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PRICE TRANSMISSION ANALYSIS ALONG THE FOOD CHAIN

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ABSTRACT: *Vertical price transmission between wheat and flour markets in Kazakhstan has been analyzed using monthly data during the period 2000-2010. Officials applied a wide variety of policies in response to global wheat price increases, often causing adverse and unintended effects on regional domestic wheat and flour prices. Overall, short-run policies aimed especially at mitigating wheat and flour prices were unsuccessful, causing greater instability and uncertainty in domestic market. The results confirm that price transmission between wheat and flour switched over the period. The PMG model was performed separately with the two regimes, and indicated that price transmission significantly altered under regime changes. Although overall coefficient differences in the two regimes are modest, the results across regions have different patterns in depicting huge differences in coefficients and magnitude. Moreover, The Granger causality test implies that the global wheat price is a good determinant of price differences across oblasts (regions).*

KEYWORDS: Wheat Production, Price Transmission, Divergence, Export,Kazakhstan

INTRODUCTION

Most empirical studies have shown that the nature of food price volatility has over recent decades (FAO, 2008). During the 2007-2009 period, the food and financial crisis caused significant social problems and increased the global number of hungry people. The world price of grain, wheat, oilseeds and rice almost doubled between 2005 and 2007, and sky-rocketed again in 2008 and 2011. Evidently prices of oil and other energy products are a crucial factor in the increasing costs of agriculture products. Furthermore, a boost in the demand for biofuel products followed the oil products' price increase, and will further raise prices for agriculture products (OECD, 2008). Recent FAPRI projection programs indicate that the price volatility will persist over the coming decade, not only for energy and main crops but also for all agriculture products (CRS Report for Congress, 2008).

Kazakhstan, along with Russia and Ukraine accounted for 15% of global grain exports during the 2007- 2009 period, and reached a record peak in wheat trade of 26% in 2008-2009 which left behind wheat exporting giants such as the US and EU (EBRD and FAO, 2009). These countries are thus becoming major exporters of grain worldwide. Like in other cases, one of these countries practiced banning grain exports to limit price volatility, particularly in the immediate aftermath of a fire accident in Russia last year. Although this could be a sound policy to mitigate price volatility, banning can lead to higher price volatility of agriculture goods as it lowers the profit margins of the farmers. Therefore such remedy policies typically cause uncertainty and represent a high risk in the long-run (William, M.H, 2011, AEF).

Many countries have employed administrative rather than economic tools to mitigate price fluctuations, and have responded through government interventions. Indeed, many countries adopted a wide range of government intervention policies to confront soaring food prices in

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the 2007-2008 period (FAO, 2008). The policy measures were characterized as short-run, and varied across countries. Policy measures employed to mitigate price spikes included the reduction of import tariffs and quotas, import taxes on foods, export bans and restrictions, and domestic price administering (Gruininger and von Cramon, 2008).

LITERATURE REVIEW

A broad range of literature exists regarding price transmission and market integration, and is mainly concerned with the level of impact transmitted from one market to another. In particular scientists studying vertical transmission have focused on the speed of adjustment, magnitudes and their nature (Vavra and Goodwin, 2005). This is due to the fact that researchers are eager to examine the influence of market agents' behavior on price relationships which could be observed by asymmetric price transmission models. In their pioneering research on switching regression models, Baulch (1997) suggested that using switching models such as the parity bounds model is more efficient in analyzing the comovements in different markets than conventional market integration models. In addition, McNew and Fackler (1997) and Barret (2001) argue that conventional cointegration methods of market integration are not informative and reliable. Thus, asymmetric price transmission must be interpreted as a law in economic theory (Peltzman, 2001).

Following arguments against linear cointegration methods, economists initiated much more reliable methods to account for asymmetric price comovements. Nonlinear methods such as the threshold cointegration model have been adapted in several studies. One of the studies (Goodwin and Piggot, 2001) used the threshold cointegration method to disclose the transaction costs' impact on price transmission in spatially separate markets. In contrast with their study, Sephton (2003) argued that the prices are not persistently spatially diverging, using multivariate threshold and nonlinear cointegration methods. Similarly, Meyer (2004) applied a two-threshold model to test threshold significance in examining the of role transaction costs, as many previous studies have been criticized for ignoring this.Subsequent studies (Meyer and von Cramon-Taubadel, 2004) on price transmission have switched focus to its effect on policy decisions and welfare effects, and have also observed that regime switches depend on the increasing or decreasing nature of food prices.

Divergence of Flour Price across Regions in Kazakhstan

According to a FAO report (March, 2011) the Food Price Index rose 236 points in 2011, establishing a new record in nominal terms since 1990. According to statistics, this was due to price increases in wheat, rise and maize. Clearly, dramatic oil price fluctuations, and especially the increase in recent years, has worsened the situation. Using monthly data standard deviation the yearly oil price volatility has been estimated for Kazakhstan since 1997 in graph 1 below, where one can observe large fluctuations in both oil and wheat prices, especially since August 2007. The estimated correlation coefficient of price volatilities is 0.64, implying a good (if not perfect) correlation for the period from January 2000 to August 2007. However for the period from August 2007 to July 2008, the spell of rapid increases in Urals Oil Prices, the correlation coefficient between prices is 0.87, demonstrating an almost perfect correlation. This data implies that countries nowadays cannot isolate themselves from the external shock of price increases.

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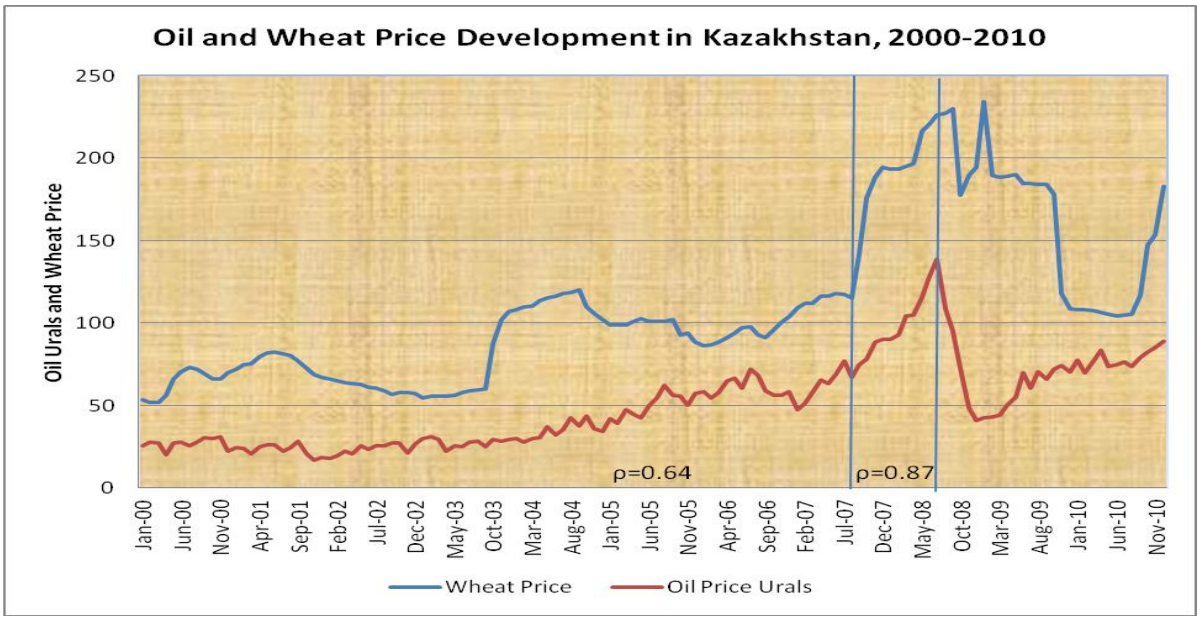
Figure 1: Oil and Wheat Price Development in Kazakhstan, 2000-2010



Source: Ural crude (oil_ural crude): Datastream; world oil price (oil_world): IFS/IMF; price of oil exported by Kazakhstan (oil_kazakh): Statistical Agency of the Republic of Kazakhstan. Note: USD/barrel. The barrel price for Kazakh oil sales is converted from the price per ton (1 ton=7.3 barrels). Wheat Price: average of wheat prices for 14 regions of Kazakhstan, USD per ton; Statistical Agency of Kazakhstan

Dramatic food price hikes trigger inflation rates for countries importing energy and agricultural goods through import mechanisms, while in the case of exporting countries inflation is brought about by natural resources export income. Thus as the national currency appreciates against other currencies its domestic goods become less competitive, particularly industry and agriculture sector goods.

Although FAO data indicates that June 2010 global food prices remained 22% below their June 2008 peak, national data shows that food prices in Ukraine, Russia, Turkey and Kazakhstan posted double-figure increases during this time. Recent developments, including scorching hot weather and drought in Russia and Kazakhstan, and too much rain in Ukraine (see the map below), are causing alarm for governments and observers in these countries. In the face of declining crop production, governments in Russia, Ukraine and Kazakhstan have undertaken similar steps to mitigate food price increases.

Dramatic increases in food prices have led to flour price divergence across regions, also the disintegration of the flour market in Kazakhstan. Figure 2 depicts flour and wheat price divergence, estimated as standard deviation of prices across regions (oblasts). It can be noted that the price divergence of flour (relative to wheat price divergence) has been sharply increasing since August 2007. Strikingly, flour prices reached a maximum level in the Akmola and Astana regions, while West Kazakhstan had the lowest level prices among all other regions. Akmola is one of three leading wheat producing regions in Kazakhstan, whereas the West Kazakhstan region, one of the largest oil producing oblasts, has one of the lowest indicators of agriculture production. The Almaty oblast is the same distance from the

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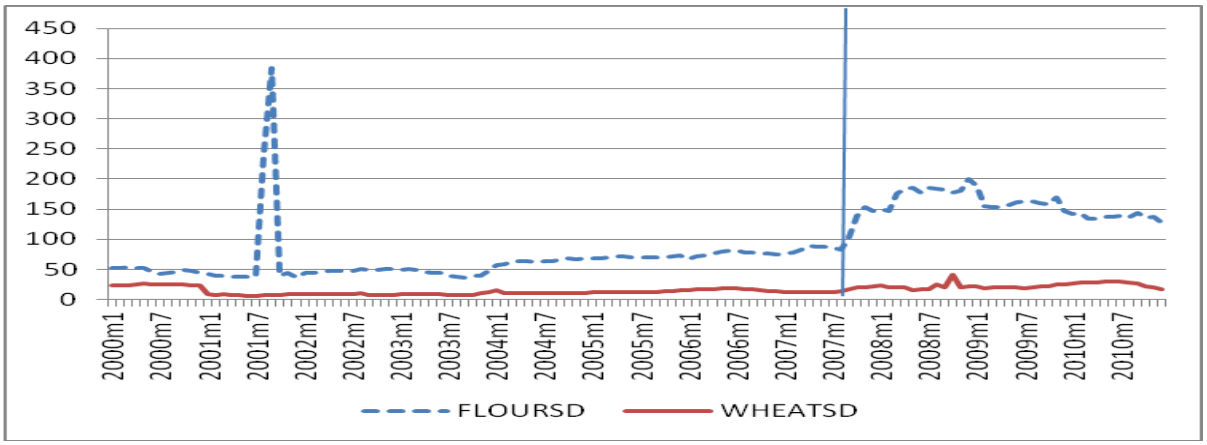
Eastern Kazakhstan regions as the West Kazakhstan oblast, is a leading wheat producing oblast and recorded significantly higher flour prices than other regions.

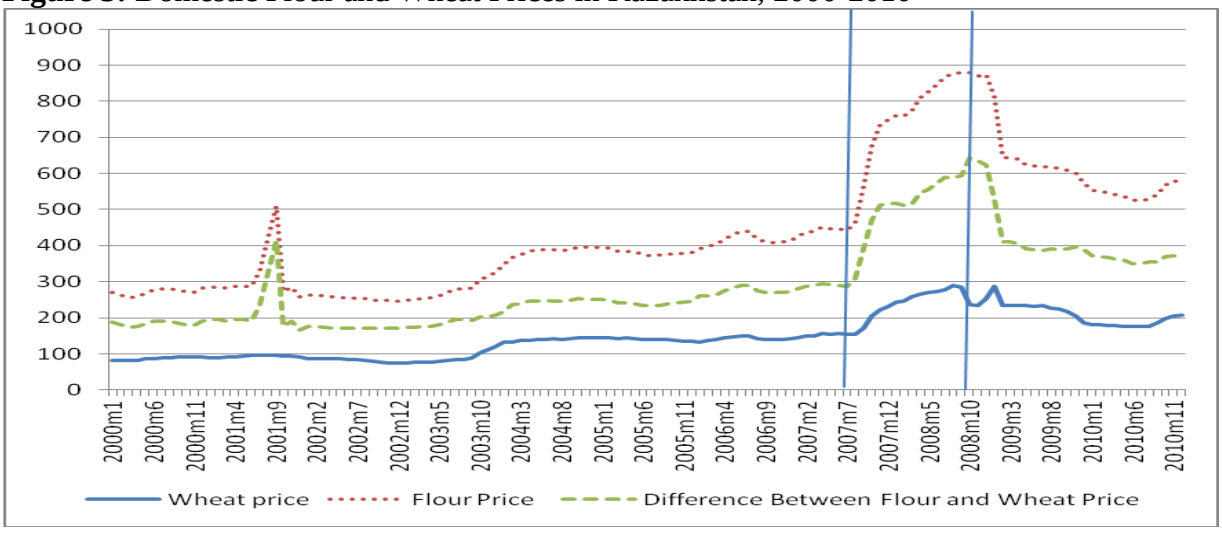
Figure 2: Wheat and Flour Price Divergence across Regions of Kazakhstan, 2000-2010



Source: Statistical Agency of the Republic of Kazakhstan.
Note: standard deviation of wheat and flour prices across 14 regions in Kazakhstan, USD per ton; Statistical Agency of Kazakhstan

The dynamics and differences between domestic flour and wheat prices are depicted in Figure 3. It is observed from the Figure 1 that both wheat and flour prices started increasing sharply since August 2007.Interestingly, the price difference between flour and wheat prices (shown by the dashed line in Figure 1) started increasing concurrently. In August 2007 we observe a sharp increase in the difference between flour and wheat prices, reaching a maximum level in October 2008. Afterwards, there was an instant decrease in the difference until March 2009 and has been gradually falling since then.

Figure 3: Domestic Flour and Wheat Prices in Kazakhstan, 2000-2010*



Source: Statistical Bulletin of Republic of Kazakhstan, *-in terms of USD per ton

For example, the grain price for 3rd class wheat (the highest class in Kazakhstan) increased from 200 to350 USD per ton, representing an increase of 75% in 2007. It further increased to

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410 USD per ton in March 2008, before declining in response to global price fluctuations (Robinson, 2008). Furthermore, it is discernible from Figure 3 that neither the export ban nor export licensing practice, aimed to shield domestic wheat and flour markets from global price fluctuations, succeeded. Indeed, in the period 2007-2008 domestic wheat prices increased by more than 100%, recording a peak in summer 2008 (D'Souza, 2011).

Two-sample t-tests with equal variances for wheat and flour prices across regions were applied to test the integration level of both markets (Tables 1 and 2 in the Appendix section). The test results indicate that the flour market is highly disintegrated, as prices significantly differ among regions in in comparison to the wheat market. Furthermore, flour prices in Akmola region – one of the wheat planting regions of Kazakhstan – are significantly high than other neighboring wheat production leaders such as the North Kazakhstan and Kostanay oblasts. This pattern exists across all regions of Kazakhstan, even if those regions are close neighbors and are not advantaged in terms of transportation costs. Moreover, the flour market is less integrated than the wheat market, as prices significantly differ among regions. Why have flour and wheat prices not increased in parallel since 2007? Why is there a high divergence of prices across different regions in the flour market (in comparison with the wheat market)? What was the source of the rising price divergence across different regions in the flour market? Why have flour prices started to diverge dramatically since August 2007? Were government policies able to isolate the domestic market from the global price increase effect?

Unauthorized Export Ban on Exports

The majority of wheat is exported in a north direction to world markets via Russian Railways. For some reason, the right to transport wheat and flour exclusively belongs to Russian Railways, including its subsidiaries such as "LP Trans" and "Rusagrotrans." Russia enacted a grain export ban in 2010 as a consequence of extreme draught, while a wheat export ban was introduced during the period from 15th August 2010 to 31st December 2010 (BSSS News, 2010). Naturally this policy affected the domestic wheat and flour prices. Moreover, Russian officials could not establish an agreement with Kazakhstan for the introduction of a joint export ban, as Kazakh officials stated that there is plenty of wheat to supply both world and domestic markets. However Kazakh wheat exporters claim that Russian Railways artificially set an export ban on flour exported from Kazakhstan. Strikingly, oil, coal and wheat products were not subject to such unofficial export bans (Fortunova, 2010).

Two possible reasons could explain this unauthorized export ban. Firstly, railways companies preserve the interests of monopolies, or in some cases they belong to wheat and flour exporting monopolies. Secondly, Russia could put pressure on Kazakhstan in the face of increasing wheat and flour prices. Specialists strongly support the former reason as there were no cases of wheat export bans. Identical cases also occurred in the South direction as well (flour is a major exported product to Uzbekistan and other Central Asian countries). Experts claim that the export ban put into place by railways companies was unauthorized, and as a result tons of wheat were stuck in customs (Korneva, 2010)

Panel Cointegration Test

Prior to investigating the cointegration relationship between flour and wheat prices, we should confirm the integrational characteristics of the data series. To accomplish this task an IPS (Im, Pesaran and Shin, 2003) unit root test for panel data is executed. The statistical

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department data of wheat and flour prices in dollars per ton for 14 regions (oblasts) in Kazakhstan is used. As reported in Table 4, the main findings show that both wheat and flour prices are integrated of order one. It is observed that at levels, one is unable to reject the null hypothesis, while we can after the data series are differenced.

Table 4: Results of the IPS unit root tests for the full sample

Variable	**Level**		**1st difference**	
	Constant	Constant and trend	Constant	Constant and trend
Lnp_flour	2.35 (0)	4,69 (0)	-34.26 (0) ***	-34.78 (0)***
Lnp_wheat	1.62 (0)	1.04 (0)	-36.62 (0)***	-37.31 (0)***

Note: Numbers in parentheses are lag levels determined by the Schwarz Bayesian Criterion.
***Indicates significance at the 1% level.

In the second stage, we examine cointegration tests to discover whether flour and wheat prices are integrated, namely whether they have a long-run relationship. The data series used in this research shows evidence of strong nonstationarity. Since we made sure that the data series are integrated of order one, cointegration tests could be examined. Two types of tests are utilized and presented in Table 5: the Pedroni (1999) based residual test and the Westerlund (2007) ECM panel cointegration test. The number of optimal lags for the model was chosen according to the Schwartz Bayesian Criterion. Panel cointegration tests results are reported in Table B2. The main findings suggest that the data series, flour and wheat prices are cointegrated.

Table 5: Panel cointegration tests results

Test Statistics	Pedroni based residual cointegration test*		Test Statistics	Westerlund ECM panel cointegration test
	Individual	Individual and intercept		
Panel *v*	4.15***	15.02***	Gt	-4.068 ***
Panel *rho*	-9.22***	-13.66***	Ga	-29.531***
Panel *pp*	-5.36***	-6.44***	Pt	-16.841***
Panel *ADF*	-4.66***	-3.74***	Pa	-33.796***
Group *rho*	-6.70***	-10.41***		
Group *pp*	-4.98***	-5.79***		
Group *ADF*	-4.14***	-2.86***		

Note: ***indicates significance at the 1% level.
*-Newey based automatic badwith selection and Bartlett Kernel

The Panel VECM model for the data series and causality tests were performed as a following step and a causality test has been examined for the short-run and long-run relationship, as reported in Table 6. As a first step, the Panel VECM is estimated byh employing Blundell and Bond's (1998) system GMM estimator. The significance of causality tests are determined by F-statistics from the Panel VECM. The Wald test of causation examines the different sources of causation. We observe two-way causality in almost all cases, except for in the 2007-2010 period when wheat price is not good predictor of flour price. This is the implication of the flour price regime driven during the 2007-2010 period, as the export ban was set on flour rather than wheat.

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Table 6: Wald F-statistics from Panel VECM estimation

Short-run causality test		F-statistics for 2000-2007 period	F-statistics for 2007-2010 period
		Regime 1	Regime 2
D(Lnp_wheat)	D(lnp_flour)	10.84 (0.00)***	4.53 (0.03)**
D(lnp_flour)	D(Lnp_wheat)	4.69 (0.03)**	25.45 (0.00)***
Long-run Causality		F-statistics for 2000-2007 period	F-statistics for 2007-2010 period
D(Lnp_wheat)	D(lnp_flour)	10.84 (0.00)***	0.59 (0.44)
D(lnp_flour)	D(Lnp_wheat)	49.57 (0.00)***	40.68 (0.00)***

Note: p-values in paranthesis

CONCLUSION

Vertical price transmission between wheat and flour markets in Kazakhstan has been analyzed using monthly data during the period 2000-2010. Officials applied a wide variety of policies in response to global wheat price increases, often causing adverse and unintended effects on regional domestic wheat and flour prices. Overall, short-run policies aimed especially at mitigatating wheat and flour prices were unsuccessful, causing greater instability and uncertainty in domestic market.

We found evidence of global market price spikes and government policies as a response leading to the divergence of prices across regions of Kazakhstan, which is especially notable in the flour market. Strikingly, flour prices are significantly higher in some wheat producing regions. Regional administrative units were often obsessed with preserving regional food security, imposing undisclosed bans and regulations for flour, thus soaring flour price differences across regions caused flour market disintegration.

The results confirm that price transmission between wheat and flour switched over the period. The PMG model and Granger causality test were applied to examine vertical price transmission between wheat and flour. The PMG model was performed separately with the two regimes, and indicated that price transmission significantly altered under regime changes. Although overall coefficient differences in the two regimes are modest, the results across regions have different patterns in depicting huge differences in coefficients and magnitude. Moreover, The Granger causality test implies that the global wheat price is a good determinant of price differences across oblasts (regions).

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