INFLUENCES OF THE GOVERNMENTAL MARKET INTERVENTIONS ON WHEAT MARKETS IN SERBIA DURING THE FOOD CRISIS 2007/2008

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Abstract

This paper analyzes how the market interventions of the Serbian government during the food crisis 2007/2008, inter alia a de facto export ban, have affected domestic wheat markets. Besides a comprehensive description of the crisis policy and its effects on the Serbian wheat market, we investigate how it influences the equilibrium and stability of the Serbian wheat market and its integration with the world market within a price transmission model. Applying a Markov-switching error correction model to weekly wheat grower prices in Serbia and world market prices, two states of the wheat market are identified. Our results suggest that although the long-run price elasticity did not change during the crisis, the market equilibrium was disrupted and the market stability reduced. Also, we find that the price dampening effect of the export restrictions was only short-lived, and that Serbian wheat grower prices even increased above the world market level.

Key words: international market integration, Markov-Switching Error Correction Model, Serbia, wheat market, world market price transmission

JEL Codes: C34, Q11, Q13, Q17, Q18

1. Introduction

World market prices for agricultural raw products have risen dramatically during the past years leading to the global food crises. For instance, F.O.B. US Louisiana Gulf prices for wheat, corn and rice increased by 182 %, 236 % and 202 %, respectively from June 2006 until June 2008 (USDA, 2011).

The transmission of price increases on the world market to domestic markets is product and country specific. For example, wheat markets in Latin America seem to be highly influenced by world market price developments, whereas rice markets in China and India, which are characterized by strong political market interventions, seem to be shielded from price movements on international markets. In Africa maize prices even increased beyond the world market level in some countries (GIEWS, 2011).

Some of the factors determining the degree of price transmission from the world market to domestic markets are political interventions on domestic markets. For example, during the food crisis 2007/2008, about 101 governments worldwide implemented some policy measures to dampen price increase on domestic markets (FAO, 2008a). Different regulations were implemented comprising trade oriented, consumer oriented and producer oriented measures (FAO, 2008b). Even large exporting countries as Russia, Ukraine and Kazakhstan heavily intervened in their wheat markets especially by trade oriented measures such as export taxes, export bans and export quotas (Djuric, et al., 2009).

Serbia is a rather smaller wheat exporting country which restricted wheat exports by a de facto export ban during the food crisis 2007/2008. In addition, the Serbian government

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intervened on the market by buying out wheat from the market and canceling the wheat import tax for the quota of 200,000 t.

Wheat is besides corn one of the most important grain products exported by Serbia accounting for 11 % and 88 % of total grain exports in 2009, respectively. For Serbia wheat is not just a grain, it is very important political tool. Policy measures concerning wheat are particularly important during elections because they allow influencing wheat prices and thus the government interferes on the decisions of the Serbian Bakery Union to set the price of bread, which is the voters' primer concern. Therefore, we focus our research on wheat rather than corn which is the agricultural product with the highest export share.

Serbian wheat is not competitive regarding quality[2] and price[3] 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, CEFTA[4] members are Serbia's main trading partners.

The influence of the 2007/2008 global crisis on Serbian agriculture was not yet detailed analyzed. So far one study on this topic by Zivkov et al. (2009) exists which gives a descriptive overview of the influence of the global food crisis on the Serbian agricultural sector. Nevertheless, policy makers in Serbia are demanding a comprehensive evaluation of their crisis policy to help them designing more optimal crisis policies in the future. Also, the mechanism underlying the price transmission process from the world market to domestic markets and the factors influencing it are not yet investigated sufficiently (Zoellick, 2011). This paper aims to close this research gap by studying the effects of the governmental crisis policy on domestic wheat markets in Serbia within a price transmission model framework. Our research questions are: By which crisis policies did the government intervene on domestic wheat markets and how were they sequenced? How did they affect domestic wheat markets particularly market prices and trade volumes? Were equilibrium and stability and the integration of Serbian wheat market with the world market influenced by the crisis policies? We hypothesize that the state of the Serbian wheat market changed due to the comprehensive governmental market interventions.

The price transmission analysis is conducted within a Markov-Switching Error Correction Model (MSECM) which considers that the state of Serbia's wheat market may have altered due to the governmental market interventions during the food crisis 2007/2008. We conduct our analysis based on weekly wheat grower price data of Serbia and the port F.O.B. price of wheat in France (Rouen) as a measure for the world market price.

The paper is organized as follows. Section 2 extensively describes the policy measures implemented by the Serbian government during the 2007/2008 food crisis and its effects on the domestic wheat markets. Section 3 explains the methodology and data set utilized in the price transmission analysis. Section 4 presents empirical results and Section 5 summarizes and provides conclusions.

[2] Serbian wheat is generally qualified as wheat for animal feed rather than food quality wheat. The main reason is poor quality of seeds used for wheat production.

[3] EU member countries have highly subsidized wheat production.

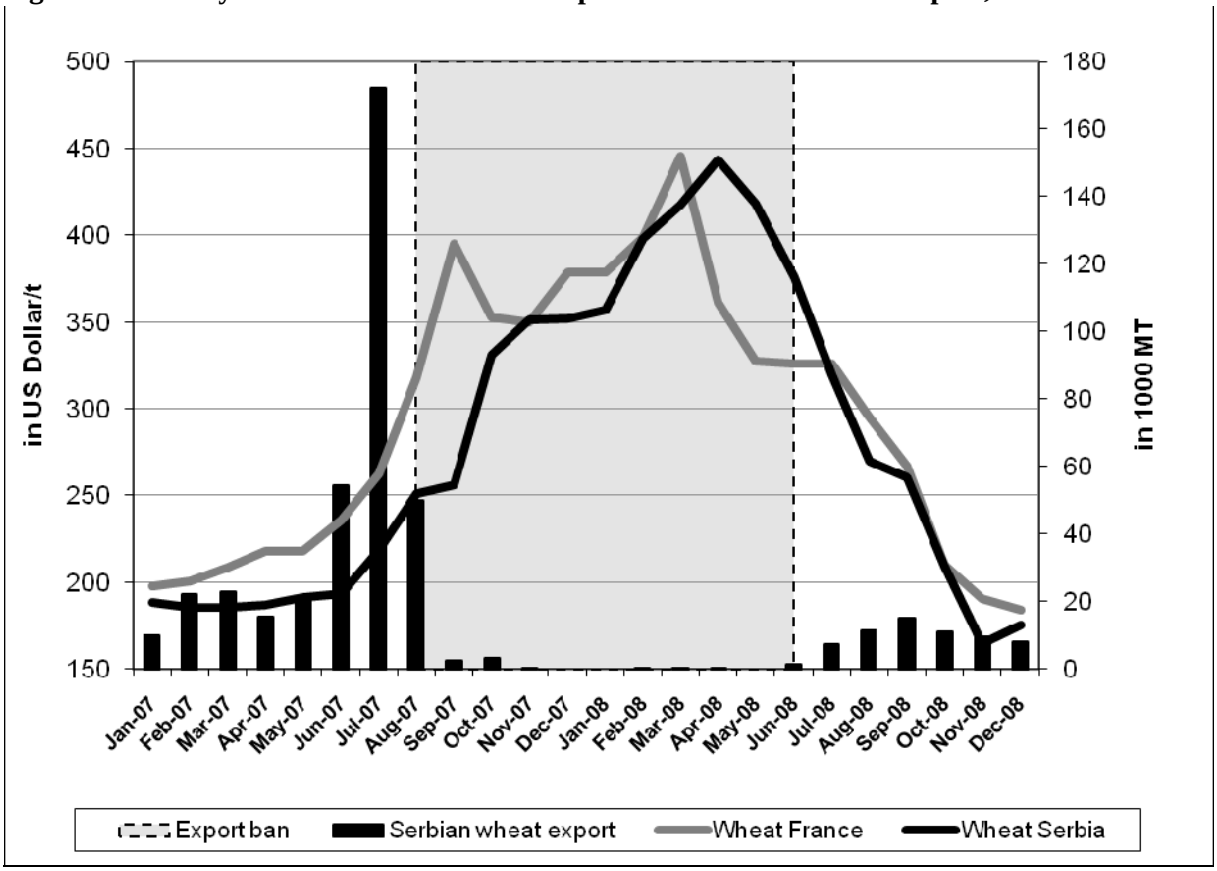
[4] The **Central European Free Trade Agreement (CEFTA)** is a trade agreement between Non-EU countries in Central and South-Eastern Europe. As of May 1, 2007, the parties of the CEFTA agreement are: Albania, Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Montenegro, Serbia and UNMIK-Kosovo.

2. Serbian Wheat Export Policy during the 2007/2008 Food Crisis

In this Section we describe the chronological sequence of Serbian governmental wheat market interventions taken during the global food crisis in 2007/2008. The information was obtained from several interviews with key experts, traders and politicians who were involved directly or indirectly in lobbying, creating or implementing these measures.

The main reason why the Serbian government felt forced to intervene on the wheat market was the dramatic increase of wheat export before the harvest in 2007. In particular, the wheat export[5] from June until the beginning of August 2007 amounted for about 276,871 t and was thus more than 13 times bigger than the monthly average of 20,000 t from the beginning of the year. This significant increase in foreign demand for Serbian wheat was induced by the low price of Serbian wheat compared to the world market price at that time (Figure 1). Therefore, the government justified the market interventions by the need to secure sufficient wheat supply for domestic consumption and to prevent domestic food prices from large increases.

Figure 1: Monthly Serbian and France wheat prices and Serbian wheat export, 2007/2008



Source: GTIS, Yugoslavian Grain Fund (Serbia) and AGPB (France), own illustration

The main governmental intervention on the wheat market was the implementation of quantitative export controls[6] on wheat implemented on August 4, 2007. The export restriction was first announced to last for 3 months until December 2007. Although the Ministry of Agriculture, Forestry and Water Management (MAFWM) announced the

[5] The main export destinations were the EU member countries, such as Germany, Cyprus, Austria, Slovenia and Romania, with about 74 % of the total wheat export in the first half of 2007, and Bosnia and Herzegovina with about 17 %.

[6] Serbian official Gazette No. 73/07, 97/07 and 126/07.

introduction of export quotas for wheat, export quotas were actually not issued. Thus, the wheat export was completely banned (USDA, 2007).
In addition, the government announced the buy-out of about 60,000 t of wheat from Serbian producers in September 2007, in order to ensure sufficient wheat stocks. Consequently, by increasing demand, wheat prices surged by about 30 % within one month putting pressure on the government to consider the renewal of the expert restrictions.
Third, on October 26, 2007 the government officially notified the extension of the export restrictions until June 15, 2008, and export quotas of the size of 80,000 t for wheat flour were issued. In the aftermath of the government's announcement, wheat prices stabilized for few weeks on a very high level.
Fourth, at the beginning of March 2008, the government made the decision to buy-out about 40,000 t of wheat from domestic market for extremely high prices. Pushed by increasing demand on the market with already very high prices, Serbian wheat prices continued to increase up to 452 US Dollar/t in April while at the same time the wheat world market price was 369 US Dollar/t.
Fifth, despite extremely high domestic wheat prices did the Serbian government abolish the wheat import tariff of 30 % within an import quota of 200,000 t not until the end of March 2008. By removing import tariff government was counting on increasing import and thus increasing domestic supply, leading to the decrease of the wheat market price. Consequently, Serbian wheat prices started to fall heavily although no wheat was imported according to the Serbian official trade statistics.
Finally, On June 15, 2008 Serbian government decided to remove the grain export ban.
During the period of governmental intensive interventions and high wheat prices the Serbian market was very thin and only small quantities of wheat were traded. According to experts' information[7], only a few wheat processing companies, who ran out of stocks, bought at these high prices, whereas most companies utilized the wheat from their own stocks.
The period after the abolishment of the export ban in June 2008 was characterized by increased uncertainty on the wheat market caused by several factors.
First, the significant price decrease on Serbian market, in fall 2008, was caused by the above average harvest in July 2008 and substantial stocks of about 350,000 t of the harvest 2007 which was not sold due to the export ban. In addition, Serbian wheat exports remained low in 2008. Regional demand for Serbian wheat was low due to an above average harvest in the whole region, i.e. Serbia's main trading partners. Thus, substantial amounts of wheat were exported not until June 2009 right before the wheat harvest started.
Besides, one of the most destabilizing factors was the reaction of Directorate of Commodity Reserves (DCR) who agreed to borrow significant amount of wheat to the processing companies who didn't have enough financial resources to purchase wheat from the market. According to experts this would be a positive reaction of the DCR in a case that there was less wheat on the market with very high prices. In the real case there was a huge amount of wheat on the market and very low official demand. The reaction of DCR caused further market destabilization and record low wheat prices.
Third, uncertainty was also present in the expectations of the new production in 2009 since the costs for sawing wheat in 2008 were very high and the utilization of basic fertilizers was 50 % less than the previous year.
The uncertainty about wheat prices was further increased by a strong draught which appeared one month before the harvest in 2009 pushing domestic prices upwards.
Finally, uncertainty on the wheat market ended right after the wheat harvest in 2009 which was the second biggest harvest in a row causing further price stabilization.

[7] List of expert's interviews is available from the authors upon request.

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.

3. Methodology and Data

Our model approach is based on the notions of market integration and price transmission. According to the (weak) Law of One Price, two spatially separated markets are in their equilibrium if the difference between the prices in these two markets equals at most the size of the costs of trade between these two markets. This condition is also known as the spatial arbitrage condition. Exogenous shocks, e.g. a decreasing supply due to bad weather in one market, might lead to prices differences exceeding trade costs and thus a temporary disequilibrium. However, if the markets are efficient, arbitrage activities in particular trade between these two markets 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 the wheat harvest is extraordinarily small in Serbia implying that the wheat grower price in Serbia is increasing beyond the world market price. Thus, 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 limited or even impossible leading to a market disequilibrium. This implies that price changes on one market are incompletely or not at all transmitted 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 extend equalized by arbitrage activities.

The economic interpretation of price equilibrium can be explored in the statistical framework of cointegration analysis where the cointegration relationship represents the long-run equilibrium. If the prices are found to be cointegrated, the system can be written as a Vector Error Correction Model (VECM) as defined by Engle and Granger (1987). The core assumption of a VECM is structural stability which means that all parameters of the data generating process are assumed to be constant.

Since it is unlikely to ensure the parameter constancy under the case of unstable Serbian agriculture policy, it is difficult to clearly identify the reactions of market participants. Even though, the exact dates of the implementation of some policy measures, e.g. grain export ban, are know one can not say with certainty when the market participants will react. Market participants can change their behavior according to their expectations before the new policy measure is introduced or abolished, or they can react with a certain delay. Also, since the state of the Serbian wheat market might change due to the restriction of exports and imports, several price transmission regimes might be observed during the time period underlying this analysis. Thus, a linear VECM will not be appropriate for our analysis. In contrast to a VECM, a MSVECM can be applied even when the state of the market changes and several price transmission regimes prevail in the market. 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 first ideas about MSVECM are tracing back to Hamilton (1989) who extended the approach of Goldfeld and Quandt (1973) about the switching regression model characterized by parameter changes that are governed by a Markov Chain. Hamilton extended this approach for the purpose of time series analysis. Later on Krolzig (1997) developed MSVECM as a special case of the more general Markov-Switching Vector Autoregression Model. During its

development, MSVECM was mostly used for business circles and financial research. Recently Brümmer, et al. (2009) introduced the usage of this model in price transmission.

In our analysis we use the following form of unrestricted[8] MSVECM specification:

$$\Delta p_t = \nu(S_t) + \alpha(S_t)\left(\beta(S_t)' p_{t-1}\right) + \sum_{i=1}^{k} A_i(S_t)\Delta p_{t-i} + u_t \qquad (1)$$

where p_t donates the vector of the prices, ν donates the vector of intercept terms, α is the vector of the speed of adjustment coefficients, β is the long-run cointegrating vector, A_i are the matrices containing the short-run parameters of the system, and u_t is the error term. The core element of the MSVECM specification is the state variable $S_t = 1,....,M$. This is an unobserved variable that indicates which of the M possible regimes governs the MSVECM at time t.

The basic idea of a Markov Switching models in general is to assume that the data generating process underlying the state variable S_t is following a Markov-chain:

$$\Pr\left(S_t \mid S_{t-i}, \Delta p_{t-1}, \beta' p_{t-1}\right) = \Pr\left(S_t \mid S_{t-1}, \Pi\right) \qquad (2)$$

The Markov property (5) states that the probability of switching to a new state t only depends on the state of the proceeding period $t-1$. Thus, the regime switching is independent of its history. The square matrix Π contains the (row-wise) probabilities $\lfloor \pi_{ij} \rfloor$ for switching from the regime in row i to the regime in column j, conditioned on the regime in the previous period. The Markov Chain is assumed to be ergodic, meaning that it should ensure a stationary distribution of the regimes, and irreducible which means that it should ensure that any regime can be reached from any other regime.

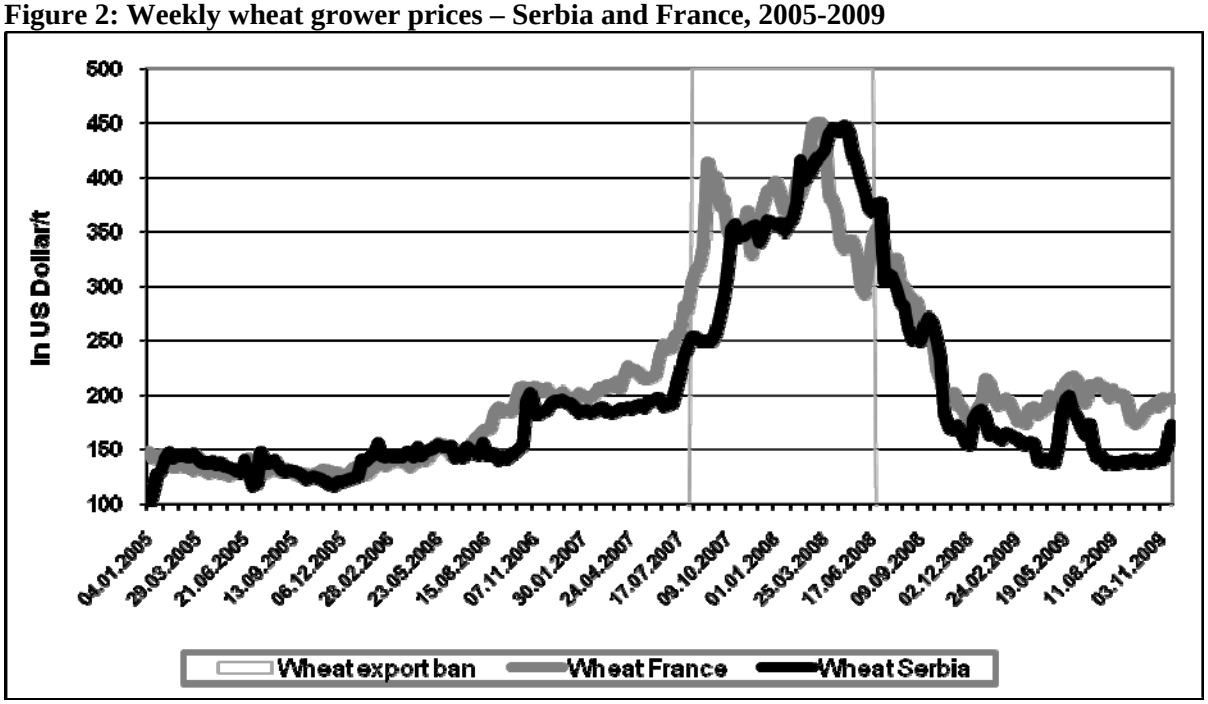
The estimation of a MSVECM is based on maximizing the likelihood function with the Expectation-Maximization algorithm developed by Dempster, et al. (1977). Later, this algorithm was significantly improved by suggestions of Hamilton (1990) and Kim (1994). A detailed explanation of the solution algorithm is given by Krolzig (1997).

In general, the estimation procedure is divided in two steps. First, the parameters characterizing the unobserved state variable and transition probabilities are estimated conditional on the starting values of the coefficients being estimated. In the second step the starting values are updated based on the estimated parameters in the first step within an iterative procedure. The procedure is stopped when the estimated parameters of two consecutive estimations do not differ significantly. The estimation procedure is available in the MSVAR package (Krolzig, 2006) for the matrix programming language Ox (Doornik, 2002).

We conduct our analysis based on the unique dataset of the weekly wheat grower price of Serbia (obtained from Yugoslavian Grain Fund) and the port F.O.B. price of wheat ("Other wheat") of Rouen (France) as a measure for the world market price (Figure 2). Our dataset covers 255 observations during the period from January 2005 until November 2009. All prices are converted by weekly exchange rates into US Dollar. All missing values are imputed based on the program Amelia in R.

[8] In the restricted specification of the MSVECM the long-run cointegration vector β is assumed to be constant and is not allowed to switch between the regimes.

Figure 2: Weekly wheat grower prices – Serbia and France, 2005-2009



Sources: Yugoslavian Grain Fund (Serbia) and AGPB (France), own illustration

4. Empirical 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 cointegrated, 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 MS(V)ECM within a restricted framework. Thus, 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 MS(V)ECM as a variable. Taking in consideration that Serbia is a small wheat exporter, and that it has no influence on the world wheat market price, we estimate a restricted univariate MSECM model in the second step. Besides, our model allows for contemporaneous price transmission. We estimate the MSECM model for different specifications with regard to the number of regimes, autoregressive parameters and lagged short-run price transmission parameters. Also, intercept, short-run price transmission, autoregressive parameters and variances may differ between the regimes. The final specification of the model is selected according to the Schwarz Criteria (SC) and Hannan and Quinn (HQ) model selection criteria. Both criteria suggest a model with 2 regimes and 1 autoregressive parameter (MS(2)ECM(1)), whereas the Akaike Information Criteria (AIC) suggests 3 regimes with 5 autoregressive parameters (MS(3)ECM(5)). Nevertheless, the model suggested by SC and HQ model selection criteria gives economically more reasonable results than the model suggested by AIC. Our optimal model is of the type MSIAH which allows all model parameters to switch between the regimes. Table 1 presents selected parameter estimates[9] for a MSECM specification with 2 regimes and 1 lag included in the model. The model diagnostics indicate

[9] Complete results are available from the authors upon request.

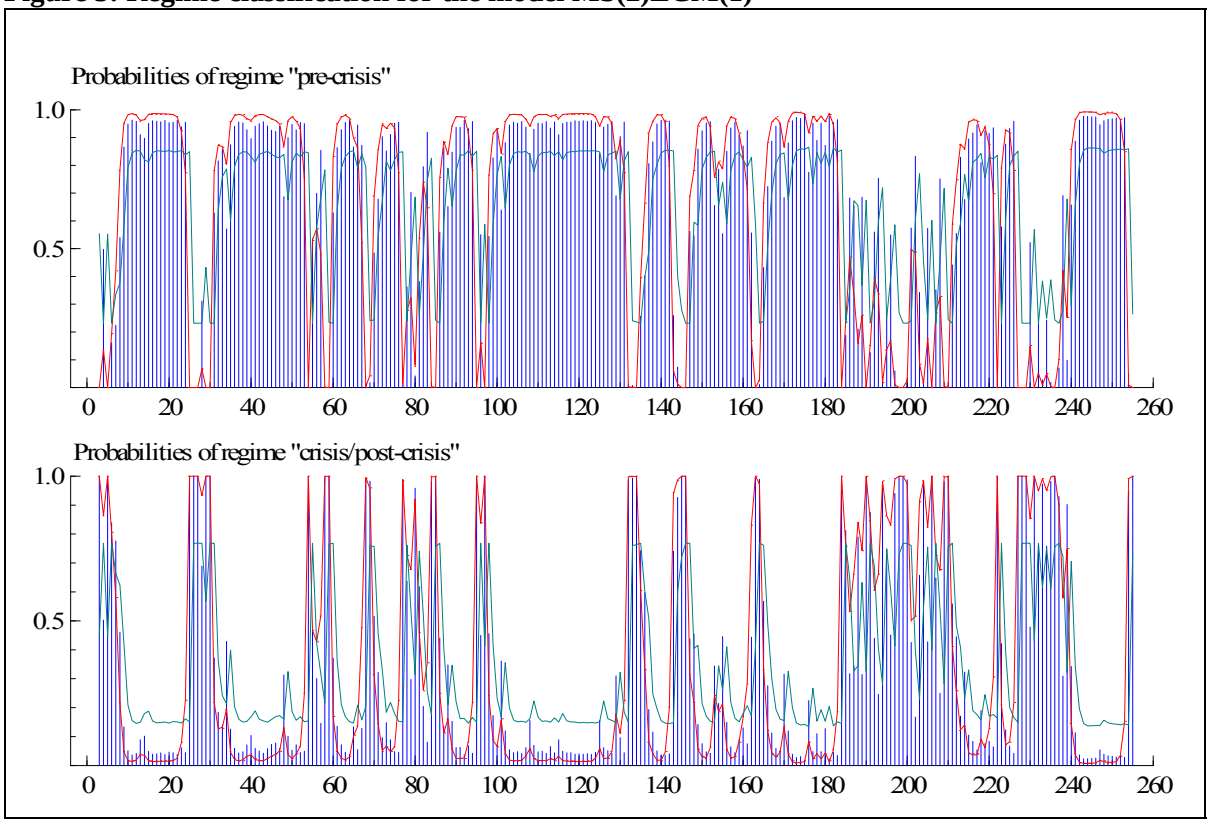
that no autocorrelation is present, and that homoscedasticity and normality of the residuals are given. The regime classification is presented in Figure 3 by indicating to which regime the 255 observations are attributed. We have identified two price transmission regimes "pre-crisis" and "crisis/post-crisis" accounting for 166 and 87 observations, respectively. The regime "pre-crisis" is found to be the most persistent with an average duration of 8 weeks while the average duration of the regime "crisis/post-crisis" is about 4 weeks.

Table 1: Selected parameter estimates of the MS(2)-ECM(1)

Market	Indicator	Normal Export 01/05-07/07 (Pre-crisis)	Export Restriction 08/ 07-06/08 (Crisis/Post-crisis)
Long-run price transmission	Elasticity	0.972	0.972
	Constant	0.081	0.081
Equilibrium			**Disrupted**
Deviation from equilibrium	Avg. |ECT|	0.082	0.144
Stability			**Reduced**
Price fluctuation	Residual standard error*	0.016	0.069

* regarding the most probable price transmission regime prevailing in this time period
Source: Own illustration

Figure 3: Regime classification for the model MS(2)ECM(1)

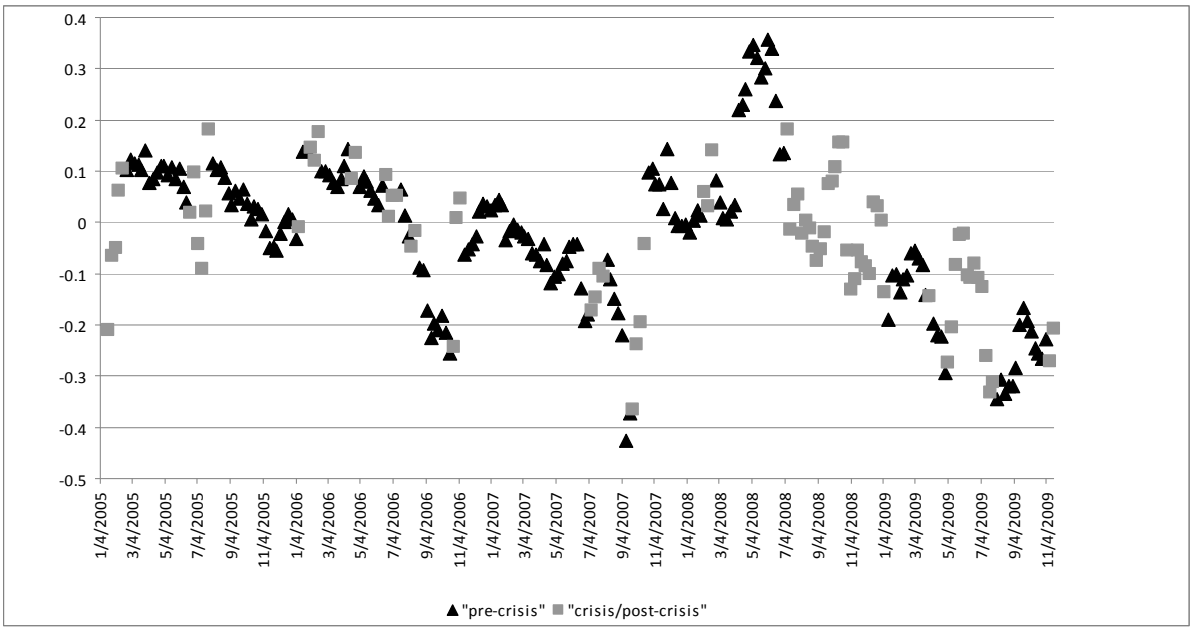


Source: Own illustration

Our model results suggest that the long-run equilibrium remained constant throughout the whole time period underlying our analysis, characterized by an elasticity of 0.972 and intercept value of 0.081. 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 76 % from 0.082 to 0.144. We find the average ECT to be positive in the "pre-crisis" regime and negative in the "crisis/post-crisis" regime (Figure 4). The

residual standard error increased 4 times during the food crisis which indicates that the instability of the market increased significantly.

Figure 4: Size of the ECT terms of two regimes ("pre-crisis" and "crisis/post-crisis")



Source: own illustration

5. Conclusions

During the global food crisis 2007/2008 the Serbian government intended to reduce the impact of rapidly increasing prices on the world and regional markets by implementing a wheat export ban in combination with a wheat flour export quota, the governmental buy-out of wheat on the domestic market and the delayed removal of the wheat import tariff. By introducing these policy measures the government was mainly influencing supply and demand of wheat on the domestic market.

Different to the experience with export restrictions in Russia and the Ukraine during the food crisis 2007/2008 (Götz, et al., 2010), 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. The main reason was the substantially increasing demand caused by the governmental buying-out from the wheat market, first in September 2007 and again in April 2008. Ultimately, by canceling import tariff of 30% for 200,000t of wheat at the end of April 2008, the government improved the conditions for rising wheat supply on the domestic market which implied that wheat prices to fell. However, the latter measure could have been implemented much earlier and might have countered the increase of domestic wheat prices.

The results from our analysis indicate that changes of the world wheat market price were not transmitted completely to the wheat producers in Serbia. The policy measures taken by the government completely banned wheat exports not allowing wheat exporters to benefit from high world prices. Our results suggest that the political market interventions implied long-lasting effects on the Serbian wheat market since a "post-crisis" regime could not be observed. Instead the "crisis/post-crisis" regime continues to prevail even after the removal of the export ban on June 15, 2008. The negative value of average ECT in the "crisis/post-crisis" regime indicates that the situation of Serbian farmers worsened.

Summarizing, this analysis has shed light on the effects of the governmental interventions on wheat market in Serbia. Our results suggest that although the long-run price elasticity remained constant throughout the whole time period underlying our analysis, the market equilibrium was disrupted. Also, the instability of Serbian wheat market increased significantly.
In future research, we will conduct vertical price transmission within the wheat market chain in Serbia in order to identify the effects of the policy measures on different market participants.
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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