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THE EFFECTS OF SWINGS IN GLOBAL WHEAT PRICES ON THE DOMESTIC MARKETS IN AFGHANISTAN

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Abstract

The recent shocks in global prices of cereals and the spillover effects of trade restrictive policies adversely affected domestic markets, particularly in the net food importing countries such as Afghanistan. This paper investigates the effects of 2007–2008 spikes in global wheat prices on the dynamics of price transmission and long-run equilibrium relationship between global and domestic wheat markets. The findings indicate that domestic and global wheat markets may be cointegrated in Regime-I (pre-break), Regime-II (post-break) and the overall sample period. Moreover, the elasticity of price transmission and speed of adjustment towards the long-run equilibrium are substantially different between the two regimes, i.e., they appear to be larger in Regime-I as compared to Regime-II. Similarly, the effect of a shock in global wheat prices on domestic wheat markets might be long-lasting in Regime-I but transitory in Regime-II. This research underlines the need for mitigating the adverse effect of spikes in global wheat prices on domestic wheat markets in the context of a landlocked net food importing country.

Keywords: *Cereals price swings, price transmission, market integration, wheat markets, Afghanistan*
JEL Codes: *Q02, Q11, Q13, Q18*

1. Introduction

The growing interdependence among countries in today's integrating world exposed poor developing countries, unprecedentedly, to the adverse effect of shocks in global food prices and the consequent trade distorting policies of exporting countries. During the past one decade the global prices of cereals (wheat, rice and maize) experienced a substantial increase when the FAO cereals price index and global prices of wheat swung up (in real terms) by about 90% and 131% between early 2007 and mid-2008, respectively. Afghan wheat markets were not shelled from the effects of spikes in global wheat prices as the real prices of wheat increased by about 99% between September 2007 and May 2008. The transmission of this enormous shock in global prices of cereals to domestic markets and the trade restrictive policies of exporting countries deteriorated food insecurity and poverty in many developing countries, especially in the net food importing countries such as Afghanistan (D'Souza & Jolliffe, 2010; Hoyos & Medvedev, 2009; FAO, 2008). Forsé and Subran (2008) reported that nearly 2.5 million more Afghans required food assistance in June 2008 who experienced transitory food insecurity due to the unprecedented increase in food prices. Policy responses of governments to prevent or mitigate the effects of the shock in global food prices varied depending upon their status as net exporters or importers. Protectionist policy measures were common among net exporters while policies aim at reducing trade barriers were often adopted by net importers (Sharma, 2011; World Bank, 2013).

Several studies have been conducted on the dynamics of cereals price transmission from global to domestic markets following the so-called food price crisis of 2007–2008. They reported instances of the pass-through of dramatic increases in global prices of cereals, at varying magnitudes, to domestic markets in the countries studied (e.g., Minot, 2011; Ghoshray, 2011; Greb *et al.*, 2012; Hassanzoy *et al.*, 2015, 2016). Previous studies rarely compared the dynamics of price transmission before and after a structural break due to the global food price shock of 2007–2008 (e.g., Greb *et al.*, 2012). Although Hassanzoy *et al.* (2015, 2016) examined the dynamics of price transmission among global and domestic markets of high and low quality rice in Afghanistan, no similar study is available for wheat markets in the country. However, the dynamics of price transmission from global to domestic markets may have essential implications for determining an efficient allocation of domestic scarce resources, improving the responsiveness of domestic food system to shocks, enhancing integration of food markets, mitigating vulnerability of poor population groups to food price spikes and encouraging efficient supply response to stabilize domestic food markets (Zorya *et al.*, 2012; Ghoshray, 2011).

Wheat is the major staple food crop in Afghanistan. It accounts for about 80% of area planted to cereals with an equal share in cereals production. The per capita consumption of wheat is 162 kg/year, one of the highest in South Asia, and its share in the daily per capita calorie intake is 66% averaged over 2009/10 to 2013/14. Wheat is mainly consumed in the form of flat breads with every meal. Overall 43% of the total consumption expenditure is spent on bread and cereals, but it is 54% for the poorest 40% of population (Central Statistics Organization, 2007). Due to the 2007–2008 food price shocks and associated increases in food costs, Afghan households experienced substantial declines in real monthly per capita consumption expenditure (especially in urban areas) with relatively little reduction in the daily calorie intake. Households increased spending on cereals while reducing spending on other food items (D'Souza & Jolliffe, 2010). This implies that increases in wheat and wheat-flour (flour) prices have negative effects on the welfare of poor households in the country. In response to the price shocks, Afghan government reduced import tariff on wheat and flour but this policy was ineffective due to the export restrictions imposed by the major suppliers of wheat and flour and the already low rate of import tariff (World Bank, 2013; Persaud, 2013).

Due to periodic droughts, domestic production of wheat is highly variable (CV = 23% during the last decade) with about 15% of post-harvest losses. Most of the surplus wheat production originates from the northern and northeastern provinces with Helmand province in the south, i.e., the country's "breadbasket." About 11% of the total wheat production is supplied to markets and consumers prefer the quality of imported wheat and flour to that of local. Since a modern and efficient wheat milling industry is not available and consumers prefer imported flour, the country imports large quantities of flour than wheat (Schulte, 2007; Persaud, 2013). On average, during 2013/14 to 2015/16, the country spent as much as 10% of its agricultural GDP (487 million USD) on the imports of wheat and flour. However, the aggregate demand for wheat in the country is about 5.1 millions tonnes averaged over 2005/06 to 2014/15 with about 15% of deficit, which is met by commercial imports and food aid. It is mentionable that the aggregate demand for wheat may be underestimated as no population census is conducted since 1979. Pakistan and Kazakhstan are the two major suppliers of wheat and flour to the country, which accounted for 36% (541,552 tonnes) and 54% (806,373 tonnes) of total wheat and flour imports (1,494,222 tonnes) during 2013/14 to 2015/16, respectively. Given the significant share of these two countries in domestic wheat and flour markets, their trade distorting policies affect wheat and flour prices in the domestic markets (Dorosh, 2008).

The preceding discussions and the prevalence of food insecurity (31% of population) and poverty (36% of population) in Afghanistan suggest that the country is very vulnerable to shocks in wheat and flour prices (Central Statistics Organization, 2014). In addition to the domestically generated shocks, transmission of the recent spikes in global wheat prices affect domestic wheat markets and deteriorate welfare of the vulnerable consumers (Dorosh, 2008; D'Souza & Jolliffe, 2010; Persaud, 2013). However, there are no empirical studies that have investigated the effects of 2007–2008 food price shocks on domestic wheat markets and trade for the country. With this background in mind, the present research is undertaken to investigate the effects of the drastic increase in global wheat prices of 2007–2008 on the dynamics of price transmission and long-run equilibrium relationship between domestic and global wheat markets.

Table 1. Description of the Data Series Used in This Study

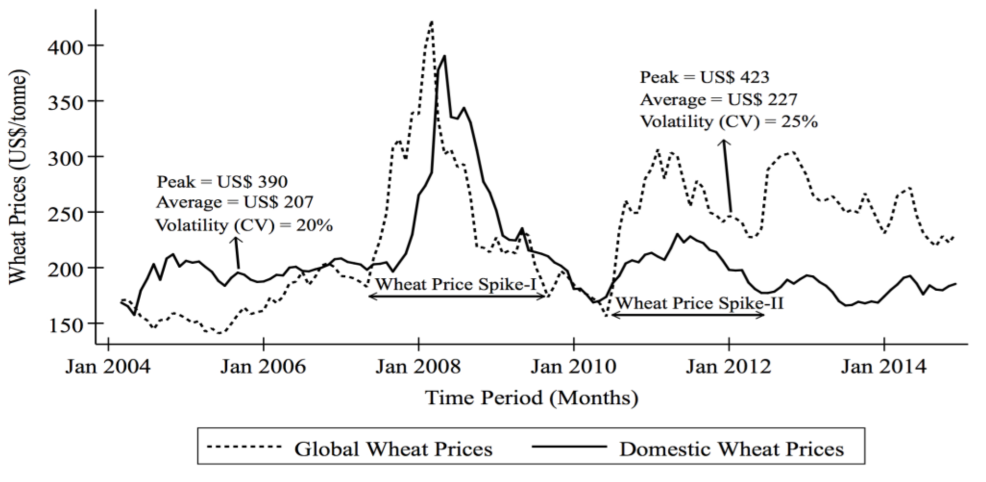
Data Series	Description	Reference
Domestic Wheat Prices	Average of the retail prices of wheat in 7 provincial central markets[a]	*Market Price Bulletins*, Vulnerability Analysis and Mapping Project of the World Food Program (WFP), Afghanistan Office
Global Wheat Prices	US No. 2 Hard Red Winter Wheat export prices (free on board) at US Gulf	Food Price Monitoring and Analysis Tool, Food and Agriculture Organization (FAO) Web: http://www.fao.org/giews/pricetool Accessed: January 15, 2015
Domestic CPIs	All items national CPIs	Central Statistics Organization of Afghanistan
USA CPIs	All items USA CPIs	International Financial Statistics, International Monetary Fund Web: http://data.imf.org Accessed: March 15, 2015
Exchange Rate	US dollars/Afghanis	
Cereal Price Index	FAO cereal price index	FAO Food Price Index, FAO Web: http://www.fao.org/worldfoodsituation/foodpricesindex/en/ Accessed: December 15, 2015
Miscellaneous	Annual data of wheat production, imports and consumption	FAOSTAT, Central Statistics Organization and Ministry of Agriculture, Irrigation and Livestock, Afghanistan (Agricultural Prospects Reports: 2005/06 to 2014/15)

Notes: CPIs stands for Consumer Price Indices; [a]Kabul, Jalalabad, Kandahar, Hirat, Maimana, Balkh and Faizabad

2. Data and Methods

2.1. Data Used in Analysis

To achieve the objective of this study, monthly data on global and domestic wheat prices, consumer price indices and exchange rates were collected for a period from March 2004 to December 2014. Monthly cereals price indices along with annual data on wheat production, consumption and imports were also used to complement the analysis. Table 1 describes the data series and their sources. Most of the studies on global to domestic price transmission used US No.2 Hard Red Winter Wheat (US No.2 HRWW) at US Gulf as global reference price for wheat (e.g., Minot, 2011; Ghoshray, 2011; Greb *et al.*, 2012). Given the purpose of this study, the export prices of US No.2 HRWW at US Gulf are taken as the global reference prices whereas the average of the retail prices of wheat in the seven provincial central markets (Kabul, Jalalabad, Kandahar, Hirat, Maimana, Balkh and Faizabad) are assumed as the domestic reference prices for wheat. It should be noted that the real global and domestic wheat prices are used throughout the analysis.



Source: Own Presentation Using FAO and WFP Data

Figure 1. Pattern of Changes in Global and Domestic Wheat Prices (real): March 2004 to December 2014

2.2. Pattern of Changes in Global and Domestic Prices of Wheat

Figure 1 depicts that the global and domestic prices of wheat traced similar changing patterns during March 2004 to December 2014, but global wheat prices appear to be more volatile than domestic wheat prices, which is reflected in the coefficient of variation of 25% and 20%, respectively. The relatively low variability in domestic wheat prices may be due to, *among others*, the fact that imports play an important role in the stabilization of domestic wheat prices. That is, in the absence of export restriction by the major suppliers of wheat to Afghanistan, i.e., Pakistan and Kazakhstan, wheat imports may reduce variability in domestic wheat markets. This is mirrored in the higher variability of wheat production as compared to its consumption in the country (Persaud, 2010). The dramatic upswing of wheat prices occurred between early 2007 and 2008 when the global prices of wheat more than doubled (increased by 131%) while domestic wheat prices almost doubled (increased by 99%). This was followed by a relatively large decline in both global and domestic wheat prices, respectively, by 63% and 57% between early 2008 and mid-2010. Another dramatic increase was observed between early 2010 and mid-2011 when global and domestic wheat prices experienced an increase of as much as 97% and 37%, respectively. In a nutshell, both price series traced similar changing patterns implying integration of domestic wheat markets to that of global markets in terms of co-movement of prices.

2.3. Methods of Analysis

Augmented Dickey and Fuller (1979) and Phillips and Perron (1988) unit root tests were employed to examine the non-stationarity property and order of integration of the global and domestic wheat prices. The dramatic increase in global food prices of 2007–2008 may have induced a break in the price series. Hence, Lee and Strazicich (2003) unit root test (LS test) with a single break in level (Model-A) and both in level and slope (Model-C) was used to test for unit root in the presence of a possible structural break and to endogenously determine a break point for dividing the entire price series into two separate regimes.

To measure the effects of the dramatic spikes in global wheat prices of 2007–2008 on domestic wheat markets, the entire sample was divided into two sub-samples, i.e., Regime-I (from March 2004 to February 2008) and Regime-II (from March 2008 to December 2014), as in Greb *et al.* (2012). Unlike Greb *et al.* (2012), the break point (February 2008) was endogenously determined by Model-A of the LS test in the first difference of global wheat prices. However, after the unit root tests confirmed that the price series are integrated of the same order, Johansen (1988) test of cointegration was employed to study the long-run relationship between domestic and global wheat prices in each of the two regimes as follows:

$$\Delta P_t = \pi P_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \, \Delta P_{t-i} + \varepsilon_t \tag{1}$$

where, P_t is a vector of I(1) wheat price series; π is the cointegrating matrix; and ε_t is a vector of white noise disturbance terms. The intercept is restricted to the cointegrating equation as suggested by Johansen and Juselius (1990) Chi-square test (see Appendix 1). Johansen's trace statistic was used to determine the number of cointegrating equations between domestic and global wheat prices as follows:

$$\lambda_{trace}\,(r) = -T \sum_{i=r+1}^{p} \ln\left(1 - \hat{\lambda}_i\right) \tag{2}$$

where, T is the total number of observations and $\hat{\lambda}_i$ shows the i^{th} characteristic root.

Previous studies on price transmission often selected the type of model rather subjectively without using an objective method for model comparison. However, we used Hansen and Seo (2002) statistical test for direct model comparison, which tests the null hypothesis of linear cointegration against the alternative of threshold cointegration. Since the test failed to reject the null hypothesis (see Appendix 2), a linear Vector Error Correction Model (VECM) was considered to examine the dynamics of price transmission between domestic and global wheat markets in each of the two regimes as follows:

$$\Delta P_t^d = \mu_0 + \alpha\left(P_{t-1}^d - \beta P_{t-1}^g\right) + \sum_{i=1}^{p} \delta_i \, \Delta P_{t-i}^g + \sum_{i=1}^{p} \gamma_i \, \Delta P_{t-i}^d + \upsilon_t \tag{3}$$

where, ΔP_t^d is the first difference of domestic wheat prices, i.e., $P_t^d - P_{t-1}^d$; P^d and P^g stand for logarithm of real domestic and global wheat prices, respectively; μ_0 is the constant term; α is the speed of adjustment; β is the elasticity of price transmission; δ and γ are coefficients of previous period's change in global and domestic wheat markets, respectively; and ν_t is i.i.d error term.

Since a standard VECM is linear in nature, identification of separate regimes for before and after the price spike allows for non-linearity in coefficients of the model and improves it to a regime dependent model (Greb *et al.*, 2012). However, the orthogonalized impulse response functions were estimated to trace the effect of a unit shock in global wheat prices on domestic wheat prices in Regime-I and Regime-II (Enders, 2015). Akaike and Bayesian Information Criteria were used to select the appropriate lag order for the unit root tests, cointegration test and VECM.

3. Empirical Results

3.1. The Order of Integration of Global and Domestic Wheat Prices

Augmented Dickey and Fuller (1979) and Phillips and Perron (1988) unit root tests were estimated considering the deterministic terms of only drift and drift plus a linear trend. The appropriate lag order was selected using Akaike and Bayesian Information Criteria. Table 2 presents the results of Augmented Dickey and Fuller (ADF) and Phillips and Perron (PP) unit root tests in level and the first difference of global and domestic wheat prices. The results of ADF and PP unit root tests with only intercept and both intercept and a linear trend indicate that global and domestic wheat prices are non-stationary in level but they are stationary in the first difference. In other words, the price series are integrated of order one, I(1).

Table 2. Results of ADF and PP Unit Root Tests for Global and Domestic Wheat Prices

Price Series	Lag	ADF Test		PP Test	
		with Drift (Intercept)	with Drift and Trend	with Drift (Intercept)	with Drift and Trend
Unit root test in level					
Global Wheat Prices	2	-2.185	-2.544	-1.998	-2.207
Domestic Wheat Prices	4	-2.694	-3.307	-2.278	-2.457
5% Critical Value		*-2.884*	*-3.446*	*-2.884*	*-3.445*
Unit root test in the first difference					
Global Wheat Prices	2	-8.869**	-8.845**	-8.918**	-8.928**
Domestic Wheat Prices	4	-4.661**	-4.636**	-9.012**	-9.059**
1% Critical Value		-3.482	-4.032	-3.482	-4.031

Notes: ** Indicates 1% level of significance; ADF and PP stand for Augmented Dickey and Fuller and Phillips and Perron, respectively; and the lag order is selected using Akaike and Bayesian Information Criteria.

The standard unit root tests are biased towards non-rejection of a false null hypothesis of unit root in the presence of a structural break (Perron, 1989). Thus, Lee and Strazicich (2003) unit root test (LS test) with a single structural break was carried out to examine whether a possible break in level (Model-A) or both in level and trend (Model-C) of the price series affected the unit root process. Table 3 reports the results of LS test. It is evident from the Table that both global and domestic wheat prices are non-stationary in level whereas they are stationary in the first difference. Although, Model-C showed that domestic wheat price series is non-stationary in first difference, it is not supported by the corresponding Model-A as well as ADF and PP unit root tests. Hence, ADF, PP and LS unit root tests confirmed that the global and domestic wheat prices are integrated of order one.

Table 3. Results of Lee and Strazicich Unit Root Test with One Structural Break

Price Series	Lag	Model A (break in level)		Model C (break in level & slope)	
		Test Statistic	Break	Test Statistic	Break
		Unit root test in level			
Global Wheat Prices	2	-2.528	2008:01	-2.860	2007:06
Domestic Wheat Prices	4	-3.191	2008:08	-4.848	2009:05
		Unit root test in the first difference			
Global Wheat Prices	1	-7.620**	2008:02	-8.123**	2007:12
Domestic Wheat Prices	3	-4.109*	2008:08	-4.098	2008:08
1% Critical Value (LM_τ)		-4.545		-5.823	
5% Critical Value (LM_τ)		-3.842		-5.286	

Notes: Model A allows for a one-time change in the intercept or level while Model C allows for a change in both level and trend or slope; ** and * shows 1% and 5% levels of significance, respectively; The critical values are taken from Lee and Strazicich (2003); and the lag order is selected using Akaike and Bayesian Information Criteria.

3.2. Cointegration between Domestic and Global Wheat Markets

It was shown in the previous section that the global and domestic wheat prices are integrated of the same order, which is a pre-requisite for conducting cointegration test. Johansen's cointegration test is estimated with intercept in the cointegrating vector for the overall period as well as for Regime-I and Regime-II. Akaike and Bayesian Information Criteria are used to select an appropriate lag order. Table 4 presents the results of cointegration between domestic and global wheat markets. The results show that the null hypothesis of no cointegration is rejected for Regime-I, Regime-II and the overall period at the conventional levels of significance. That is, domestic and global wheat markets are cointegrated in the pre-break (Regime-I), post-break (Regime-II) and the overall period of this study. This suggests that domestic and global wheat prices may move together despite the trade distortions that happened following the enormous spikes in global prices of cereals.

Table 4. Results of Johansen's Cointegration Test for the Pairs of Domestic and Global Wheat Markets

Null Hypothesis	Trace Statistic			Critical Value	
	Regime-I	Regime-II	Overall	5%	1%
$r = 0$	34.92**	32.20**	20.29*	19.96	24.60
$r \leq 1$	6.26	8.62	8.74	9.24	12.97
Lag	1	2	2		
Observations	47	80	128		

Notes: r stands for the number of cointegrating vectors; ** and * show 1% and 5% levels of significance; the lag order is selected using Akaike and Bayesian Information Criteria; Intercept is restricted to the cointegrating equation; Regime-I: March 2004 to February 2008; and Regime-II: March 2008 to December 2014.

The existence of cointegration between domestic and global wheat markets may be explained, among others, by the following factors. First, Afghan government is not directly involved in wheat production and trade (free market regime). Second, a lower tariff on imports (about 5%) with no quantitative trade restrictions have been implemented. Third, due to the high variability in domestic wheat production, lack of a competent flour producing industry, low marketable surplus (<11% of production) and the consumers' preferences in favor of imported flour, the country has to constantly import a considerable amount of wheat and flour. The markets for tradeable commodities (importable or exportable) are more likely to be cointegrated with their corresponding global market than non-tradable commodities. Fourth, reconstruction of the national 'Ring Road' and other secondary roads provide opportunities for better integration of domestic markets. However, the landlocked status, fragile transportation and communication infrastructure (the Ring Road is being damaged in some areas by insurgents and many secondary roads are still not asphalted. The Salang Pass, which connects northern provinces with the rest of Afghanistan, is often blocked during winters due to heavy snow or snow slides. Communication services are sometimes banned by the insurgents in areas of their influence.), corruption in customs management, political instability and trade distortive policies of the supplier countries are assumed to lower the degree of cointegration (Persaud, 2013; Schulte, 2007; Khan, 2007). Although, domestic wheat markets are cointegrated with global wheat markets, the strength and stability of this long-run relationship is critical for any country.

3.3. Price Transmission from Global to Domestic Wheat Markets

Since domestic and global wheat markets are cointegrated, the dynamics of price transmission from global to domestic markets are estimated using a Vector Error Correction Model (VECM) originated by Engle and Granger (1987). The results of VECM for Regime-I and Regime-II are presented in Table 5. It is evident from the Table that the coefficient of long-run relationship is statistically significant in Regime-I but not in Regime-II with the value of 0.39 and 0.02 in absolute terms, respectively. This suggests that as much as 39% of a change in global wheat prices is transmitted to domestic wheat market in regime-I. Moreover, the error correction coefficients of -0.42 in Regime-I and -0.08 in Regime-II have the correct signs for convergence and are statistically significant at the 1% level. That is, about 42% and 8% of a unit deviation from the long-run equilibrium between global and domestic wheat markets is corrected each month in Regime-I and Regime-II, respectively. While it takes approximately 2 months to eliminate 50% of any deviation from the long-run equilibrium in Regime-I, about 9 months are required to remove a similar magnitude of the deviation in Regime-II. Hence, the extent of price transmission and error correction are larger in Regime-I as compared to Regime-II.

The sharp contrast in the dynamics of price transmission between the two regimes may be explained by, *inter alia*, the following factors. First, the export restrictions were imposed by Pakistan and Kazakhstan, the major suppliers of wheat and flour to Afghanistan, due to the food price crisis of 2007–2008 in Regime-II. These two countries jointly accounted for 89% (1,429,510 tonnes) of total wheat and flour imports (1,610,113 tonnes) during 2014/15. The restrictions on wheat exports lasted for 3 years from 2007 to 2010 in case of Pakistan whereas Kazakhstan relaxed export restrictions after 6 months of ban, i.e., April 2008 to September 2008 (Sharma, 2011). Second, in a span of 4 years (2004/05 to 2007/08) that makes Regime-I, domestic wheat production was adversely affected by two droughts in 2004/05 and 2006/07. The demand for wheat import was also influenced by the prospects of a decline in the wheat production of 2008/09. Although Regime-II started with a severe drought in 2008/09, the remaining years experienced a bumper wheat production with a relatively low wheat production only in the drought year of 2011/12 (see Agricultural Prospects Reports 2005/06 to 2014/15 of Afghan agriculture). This situation resulted in a relatively higher demand for wheat imports in Regime-I than Regime-II. Additionally, 2002–2008 was the peak period of the repatriation of Afghan refugees during which about 4.4 million refugees returned to the country (UNHCR, 2009). This may have substantially increased demand for wheat imports in Regime-I. This suggests that arbitrage opportunities may be larger and remunerative in Regime-I, which implies a faster speed of adjustment and magnitude of price transmission during this regime. Third, Pakistan is the largest trading partner of Afghanistan, but trade and transit problems, insurgency around the border and the recent gloomy political relationship may have hindered trade between the two countries. The intensity of these problems increased in Regime-II (Parto *et al.*, 2012). Eventually, Afghan government turned to Kazakhstan and signed an agreement in November 2015 under which Kazakh milling wheat and flour are to be exported to Afghanistan at fair market prices.

Table 5. Results of Vector Error Correction Model (VECM) for the Pairs of Domestic and Global Wheat Markets

Coefficients of VECM & Diagnostics	Regime-I (Mar. 2004 to Feb. 2008)			Regime-II (Mar. 2008 to Dec. 2014)		
	Estimate	P-Value	SE	Estimate	P-Value	SE
μ_0	0.000	0.963	0.006	-0.002	0.597	0.004
α	-0.417**	0.000	0.075	-0.080**	0.000	0.021
β	-0.390**	0.000	0.069	-0.024	0.933	0.291
δ_1	-0.081	0.399	0.096	0.047	0.392	0.055
δ_2	-0.265**	0.005	0.095			
γ_1	0.194*	0.101	0.118	0.215**	0.005	0.076
γ_2	0.136	0.302	0.131			
Half-Life	2 months			9 months		
Lag	2			1		
AIC	-6.453			-6.426		
BIC	-5.931			-6.158		
LRM Test (1)	3.252	0.517		6.079	0.193	
LRM Test (2)	3.491	0.479		2.820	0.588	
JB Test	2.182	0.336		1.540	0.463	
Observations	45			80		

Notes: ** and * denote 1% and 10% levels of significance; μ_0 is the constant term; α is the speed of adjustment; β is the elasticity of price transmission; δ and γ are short-run coefficients of global and domestic wheat prices, respectively; the lag order is selected using Akaike and Bayesian Information Criteria ensuring that the residuals are not serially correlated; LRM test (1 and 2) stands for the Lagrange-multiplier test that examines the null hypothesis of no autocorrelation at lag order 1 and 2; JB test refers to the Jarque-Bera test for the null hypothesis of normally distributed disturbances; and SE is the Standard Error of estimates.

Analyzing a large set of cereals markets in developing countries during 1995 to 2011, Greb *et al.* (2012) reported a median elasticity of price transmission of 0.58 and 1.01 with adjustment coefficients of -0.68 and -0.21 in pre-break (July 2007) and post-break periods, respectively. As compared to their findings, the extent of price transmission and speed of adjustment found in this research are rather low in both regimes. The same factors mentioned above and those listed in the previous section should have been in place. Meanwhile, this may be due to the difference in the break points, when the break point in this study is 7 months late (February 2008) during which domestic prices were still vulnerable to the spikes in global prices.

3.4. The Effect of a Shock in Global Wheat Prices on Domestic Wheat Markets

The orthogonalized impulse response function was estimated for each of the two regimes to trace the effects of a shock in global wheat prices on domestic wheat prices. Figure 2 and Figure 3 display the estimated impulse response functions for Regime-I and Regime-II, respectively. The effect of a shock in global wheat prices on domestic wheat markets in Regime-I showed a rapid increase initially, but the rate of increase is reduced afterwards and stabilized at a higher level (Figure 2). This implies that the swings in global wheat prices may have a profound and long-lasting effect on domestic wheat markets in Regime-I. Moreover, a shock in global wheat prices may have a limited effect on domestic wheat markets in Regime-II for the first 4 months, but the effect is rapidly reduced after that (Figure 3). This means that, a shock in global wheat prices may have only transitory effect on domestic wheat markets in Regime-II. These findings are in line with the results of price transmission.

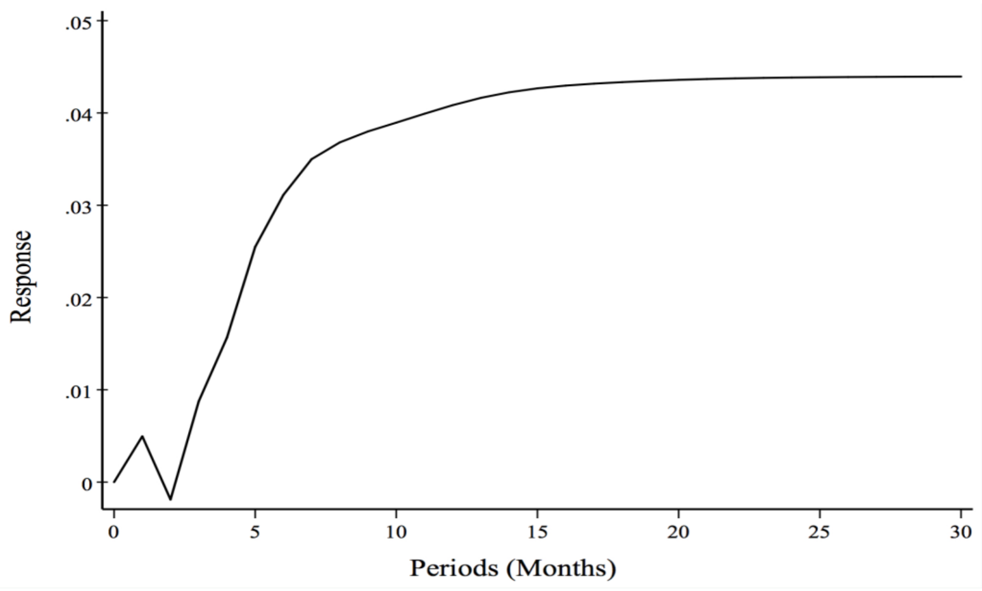


Figure 2. Response of Domestic Wheat Prices to a Shock in Global Wheat Prices in Regime-I

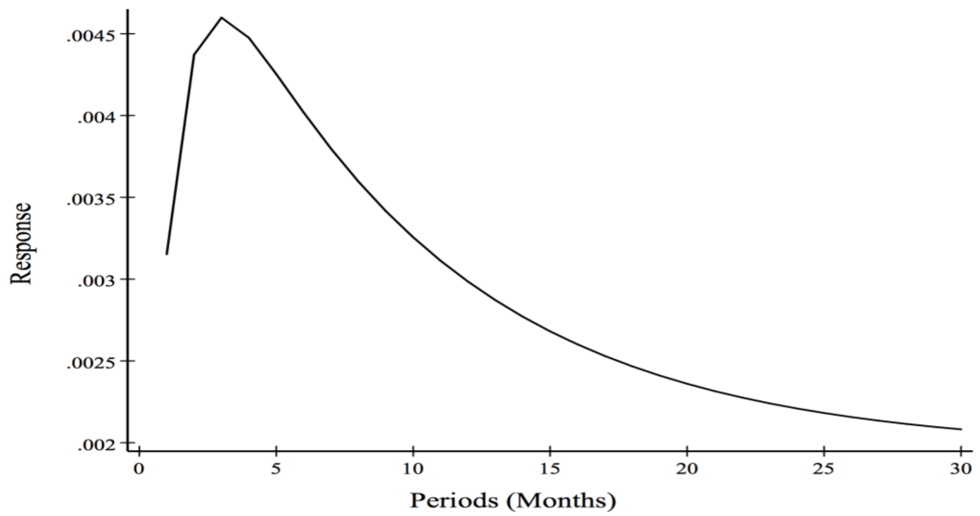


Figure 3. Response of Domestic Wheat Prices to a Shock in Global Wheat Prices in Regime-II

4. Conclusions and Policy Implications

Despite the landlocked situation, poor and fragile infrastructure and political instability coupled with the global food price shocks and consequent export restrictions, domestic wheat markets are integrated to global wheat market in Regime-I, Regime-II and the overall period of analysis. This may be due to the stronger dependence of the domestic wheat markets on global and regional wheat markets. Furthermore, the substantial difference in the magnitude of price transmission and speeds of adjustment towards equilibrium between the two regimes, i.e., they are larger in Regime-I than Regime-II, indicates that the global food price spikes of 2007–2008 may have (directly and/or indirectly) affected the dynamics of price transmission between global and domestic wheat markets. This is also consistent with the results of impulse response analysis. However, the point estimates of the magnitude of price transmission and speed of adjustment are relatively smaller, particularly in Regime-II, implying that domestic and global wheat markets may be weakly integrated, which shall be improved through reasonable policy measures that may address, *inter alia*, the problems discussed in sections 3.2. and 3.3. of this article.

The food price swings and the spillover effects of trade restrictive policies of the major wheat suppliers to the country (Pakistan and Kazakhstan) destabilized domestic wheat markets and trade. Although imports played a key role in buffering the variable domestic production and stabilizing domestic wheat prices, this buffering role may be questioned under a shock in global and the suppliers' wheat prices. Unless there are no prohibitive restrictions on wheat exports by the supplier countries, trade policy measures such as reduction of import tariffs may not be useful in stabilizing domestic wheat markets. Thus, it may be necessary for the country to maintain strategic wheat reserves, which can be used in case of tight market situations. Emergency programs such as safety-nets appears necessary to protect the most vulnerable households from the adverse effects of food price shocks. Measures such as increasing productivity of wheat, reducing post-harvest losses, developing a modern and efficient wheat milling industry and improving, and diversifying trading relationships may be effective for ensuring long-term stability of wheat markets and food security. Such measures may equally be important for other net food importing landlocked developing countries.

5. Recommendations for Future Research

Future studies can expand the analysis by including many net food importing countries along with their supplier countries and global market. It may also be of interest to use econometric methods that consider asymmetric adjustment and threshold behavior in the data analysis.

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Appendix 1. Results of Johansen and Juselius (1990) Chi-square Test

Estimates		Regime-I	Regime-II	Overall
Characteristic root of Restricted Model $(\hat{\lambda}_i^*)$		0.125	0.102	0.066
Characteristic root of Unrestricted Model $(\hat{\lambda}_i)$		0.123	0.101	0.066
Test Statistic		0.077	0.060	0.049
Critical Value	5%	3.842		
	10%	2.706		

Notes: Johansen & Juselius (1990) Chi-square statistic examines the null hypothesis of an intercept in the cointegrating vector against the alternative of a linear trend in the variables. Its formula is given below (Enders, 2015):

$$Test\ Statistic = -T \sum_{i=r+1}^{n} \left[\ln\left(1-\hat{\lambda}_i^*\right) - \ln\left(1-\hat{\lambda}_i\right)\right] \sim \chi^2_{(n-r)}$$

Appendix 2. Results of Hansen and Seo (2002) Test for Models Comparison

Test Statistic	Critical Value			Bootstrap Replications	Null Hypothesis
	1%	5%	10%		
17.10	21.78	18.42	17.11	1000	Linear Cointegration