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THE INFLUENCES OF EXPORT CONTROLS ON WHEAT MARKETS IN SERBIA DURING THE FOOD CRISIS 2007-2008

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**Paper prepared for presentation at the 113th EAAE Seminar
“THE ROLE OF KNOWLEDGE, INNOVATION AND HUMAN CAPITAL
IN MULTIFUNCTIONAL AGRICULTURE AND TERRITORIAL RURAL
DEVELOPMENT”, Belgrade, Republic of Serbia
December 9-11, 2009**

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Abstract

During the food crisis in 2007/2008 the government of Serbia restricted the export of wheat to ensure that wheat supply on the domestic market is sufficient thereby dampening the increase in consumer food prices.

This study investigates the effects of the export restriction on the integration, equilibrium and stability of its domestic wheat market. Within the framework of a Markov-switching error correction model, we utilize weekly wheat grower prices of Serbia and world market prices and compare the state of the wheat market prevailing in the time period before the crisis to when the exports controls are effective.

Our results suggest that although the degree of market integration and thus the long-run price elasticity do not change during the crisis, the market equilibrium was disrupted and the stability was reduced during the crisis. Also, we find that the price dampening effect of the export restrictions prevailed only in a short time period and that the Serbian wheat grower prices even increased beyond the world market afterwards.

Key words: wheat market, international market integration, price transmission, Markov-switching vector error correction model

1. Introduction

World market prices for agricultural raw products have risen dramatically during the past years leading to the global food crises. For example, for wheat the world market price (FOB Rouen-France) increased by 313% from January 2006 to January 2008.

Several studies have analyzed the causes of food crises e.g. PIESSE and THIRTLE (2009), MEYERS and MAYER (2008), VON BRAUN et al. (2008) and HEADEY and FAN (2008) identifying several factors. First of all rising energy prices had a strong impact on the costs of agricultural production and trade. Also, wheat production in some of the major wheat exporter countries, such as USA, Australia and Ukraine, was particularly low due to unfavorable weather conditions. Also, the intensive development of biofuel industry due to its subsidization in many industrial countries fostered the increasing utilization of cereals for non-food purposes.

Many governments have responded to the global rise in food prices by political interventions on their markets. About 101 governments worldwide implemented some policy measures between mid-2007 to mid-December 2008 to dampen price increase on domestic markets (FAO, 2008). A wide variety of different short-run policy measures were implemented as e.g. the reduction of import tariffs and taxes,

domestic price control, export taxes and export restrictions (GRUENINGER and VON CRAMON, 2008).

Serbia is one of the European countries which implemented policy measures to reduce the impact of soaring world market prices on domestic prices. This paper is unique in investigating the effects of these trade policy measures on the domestic markets. In particular, we analyze how export controls have affected the integration, equilibrium and stability of Serbia's domestic wheat market. We utilize a Markov-switching vector error correction model analyzing how the state of Serbia's wheat market altered during the time period when export restrictions prevailed compared to the time period before the crisis.

The paper is organized as follows. Section 2 describes agricultural trade policy in Serbia. Section 3 describes Serbia's wheat export policy during the food crisis 2007-2008. Section 4 describes the methodology and data, and Section 5 presents the results of empirical analysis. Section 6 discusses the results and provides conclusions.

2. Serbia's Wheat Trade Policy

Serbia's agricultural sector is characterized by high soil quality, favorable climate, and a good strategic trading location. After planned agricultural production during communist era, producers are now confronted with more open markets facing international competition. Agriculture's share of GDP is falling steadily (as expected in a transition economy), yet the sector remains the country's largest export earner and largest employer.

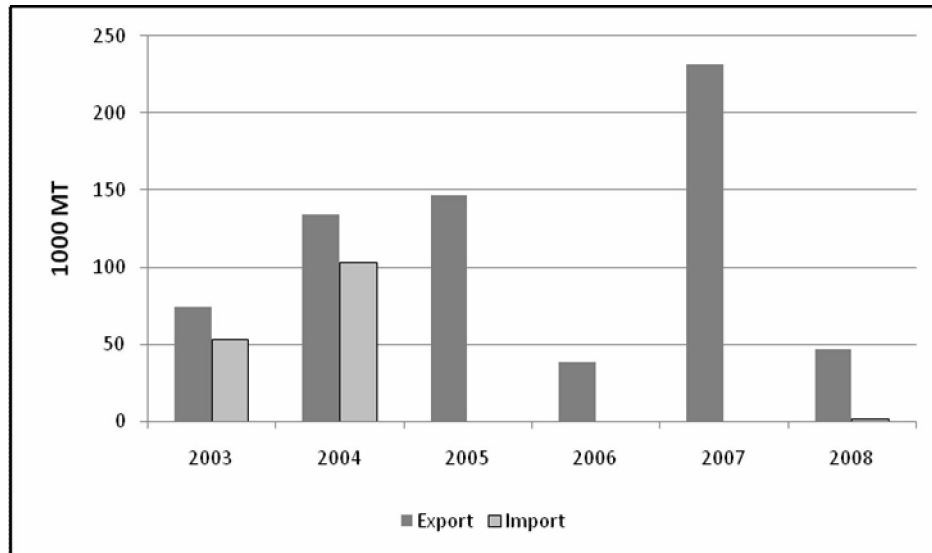
The export of agricultural raw products is steadily increasing during the last years with cereals representing one of the most important export products. Total grain export amounted about 172 million US\$ in 2008, accounting for 24% of total agricultural exports. The main commodities corn and wheat represent 79% and 12% of total grain export in 2008, respectively.

In general, Serbia is a net exporter of wheat (Figure 1). Though, in the year 2003 the harvest was extremely low, and thus Serbia needed to import about 100,000 t of wheat in 2003 and 2004 in order to stabilize the market.

Serbia's wheat production is not competitive regarding quality and price with major export countries in the region such as Hungary and Ukraine, but it is very competitive in countries of former Yugoslavia such as the FYR Macedonia, Bosnia and Herzegovina and Montenegro (WORLD BANK, 2006). These countries have huge structural cereal deficits and they prefer Serbia as trading partner due to low trade costs and good political relations. Therefore, CEFTA¹ members are Serbia's main trading partners.

¹ The **Central European Free Trade Agreement (CEFTA)** is a trade agreement between Non-EU countries in Central and South-Eastern Europe. As of 1 May 2007, the parties of the CEFTA

Figure 1 - Serbian wheat export and import, 2003-2008



Source: Statistical office Serbia

In the course of Serbia's trade liberalization, the maximum import tariff for agricultural products has been reduced from 40% to 30% in 2003 (WORLD BANK, 2003). Though, the import tariff on wheat remained very high at the level of 30%. Also, export licenses were imposed from June 28, 2003 until November 27, 2004. During this period trading companies were obliged to submit an official export or import request to the Serbian government. Quantitative export controls for wheat and corn among several other agricultural commodities were again imposed on August 4, 2007 lasting until June 15, 2008.

3. Policy Measures and Trade Regime regarding Wheat during the Food Crisis 2007/2008

On August 4, 2007 the Serbian government imposed quantitative export controls² on wheat and corn, in order to prevent exports from Serbia and to secure supply for domestic consumption. Although the Ministry of Agriculture, Forestry and Water Management (MAFWM) announced the introduction of export quotas for wheat, export quotas were actually not issued, thus the export was completely restricted (USDA GAIN REPORT, 2007).

agreement are: Albania, Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Montenegro and Serbia with Kosovo.

² Serbian official Gazette No. 73/07, 97/07 and 126/07

The export restriction was first announced to last for 3 months until December 2007, but on October 26, 2007 the government notified the extension of the export restrictions until June 15, 2008, and export quotas of the size of 80,000 t of wheat flour were issued.

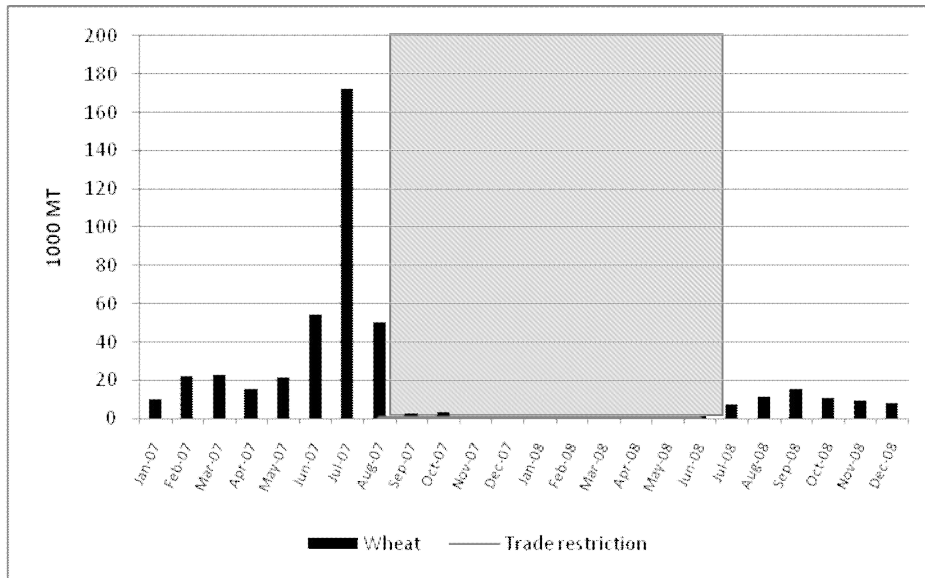
The main reason for implementing trade restrictions was securing sufficient wheat supply for domestic consumption. Serbian wheat production was declining in 2006 and 2007. Wheat production in 2007 was almost at the same level as in the previous year amounting about 1,900,000 t with average yields of 3.3 t per ha (Statistical office of Serbia). Also, total domestic consumption was of the size similar to the previous year amounting 1,750,000 t (MAFWM, Serbia). Therefore, concerns about securing sufficient wheat supply for domestic consumption was not induced by low production but rather by the dramatic increase in Serbian wheat exports in the first half of 2007. In particular, from January to July 2007, Serbia's wheat exports amounted 232,179 t, corresponding to an increase by 504 % when compared to 2006 (Figure 2). The main export destinations were the EU (Germany, Cyprus, Austria, Slovenia and Romania) with 68.77% of the wheat exports³, and Bosnia and Herzegovina (17.12%).

Another reason for the high demand for Serbian wheat in this time period was the relatively low price of Serbian wheat compared to the world market price. In the first half of 2007 the Serbian wheat price was either lower than or at most as high as the world market price so that Serbian wheat was very competitive which increased foreign demand (Figure 3).

Significant regional demand and growing prices on the world market dramatically influenced the relatively small Serbian wheat market. For example, to secure their own stocks, domestic wheat demand by mills and huge industrial companies increased substantially in September and October 2007. This implied that the wheat price increased to 358 US\$ in December 2007 (Figure 3).

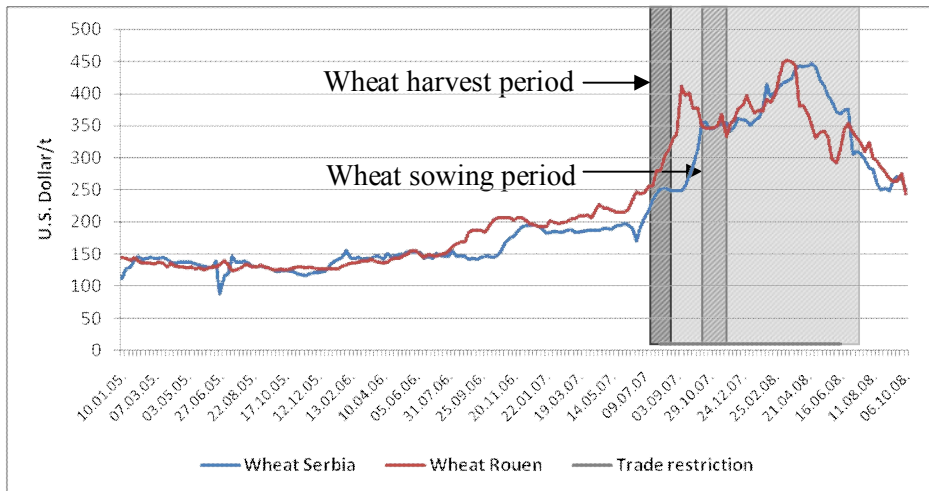
³ In 2007 EU had significant losses in wheat which caused increase in imports of 35% comparing to previous year (2006).

Figure 2 - Monthly wheat export, 2007-2008



Source: The Global Trade Atlas

Figure 3 - Weekly wheat silos prices 2005-2008



Source: Yugoslavian Grain Fund

In the aftermath of the government’s announcement that trade restrictions will be extended until June 2008, wheat prices stabilized for few weeks on a very high level. The stabilization of wheat prices was also supported by the governmental

announcement of the buy-out of about 60,000 t of wheat from Serbian producers in September 2007 in order to ensure enough wheat stocks.

At the beginning of 2008, Serbian wheat prices continued to increase up to 452 US \$/t in April while at the same time the wheat world market price was 369 US \$/t. This induced the government to abolish the wheat import tariff of 30% within an import quota of 200,000 t. In light of a good wheat harvest in 2008 and the stabilization of the wheat market, the Serbian government abolished the export controls on June 15, 2008.

The influence of the above described wheat trade policy measures during the food crisis 2007/2008 on the state of the Serbian wheat market, i.e. equilibrium, stability and international integration is analyzed in the next section.

4. Impact of the food crisis policy measures on Serbia's wheat market

4.1 Method and data

According to the (weak) Law of One Price, two spatially separated markets are in their equilibrium if the difference between the prices of these two markets equals at most the size of the costs of trade between these two markets. Exogenous shocks, e.g. a decreasing supply due to bad weather, might lead to a temporary disequilibrium, but if the markets are efficient, then arbitrage activities (e.g. trade) of market participants imply that the prices are driven back to their equilibrium level and thus that the market equilibrium is restored (FACKLER and GOODWIN, 2001). For example, suppose that the wheat grower price in Serbia is increasing beyond the world market price level, traders may make a profit by selling wheat from the world market on the Serbian wheat market. Then, wheat supply increases, implying that prices on the Serbian market decrease at most to their equilibrium level which is equal to the world market price plus the costs of transporting and selling wheat bought on the world market on the Serbian market. However, if trade is restricted, then arbitrage is incomplete or even impossible leading to market disequilibrium. This implies that price changes on one market are incompletely or not at all transmitted from one to the other market thereby decreasing the degree of market integration. If markets are separated or integrated only to a low degree, then the stability of the market price may decrease because price differences are not or only to a limited extent equalized by arbitrage activities.

In this study we investigate the effects of the export restriction on the state of the domestic wheat markets within the framework of a Markov-switching vector error correction model (MSVECM) tracing back to HAMILTON (1989). A MSVECM was first designed by KROLZIG et al. (2002) to analyze business cycles and was recently introduced in the analysis of price transmission by BRÜMMER et al. (2009). In contrast to a linear vector error correction model (VECM), which is a time-series model adequate to analyze a market in a time period when the market

prevails in one particular state which is characterized by one price transmission regime, a MSVECM can be applied even when the state of the market changes and several price transmission regimes prevail in the market. In our case we hypothesize that the state of the Serbian wheat market changes due to the restriction of exports and imports and several price transmission regimes might be observed during the time period underlying this analysis.

A further advantage of the MSVECM is that it allows distinguishing different price transmission regimes even if the state variable, which governs the regime switches, can not or only incompletely be observed. The state variable determines the probability with which a particular regime prevails in the market at a given point of time. The MSVECM is based on the assumption that the data generating process underlying the state variable is following a Markov-chain. This implies that the state of the market of tomorrow is determined only by the state of the market of today but not of yesterday.

The parameters of a MSVECM are estimated by maximizing the likelihood function with the expectation maximization algorithm (KROLZIG, 1997). Based on starting values for the parameters to be estimated, the parameters characterizing the unobserved state variable and the probability of a change of one regime to another regime (transition probability) are first estimated. In the next step, the starting values are updated based on the parameters estimated in the first step within an iterative procedure. This procedure is stopped when the parameter estimates of two consecutive estimations do not differ significantly.

We conduct our analysis based on 190 observations of the weekly wheat grower price of Serbia (obtained from Yugoslavian Grain Fund) as a measure for the wheat price of Serbia and the port F.O.B. price of wheat ("Other wheat's") of Rouen (France) as a measure for the world market price (Figure 3). The time period underlying our analysis last from January 2005 until October 2008.

4.2 Results

The results of the ADF test and the KPSS test suggest that both data series are integrated of order 1. Further, Johansen's test on cointegration finds that the Serbian wheat grower price and the wheat world market price are co integrated, which can be interpreted economically that a long-run equilibrium between these two markets exists and that the Serbian wheat market and the world wheat market are integrated. Thus, the preconditions for utilizing an error correction model are given.

The results of the τ -Test of HANSEN and JOHANSEN (1999) suggest that the long-run equilibrium relationship is stable throughout the whole time period underlying our analysis. This justifies estimating the MSVECM within a restricted framework. This means that the long-run equilibrium relationship (cointegration vector) is estimated separately in the first step. Next we retrieve the error correction term from this long-run

equilibrium relationship which enters the MSVECM as a variable. In the second step the MSVECM is estimated in an iterative procedure. The final specification of the model is selected by several model selection criteria (AIC, HQ and SC). Table 1 presents selected parameter estimates⁴ for a MSVECM specification with 3 regimes and 2 lags included in the model. The model diagnostics indicate that no autocorrelation, homoscedasticity and normality of the residuals are given.

Table 1 - Selected parameter estimates of the MS (3) – VECM (2)

Market	Indicator	Normal Export 01/05-05/08 (Pre-crisis)	Export Restriction 08/ 07-06/08 (Crisis)
Prices	Avg. world market price	164	368
	Avg. producer price	154	363
	Producer price in % wmp*	95%	99%
Long-run price transmission	Elasticity	0.978	0.978
	Constant	0.01	0.01
Equilibrium	General		Disrupted
Deviation from equilibrium	Avg. ECT	0.102	0.170
Adjust. dynamics	Speed of adjustment**	-0.09	-0.07
Stability	General		Reduced
Price fluctuation	Residual standard error**	0.016	0.025

* wmp = world market price

** regarding the most probable price transmission regime prevailing in this time period

5. Discussion

Table 1 shows the wheat world market prices and the Serbian producer prices which more than doubled during the food crisis. In the time period before the food crisis, the producer price was mostly below the world market price amounting on average 95% of the world market price. Though, during the food crisis, when export restrictions were effective, the difference of the wheat grower price to the world market price first increased but decreased thereafter. Finally, the producer price even increased beyond the world market price (Figure 1). Therefore, the

⁴ Complete results are available from the authors upon request.

Serbian wheat producer price amounted about 99% of the world market price on average during the food crisis.

Our model results suggest that the long-run equilibrium and thus the degree of market integration remained constant throughout the whole time period underlying our analysis, characterized by an elasticity of 0.978 and intercept value of 0.01. Though, the deviations from the long-run equilibrium increased during the crisis, corresponding to the increase in the average absolute value of the error correction term (ECT) by 67% from 0.102 to 0.170. Since the speed of adjustment decreased by 22% during the crisis, the time period within which deviations from the long-run equilibrium were corrected increased. This might result from the export restrictions which inhibit arbitrage activities which restore the long-run equilibrium if the prices are temporarily in disequilibrium.

The increase of the residual standard error by almost 60% during the food crisis indicates that the stability of the market increased significantly.

In contrast to our expectations, and different to the experience with export restrictions in Russia and the Ukraine during the food crisis 2007/2008, the export controls in Serbia did not achieve that the grower price increased at a slower degree than the world market prices. In contrast, the wheat grower price of Serbia even increased beyond the world market price in the time period January 2008 to June 2008. This development might have been caused by extremely high fuel and fertilizer prices prevailing during the wheat sowing period lasting from October to November 2007. This implied that a lot of farmers could not afford to buy the required fertilizer, and since farmers had difficulties to get credits due to the financial crisis, less wheat area than in the previous year was sown. Total wheat harvest area in 2007 was 463.000 ha which is the lowest area harvested since the Second World War. Therefore, analysts expected a wheat supply shortage in Serbia prevailing even after the harvest in fall 2008. Wheat prices in Serbia even increased beyond the world market price, since high import taxes prevented wheat imports from the world market. Although the Serbian wheat producer price was extremely high, some traders even didn't sell their wheat but kept it stored hoping that prices would increase even more. During this time period of extremely high prices, the Serbian market was very thin and only small quantities of wheat were traded. According to experts' information, only a few wheat processing companies who ran out of stocks bought at these high prices, whereas most companies utilized the wheat kept in their stocks. This implied that the government maintained the export controls although other countries as Ukraine and Russia had removed their export restrictions in March 2008 in light of the expectation of a "bomber" harvest. Due to excellent weather conditions, the wheat harvest turned out to be above average even in Serbia and the export controls were removed in June 2008 implying that the wheat producer price started to decrease at a level which is lower than the world market price.

6. Conclusions

This analysis has shed light on the effects of the restriction of wheat exports during the food crisis in Serbia. Our results suggest that although the degree of market integration and thus the long-run price elasticity do not change during the crisis, the market equilibrium was disrupted and the stability was reduced during the crisis. Also, we find that the price dampening effect of the export restrictions prevailed only in a short time period and that the Serbian wheat grower prices even increased beyond the world market afterwards.

In future research, the causes which have led to the increase in the Serbian wheat grower price beyond the world market price have to be investigated within interviews with market participants more comprehensively. Also, based on a comparison of the costs and benefits of alternative policy measures policy options should be designed which would allow the Serbian government to respond to increasing world market prices in the future more efficiently.

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