AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Black Sea and World Wheat Market Price Integration Analysis

Kateryna Goychuk and William H. Meyers
University of Missouri-Columbia

Dynamics of the Russian and Ukrainian wheat exports and imports

Russian and Ukrainian Wheat Exports (1000 MT)

	Country	2008/09	2009/10	2010/11	2011/12
1	United States	27,101	24,172	35,977	28,071
2	Australia	13,450	13,764	18,477	23,041
3	Russia	18,393	18,556	3,983	21,627
4	Canada	18,674	18,992	16,768	17,603
5	EU-27	25,351	22,115	22,906	16,439
6	Argentina	8,651	5,255	7,742	11,949
7	Kazakhstan	5,701	7,871	5,519	10,619
8	Ukraine	13,037	9,337	4,302	5,436
9	Turkey	2,342	4,363	2,945	3,680

> 50% of
total wheat
is exported
to **North
Africa** and
**Near East
Asia**

Objective of the study

- to investigate short- and long-run wheat price dynamics between Ukraine and Russia and other major wheat exporters - United States, European Union (EU), and Canada.

More specifically the goals are...

- To check whether Black sea wheat markets are integrated with the world grain markets
- To analyze if the price transmission is symmetric (for the pairs of series that are cointegrated)
- To investigate the short run dynamics between cointegrated series

Methods used

- ❑ Testing for Unit Roots (ADF, PP, and KPSS)

- ❑ Testing for Cointegration (long-run relationship)
 - ❑ Residual based test [primary one]
 - ❑ Johansen's Maximum Likelihood test

- ❑ TAR, M-TAR (asymmetric price adjustment)

- ❑ Error-Correction Model (short-run dynamics)

Data

- Monthly wheat FOB prices for:
 - **Russian Soft Wheat (Black Sea ports)**
 - **Ukrainian Feed Wheat (Black Sea ports)**
 - **Canadian Western Red Spring Wheat (St. Lawrence)**
 - **US Soft Red Winter Wheat (Gulf ports)**
 - **French Soft Wheat (Rouen)**
- Time span: **from July 2004 till October 2010**
- Prices were obtained from **the International Grain Council**

Comparison of the analyzed wheat price series, \$ per ton

Step 1: Testing data stationary

- Augmented Dickey-Fuller (ADF)
- Philips-Perron (PP) tests
- Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test

The results suggested that all series are $I(1)$ stationary

Step 2: Cointegration tests

- ❑ **Cointegration** presupposes that observable variables exhibiting non-stationary behavior will nonetheless be linked in the long-run

- ❑ Two methods:
 - ❑ Johansen Maximum Likelihood Method (both multiple and pairwise comparisons)
 - ❑ Engel and Granger residual based test (only pairwise comparisons)

Cointegration test results – Johansen ML on multiple series (trace test)

Ho(Rank=r)	H1(Rank>r)	Trace	5% CV
0	0	112.08**	75.74
1	1	63.47**	53.42
2	2	27.87	34.8
3	3	12.26	19.99
4	4	5.89	9.13

Cointegration tests' results – pairwise for **Russia**

Pairs of series	Engel and Granger procedure			Johansen method		
	# of lags	ADF	PP			
				Ho(H1)	Trace	5%CV
Russia-France	2	-5.32**	-5.24**	R=0((r>0)	25.98**	19.99
				R=1(r>1)	6.69	9.13
Russia-Canada	1	-2.30	-2.38	R=0((r>0)	13.23	19.99
				R=1(r>1)	5.12	9.13
Russia-USA	1	-3.79**	-3.81**	r=0((r>0)	15.47	19.99
				R=1(r>1)	3.75	9.13

Asterisks denote levels of significance (* for 10 percent, ** for 5 percent). The 5% and 10% critical values for tests with a drift are -3.42 and -3.10 respectively. Critical values were obtained from MacKinnon (1991).

Cointegration tests' results – pairwise for Ukraine

Pairs of series	Engel and Granger procedure			Johansen method		
	# of lags	ADF	PP			
				Ho(H1)	Trace	5%CV
Ukraine-France	3	-2.33	-3.64*	R=0((r>0)	24.66**	19.99
				R=1(r>1)	5.28	9.13
Ukraine - Canada	1	-1.90	-1.99	R=0((r>0)	12.48	19.99
				R=1(r>1)	4.70	9.13
Ukraine-USA	2	-2.91	-3.24*	r=0((r>0)	12.48	19.99
				R=1(r>1)	4.56	9.13

Asterisks denote levels of significance (* for 10 percent, ** for 5 percent). The 5% and 10% critical values for tests with a drift are -3.42 and -3.10 respectively. Critical values were obtained from MacKinnon (1991).

Therefore,

- Based on the results we confirm cointegration of Russian-French, Russian-US and Ukrainian-French pairs of prices
- The long-run elasticities are equal to
 - 1.04 (case of Russia-France)
 - 1.16 (case of Russia-USA)
 - 1.05 (case of Ukraine-France)

Possibility of a structural break?

Source: IGC, 2011

Chronology of government decisions on grain export restrictions and export quotas, starting from 2006 (1000 MT)

Period	Wheat	Barley	Corn
10/17/2006-12/31/2006	400	600	600
12/14/2006-06/30/2007	3	600	500
02/15/2007-06/30/2007	228	606	30
02/26/2007-06/07/2007		Quotas cancelled	Quotas cancelled
06/08/2007-06/30/2007	Quotas cancelled		
07/01/2007-10/31/2007	3	3	3
01/01/2008-03/31/2008	200	400	600
01/01/2008-07/01/2008	1,200	900	
05/21/2008	Quotas are cancelled		
08/2010	500	500	2,000
10/2010-12/2010	500	200	2,000
12/2010	1,000	200	3,000
03/2011	1,000	200	5,000
05/2011	Quotas are cancelled		
05/2011-01/2012	Tariffs are introduced		
10/2011	Tariffs cancelled, except for barley (01/01/2012)		

Source: UkrAgroConsult, FAO, 2009

TAR model snapshot

$$\Delta \bar{\varepsilon}_t = \gamma_1 \bar{\varepsilon}_{t-1} + \sum_{i=1}^p \gamma_{i+1} \Delta \bar{\varepsilon}_{t-i} + \omega_t$$
$$\Delta \bar{\varepsilon}_t = I_t \gamma_1 \bar{\varepsilon}_{t-1} + (1 - I_t) \gamma_2 \bar{\varepsilon}_{t-1} + \varphi_t, \text{ where}$$

$$I_t = \begin{cases} 1 & \text{if } \bar{\varepsilon}_{t-1} \geq \tau \\ 0 & \text{if } \bar{\varepsilon}_{t-1} < \tau \end{cases}$$

Step 3: Testing for asymmetric price transmission – TAR model*

	Russia - France	Russia-USA	Ukraine –France
Variable	Parameter estimate	Parameter estimate	Parameter estimate
γ_1	-0.80 (-5.31)**	-0.26 (-2.05)*	-0.22 (-1.18)
γ_2	-0.74 (-4.76)**	-0.36 (-2.30)*	-0.38 (-2.75)**
$H_0: \gamma_1 = \gamma_2 = 0(\Phi)$	22.08**	4.38**	6.82**
$H_0: \gamma_1 = \gamma_2 (F)$	0.11[0.74]	0.24 [0.62]	0.33 [0.57]
τ	-0.019	-0.04	0.016

*M-TAR model provided similar results

Step 3: Testing for asymmetric price transmission – cont.

- The results show that for all three cointegrated pairs of wheat prices the price transmission is **symmetric**
 - This implies that the adjustment towards the equilibrium is of the same magnitude regardless of the direction of the change.
-

Step 4: Error-Correction Model

- Error Correction Models (ECMs) estimate the speed at which a dependent variable returns to equilibrium after a change in an independent variable
- Before the ECM can be formed, there first has to be evidence of cointegration

ECM results

	Speed of adjustment, α_1	Test F-value	Time of adjustment
Russia-France	-0.48**	12.32**	3.5 months
Russia - USA	-0.20**	10.69**	10 months
Ukraine - France	-0.20**	11.38**	10 months

Policy Implications

- Trade liberalization issues
 - Long-run transmission results indicate that Ukraine and Russia are integrated with the world market
 - Transmission is symmetric
- Estimation of elasticities
 - Modeling global wheat market behavior
- Future research

THANK YOU!