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

EFFEKTE DER STAATLICHEN MARKTINTERVENTIONEN AUF DEN WEIZENMARKT IN SERBIEN WÄHREND DER NAHRUNGSMITTELKRISE IN 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 market. 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 the market equilibrium was disrupted and that the market stability was reduced especially after the export ban and during the so called "adjustment" regime. 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, food crisis

Zusammenfassung

Wir analysieren wie sich die Interventionen der serbischen Regierung auf den Weizenmarkt, insbesondere das Exportverbot, während der Nahrungsmittelkrise 2007/2008 auf den inländischen Weizenmarkt ausgewirkt haben. Basierend auf Experteninterviews liefert dieser Beitrag zunächst eine detaillierte deskriptive Analyse der Politikmaßnahmen sowie deren Effekte auf Marktpreise und Handelsmengen. Darüber hinaus werden die Einflüsse der Krisenpolitik bzw. der Krise selbst auf das Gleichgewicht, die Stabilität sowie die Integration des inländischen Weizenmarktes in die Weltmärkte untersucht. In einem Markov-Switching Fehlerkorrekturmodell, welches auf der Grundlage von wöchentlichen Erzeugerpreisen für Weizen in Serbien sowie Weltmarktpreisen geschätzt wird, lassen sich zwei Preistransmissionszustände identifizieren. Unsere Ergebnisse weisen darauf hin, dass das Marktgleichgewicht gestört wurde, und dass die Marktstabilität besonders nach dem Exportverbot und während des so genannten "Anpassung"-Regime reduziert wurde. Darüber hinaus war der preisdämpfende Effekt des Exportverbots nur von kurzer Dauer; vielmehr stieg der serbische Weizenpreis weit über das Niveau des Weltmarktpreises an.

Schlüsselbegriffe: Internationale Marktintegration, Markov-Switching Fehler Korrektur Modell, Serbien, Weizenmärkte, Nahrungsmittelkrise

1. Introduction

World market prices for agricultural raw products have risen dramatically during the past years leading to the global food crisis in 2007/2008 and the price peaks on world markets prevailing since summer 2010. For instance, F.O.B. U.S. 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 (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. During the food crisis 2007/2008, about 101 governments worldwide implemented some policy measures to dampen price increase on domestic markets (FAO, 2008).

Even large exporting countries heavily intervened in their wheat markets especially by trade oriented measures such as export taxes (Russia 2007/2008), export bans (Kazakhstan 2007/2008, Russia 2010) and export quotas (Ukraine 2007/2008 and 2010) (DJURIC *et al.*, 2009). The implementation of the export ban in Russia in August 2010, which was followed by an export quota in Ukraine in October 2010, is seen as one of the major causes of the dramatic increase in wheat prices on world markets in 2010 (FAO, 2010a and 2010b; FAN, 2010).

Serbia, a small wheat exporting country which is a potential EU accession candidate, has also intervened it its wheat export market in 2007/2008 and again in 2011. The new agricultural minister, who just came into office on March 14, 2011, introduced a wheat and wheat flour export ban on March 17, 2011. This decision was followed by the implementation of wheat flour export quota system on March 31, and cancelation of import tariff for 100,000 t of wheat on April 8, 2011.

This paper focuses on the effects of Serbia's crisis policy on domestic wheat market in 2007/2008. Our research questions are: By which crisis policies did the government intervene on domestic wheat market and how were they sequenced? How did they affect domestic wheat market 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 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 more 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).

We conduct our analysis within a price transmission model approach utilizing 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. Our data base comprises 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[1].

[1] In the following text "world market" price for wheat will refer to the F.O.B price of wheat at the port of Rouen in France. For details see footnote 12 in Section 3.

Wheat is besides corn one of the most important grain export products of Serbia, accounting for 11 % and 88 % of total grain exports in 2009, respectively. In addition, the price of wheat and bread is of high political importance. Policy measures concerning wheat are particularly important during elections because they allow influencing wheat prices. Also, the government trying indirectly to influence the price of bread, which is the voters' primer concern, via the negotiations with the Serbian Bakery Union. Therefore, we focus our research on wheat rather than corn.

Serbia has great, unused, potential in wheat production. All preconditions for large-scale wheat production are present: good quality arable land, very favorable weather conditions, low labor costs, adequate number of storage facilities. Nevertheless, total area harvested is reduced for more than 200,000 ha or about 30 % in last 10 years. Average yield per hectare is about 3.4 t. Some of the estimations are showing that the average wheat yields in Serbia can reach 6 t/ha with the utilization of adequate agro-technical measures (Dragovic and Maksimovic 2000; Madic *et al.*, 2010). The main obstacles for using this potential are: low input utilization (seeds and fertilizers), traditional production, small plots (about 3 ha in average), usage of agro-technical measures is very low, etc.

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 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 market. 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. Governmental interventions on wheat market 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.

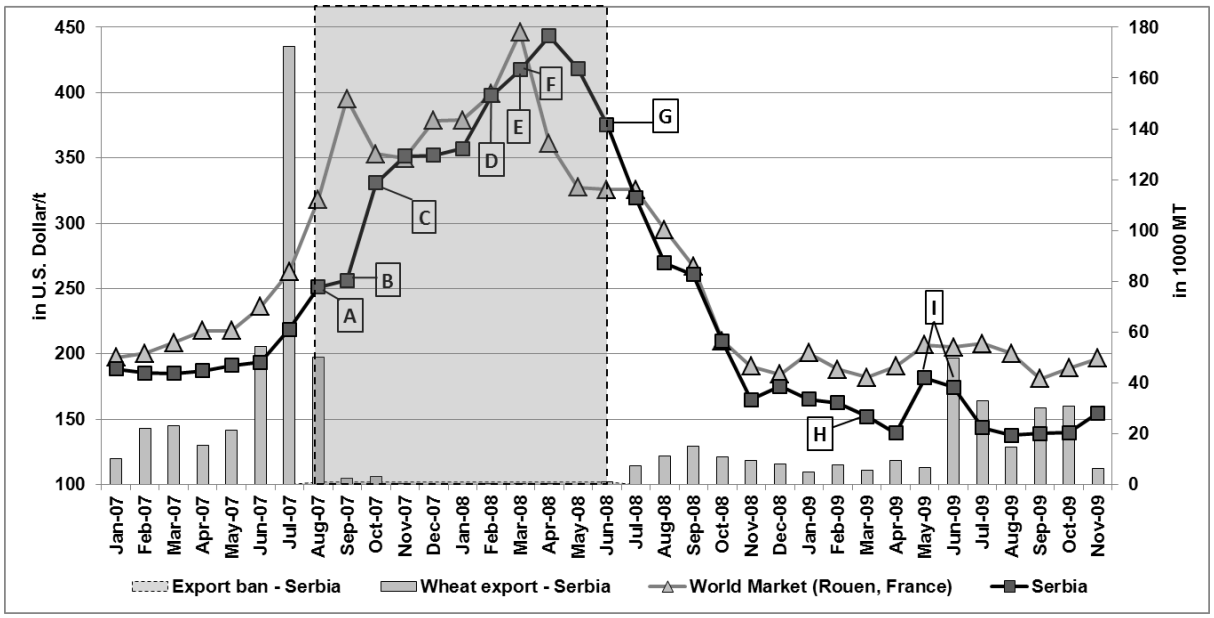
[2] Serbian wheat is generally qualified as wheat for animal feed rather than food quality wheat. The main reason is poor quality of seeds used for wheat production.

[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.

[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 %.

Figure 1: Monthly Serbian and "world market" (Rouen, France) wheat prices, Serbian monthly wheat export and implemented policy measures, 2007/2009



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 (Figure 1, A). 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 introduction of export quotas for wheat, export quotas were actually not issued. Thus, the wheat export was completely banned (USDA, 2007).

In addition, the Directorate of Commodity Reserves (DCR)[7] announced buying-out of about 60,000 t of wheat from Serbian producers in September 2007, in order to ensure sufficient wheat stocks (Figure 1, B). 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 for 90 additional days, and export quotas of the size of 80,000 t for wheat flour were issued (Figure 1, C). In the aftermath of the government's announcement, wheat prices stabilized for few weeks on a very high level.

Fourth, on February 29, 2008 the government officially extended the export restrictions until June 15, 2008 (Figure 1, D). This time the additional wheat flour export quota of 20,000 t was issued.

Fifth, at the beginning of March 2008, the DCR made the decision to buy-out about 40,000 t of wheat from domestic market for extremely high prices (Figure 1, E). Pushed by increasing demand on the market with already very high prices, Serbian wheat prices continued to increase up to 452 U.S. Dollar/t in April while at the same time the wheat world market price was 369 U.S. Dollar/t.

Sixth, 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 (Figure 1, F). In period March/April 2008, Serbian wheat prices were about 20 % higher

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

[7] The DCR is the official governmental body responsible for national commodity reserves. Serbian Ministry of Trade and Services has the direct control over this institution.

than world market prices. 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 (Figure 1, G).
When the government heavily intervened in the Serbian wheat market, the market was very thin and only small quantities of wheat were traded. According to experts' information[8], 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 wheat harvest in July 2008 and by substantial wheat stocks of about 350,000 t from the 2007 harvest which was not sold due to the export ban. In that moment there was about 600,000 to 800,000 t of wheat over the annual domestic consumption. In addition, regional demand for Serbian wheat was low due to an above average harvest in the whole region. Thus, Serbian wheat exports remained low even in 2008, further increasing domestic stocks.
In this moment it would be reasonable to expect significant wheat export since Serbian wheat prices were very low compared to the world market prices (Figure 1). Nevertheless, in the situation like this, when wheat supply on domestic and world market is very high and prices are low, the quality of wheat starts to play more important role than price. Concerning the overall quality of Serbian wheat, from 2008 harvest, it was classified as the II class (considering content of protein and sedimentation value) or not that good for milling. This qualification pushed Serbian wheat aside compared to the wheat of other regional competitors (e.g. Hungary and Romania) who had better wheat quality.
Another important fact is that DCR bought about 40,000 t of wheat at the end of April and beginning of May 2008 but it didn't remove the wheat from the sellers' silos which enable silo owners to buy more wheat during the harvest because of the lack of space. The main consequence of this decision was reduced demand on domestic market.
Besides this decision of the DCR, there was another unexpected decision where the DCR agreed to borrow significant amount of wheat to the processing companies who didn't have enough financial resources to purchase wheat from the market (Figure 1, H). It was agreed that processing companies return the borrowed wheat, the same quantity, within one year. According to experts, this market intervention by the DCR would have been adequate in case wheat supply was extremely low implying extremely high prices. Actually, wheat supply was high whereas market demand was low. Thus, the DCR further decreased market demand for wheat such that wheat prices dropped to a record low price level which further destabilized the market.
Since the costs for sawing wheat in 2008 were very high implying that the utilization of basic fertilizers was 50 % less than the previous year, uncertainty was high regarding the expected wheat production in 2009. The uncertainty about wheat prices was further increased by a strong draught in May and June 2009, one month before the harvest, which had a price increasing effect (Figure 1, I).
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.

[8] 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 cannot 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 Markov Switching Vector Error Correction Model (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, cannot 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[9] MSVECM specification:

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

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:

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

The Markov property (2) 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 $[\pi_{ij}]$ 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).

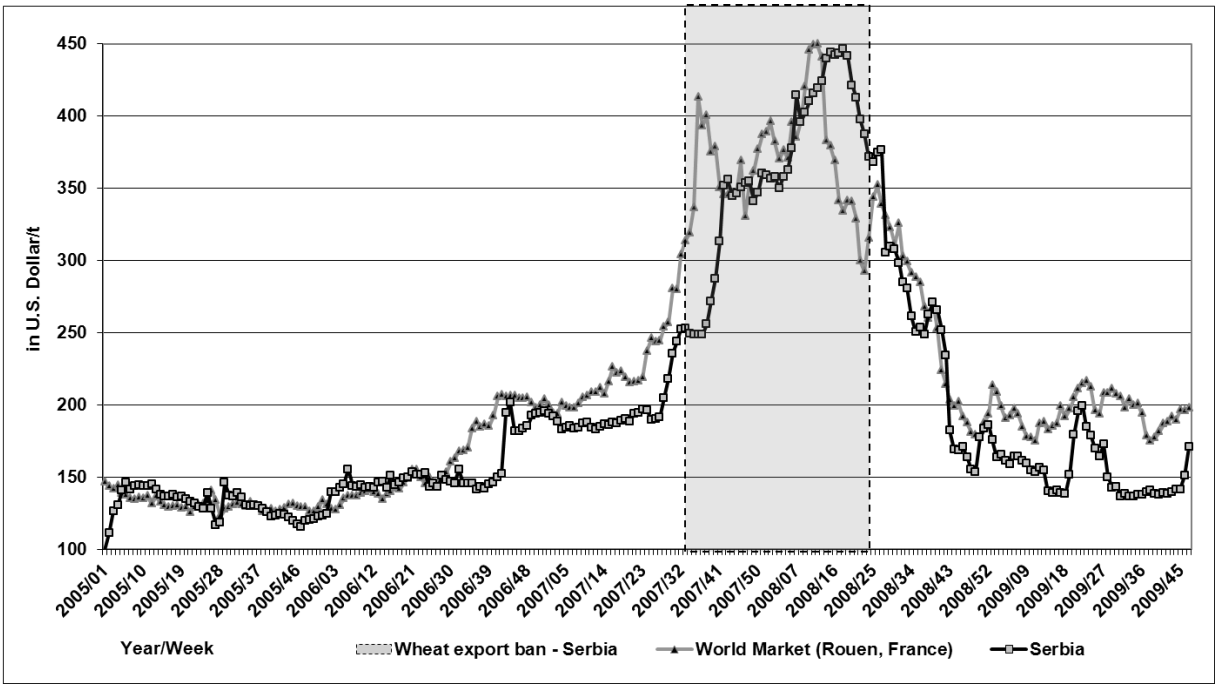
We conduct our analysis based on the unique dataset of the weekly wheat grower price of Serbia measured as the F.C.A.[10] silo selling price (obtained from Yugoslavian/Serbian Grain

[9] 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.

[10] F.C.A. – Free Carrier – (named place) – The seller hands over the goods, cleared for export, into the custody of the first carrier (named by the buyer) at the named place (INCOTERMS 2010).

Fund) and the port F.O.B.[11] price of wheat ("Other wheat") of Rouen (France) as a measure for the world market price[12] (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 U.S. Dollar. All missing values are imputed based on the program Amelia in R.

Figure 2: Weekly wheat prices in Serbia (F.C.A. silo selling price) and "world market" (F.O.B. Rouen, France), 2005-2009



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

4. Empirical Results

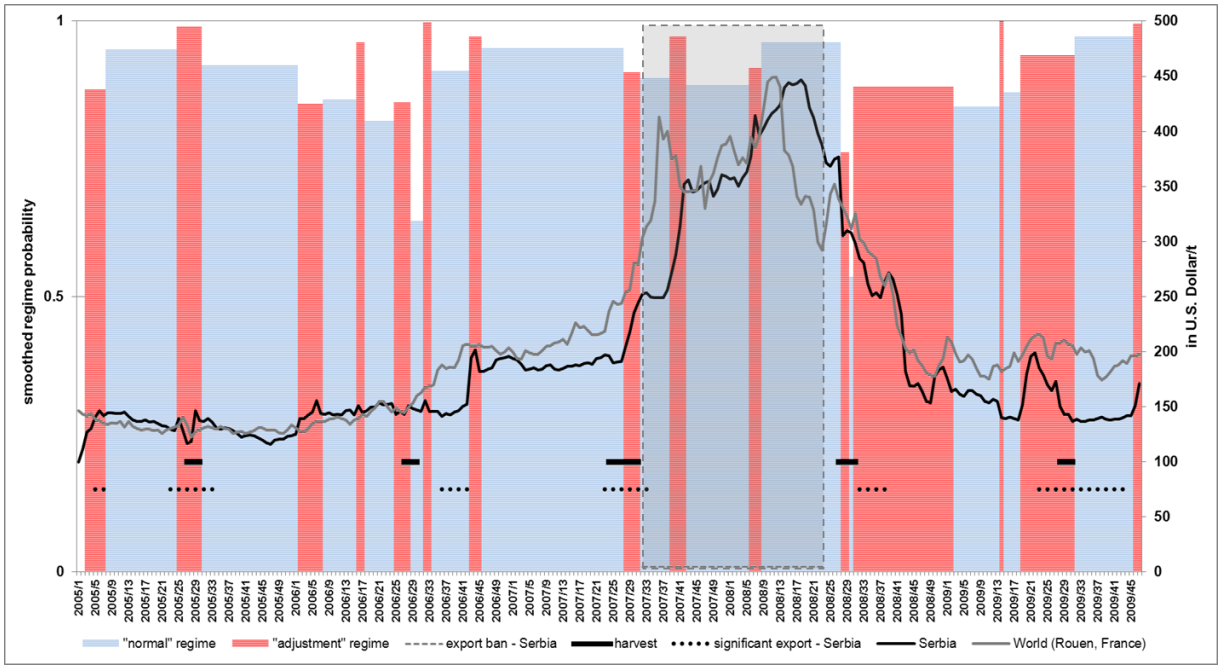
Prior to the model estimation we conducted the unit root and cointegration tests. The results of the ADF test and the KPSS test suggest that both data series are integrated of order 1. Further, Johansen's test on cointegration finds that the Serbian wheat grower price and the wheat world market price 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 the Error Correction Model are given. Further we compared differences in the log-likelihood function values between the linear VECM and preferred MS(V)ECM where the results suggest that non-linear MS(V)ECM is superior.
The results of the τ-Test of (HANSEN and JOHANSEN, 1999) suggest that the long-run equilibrium relationship is not stable throughout the whole time period underlying our analysis, justifying the estimation of the MS(V)ECM within an unrestricted framework. This, more flexible, framework allows that short-run price transmission parameters and those

[11] F.O.B. – Free On Board – The seller has to deliver goods on board a vessel designated by the buyer (INCOTERMS 2010).

[12] Since most of Serbia's wheat exports are imported by the Balkan and the Central Europe region, the prices for wheat traded at the Hungarian commodity exchange is the most important price for Serbian traders. However, this study aims to capture the effects of the government export ban on the integration of Serbian markets in the world wheat markets. Experts confirm that prices at the MATIF commodity exchange often serve as world market price for Serbian traders. Therefore, we choose the Rouen harbor prices as a measure for the world market price.

specifying the long-run equilibrium might change during the observed time period. The long-run equilibrium parameters are retrieved indirectly from the parameters of the MS(V)ECM.
Taking in consideration that Serbia is a small wheat exporter, and that it has no influence on the world wheat market price, we estimate an unrestricted univariate MSECM model. 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)).
Our optimal model is of the type MSIAH[13] which allows all model parameters to switch between the regimes. The model diagnostics indicate that no autocorrelation is present, and that homoscedasticity and normality of the residuals are given.
For better understanding of the estimated model parameters it is necessary first to describe the two different states of market integration (two price transmission regimes) that our model is consist of. Figure 3 represents the smoothed regime probabilities which take the full sample information into account. Thus, it indicates the probability of the most likely regime to which one observation is attributed. Each observation corresponds to a particular week.

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



Source: own illustration based on the model specification

Observing the regime probabilities in Figure 3 we can say that in general domestic wheat market in Serbia is characterized by high number of switches between the price transmission regimes during the observed period.
A "normal" regime contains 164 observations and it is the dominant regime during the observed time period. Average duration of this regime is less than 9 weeks. The "normal" regime is very often supplemented by a second regime called "adjustment" regime which contains 89 observations with an average duration of less than 5 weeks. Before the

[13] This means that we allow the intercept (I), the short-run price transmission, the autoregressive parameters (A), and the variances/heterogeneity (H) to switch between the regimes.

implementation of the wheat export ban, in August 2007, switch from the "normal" to "adjustment" regime was taking place mainly before/during the wheat harvest (Figure 3), during the periods of significant Serbian wheat export (e.g. June, July and August 2005, September and October 2006, Jun, July and August 2007) or in the periods of bad weather conditions which had significant effect on forthcoming wheat harvest (e.g. June 2005 or April 2006). During the period of the wheat export ban "normal" regime was prevailing where the "adjustment" regime was appearing one or two weeks in October 2007 and February 2008, both times when the official extension of the export ban was taking place and it is also matching with the period when the government was buying-out wheat from the market (September 2007 and March 2008) indicating that these governmental decisions was causing short instability on the domestic wheat market. After the cancellation of the wheat export ban, in June 2008, the most prevailing regime was the "adjustment" regime indicating higher market and price instability caused by the factors explained in Section 2.
Some selected parameter estimates[14] for the MSECM specification with 2 regimes and 1 lag included in the model are presented in Table 1.

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

Market	Indicator	"normal" regime	"adjustment" regime
Long-run price transmission	Elasticity	1.174 (0.174)*	0.870 (0.130)*
	Constant	-0.997	0.606
Equilibrium			
Deviation from equilibrium	Regime specific Avg. ECT	-0.0002	-0.009
Adjust. dynamics	Speed of adjustment**	-0.029	-0.284
Stability			
Price fluctuation	Residual standard error**	0.016	0.066

* difference from the perfect price transmission (β=1), in absolute values
* *regarding the most probable price transmission regime prevailing in this time period
Source: own illustration

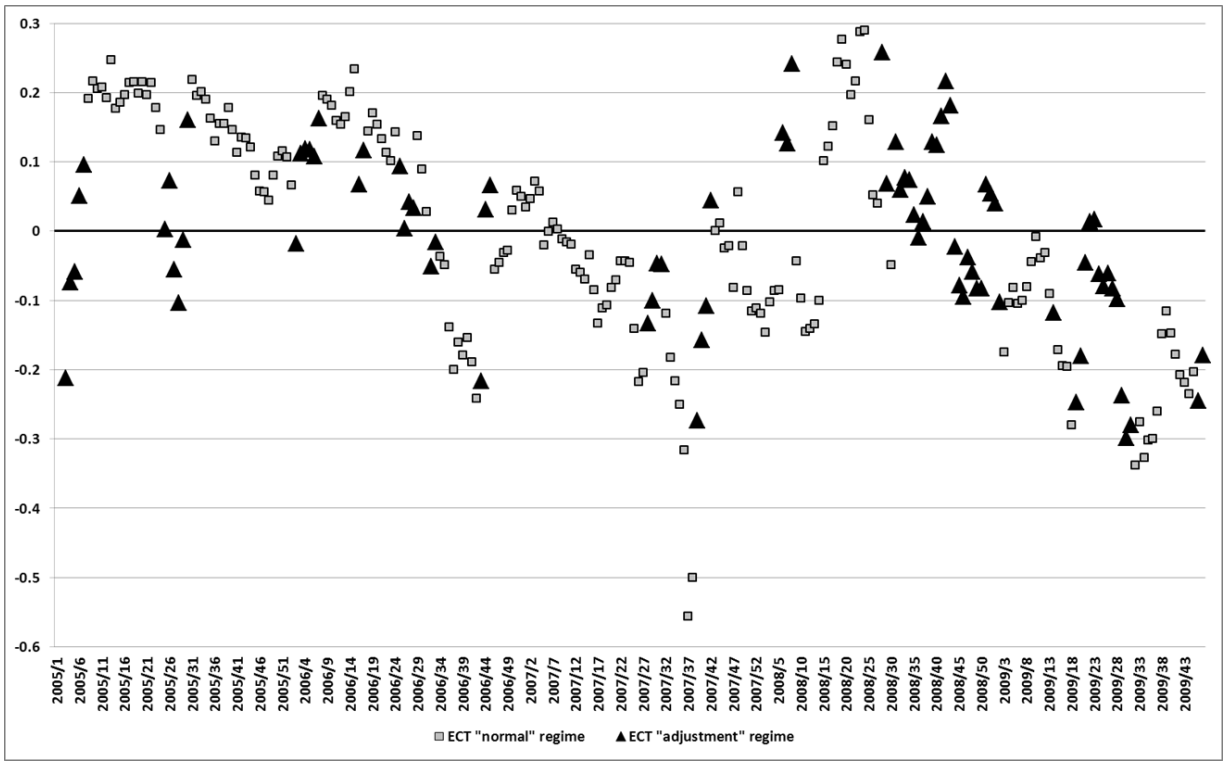
I order to define the integration of the Serbian domestic wheat market in the world market we need to observe at least the following two parameters: long-run equilibrium and the speed of adjustment. Concerning long-run equilibrium, long-run price transmission, we find that price transmission elasticity was improved in the "adjustment" regime compared to the "normal regime" since the difference from the perfect price transmission (when β=1) was reduced. Concerning the speed of adjustment, it raise to the level of 969 % in "adjustment" regime compared to the speed of the adjustment in the "normal" regime (Table 1). These results indicate that whenever the Serbian wheat market is disturbed market agents are trying to restart the arbitrage activities as soon as possible which are accelerating the speed of adjustment toward long-run equilibrium.
Concerning the equilibrium between Serbian wheat market and world wheat market it is defined by the size of the deviation from the long-run price equilibrium (Error Correction Term – ECT). Market is said to be in its equilibrium if the ECT=0. If the ECT>0 than the domestic prices are above the equilibrium, whereas ECT<0 means that domestic prices are below the equilibrium. The estimated ECT for each regime of our model is presented in Figure 4. Concerning the regime specific size of the ECT we find that is slightly negative during the "normal" regime, dropping considerably in "adjustment" regime. These facts make evident that domestic Serbian wheat market have been temporarily disturbed when the

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

"adjustment" regime is prevailing, especially after the cancellation of the export ban where the price of Serbian wheat was pushed strongly under the equilibrium level. Thus, the situation of the Serbian wheat growers was worsening since they could get less money for their wheat on the market (see Section 2 for the factors influencing very low wheat prices on Serbian domestic market).

Another important parameter which is indicating the stability of the market is the regime specific standard error. The estimated standard error for the "adjustment" regime is substantially higher than in the "normal" regime (+313 %) indicating that instability of the market increased significantly during the "adjustment" regime and especially after the cancelation of the export ban.

Figure 4: Size of the ECT terms of two regimes ("normal" and "adjustment")



Source: own illustration

Summarizing the empirical results we can say that implementation of the wheat export ban did not influence directly the market integration and price transmission during the period of the export ban, but rather it had a significant post effect on the wheat market for the period of about one year July 2008/July 2009.

5. Conclusions

During the global food crisis 2007/2008 the Serbian government intended to dampen the transmission of rapidly increasing prices on the world and regional markets and to inhibit wheat exports. This aim was followed by implementing a wheat export ban in combination with a wheat flour export quota, several governmental buy-outs of wheat on the domestic market and the delayed removal of the wheat import tariff.

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. The wheat export ban was effective only in a short-run, first few weeks of its implementation in August 2007. Nevertheless, the wheat grower price of Serbia even increased beyond the world market price

in the time period January to June 2008. The main reasons were uncertainty about the duration of the export ban (export ban was extended two times, see Section 2) and also the substantially increasing demand caused by the governmental buying-out from the domestic wheat market, first in September 2007 and again in April 2008. Ultimately, by canceling the import tariff of 30 % at the end of April 2008, the wheat price started to fall. However, the latter measure should have been implemented much earlier to counter 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. Nevertheless, we could not identify the so called "crisis" regime during the period of the export ban since the "normal regime" was prevailing. Comprehensive additional governmental interventions during the wheat export ban were causing periodical market instability and significant price volatility.

Our results further suggest that the political market interventions had long-lasting effects on the Serbian wheat market especially after the cancellation of the export ban in Jun 2008. In particular, "adjustment" regime was prevailing on the market for almost one year characterized by increased price transmission elasticity and faster speed of adjustment indicating that market agents were restoring the arbitrage activities after the export ban. Consequently, the deviation from the equilibrium between Serbian wheat grower prices and world wheat prices increased pushing Serbian wheat producers in not favorable position. At the same time, 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 more efficiently to increasing world market prices in the future.

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