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Afghanistan's Food Security: Evidence from Pakistan and Afghanistan Wheat Price Transmission using Threshold Vector Error Correction Model (TVECM)

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ABSTRACT

Afghanistan's food security mainly depends on Pakistan's wheat prospect, circumstances, agriculture policies, and market price dynamics. This study explores the price transmission mechanism of the wheat flour and wheat grain between Pakistan and Afghanistan using monthly price pairs from January 2003 through October 2017. The paper investigates the existing knowledge of how Pakistan's agricultural policy and wheat market affects the wheat market and food security of Afghanistan. The results confirm that the wheat flour price of Pakistan is found to be driving the price of wheat flour of Afghanistan. This implies that wheat flour price of Pakistan evolves independently, and that wheat flour price of Afghanistan balances any divergence in the long-run relationship between the two markets prices. The policy implication is to eradicate transaction costs as well as procuring timely wheat grain and flour, in order to maintain price stability between Pakistan and Afghanistan wheat markets.

Keywords
Afghanistan food security; Wheat grain & flour; Pakistan; market integration; TVECM

JEL Classification
Q13; F13; Q2

1. Introduction

A timely and adequate supply of food and household food security is a great challenge for many developing countries (Chabot & Dorosh, 2007). FAO defines food security as; physical and economic access to sufficient, safe and nutritious food by the household to fulfill dietary needs and food preference to attain health living standard" (FAO, 1996). Similarly, Jones et al., (2013) classify food security into four dimensions: availability, accessibility, and utilization, and stability of each of these dimensions.

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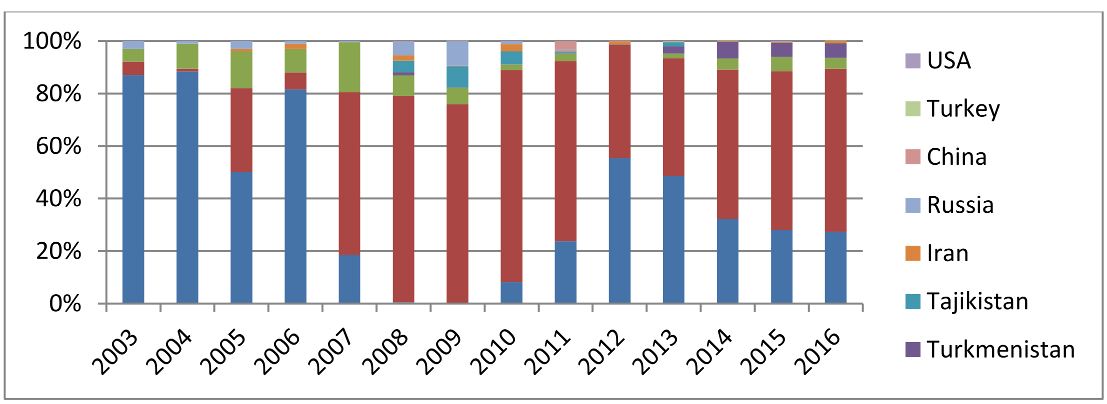
Food insecurity has been remained as one of the priorities of national and international policy agendas due to frequent global food crises. Consequently, it causes drastic implications for poverty, health, and nutrition (D'Souza & Jolliffe, 2013). Accordingly, the current study explores the wheat shortage of wheat availability and accessibility and its subsequent effect on the food security situation of Afghanistan. Importantly, the wheat shortage is used as an indicator of food insecurity as wheat is one of the largest source of energy, thus manifesting the importance of the study, from a food security perspective (FAO, 2016a). Moreover, mostly the impoverished segment of the society's food security depends on the timely availability of wheat grain and wheat flour.

According to the World Food Program, Afghanistan is one of the world's most vulnerable country in terms of food absorption-suffers from consistent food insecurity and households significant share of income spend on food (D'Souza & Jolliffe, 2010). Moreover, Afghanistan is one of the biggest importers of wheat in the world and almost one-third of Afghanistan's domestic wheat requirements are fulfilled by imports (see Figure 1). On average Afghanistan' wheat consumption is 143 kg/year per head slightly above the regional average and constitutes 66 % of the calories of the domestic diets (FAO, 2016a). On average, Afghanistan import 2.1 million MT annually mostly from Pakistan and Kazakhstan (Central Statistics Organization of Afghanistan, 2016). Similarly, the wheat milling industry is underdeveloped in Afghanistan though well developed in Pakistan (FAO, 2016a). Hence, a major portion of wheat imported by Afghanistan is wheat flour instead of wheat grain. Thus, Afghanistan wheat flour imports from Pakistan continue in part because of the lack of milling capacity to produce high-quality of wheat flour and in part due to high incomes, hence, mostly urban households demand better quality imported wheat flour (Chabot & Dorosh, 2007). Thus, Afghanistan's food security mainly depends on Pakistan's wheat prospect, circumstances, agriculture policies, and market prices.

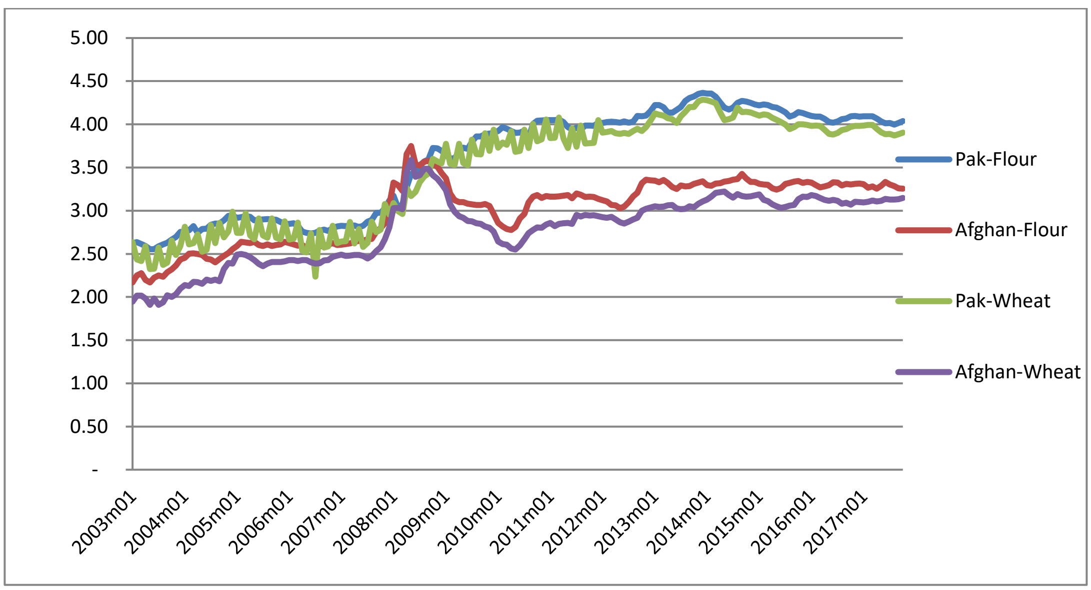
Figure 1 by countries: Afghanistan wheat grain and flour import during 2003-2016



Source: Central Statistics Organization of Afghanistan (2016), Author's calculation

Pakistan is a major contributor of wheat production in the region, however with a population of more than 200 million has also the highest domestic requirements. Pakistan often imposes inter-provincial, inter-district and inter-region restrictions on wheat transportation to procure a targeted quantity of wheat for maintaining food price stability. Moreover, the Pakistan government is constantly regularizing her wheat market by purchasing from farmers, then releasing the wheat to the mills industry at a fixed price. Pakistan supply wheat flour to Afghanistan, regularly (USDA, 2016). Moreover, the ban of wheat export of Pakistan had drastic consequences on the food security of Afghanistan manifested from the escalating wheat and flour prices during the 2009-10 periods (see Figure 2). It negatively affected all the stakeholders in the value chain. This could also cause inconsistent supply to Afghanistan. Similarly, from Pakistan, a consistent and abundant wheat supply will keep the wheat price stable as well as keeping in at an affordable rate in Afghanistan. Moreover, Afghan Transit Trade Agreement (ATTA) is not fully implemented. This could affect trade between the two trading economies and encourage informal and illegal trading.

Figure 2 Pakistan and Afghanistan wheat grain &flour prices series trend (2003-2017)



Note: author’s calculation

Keeping in view the food security scenario in Afghanistan, this study investigate the impact of the regional producer of wheat such as Pakistan that could have the greatest expected impact on the wheat markets of Afghanistan. The food and agricultural organization (FAO) revealed that more than 53.2 percent of households faced food insecurity in 2019, and almost 11million habitants need food aid (Samim & Zhiquan, 2020) Moreover, food insecurity is a widespread and serious issue, due to insufficient, limited access and poor utilization of food, in Afghanistan (D'Souza & Jolliffe, 2013). Thus, it is important to review the existing knowledge of how Pakistan's wheat price fluctuation affects both wheat markets and subsequent food security situation and outlook in Afghanistan. In addition, the study fills the existing research gap and will help in improving the food security analysis and the estimation of food demand in Afghanistan. Moreover, the contribution of the study is the spatial product integration of horizontal price transmission between Pakistan and Afghanistan wheat grain and wheat flour markets using monthly retail price data from January 2003 to October 2017. The preceding paragraph will discuss the existing literature on spatial price transmission mechanisms.

Market integration of agriculture goods has acquired colossal attention in empirical field of studies in development economics. Similarly, emerging economies have embarked on opening their domestic markets incorporating structural reforms and trade liberalization policies. Moreover, price signal transmits smoothly among in an integrated markets. Smooth trading of goods among markets helps in transferring of supply of goods from excessive good market to a market of shortage one (Barrett, 2008). Subsequently, price stability and trade openness results in allocative efficiency which could improve living standard of the people. (Srinivasan & Jha, 2001). Basically, (Engle & Granger, 1987) advanced the idea of cointegration, highlighting a linear combination of variables. A linear combination of variables exhibits a stable long-run behavior depicted by the vector error correction model.

However, economic theory arguments favor that deviation from the long-run equilibrium is not instant, instead, the long-run adjustment happens after a certain threshold level is reached, mainly, because of transaction cost as well as price stickiness (Balke & Fomby, 1997). In that situation, threshold cointegration comes into play. Specifically, the data pairs used in the current study show the properties of non-symmetry patterns particularly during the 2008/09 period due to the temporary export ban of wheat from Pakistan to Afghanistan. Economic theory put forward another argument in favor of threshold cointegration, which states that the divergence from the equilibrium adjusts asymmetrically instead of symmetric pattern due to market power, menu cost, or some other political reasons (Levy et al., 1997).

Numerous studies are available based on spatial wheat market asymmetric price transmission mechanism (Ghoshray, 2007) (Ahmed & Singla, 2017); (Z. Bakucs et al., 2015); (L. Z. Bakucs et al., 2012); (Pall et al., 2013) (Dawson et al., 2006); (Esposti & Listorti, 2018); (Brosig et al., 2011). In the same way, the law of one price has been investigated for the spatial Turkish wheat market by Eryigit & Karaman, (2011). Similarly, Goychuk & Meyers, (2014) investigated the Russian and Ukrainian wheat markets and comparing with the US, the EU and Canada wheat markets. Indian wheat markets also suggest asymmetries in price adjustment (Ghoshray, 2007); (Ghoshray and Ghosh, 2011). Moreover, for Pakistan and Afghanistan, only conventional cointegration methods have been used (Chabot & Dorosh, 2007) (Persaud, 2012) (Halimi et al., 2015).

To the best of my knowledge, there is no such studies investigating wheat market integration between Pakistan and Afghanistan using advanced dynamic models.

The rest the paper is organized as follows. Section 2 presents the data and empirical method, followed by empirical results and discussions in section 3. Finally, section 4 concludes and suggests some policy recommendations.

2. Theoretical framework

The theoretical framework of the study is based on the Law of One Price (LOP), which considers a frictionless market, meaning that the price of identical commodities will have the same price globally, irrespective of their location (Fackler & Goodwin, 2001). Co-integration between two commodities market implies that price in the two markets may behave differently in the short-run period, however, that converging into a stable equilibrium in the long-run period (Rapsomanikis et al., 2006). Transaction cost and border restriction are the major cause of price inequality, nevertheless, domestic policies affecting price formation do also affect both vertical and spatial price relations (Baffes & Ajwad, 2001; Cramon-Taubadel, 1998).

Consider prices of a good in two spatially separated markets $\boldsymbol{P_{1t}}$ and $\boldsymbol{P_{2t}}$, then the Law of One Price postulates that allowing for border and domestic policies transaction cost *c*, suppose transporting the wheat from Pakistan wheat market to Afghanistan wheat Market, the established relationship between the prices is given:

$$\boldsymbol{P_{1t} = P_{2t} + c} \tag{1}$$

A complete price transmission occurs in two markets where changes in one market price such as wheat price in Pakistan are transmitted instantaneously to the other price such as Afghanistan. Thus, indicating spatially separated integrated markets. Moreover, this implies that if price changes are not converge quickly, depicting imperfect price transmission in the short run, however, perfect/complete price convergence in the long run. Thus, changes in the price at one market that is Pakistan, may require considerable time period to be transmitted to other market that is Afghanistan due to many reasons, particularly domestic policies, marketing structure, the contractual arrangements, lags caused in transportation and unwarranted price control. Similarly, asymmetric response of one market price to another market price implies nonlinear adjustment. Thus, asymmetric price responses uses the asymmetric error correction model proposed by Granger & Lee, (1989) or threshold cointegration models developed by Enders & Granger, (1998).

Importantly, the interpretation of the short run adjustment parameters captures the speed of price transmission, whereas, the long run multiplier is interpreted as a measure of the degree of price transmission from one market to another market (Prakash, 1999). Therefore, the current study will investigate wheat price transmission between Pakistan and Afghanistan spatially separated wheat market through a linear as well as threshold cointegration models.

3. Data Description and Empirical Method

3.1 Data and Variables

The data use in the analysis consists of monthly retail prices of wheat grain and wheat flour from January 2003 through October 2017. The data for Pakistan wheat price series are taken from various issues of Monthly Review of Price Indices, Government of Pakistan, and Federal Bureau of Statistics. While the data source of Afghanistan comes from Global Information Early Warning System (GIEWS) of the Food and Agriculture Organization (FAO) of the United Nations. Finally, the data series of wheat grain and wheat flour for both countries are adjusted with the exchange rate. The subsequent analysis is carried out on the logarithm of prices.

3.2 Stationary Test and Lag Selection

To start with potentially non-stationary time series data the price series will be initially tested for their order of integration using the (Dickey & Fuller, 1979)Augmented Dickey Fuller (ADF) unit root test (1979, 1981), PP by (Phillips & Perron, 1988) and KPSS by (Kwiatkowski et al., 1992). The first two unit root test that is the ADF test, and PP test null hypotheses indicate that the price series carry unit root process. In contrast, the KPSS null hypothesis test indicates that the price series is level or trend stationary. Accordingly if the price series are non-stationary at level, then there is danger of spurious regression and we need to test for the presence of a true cointegration relationship. Moreover, the optimal lag length is selected using the AIC, BIC, EPE and the HQ. The optimal lag length will be selected based on the aforementioned criterion, having minimum of the test values.

3.3 Linear Cointegration Analysis

The wheat price long run cointegration is checked by rank (Johansen, 1995) cointegration procedure. The Johansen cointegration technique is the most appropriate procedure to employ, for the data series which is integrated of the same order, the. Consequently, the (Johansen, 1988) Johansson (1988, 1995), Vector Error Correction Model is specified as:

$$\Delta Y_t = \sum_{i=1}^{k-1} \theta_i \; Y_{t-i} + \vartheta \, Y_{t-1} + \mu + \varepsilon_t \qquad (2)$$

Where Δ represents difference operator, μ stand for drift parameter, ϑ is the $p*p$ matrix $\vartheta = \alpha\beta'$, where adjustment coefficient is represented by α and β contains cointegrating vector. The tests are based on calculated by the likelihood test calculate the Trace and maximum Eigen-values of the Johansen test. However, the drawback of this method is that it assumes that the cointegrating vector remains constant during period of analysis. The long run relationship changes between the variables owing to technological progress, economic crisis, political upheaval, institutional development, policy, or regime change. For this reason, we use the (Gregory & Hansen, 1996) test as a robust check of cointegration incorporating structural break in the data analysis.

3.4 Gregory and Hansen Test

(Gregory & Hansen, 1996) cointegration test allows for possible structural breaks. The simple Greogory and Hansen model with regime shift is written as:

$$Y_t = \mu_1 + \mu_2\emptyset_{tk} + \beta_1 X_t + \beta_2 X_t \emptyset_{tk} + \varepsilon_t \quad (3)$$

Where k is the regime shift or breaks date, and $\emptyset$ is a dummy variable such as

$$\emptyset_{tk} = \begin{cases} 0 & if \quad t \leq k \\ 1 & if \quad t > k \end{cases}$$

This test has three statistic such as, ADF^*, Z_α^* and Z_t^*. The null hypothesis of no cointegration with structural break tests against the alternative hypothesis of cointegrtaion. The single break date determines endogenously. The null hypothesis rejects if the statistic is smaller than the corresponding critical values.

3.5 Threshold Cointegration

Finally, (Hansen & Seo, 2002) two-regime threshold cointegration model is used to investigate the long run relationship between the price pairs. The two-regime threshold model for Pakistan and Afghanistan price pairs with cointegrating vector and threshold parameter is given by:

Regime 1

$$\begin{bmatrix} \Delta p_t^{Pak} \\ \Delta p_t^{Afg} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \beta_i^{pak,pak} & \beta_i^{pak,afg} \\ \beta_i^{afg,pak} & \beta_i^{afg,afg} \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^{Pak} \\ \Delta p_{t-i}^{Afg} \end{bmatrix} + \begin{bmatrix} \theta_1^{Pak} \\ \theta_1^{Afg} \end{bmatrix} [ECT_{t-1}] + \begin{bmatrix} \varepsilon_t \\ \epsilon_t \end{bmatrix} \; if$$

$$ECT_{t-1} \leq \gamma$$

Regime 2

$$\begin{bmatrix} \Delta p_t^{Pak} \\ \Delta p_t^{Afg} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \beta_i^{pak,pak} & \beta_i^{pak,afg} \\ \beta_i^{afg,pak} & \beta_i^{afg,afg} \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^{Pak} \\ \Delta p_{t-i}^{Afg} \end{bmatrix} + \begin{bmatrix} \theta_1^{Pak} \\ \theta_1^{Afg} \end{bmatrix} [ECT_{t-1}] + \begin{bmatrix} \varepsilon_t \\ \epsilon_t \end{bmatrix} \; if$$

$$ECT_{t-1} > \gamma \quad (4)$$

Where γ is the threshold parameter and "*Pak*" and "*Afg*" represent Pakistan and Afghanistan wheat grain and wheat flour price pairs, respectively. Unlike, other methodologies which assume parameters are known before, the method of (Hansen & Seo, 2002) Hansen and Seo, (2002) assumes both β and γ are unknown and estimated from the data. Similarly, the error correction coefficient shows the speed of adjustment of the market wheat prices back towards equilibrium.

Furthermore, Hansen & Seo, (2002), recommended a heteroskedastic consistent LM test statistics for the null hypothesis of linear cointegration against the alternative of threshold cointegration.

$$supLM = sup_{\gamma l \leq \gamma \leq \gamma u} LM\ (\tilde{\beta}_{,}\ \gamma) \qquad (5)$$

Where $\tilde{\beta}_{,}$ is the β estimated.

Finally, (Hansen & Seo, (2002) explain the sampling distribution either through fixed regressor bootstrap of Hansen, (1996) or a parametric residual bootstrap algorithm.

4. Empirical Results and discussions

4.1 Stationary check and lag length selection criteria

A suitable lag length of the wheat grain and wheat flour prices pairs for both Pakistan and Afghanistan markets are determined by the FPE, AIC, SBIC, HQIC, and LR. The optimal lag length chosen by these tests are four *(L = 4)* for both Pakistan and Afghanistan wheat grain markets. While, maximum lag length *(L = 2)* for Pakistan wheat flour markets and *(L = 4)* for Afghanistan wheat flour market. In selecting the lag length of the VAR of bivariate threshold cointegration we use the above mention selection criterion, all of them leading to maximum lag length *(L = 4).*

All the tests used for stationary check, show that the price pairs of wheat (both grain and flour) for both markets is non-stationary at level (trend & constant) except for Afghanistan wheat grain and wheat flour prices based on ADF test. Whereas, the price pairs become stationary in their first difference and significant at 1 % level. The results of both non-stationary and stationarity price pairs are shown in Table 1.

Table 1 Unit Root Test Results

Level form						
Var.	*ADF*		*PP*		*KPSS*	
	Constant	*Trend*	*Constant*	*Trend*	*Level*	*Trend*
Pak-F	-1.78	-0.77	-1.50	-0.50	15.9-1.21	2.84-0.23 k = 13
Afg-F	-2.68*	-3.50**	-2.18	-2.34	10.9-0.96	1.74-0.18 k = 9
Pak-W	-1.69	-0.83	-1.32	-2.71	15.5-1.2	2.54-0.23 k = 13
Afg-W	-2.86**	-3.89**	-2.03	-2.30	11.9-1.01	1.58-0.16 k = 7
First difference form						
Pak-F	-6.39***	-6.58***	-10.37***	-10.48***	0.51-0.26***	0.19-0.11*** k = 13
Afg-F	-4.40***	-4.48***	-9.94***	-9.96***	0.22-0.12***	0.05-0.03*** k = 13
Pak-W	-6.53***	-6.81***	-30.13***	-30.61***	0.03-0.18***	0.02-0.11*** k = 13
Afg-W	-3.99***	-4.06***	-10.26***	-10.22***	0.20-0.09***	0.06-0.03*** k = 13

Where $\propto = 0.01; \propto = 0.05; \propto = 0.1,$ indicated by $***, **, *$ $respectively.$

Till lag 13, the price series are trend stationary in their first differences, because the KPSS test statistic values are less than the critical values.

Pak-F = Pakistan flour price, Pak-W = Pakistan wheat price. Afg-F = Afghanistan flour price, Afg-W = Afghanistan wheat price.

4.2 Johansen Test for Cointegration

First checking the stationarity and optimal lag length selection, Johansen Cointegration technique is employed to investigate the long run relationship between the wheat grain and flour markets of Pakistan and Afghanistan. The findings of the Johansen test are illustrated in Table 2.

The null of no cointegration is rejected as the trace statistic at $r = 0$ exceeds it critical value for all price pairs. In contrast, the null hypothesis is not rejected, as one or less cointegrating equations exist, because trace statistic at $r = 1$ is less than its critical value for all price pairs. The result of price series reveal that both markets combinations are cointegrated of order 1 indicating a long run relationship between the two market price pairs.

Table 2 Rank Johansen Cointergation Results

Series	*Rank = r*	*Trace Statistic*	*Critical value (5%)*	*Results*
Pakf-Afgf	0	16.93	15.41	r = 1
	1	3.045*	3.76	
Pakw-Afgw	0	16.75	15.41	r = 1
	1	2.846*	3.76	

Note: significance at $\propto = 0.05$ is indicated by *. Pakf-Afgf stands for Pakistan and Afghanistan Flour price series, while Pakw-Afgw stands for Pakistan and Afghanistan Grain price series.

4.3 Gregory-Hansen Test for Cointegration with Regime Shifts

Similarly, if there is a break in the price series (see Figure 2) indicating that the test of linear cointegration is biased towards not rejecting the null hypothesis of no cointegration.[1] To handle this issue a test is proposed by (Gregory & Hansen, 1996) where the data of structural change is estimated endogenously. The test reject the null hypothesis of no structural break and the break dates turns out December 2008. The time period of the break coincides with the ban of wheat exports by Pakistan to Afghanistan during 2008 and 2009. This ban of wheat exports has been a significant change in the Pakistan domestic agriculture policy. The policy change/regime shift threatens food security of Afghanistan manifested from the prices increase of Afghanistan wheat grain and wheat flour markets during the period 2008 and 2009. Table 3 shows the results of the regime shifts.

Table 3 Gregory and Hansen structural break test

Pakistan-Afghanistan Wheat Flour						
Cointegration models	*Break point*	*Test statistic*	*Critical value*			*Reject Ho if no CI*
			1 %	*5%*	*10 %*	
ADF*	2008M12	-5.39**	-5.47	-4.95	-4.68	Yes
Zt	2009M02	-5.30**	-5.47	-4.95	-4.68	Yes
Za	2009M02	42.82*	-57.17	-47.04	-41.85	Yes
Pakistan-Afghanistan Wheat Grain						
ADF*	2008M12	-5.08**	-5.47	-4.95	-4.68	Yes

[1] We have already rejected the null of no cointegration above. So even if this bias is present, it cannot be strong enough to change the results of the cointegration tests. However, we still include Gregory and Hansen test because it helps us in finding the exact regime shift time period, because we are also interested to find out the regime shift due to the export ban of Pakistan to Afhanistan.

Zt	2009M01	-9.05***	-5.47	-4.95	-4.68	Yes
Za	2009M01	-114.42 ***	-57.17	-47.04	-41.85	Yes

Note: The critical values are from Gregory – Hansen (1996a)

4.4 Test of Null Hypothesis of Linear Cointegration versus Threshold

Finally, Hansen & Seo, (2002) test confirms the threshold cointegration for both markets: Pakistan-Afghanistan wheat flour and Pakistan-Afghanistan wheat grain market prices pairs. Test statistic and fixed regressor bootstrap both reject the null of linear cointegration at 5% and 10% significance level. Therefore, the threshold model is preferred over other conventional models.

Table 4 Test of linear versus Threshold Cointegration

a. Test of linear versus threshold cointegration by Hansen and Seo (2002)[a]			
Test Statistic:	35.853**	(Threshold value maximize: -2.098)	
P-Value:	0.035	(Fixed regressor bootstrap)	
Critical values:	0.90%	0.95%	0.99%
	33.018	35.004	39.594
Number of bootstrap replications:			1000
Cointegrating value (estimated under restricted linear model):			-1.876
b. Test of linear versus threshold cointegration of Hansen and Seo (2002)[b]			
Test Statistic:	24.987**	(Maximized for threshold value: -1.122)	
P-Value:	0.031	(Fixed regressor bootstrap)	
Critical values:	0.90%	0.95%	0.99%
	22.487	24.130	26.983
Number of bootstrap replications:			1000
Cointegrating value (restricted linear model):			-1.619

a = Pakistan Afghanistan Wheat Flour Cointegration
b = Pakistan Afghanistan Wheat Grain Cointegration

4.5 Long Run and Short Run Relationship between the Wheat (flour & grain) Market Price Pairs

Wheat Flour Market Integration Results

Table 5 presents the long run and short run relationship between the two price pairs utilizing threshold vector error correction model (TVECM). The estimated cointegration relationship is (1, -1.17) and threshold parameter is γ = -0.27, dividing the data into two regimes. The extreme regime consists of only 15% of the observations (regime 1), while the general regime and consists of 85% of the observations (regime 2).

For the wheat flour markets: both Pakistan and Afghanistan wheat flour markets depict significant error correction adjustment in regime 1 at 1% and 10% significance level, respectively. Specifically, for Pakistan the coefficient ECT_{t-1} (0.19) indicating the speed of adjustment back to the long run equilibrium, that is nearly 19% of disequilibrium of the previous month shock adjust back to the long run equilibrium in the current month. Whereas, adjustment coefficients are not significant for both flour markets in regime 2. Thus, confirming the threshold model, as transaction cost or temporarily ban on exports slow down the long run price adjustment between the two flour markets. These findings are in line with the previous studies such as, Griffith & Piggott, (1994) revealed asymmetries for Australian animal markets.

The impact of Pakistan lagged period prices on current Afghanistan flour price are significantly higher than that of the impact of Lagged period price of Afghanistan prices on current Pakistan price in the short run though limited to regime 1. Specifically, the lagged one and lagged two period price impacts of Pakistan on the current flour price of Afghanistan is significant. This mean that Pakistan wheat flour price is found to be the driving the price of the Afghanistan wheat flour price. This implies that Pakistan wheat flour price follows independent pattern, and that the Afghanistan wheat flour price adjusts to correct any disequilibrium in the long run between the two markets prices. In addition, the impact of own lagged period price of Afghanistan is significant. Moreover, in regime 2 only Afghanistan current price is affected by its lagged one period price. This shows that Afghanistan flour prices are very sensitive to any previous shocks.

Table 5 Wheat Flour Market Integration Results

Dependent variable	Δp_t^{Pak}		Δp_t^{Afg}	
	Regime-1	*Regime-2*	*Regime-1*	*Regime-2*
ECT_{t-1}	$-0.193(0.000)$ ***	$-0.017(0.208)$	$0.155(0.020)$ *	$0.003(0.839)$
Intercept	$-0.048(0.014)$ *	$0.007(0.068)$	$0.047(0.568)$	$0.003(0.463)$
Δp_{t-1}^{Pak}	0.220 (0.130)	$0.184(0.055)$	-0.053 (0.626)	$0.069(0.458)$
Δp_{t-2}^{Pak}	-0.253 (0.084)	$0.007(0.937)$	-0.310 (0.008)**	$-0.043(0.668)$
Δp_{t-3}^{Pak}	-0.146 (0.369)	$0.041(0.671)$	$0.249(0.005)$ **	$0.103(0.299)$
Δp_{t-4}^{Pak}	$-0.091(0.606)$	$-0.079(0.404)$	$-0.192(0.065)$	$-0.074(0.411)$
Δp_{t-1}^{Afg}	0.461(0.009)**	$-0.003(0.984)$	0.407 (0.002)	$0.400(0.000)$ ***
Δp_{t-2}^{Afg}	-0.770 (000)***	$0.022(0.851)$	0.151 (0.286)	$0.049(0.686)$
Δp_{t-3}^{Afg}	$0.108(0.956)$	$-0.030(0.801)$	0.590 (0.000) **	$0.053(0.661)$
Δp_{t-4}^{Afg}	0.403 (0.059)	$-0.074(0.519)$	0.096 (0.442)	$-0.072(0.510)$

Note: parenthesis incorporates Eicker-White SE. *** *p<0.01;* ** *p<0.05;* * *p<0.1*
Regime1: $ECT_{t-1} \leq$ -0.27; Regime2: $ECT_{t-1} >$ -0.27

Wheat Grain Market Integration Results

Similarly, Table 6 presents the results of wheat grain prices of both countries, estimated by maximum Likelihood at the VAR lag length four (L = 4). The estimated cointegration relationship is (1, -1.21) and the threshold parameter is γ = -0.31, dividing the data into two regime. Regime 1 consists of only 15% of the observations, while regime 2 consists of 85% of the observations.

The adjustment coefficient for wheat grain market for Pakistan is insignificant in both regimes however, significant for Afghanistan only in regime 1. The reason could be due to Afghanistan wheat grain market integration with other regional markets particularly Kazakhstan and Uzbekistan. Therefore, any deviation from short run shock is quickly adjusted in the long run. For regime 1, the own lagged period prices of both countries have a significant impact on the current prices of respective country. Moreover, the lagged four period price influence of Pakistan on Afghanistan current price is significant in regime 1. This shows that any change in current period wheat price of Pakistan affect Afghanistan wheat grain price after four months. For regime 2, up to lagged 3 periods, own prices impact current price of both countries. Interestingly, lagged one period price of Afghanistan affects Pakistan current wheat grain price.

Table 6 Wheat Grain Market Integration Results

Dep. Va.	Δp_t^{Pak}		Δp_t^{Afg}	
	Regime-1	*Regime-2*	*Regime-1*	*Regime-2*
ECT_{t-1}	$-0.195(0.102)$	$0.008(0.803)$	$0.149(0.009)$ **	$0.016(0.315)$
Intercept	$0.045(0.492)$	$0.0001(0.991)$	$0.082(0.011)$ *	$-0.0004(0.941)$
Δp_{t-1}^{Pak}	$-0.492(0.015)$ *	$-0.806(000)$ ***	$-0.211(0.375)$	$0.845(0.0002)$ ***
Δp_{t-2}^{Pak}	$-0.525(0.004)$ **	$-0.397(0.0006)$ ***	$-0.3263(0.215)$	$-0.0224(0.9233)$
Δp_{t-3}^{Pak}	$-0.224(0.332)$	$0.256(0.021)$ *	$-0.042(0.847)$	$-0.286(0.221)$
Δp_{t-4}^{Pak}	$-0.241(0.182)$	$0.126(0.130)$	$-0.245(0.352)$	$-0.246(0.276)$
Δp_{t-1}^{Afg}	$0.067(0.486)$	$.045(0.277)$	$0.400(0.0006)$ ***	$0.236(0.028)$ *
Δp_{t-2}^{Afg}	$-0.0540(0.542)$	$0.0184(0.7351)$	$-0.2390(0.059)$	$0.1030(0.3573)$
Δp_{t-3}^{Afg}	$-0.181(0.103)$	$-0.009(0.855)$	$0.680(0.000)$ ***	$0.229(0.042)$ *
Δp_{t-4}^{Afg}	$-0.295(0.0008)$ ***	$-0.023(0.553)$	$0.230(0.070)$	$0.016(0.879)$

Note: parenthesis incorporates Eicker-White SE: **** p<0.0; ** p<0.05; * p<0.1*
Regime1: $ECT_{t-1} \leq$ -0.31; Regime2: $ECT_{t-1} >$ -0.31

5. Conclusion and Policy Implications

Afghanistan food security mainly depends on Pakistan wheat situation, outlook, policies and prices. The high prevalence of consumption makes wheat grain and flour markets the most significant agricultural market to evaluate in relation to food security. This study investigates the price transmission mechanism of wheat flour and grain markets between Pakistan and Afghanistan. The finding confirms that there exist threshold cointegration between the two markets. The striking finding which we infer from this study is that wheat flour price of Pakistan is found to be the driving the price of wheat flour price of Afghanistan. This implies that Pakistan wheat flour price follows independent pattern, and that the Afghanistan wheat flour price adjusts to correct any disequilibrium in the long run between the two markets prices.

In addition, the recent spike in the wheat price of Pakistan is mainly due to production fluctuation rather than market manipulation (inadequate irrigation water supply, post-harvest losses, high cost agriculture inputs, and high cost of doing business hurting competitiveness of Pakistan). As the food insecurity is linked to poverty, therefore, dietary quality significantly declines in times of high inflation. Thus, Pakistan wheat policies have repercussions for both national and households' food security situation in Afghanistan. From policy perspective, the more integrated the markets, the better it convey price signals to the policy and decision makers, marketing of the commodities and efficient allocation of commodities within and among the regions. Afghanistan will remain subject to wheat supply disruption and price spike as long as its domestic production is underdeveloped. Therefore, reducing transaction cost and implementing an efficient wheat procurement policy will help in the long run equilibrium convergence and price stability. Importantly, it is suggested to revisit the procurement pricing policy, facilitating trade openness and smooth running of the wheat transport between Pakistan and Afghanistan.

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