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International wheat price volatility and the increasing export
of Russia, Kazakhstan and Ukraine

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Abstract

Increasing price volatility of agricultural commodities over the last decade has focused a growing body of literature to identify the influencing factors of price variability. We analyze the effect of increasing wheat export from the Former Soviet Union (FSU) countries to the international wheat market and price volatility. The major wheat producer and exporter FSU countries, Russia, Ukraine and Kazakhstan have experienced increasing share on the international wheat market. An ordinary least square method is applied to estimate the influence of wheat export from Russia, Ukraine and Kazakhstan on the international wheat price volatility. We found evidence of positive relationship between international wheat price and the expanding net wheat export from FSU.

Keywords: wheat price volatility, wheat export, FSU countries

JEL classification: Q17, O13

1. INTRODUCTION

Volatility has increased over the most recent years, but there have also been periods of high volatility in the past, and except the case of grains, the recent situation on agricultural markets does not appear exceptional (Gilbert and Morgan, 2010). The evidences suggest that the volatility of agricultural prices have changed over the recent decade (FAO, 2010; McKenzie and Kunda, 2009; Sumner, 2009). Price volatility can have long run impact on the incomes of producers and the trading positions of countries on the one hand and can make planning production more difficult on the other. The increasing volatility results in an overall welfare loss in spite of the fact that there may be some who benefit from higher volatility. This paper seeks to study the impact of wheat trade from Russia, Ukraine and Kazakhstan on the volatility of international wheat market. Russia, Ukraine and Kazakhstan have high wheat production potentials due to the highly fertile soil and availability of land.

However wheat production has decreased since the beginning of transformation in these countries in the nineties as a consequence of decreasing arable land used for wheat production and of declining yields. Thus, Russia, Ukraine and Kazakhstan have substantial unrealized wheat production potentials and are seen as three important countries which could contribute significantly to the increase in global wheat production and export. Jones et al. (1996) presented evidences that the evolution of Former Soviet Union (FSU) countries to self-sufficiency in the world wheat market could have substantial effects on world trade, price levels and patterns. The wheat foreign trade of Russia, Ukraine and Kazakhstan has experienced major changes in the last thirty years which can be delimited in three diverse periods. In the first period from 1980 to 1992 the Soviet Union was net importer of wheat, when 13-20 million tons per year is imported.

The grain production decline during the early transition is attributed to decline in the use of production inputs, which accounts for over one half of the total output decline, while whether effects account for about 35% of the decline and the rest is attributable to the decline in the technical efficiency of collective farms (Kurkalova and Carriquiry, 2002).

The second period from 1993 to 2001 is characterised with almost no wheat foreign trade of these countries as the purchasing power of population has decreased sharply. The third period is from 2002 since Russia, Ukraine and Kazakhstan have been exporting yearly in average about 20 million tons of wheat. These Former Soviet Union (FSU) countries become net exporter on the wheat international markets with high fluctuation of wheat export volume. OECD and USDA in their wheat market outlook consider this region a major wheat export player in the following years. In the first period Russia, Ukraine and Kazakhstan imported yearly 15-20% of the world wheat export, in the second period the import of this region amounted yearly 1-5% of global wheat market, while in the third period this region become major exporter on the wheat markets by delivering yearly 8-20% of the international wheat export. The instability increased on the world markets itself, in the period between 2005 and 2009 attained its peak during the food crisis in 2007/2008. Götz et al. (2010) provided evidences that increase of instability was particularly pronounced in Russia and Ukraine comparative to Germany and US where the instability increased also, but at much lower degree than for the FSU countries. The FSU countries are exporting wheat on the international markets since 2001 and their wheat supply is increasing and fluctuating. These countries exported 4.6 and 21 million tons in 2001 and 2002 respectively. In 2009 the wheat export of these countries was 29.6 million tons and is expected to increase to 31.5 million tons by 2019. The wheat export increase of these countries is combined with the increase of domestic consumption: per capita consumption of wheat in these countries is expected to increase by 14% between 2009 and 2019 (Taylor and Koo, 2010).

The wheat production and export of these FSU countries contribute to the variability of wheat international prices because of the dry continental weather conditions in these countries which result extreme whether condition. In the years with abundant wheat production Russia, Ukraine and Kazakhstan are able to deliver their excess wheat production on the international markets as a result of improved transport and logistic capacity. The aim of this paper is to investigate the effect of the wheat export volume from these FSU countries to world wheat markets on the variability of wheat international prices. The paper is structured as follows. The second section gives a quick review of some background issues regarding wheat price volatility. The third section outlines the estimation methodology. The forth section describes the empirical results, and the last section concludes.

2. PRICE VOLATILITY

The complex topic of price volatility of agricultural commodities is studied in the literature more intensively from three decades ago. Traditionally, volatility in agricultural prices has been attributed to low price and income elasticity of agricultural products, unforeseeable and unpreventable exogenous shocks like weather, and the very different nature of agricultural

planning process, where production decision for most farm products are made much in the advance of the time the product is marketed (Starleaf, 1982).

Reviewing grain market volatility literature Wright (2011) presented a traditional grain storage model and investigated the possible influencing factors of the grain price volatility. He emphasised the difficulties to obtain reliable data, the potential influence of oil price volatility, low interest rates and price bubbles, the effects of excess global liquidity, of market panic, of income expansion in India and China, and the biofuel demand on the grain price volatility. However the price volatility of grains is influenced by many factors it seems to be as relevant for understanding of these markets the consumption, the supply and the stocks of these products as it was decades ago. Póór and Hegedűsné (2007) found that the interaction of the demand and the supply, the export and import, the support, the domestic consumption, and the forage price can be considered as most important factors at price volatility examination.

There is ample empirical evidence that the volatility of many price time series do not stay constant over time. Changes in volatility are evident in simple plots of the absolute changes in prices from period to period. We consider the factors listed below, each with short justification. We are unable to include all factors in the same model over the whole period do to data constraints. Therefore, a subset of these factors enters to the model, depending on the data availability

Past volatility of wheat prices may influence the production decision of farmers and therefore the behaviour of agricultural prices. The empirical estimation of volatility by applying ARCH or GARCH procedures revealed that there are periods of relatively high and low volatility, which is partly driven by speculative forces. The relative risk aversion attitude of farmers and the negative response of agricultural sectors in less developed countries (Behrman, 1968) suggest that in case of high wheat price past volatility periods farmers are reducing their production. Past volatility influences price expectations of farmers and we expect positive relation of this variable to the present volatility. *Volatility of input and substitute products prices* there are potential influencing factors of wheat price volatility. In this paper oil price volatility is considered as a proxy of input prices. There is a strong link between input costs and output prices. Fertilizer prices, mechanize agriculture and freight costs are all dependent on oil prices which determine the price of wheat. Therefore we expect a positive relation between volatility of oil prices and wheat price volatility. Although wheat is used primarily for human consumption, it is also an excellent feed grain for poultry and livestock. Feed use of wheat tends to be highly variable and depends on the quality of wheat crop and the relationship between wheat and other feed grains. Therefore as a substitute product for feed wheat is used maize, and is expected on the bases of risk avers attitude of farmers that in the periods of high maize price volatility decreases wheat price volatility.

The volume of net wheat export from FSU countries (Russia, Ukraine and Kazakhstan) and USA and in the second model the export share of USA and FSU countries would lead to the potential price variation differently. The empirical observations suggest that in the periods of

increasing wheat net exports from the most important wheat exporter country, from US the price volatility of wheat decreases. Therefore the expected sign of this variable is negative. In this paper is tested the assumption that FSU countries' influence on the wheat price volatility is positive due to high fluctuation on the export volume as a consequence of extreme weather conditions.

The world stock of wheat influences the maximum price of wheat at international level as well. Because of this if the level of the wheat stock is low we expect higher prices at the international market and vice versa if the quantity of wheat stock is higher the price will be lower.

3. METHODOLOGY AND DATA

The paper investigates the effect of increasing wheat export from Russia, Ukraine and Kazakhstan on the world wheat price variability applying production theory. Following Balcombe (2009) decomposition approach the below model (1-2) is employed.

$$PV_{w,t} = \beta_0 + \beta_1 PV_{w,t-1} + \beta_2 PV_{c,t} + \beta_3 PV_{o,t} + \beta_4 NX_{US,t} + \beta_5 D_{1,FSU} NX_{FSU,t} + \beta_6 t + u_t \quad (1)$$

Where u_t is the error term, $PV_{w,t}$ is the volatility of wheat international price, Ukraine and Kazakhstan (FSU), $NX_{US,t}$ is the net wheat export of United States (US), t is the time trend, $PV_{c,t}$ and $PV_{o,t}$ stand for volatility of corn international price and of oil world price respectively. $D_{1,FSU} NX_{FSU,t}$ is a dummy variable for net wheat export of Russia, Ukraine and Kazakhstan with value 1 from 2002 to 2010 and 0 from 1980 to 2001.

In the second model we are using export share data instead of net wheat export data to control for the model variation.

$$PV_{w,t} = \beta_0 + \beta_1 PV_{w,t-1} + \beta_2 PV_{c,t} + \beta_3 PV_{o,t} + \beta_4 SX_{US,t} + \beta_5 D_{1,FSU} SX_{FSU,t} + \beta_6 t + u_t \quad (2)$$

Where u_t is the error term, $PV_{w,t}$ is the volatility of wheat international price, Ukraine and Kazakhstan (FSU), $SX_{US,t}$ is the wheat export share of United States (US), t is the time trend, $PV_{c,t}$ and $PV_{o,t}$ stand for volatility of corn international price and of oil world price respectively. $D_{1,FSU} SX_{FSU,t}$ is a dummy variable for export share of Russia, Ukraine and Kazakhstan with value 1 from 2002 to 2010 and 0 from 1980 to 2001.

A variety of measures of price volatility have been used in the literature. Usually, the measures used are some variant on the standard deviation of the difference in annual or quarterly or monthly commodity prices, for example, the standard deviation of the percentage change in the exchange rate or the standard deviation of the first differences in the logarithmic exchange rate. In this article, in order to capture ex-ante commodity price uncertainty, the latter

measure is used. We constructed the measure of commodity price volatility based on monthly average nominal wheat and maize price for the period from 1980 to 2010.

A standard deviation of the first differences in the monthly nominal commodity price over the twelve months (m) is applied to estimate commodity price volatility for year t:

$$PV_{jt} = \sqrt{\frac{\sum_{m=1}^{11} (x_{j,m} - \bar{x}_{j,t})^2}{11}} \quad (3)$$

where $x_{j,m} = \ln e_{j,m} - \ln e_{j,m-1}$, $\ln e_{j,m}$ is the logarithm of the monthly nominal j commodity's price at the time (month) m, and $\bar{x}_{j,t}$ is the mean of $\bar{x}_{j,m}$ over the twelve months of the t year.

Table 1: Summary statistics of the data used

	Mean	Standard Deviation	Min	Max
Wheat price volatility	0.0601	0.0318	0.0257	0.1365
Maize price volatility	0.0549	0.0232	0.0211	0.1087
Crude oil price volatility	0.0745	0.0405	0.0163	0.1845
Net export of wheat (FSU)	-1.2555	15.6583	-25.0790	23.7954
Net export of wheat (US)	29.7241	6.3524	21.3484	43.9077
World stock of wheat	0.1659	0.0270	0.1125	0.2103
Export Share of FSU countries	0.0696	0.0688	0.0032	0.2026
Export Share of USA	0.2887	0.0677	0.1849	0.4597

Source: own elaboration

Yearly export and import data of wheat and corn is extracted from FAO (2010) database for from 1980 to 2010 (Table 1). The net export (NX) is calculated as a difference of export and import. The export share (SX) is the share of export volume of the total stock of wheat export. Russia, Ukraine and Kazakhstan (FSU) are net importer of wheat on average during the whole analyzed period and become net exporter since 1994. During the Soviet Union period the average wheat net import was 17 million tons, while the average net export is also 17 million tones. Monthly wheat, corn and crude oil price data is collected from Chicago Board of Trade (2011) and are used for calculating yearly price volatility based on (3).

4. ESTIMATION RESULTS

Applying model (1) the estimation results indicate a very low positive effect of net wheat export of Russia, Ukraine and Kazakhstan on international wheat price volatility, which indicate that increasing FSU wheat export contribute to the increase of international price volatility of wheat. The price volatility of crude oil show also the expected positive sign, but is not significant as well as the net export of US wheat. The negative sign of US wheat net export indicate that US wheat export has a stabilizing role in the world wheat market. When US wheat

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export increase in the world markets, the price volatility is decreasing and conversely when US wheat export decrease the price volatility is increasing (Table 2.).

Table 2: The international price volatility and the wheat export of FSU countries (Model

1)

Independent Variables	Coefficients
Net wheat export dummy (FSU)	2.39E-9 ***
Net export of wheat (US)	-4.43E-10 ⁻¹⁰
Volatility of corn prices	0.107
Volatility of crude oil prices	0.105
Past volatility of wheat	0.36**
Time trend	-9.38E-4
constant	3.73E-2
N	31
Adjusted R ²	0.5769

Note: N – Number of observations.

***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels

Source: own elaboration

If we change the net wheat export data into export share data we can get to similar results (Table 3.). The FSU countries and the past volatility influence mainly the international wheat price volatility. If the export share in FSU countries is growing the volatility is increasing and if the past volatility is fluctuating it has effect on the future or present price volatility, because past volatility influences the present or future price expectations of farmers.

Table 3: The international price volatility and the wheat export of FSU countries (Model

2)

Independent Variables	Coefficients
Export share (FSU)	0.3890***
Export share (US)	0.0639
Past volatility of wheat	0.4031**
Volatility of crude oil prices	0.1246
Volatility of corn prices	0.1721
Wheat stocks	0.1654
Time trend	-0.0012
constant	-0.0326
N	30
Adjusted R ²	0.5786

Note: N – Number of observations.

***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels

Source: own elaboration

5. CONCLUDING REMARKS

The objective of this paper was to assess the influence of change in FSU countries of wheat trade on the price volatility. The estimations of wheat price volatility model confirm our initial hypothesis that FSU countries, especially Russia, Ukraine and Kazakhstan wheat export increase contribute to the change of price volatility in the world wheat markets. The expected additional increase of FSU wheat export in the following years as forecasted by Taylor and Koo (2010) might induce the persisting or the increasing volatility of world wheat prices. The persistence or further increase of international wheat price volatility might imply raising trade costs (see Anderson and Wincoop, 2004) and changing agri-food trade patterns (see Fertő, 2008) as Russia, Ukraine and Kazakhstan wheat production and export is expanding in the global wheat market. After we have tested our two models we got to similar results. First of all the price expectations of farmers have significant effect on wheat price and than trough our results we could demonstrate the growing role of export share of FSU countries that is what we expected during our examinations.

REFERENCES

- Anderson, J. E. and von Wincoop, E. (2004): Trade Costs. *Journal of Economic Literature*, 42(3): 691-751.
- Balcombe, K. (2009): The nature and determinants of volatility in agricultural prices: An empirical study from 1962-2008. In: Sarris, A., Morrison, J. (eds.): The evolving structure of world agricultural trade. FAO, Rome, 119-137
- Behrman, J.R. (1968): Supply response in underdeveloped Agriculture. North-Holland Publishing Co. New Yourk.
- Cavallo, E. A. (2007): Output volatility and Trade Openness. Inter-American Development Bank.
- Chicago Board of Trade (2011): Monthly wheat, corn and crude oil prices. February, <http://www.cmegroup.com/market-data/datamine-historical-data/timeandsales.html>
- Food Agriculture Organization. (2011): FAO Statistical database. February, <http://www.fao.org/corp/statistics/en/>
- Food Agriculture Organization. (2010): Food Outlook-Global Market Analysis. *FAO Corporate Document Repository*, Economic and Social Development Department, November, [www . fao .org/docrep/013/al969e/al969e00.pdf](http://www.fao.org/docrep/013/al969e/al969e00.pdf)
- Fertő, I. (2008): The Evolution of Agri-Food Trade Patterns in Central European Countries. *Post-Communist Economies*, 20(1): 1-10.
- Gilbert, C.L. and Morgan, C.W. (2010): Food price volatility. *Philosophical Transactions of the Royal Society*, 356: 3023-3034.
- Götz, L., Glauben, T. and Brümmer, B. (2010): Impact of Export Controls on Wheat Markets During the Food Crisis 2007/2008 in Russia and Ukraine. Selected Paper for presentation at the Agricultural and Applied Economics Association 2010 AAEE, CAES and WEAA Joint Annual Meeting, Denver, Colorado, July 25-27.
- Jones, J.R., Li, S.L., Devadoss, S. and Fedane, C. (1996): The Former Soviet Union and the World Wheat Economy. *American Journal of Agricultural Economics*, 78(4): 869-878.
- Kurkalova, L.A. and Carriquiry, A. (2002): An Analysis of Grain Production Decline during the Early Transition in Ukraine: a Bayesian Inference. *American Journal of Agricultural Economics*, 84(5): 1256-1263.
- McKenzie, A.M. and Kunda, E.L. (2009): Managing Price Risk in Volatile Grain Markets, Issues and Potential Solutions. *Journal of Agricultural and Applied Economics*, 41(2): 353-362.
- Roche, M. J. and McQuinn, K. (2003): Grain price volatility in a small open economy. *European Review of Agricultural Economics* 30(1): 77-98.
- Poór, J. and Hegedűsné B. N (2007): Dynamic investigation of the purchase price and quantity of maize and pig. *Journal of Central European Agriculture*, 8(1): 39:46.

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Starleaf, D.R. (1982): Macroeconomic Policies and their impact upon farm sector. *American Journal of Agricultural Economics*, 64: 854:860.

Sumner, D.A. (2009): Recent Commodity Price Movements in Historical Perspective. *American Journal of Agricultural Economics*, 91: 1250:1256.

Taylor, R.D. and Koo, W.W. (2010): 2010 Outlook of US and World Wheat Industries, 2009- 2019. *Agribusiness and Applied Economics* 662, Centre of Agricultural Policy Trade Studies, North Dakota State University.