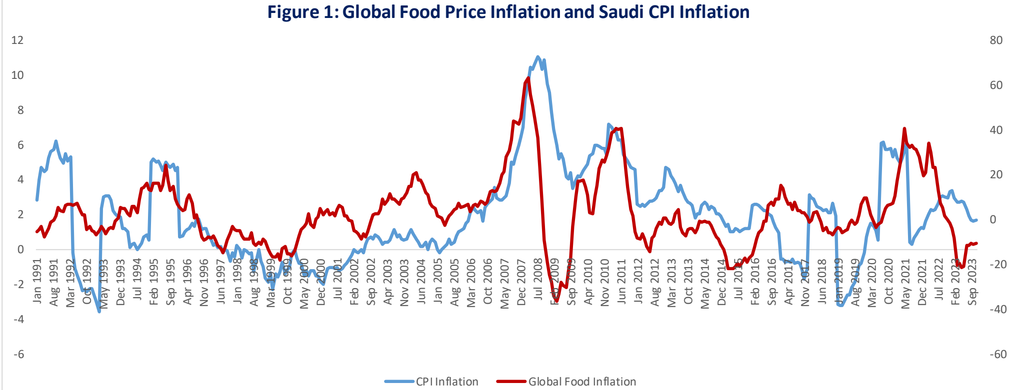
1. Introduction

Volatility in global food prices has been a key concern to policymakers across the globe as increases in food prices are usually passed into domestic prices, unlike declines in food prices that are rarely passed into domestic prices. Indeed, global food prices have witnessed ups and downs, as revealed by historical data and displayed in Figure 1. For example, world food prices increased sharply during the 2000s when international food prices accelerated sharply by 21 percent in April 2004 due to the higher demand, higher input costs associated with oil, bad harvest, and export restrictions, according to the IMF (2008). A similar episode also occurred during the global financial crisis of 2007-08, with global food prices increasing sharply by 63 percent in March 2008. The key factors behind the shocks in global food prices during the 2008 global financial crisis, according to Mittal (2009), include higher energy costs, increasing demand from emerging economies, and lower production of agricultural products. Nevertheless, international food prices also saw some declines; in March 2009, for example, prices declined by 36 percent. In recent years, volatility in global food prices returned to the scene during the COVID-19 pandemic and following the Russia-Ukraine conflict. Due to these developments, food prices increased by 40.6 percent in June 2021 and by 34 percent in March 2022.

Such fluctuations in global food prices are important for the Saudi economy due to its heavy reliance on imported goods, particularly food products. Global food prices appear to be a main source of inflationary pressure in Saudi Arabia as both global food prices and domestic food prices tend to co-move together, as shown in Figure 1.

Figure 1: Global Food Price Inflation and Saudi CPI Inflation



Source: IMF, FAO, and Authors' calculation

In addition, the latest statistics by the General Authority of Statistics indicated that Saudi imports of food goods accounted for roughly 15.7 percent of total imports in 2022. This, in turn, shows that Saudi Arabia's dependence on imported food remains substantial due to population growth, high income, and high demand for consumption goods. The share of food and beverages in the consumption basket of Saudi Arabia represents 18.8 percent of the total consumer basket, indicating the influential role of food on overall consumer domestic prices.

Therefore, examining the link between global food prices and domestic prices is essential for policymakers, as rising global food prices can generate inflationary pressure and complicate macroeconomic management. In other words, increasing global food prices may increase the fiscal cost for food subsidies, which in turn may deteriorate fiscal balance.

The rest of the paper is structured as follows. Section 2 presents the literature review, and section 3 describes the employed dataset. Section 4 presents the econometric methodology, while section 5 presents and discusses the empirical results. Section 6 summarizes the paper and concludes with policy recommendations.

2. Literature Review

There is abundant literature discussing the transmission of global food prices into domestic prices covering both advanced and developing economies. For instance, Quiroz and Soto (1995) employ data from 78 countries to analyze the effects of food prices on domestic prices over the period 1966-1991. The empirical results, based on the estimated panel data model, showed the lack of transmission of food prices in the long run in one-third of the sample; for the rest of the countries, however, the study concludes that the transmission of global food prices into domestic prices may take years. Blomberg and Harris (1995) investigated the association between US consumer prices and multiple commodity price indices, including the food price index from 1970 to 1994, based on a vector autoregressive (VAR) framework. Their evidence reveals that food prices have a positive and significant impact on core inflation, implying their capability to capture inflation. Cutler et al. (2005) utilized monthly data spanning from Jan 1980 to November 2004 to probe the impact of commodity prices, including food prices, on inflation in China, Hong Kong, and the USA. Based on the VAR framework and Granger causality test, the empirical findings showed that changes in food prices capture inflationary pressure in both China and Hong Kong.

Furthermore, Lmai et al. (2008) investigated the impact of agricultural commodity prices on domestic prices in both China and India based on an annual dataset covering the period 1966-2005. Their estimated error correction models showed that the pass-through of commodity prices into domestic prices takes up to three years in both countries. Helbling et al. (2008) analyzed the impact of higher commodity prices in both advanced, emerging, and developing economies and concluded that the pass-through of commodity prices in emerging economies is three times higher than in advanced economies. Walsh (2011) explored the effects of food prices on consumer prices in 91 economies from 1985 to 2008 based on the vector autoregressive (VAR) framework and concluded that there is a significant impact of food prices on inflation, especially in developing countries. Jongwanich and Park (2011) examined whether global food and oil price shocks influence the inflation environment in developing Asia based on quarterly data from 1996 to 2008. Their empirical analysis based on the VAR framework indicated that developing Asia's domestic inflation shields itself from global food and oil price shocks due to the government's role; therefore, the pass-through was limited. Lora et al, (2011) examined the impact of global food prices on domestic inflation in four Latin American countries[2] based on the VAR model with monthly data from 2006 to 2010. The estimated results indicated that within six months of an international food price shock, domestic inflation will increase by more than 10 percent of the increase in international prices.

Similarly, Jalil and Tamayo (2011) investigated the impact of global food prices on domestic inflation in Latin American countries[3] by estimating a VAR model based on quarterly data from

[2] These countries include Bolivia, the Dominican Republic, El Salvador and Guatemala.
[3] These countries include Brazil, Chile, Colombia, Mexico, and Peru.

2000 to 2010. The econometric analysis confirmed that world food prices generate additional inflationary pressure in these countries. Ghoshray (2011) examined the impact of various food prices on domestic prices in selected Asian economies[4] by using monthly data and employing various econometric techniques. The empirical analysis showed the significant impact of food prices on domestic markets. Chuah et al. (2013) utilized a monthly dataset to assess the impact of global food prices on inflation in Malaysia. The estimated model revealed that global food prices have a positive and significant impact on domestic inflation. For the case of Egypt, Al-Shawarby and Selim (2013) relied on the VAR model and step-wise regression to estimate the pass-through of global food price shock into domestic inflation based on a monthly dataset starting from 2000 to 2011. Their empirical findings showed that the impact of global food prices appeared to be significant and high in the short run rather than the long run.

Ianchovichina et al. (2014) also estimated the pass-through of global food prices into domestic food prices in 18 MENA countries, including Saudi Arabia, by employing monthly data spanning from 2000 to 2011. Their empirical results, based on the vector autoregressive model, indicated the essential role of global food prices in affecting domestic food prices. Of course, the pass-through coefficients vary from one country to another. In addition, they found evidence suggesting the asymmetric impact of world food prices on domestic food prices. Belke and Awad (2015) attempted to analyze the impact of world food price fluctuations on domestic inflation in seven MENA countries based on a multiple regression analysis with quarterly data from 1991:Q1 to 2011:Q4. The estimated regressions indicated the significant impact of global food price shocks on domestic prices. The impacts vary from short to long run and from one country to another.

Zaman and Ali (2018) attempted to assess the impact of changes in food prices on non-food prices in 47 developing countries from 2000 to 2014 based on a panel data model. The empirical evidence confirmed the positive and significant impact of food prices on non-food inflation. El-Karimi and El-Ghini (2020) explored whether global food prices influence domestic prices in

[4] These economies consist of India, Thailand, Philippines, People’s Republic of China, and Indonesia.

Morocco or not by utilizing data from 2004 to 2018. The reported findings based on the structural vector autoregressive model confirmed the critical role of food prices on domestic prices. In addition, the authors concluded that a positive shock in global food prices generates more domestic inflation pressure than a negative one.

Relating to Saudi Arabia, however, the literature appears to be scarce. Indeed, despite there are several studies examining factors influencing domestic prices (e.g. Basher & Elsamadisy (2012); Al Rasasi & Banafea (2015); Bokhari (2018); Osman et al. (2019); Alsheikh & Rana (2021)) there are few studies paying attention to the impact of global food prices on domestic prices in Saudi Arabia. For example, Al Rasasi et al. (2017) investigated the relationship between global food prices and domestic prices in Saudi Arabia based on a monthly dataset from 2000 to 2016. The authors confirmed the presence of a long-run relationship between food prices and domestic prices; they also found evidence supporting the predictive power of global food prices in capturing domestic price movements. Other studies (e.g. Alkhareif et al. (2017), and Alsabban et al. (2023)) considered import prices to examine their impact on domestic prices and concluded that there is a significant impact of import prices on domestic inflation.

3. Dataset

The utilized dataset consists of monthly data ranging from January 1990 to November 2023 (407 observations) collected from the International Monetary Fund (IMF) and Food and Agriculture Organization (FAO) of the United Nations databases. All variables are expressed in logarithm form[5].

[5] It is worthy to mention that the IMF CPI data are based on the 2010 base year.

4. Econometric Methods

4.1. Linear Autoregressive Distributed Lag (ARDL) Model

The starting point of our analysis is to assess the symmetric relationship between global food prices and domestic consumer prices. In doing so, we proceed with our assessment based on the autoregressive distributed lag framework developed by Pesaran et al. (2001) to check whether a long-run relationship exists among the variables of interest or not. The benefits of choosing this approach, according to Nkoro and Uko (2016), can be summarized in four points. Firstly, estimating the ARDL model does not require the stationarity condition of the variables; indeed, the ARDL model deals with the issue of mixed order of integration. Secondly, it is suitable for small sample sizes. Thirdly, it deals with possible serial correlation and endogeneity issues by selecting the appropriate lags. Lastly, the error correction term derived from the ARDL model makes it more likely to comprehend the long-run relationship and the short-run dynamics. With all these advantages, it is important to ensure that the order of integration for the employed variables is *I(1)* and not *I(2)*. Therefore, we test for the stochastic properties of the variables by conducting Augmented Dicky-Fuller and Phillips and Perron tests developed by Said and Dickey (1984) and Phillips and Perron (1988), respectively.

Next, to assess whether there is a cointegration relationship between global food prices and domestic prices, we begin by estimating the following basic ARDL model, producing both the short and long-run coefficients simultaneously.

$$\Delta \ln CPI_t = \beta_0 + \beta_1 \ln CPI_{t-1} + \beta_2 Food_{t-1} + \beta_3 Trend + \sum_{i=1}^{k} \mu_i \, \Delta CPI_{t-i} + \sum_{i=1}^{k} \varphi_i \, \Delta Food_{t-i} + \varepsilon_t \qquad (1)$$

Where CPI is the dependent variable and $Food$ and $Trend$ are the independent variables. $Trend$ is included in the model to capture other factors influencing prices other than global food prices. Δ reflects the first difference operator, k is the optimal lag length selected by certain criteria, while ε_t is the error term. The β coefficients capture the long-run relationship, while $\mu\ and\ \varphi$ coefficients explain the short dynamics of the model.

To examine the existence of a long-run relationship, we conducted the bounding test developed by Pesaran et al. (2001) based on F-test. According to this test, we define the null hypothesis of no cointegration among the variables as follows: $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ against the alternative hypothesis $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$. Based on the estimated F-statistics, we can determine whether there is a cointegration or not. In other words, if the F-statistics is higher than its upper bound, it implies the presence of a cointegration relationship. Nonetheless, such cointegration would disappear in case the F-statistics appeared to be below its lower bound. When the F-statistics lie between its upper and lower bounds, then it would be difficult to determine whether there is a cointegration relationship.

4.3. Non-Linear Autoregressive Distributed Lag (NARDL) Model

There is a large share of the literature analyzing the nexus between consumer prices and commodity prices based on linear models. However, several studies (e.g. Al Rasasi & Yilmaz (2016); Al Rasasi (2017); Ferrucci et al. (2010, 2016); Porqueddu & Venditti (2014); Jouf (2020); Pozo et al. (2021); Peersman (2022)) argue that the relationship between commodity prices and macro variables including domestic consumer prices are non-linear and encourage accounting for the non-linearity when analyzing such relationships.

Therefore, to account for the non-linearity in our analysis, we rely on the non-linear ARDL model developed by Shin et al. (2014). By following Shin et al. (2014), we replace $Food$ variable in equation 1 by $Food^{+}$ and $Food^{-}$ where

$$Food^{+} = \sum_{j=1}^{t} \Delta\, Food_j^{+} = \max(\Delta Food_j, 0)$$

$$Food^{-} = \sum_{j=1}^{t} \Delta\, Food_j^{-} = \min(\Delta Food_j, 0)$$

Hence, equation 1 becomes as follows:

$$\Delta \ln CPI_t = \beta_0 + \beta_1 \ln CPI_{t-1} + \beta_2 Food_{t-1}^{+} + \beta_3 Food_{t-1}^{-} + \beta_4 Trend + \sum_{i=1}^{k} \mu_i \, \Delta CPI_{t-i} + \sum_{i=1}^{k} \varphi_i^{+} \, \Delta Food_{t-i}^{+} + \sum_{i=1}^{k} \lambda_i^{-} \, \Delta Food_{t-i}^{-} + \varepsilon_t \quad (2)$$

Where CPI is the dependent variable while $Food_t^{+}$, $Food_t^{-}$ and $Trend$ are the independent variables reflecting the positive and negative fluctuations of global food prices, and other factors affecting prices respectively; Δ reflects the first difference operator, k is the optimal lag length selected by certain criteria, while ε_t is the error term. The β coefficients capture the long-run relationship while $\mu, \varphi^{+}, and\ \lambda^{-}$ coefficients explain the short dynamics of the model.

Once we estimate the model specified in equation 2, we proceed with testing for bound cointegration and estimate both the short and long-run coefficients as described above in Section 4.2.

5. Empirical Results

5.1. Unit Root Tests

It is a common procedure in time series analysis to examine the stochastic properties of the utilized variables; therefore, we start our analysis by checking whether the employed variables are stationary or not. Both stationarity tests of Augmented Dicky-Fuller and Phillips-Perron confirmed that all variables are integrated of order one, as summarized in Tables 1 and 2.

Table 1: Augmented Dicky-Fuller Test

	Level data			First difference data		
Variables	None	Constant	Trend	None	Constant	Trend
CPI	5.59	0.78	-1.02	-17.01*	-18.13*	-18.16*
Food	0.68	-1.18	-2.20	-12.25*	-12.27*	-12.25*

* denotes the rejection of the null at 5%.

Table 2: Phillips and Perron Test

	Level data		First difference data	
Variables	Constant	Trend	Constant	Trend
CPI	0.52	-1.19	-18.47*	-18.49*
Food	-1.24	-2.27	-12.74*	-12.74*

* denotes the rejection of the null at 5%.

5.2. The Linear ARDL Model Estimates

Once we confirm that all variables are integrated with order one and not integrated with order two, we test now for the presence of a long-run relationship based on the bounds test developed by Pesaran et al. (2001). Table 3 summarizes the cointegration test's results for the linear ARDL model and indicates the presence of a long-run relationship between global food prices and domestic prices since the test statistic is above the upper bound.

Table 3: Bounds Test's Results for the Linear ARDL

F-statistics	16.076					
Significance level	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Asymptotic	5.590	6.260	6.560	7.300	8.740	9.630

Note: I(0) and I(1) are respectively the stationary and non-stationary bounds.

To understand the impact of global food prices on domestic prices, we now proceed with the interpretation of the parameter estimates based on the linear model. The long-run parameter estimates confirmed the significant and positive impact of global food prices on domestic prices. In other words, the estimated impact appears to be large and roughly 0.93 percent, implying that an increase in global food prices by one percent pushes consumer prices by 0.93 percent. However, the impact in the short run is lacking as it takes time to translate into domestic prices. The estimated error correction coefficient is negative and significant, and it reflects the speed of adjustment to return to its steady state condition. In other words, the speed of adjustment is 2 percent to return to its equilibrium condition.

Table 4: Estimates of the linear ARDL model

Panel A: Long-run estimates			
Variables	**Food**	**Trend**	Constant
Parameter estimate	0.55**	0.001 **	0.03*
t-statistic	4.27	2.87	2.05
Panel B: Short-run estimates			
Variables	**ECT**		
Parameter estimate	-0.02**		
t-statistic	-5.82		
Note: * denotes the 5% significance level			

5.3. The Nonlinear ARDL Model Estimates

Since it has been documented by many researchers that the relationship between commodity prices and other macro and financial variables is nonlinear, we estimate the non-linear ARDL model to capture this nonlinearity. In particular, the non-linear ARDL model would enable us to differentiate between the impact of increasing and decreasing global food prices on domestic prices – asymmetric impact – and whether domestic prices respond differently or not. Before the interpretation of the non-linear estimates of the ARDL model, we first tested for symmetry for the global food price variable and found that there is symmetry for global food prices as the test's F-statistic =4.44 with p-value0.03 implying the rejection of the null hypothesis of the symmetric food price coefficient. Next, we investigate the existence of a long-run cointegration relation among the variables. The bounds test's results summarized in Table 5 confirm the presence of a long-run relationship as the F-statistic is greater than the upper bound at all significance levels.

Table 5: Bounds Test's Results for the Nonlinear ARDL

F-statistics	9.33					
Significance level	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Asymptotic	4.050	4.490	4.680	5.150	6.100	6.730
Note: I(0) and I(1) are respectively the stationary and non-stationary bounds.						

When it comes to the impact of increasing and declining global food prices, we found that both directions of global food prices tend to push domestic prices upward with varying magnitude. Put differently, an increase in global food prices by 1.0 percent is associated with rising domestic prices by 0.46 percent with a significant impact. However, falling global food prices do not have a significant impact even though it leads to the rise of domestic prices by 0.09 percent when global food prices increase by 1.0. The unexpected response of domestic prices to falling global food prices could be attributed to the lag effect, as it is expected to affect wholesale prices and then pass-through domestic prices in the long run, not in the short run. In addition, the domestic market needs time to readjust prices to reflect the current changes in global prices.

Table 6: Estimates of the Nonlinear ARDL model

Panel A: Long-run estimates				
Variables	$\boldsymbol{Food^{+}}$	$\boldsymbol{Food^{-}}$	**Trend**	**Constant**
Parameter estimate	0.46**	0.09	-0.002*	0.13*
t-statistic	7.08	0.65	-2.19	3.50
Panel B: Short-run estimates				
Variables	**ECT**			
Parameter estimate	-0.03**			
t-statistic	-6.13			
Note: * denotes the 5% significance level				

6. Conclusion

This paper aims to analyze the impact of changes in global food prices on domestic prices by utilizing linear and non-linear ARDL models with monthly data spanning from 1990:01 to 2023:11. The empirical analysis confirmed the presence of a long-run relationship among the two variables. While the linear model showed the large impact of global food prices on domestic prices, the non-linear model differentiates between the impact of rising and falling global food prices on domestic inflation. In other words, a 1.0 percent increase in global food prices leads to the rise of domestic prices by roughly 0.5 percent. On the other hand, falling global food prices appeared to have an insignificant impact on domestic prices. This could be attributed to that when global food prices decline, domestic prices do not adjust immediately to this decline, and more time is needed by retailers to reflect these changes. The finding of this paper is crucial for policymakers to comprehend the sources of inflationary pressure on one hand, and when designing the policies relating to inflation and social safety net. Likewise, policymakers need to address the challenges in the domestic market, in particular the reliance on imported goods, by increasing the local content for food security.

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