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The dynamics of the Ukrainian farm wheat price volatility: Evidence from a dynamic conditional correlation GARCH model development

This paper investigates the development of price volatility in the Ukrainian wheat market from 2005 till 2012 within a dynamic conditional correlation GARCH model. The results indicate that the export controls in Ukraine have not significantly reduced price volatility on the domestic wheat market. On the contrary, our findings suggest that the multiple and unpredictable interference of the Ukrainian government on the wheat export market has substantially increased market uncertainty which led to pronounced additional price volatility in the market.

Key words: DCC-GARCH, volatility, export restrictions, Ukrainian wheat market

Introduction

During the recent commodity price booms on world markets (2007/2008 and 2010/2011), export restrictions have widely been used by governments to insulate their domestic markets and prices from price developments on the world market. One of such examples is Ukraine, a country that has recently emerged from being a net importer of wheat into becoming one of its largest exporters. In 2006-08 and later in 2010-11, Ukrainian policy makers used a mix of export quotas and export tariffs to restrict wheat exports. These trade interventions aimed to protect the consumers by preventing the transmission of dramatically increasing and volatile world market prices into its domestic market. Theoretically, by reducing the export quantity, wheat export restrictions increase the supply of wheat on the domestic market which should decrease or prevent increases in domestic wheat prices. If this is the case, the consumers can indeed benefit from such policies. However, the producers are, clearly, the losers since they cannot take advantage of high world prices. Also, as previous research shows (Goychuk and Meyers, 2013), various export restrictions decrease the efficiency of the wheat market, leading to further welfare losses.

The story with volatility is a bit different, however. Market price volatility has important consequences for the welfare of both consumers and producers, especially if it is caused by adverse and unexpected shocks (Gardner et al. 1977). At the producer level, high price volatility creates uncertainty and, thus, affects the decision of the farmers to invest. At the consumer level, increases in price volatility translate in larger fluctuations in the purchasing power they hold. By insulating the domestic market from world prices, the government could theoretically protect its internal players from the transmission of high price volatility in the external market. Of course, an important assumption that needs to be made here is that price volatility is transmitted between different markets in a manner similar to the transmission of price levels by relying on arbitrage processes through trade and information flows. These transmission processes occur until the prices on the domestic and the world market differ at most by the trade costs as suggested by the Law of One Price (Fackler and Goodwin, 2001). Since export controls reduce arbitrage and thus trade flows, prices and their changes in the world market are transmitted less completely to the domestic markets. In this case, both producers and consumers benefit from reduced volatilities, holding everything else constant. And this was one of the justifications used by Ukrainian policymakers when implementing the export restrictions.

However, if export restrictions are implemented on short notice and their design is changed multiple times, as was the case in Ukraine, they increase market risk and might induce additional price variations in the domestic market. As an example, Brümmer et al. (2009) have identified a causal link between market instability and policy interventions. Investigating the wheat market in Ukraine they find increased residual variance within a Markov-switching vector error correction model in times of ad hoc and frequently uncoordinated domestic policy interventions.

This paper aims at analyzing the dynamics of wheat price volatility in the Ukrainian domestic market. Two specific research questions we are trying to answer are the following: How did price volatility on the domestic market in Ukraine develop during the export quota system compared to open trade? And how strong was the relationship between the Ukrainian and world[1] wheat price volatility? The results of this analysis would allow us to test whether the justifications to implement export restrictions with the goal of decreasing price volatility in the Ukrainian domestic market are valid.

We address these research questions by investigating the development of price volatility on the Ukrainian wheat market within a multivariate GARCH approach. For comparison, we include the German[2] wheat market, which did not experience export restrictions during the food price peaks of 2007/2008 and 2010/2011, as reference case in our analysis.

While the effects of export restrictions on the world market (e.g. MeyMartin and Anderson, 2011; Anderson and Nelgen 2012a; see Sharma 2011 for an overview) and on the domestic market (e.g. Götz et al. 2013, 2012; Abbott, 2012; Anderson and Nelgen 2012b; Grueninger and von Cramon-Taubadel 2008) have been identified in various studies, their impacts on domestic price volatility have not yet been investigated comprehensively. Anderson and Nelgen (2012b) use the standard deviation, the coefficient of variation and the Z-statistic of the domestic price relative to that of the border price as indicators for domestic market instability. The analysis is conducted for 75 countries for all agricultural products for 1955 to 2004. Results suggest that governmental market interventions only slightly increase domestic price stability. Götz et al. (2013) identify an increase in the standard error of domestic prices in Russia and Ukraine during restricted exports within a Markov-switching error correction model. They conclude that the export restrictions could not prevent the decrease of market stability when compared to Germany and the USA, two countries which did not intervene in their wheat export markets.

Section 2 gives some background information on the export quota system in Ukraine. Section 3 describes our research method, and the data is presented in section 4. Section 5 gives empirical results, and conclusions are drawn in section 6.

Background on wheat trade policy interventions in Ukraine

The government of Ukraine quantitatively limited wheat exports during the two recent commodity price booms by an export quota which was implemented within a governmental license system. Export quotas allow exports up to the amount as specified by the size of the quota. Export quotas varying between 3,000 tons and 1.2 million tons were in force from October 2006 until May 2008 and again from October 2010 until May 2011[3]. Figure 1 shows the development of the Ukrainian wheat grower price (Milling wheat class 3, ex warehouse) and the world wheat market price (French soft wheat, FOB, Rouen) with wheat exports.

These trade policy interventions were accompanied by a dramatic increase in political uncertainty since 1) the export quotas were implemented on short notice or in some cases once announced were not implemented at all, 2) their size was changed multiple times, and 3) quota distribution came along with massive corruption, particularly in 2010/2011.

For example, the wheat export quota implemented in 2010 became effective rapidly such that ships already loaded with wheat could not leave the harbor. As a result, several hundred thousand tons of wheat sat in storage temporarily on ships in Ukrainian harbors causing high additional costs to exporters (APK Inform 2010). According to traders' information, this implied that contracts could not be fulfilled, which negatively affected the international reputation of traders exporting from Ukraine. Further, the export quota implemented from 2006-2008 was first announced in October 2006 in the amount of 400,000 tons, but it was reduced to 3,000 tons in December 2006. In February 2007 the government gave notice of an increase of the quota to 230,000 tons; however, this increase was not realized. The export quota was abandoned in June 2007 but was reintroduced in July and set at a prohibitive level of 3,000 tons. The notified expansion of the export quota by 200,000 tons in fall 2007 was also not realized. In March/April 2008 the export quota was increased by 1 million tons and finally removed in May 2008 (APK Inform 2010). Also, the wheat export quota introduced in October 2010 was first announced to last until January 2011 but in December 2010 it was prolonged to March 2011, and again in February it was extended further to remain effective until the end of June 2011. Also, the majority of the export licenses were distributed to a state owned company in 2010. Foreign grain trading companies did not receive any export licenses unless they paid bribes and thus experienced high economic losses due to foregone exports.

Methods

In this study we use the Dynamic Conditional Correlation (DCC)-GARCH approach (Engle 2002) to examine and compare the dynamics of volatility of the world wheat prices and domestic wheat prices of Ukraine and Germany. Multivariate GARCH models are common methods used to study volatility in the time series. They allow for both analyzing the volatility dynamics of a particular series of interest and investigating volatility correlations and transmissions among several series. More specifically, DCC models are used to approximate a dynamic conditional correlation matrix that can be used to evaluate the level of interdependency between the series over time.[4]

Consider the following VAR model:

$$y_t = a_0 + \sum_{i=1}^{p} a_i y_{t-i} + \varepsilon_t \ (1),$$

where

y_t is a 3x1 vector of French (world), Ukrainian and German wheat price series, a_0 is a 3x1 vector of drifts, and ε_t is a 3x1 vector of error terms. ε_t has the following conditional variance-covariance matrix:

$$H \equiv D_t R_t D_t \ (2) ,$$

where $D_t = diag\{\sqrt{h_{jj}}\}$, j = 1,….,J, is a 3x3 matrix of the standardized disturbance variances from the univariate GARCH models generated for each series. A univariate GARCH (1,1) model can be represented as follows:

$$h_{jj,t} = \gamma_j + \alpha_j\, \varepsilon_{j,t-1}^2 + \beta_j h_{jj,t-1} \text{ for all j = 1,...,3 (3)}$$

with $\varepsilon_{j,t-1}^2$ being squared lagged residuals from (1), and $h_{jj,t}$ is a time-varying standard deviation that is further used in defining a GARCH-DCC model.

R_t from (2) is a 3x3 symmetric dynamic correlations matrix that is defined in a following form:

$$R_t = (diag(Q_t))^{-1/2} Q_t (diag(Q_t))^{-1/2} \text{ (4),}$$

$$\text{where } Q_t = \{\rho_{ij,t}\} = (1 - \alpha - \beta)\overline{Q} + \beta\, Q_{t-1} + \alpha(u_{t-1}u_{t-1}^{\prime}) \text{ (5).}$$

In equation (5), $Q_t = \{\rho_{ij,t}\}$ is a time varying covariance matrix of standardized residuals from (1),$\overline{Q_t}$ is unconditional variance-covariance matrix obtained from estimating a univariate GARCH in equation (3), and α and β are vectors of non-negative adjustment parameters satisfying α + β <1. Parameter α indicates the impact of the lagged error term (or, in other words, the role of the previous shocks) on the series' volatility in a current period. Parameter β represents the effect of price volatility in the previous period on volatility in the current period (Brummer et al. 2009).

The primary focus of the GARCH-DCC model is on obtaining conditional correlations $q_{ij,t}$ in R_t:

$$q_{ij,t} = \rho_{ij,t} / \sqrt{\rho_{ii,t}}\sqrt{\rho_{jj,t}} \text{ (6),} \quad -1 < q_{ij,t} < 1$$

Engle (2002) suggests using a two-step approach to estimate the DCC model by maximizing the following log-likelihood function:

$$L = \{-\frac{1}{2}\sum_{t=1}^{T}[n\log(2\pi) + log|D_t|^2 + \varepsilon_t^{\prime}\, D_t^{-2}\varepsilon_t]\} + \{-\frac{1}{2}\sum_{t=1}^{T}[\log(R_t) + u_t^{\prime}\, R_t^{-1}u_t - u_t^{\prime}\, u_t]\}$$

The terms between the first brackets are volatility components, and between the second ones is the correlation component of the log-likelihood function. Parameters D_t are obtained in the first step and then are used to estimate the correlation component in the second step.

Overall, implementation of the DCC-GARCH model requires several steps that are captured in figure 2. First unit root tests are performed on the series of interest to check for their stationarity, and in order to fit a proper model (ARMA vs. ARIMA). In our analysis, series were found to be first-difference stationary, therefore, we selected an ARIMA model. The next step is to perform an ARCH-LM test on the residuals from the ARIMA model. If ARCH errors are confirmed, ARIMA residuals are used to fit a univariate GARCH (1,1) models for each series of interest. The estimated parameters from the univariate GARCH models are further used to specify the GARCH-DCC model.

Data

We conduct our volatility analysis on the wheat market based on 417 weekly observations for the domestic price in Ukraine and Germany, and the world market price from January 2005 until December 2012. We use ex warehouse prices of milling wheat of class III of Ukraine (APK-Inform 2013; see Figure 1) and average warehouse delivery price of bread wheat of Germany (AMI 2013) as measures for the domestic wheat price. The FOB price of wheat (French soft wheat, class 1) at the port of Rouen in France, which is the primary harbor through which wheat is exported by the EU (HGCA 2013), serves as the relevant world market price for Ukraine, and Germany. All prices are real prices and are converted by weekly exchange rates into US $/t.

Empirical results

Prior to estimating the VAR and DCC-GARCH model, we check the stationarity of each analyzed series to ensure its appropriateness. All three unit-root tests (ADF, PP, and KPSS) supported the evidence of the unit-root presence in the series. Thus, the tests were re-run on the series after they were differenced in log levels. The results showed that all the differenced series are stationary, leading to the conclusion that the price series of Ukraine, France, and Germany are I(1). Figure 3 shows the series in first differences of the data in logarithm, i.e. the returns.

Table 1 provides some distribution characteristics thereof. The mean of the returns series is highest for Germany, followed by the world market price and Ukraine. The coefficient of variation indicates that price fluctuations are highest for the French world market price, followed by the domestic price for Ukraine and Germany. Skewness results indicate that the German price and the French world market price are relatively symmetrically distributed, while prices for Ukraine are less symmetric. Excess kurtosis suggests that the data series are not normally distributed so that needs to be taken into account when selecting distributions in the following steps.

In the next step we proceed with the Box-Jenkins methodology to determine the order of an ARIMA (p,q) model. Table 2 displays some diagnostics statistics for the residuals from the ARIMA (1,0)[5] model for each analyzed series. The Ljung-Box test for serial correlation of the residuals suggests that residuals are not serially correlated, therefore, the lag structure of the ARIMA models is sufficient. However, the results of the Jarque-Bera normality tests suggest that all models exhibit non normality in residuals.

Based on the results of the ARCH-LM test, we concluded that the variances of all analyzed series vary over time, and therefore, univariate GARCH (n,m) models needed to be fit for each series. The selection of an appropriate GARCH order for each wheat series under investigation was made in accordance with the minimum AIC and maximum LogLikelihood values up to n,m = 3. The results showed that for all series, GARCH order of (1,1) was the most appropriate one[6].

In the next step we use univariate GARCH results for each series to fit a DCC-GARCH model. Estimated results are provided in Table 3.

For all three analyzed series GARCH estimates α and β are significant at 5 percent level, and their sums are close to one, which is commonly observed with the high frequency data, and is suggestive of high volatility persistence. More specifically, high β coefficient implies that there is a strong impact of the own-variance on the volatility of the series. A high α coefficient, on the other hand, means that the series is susceptible to the external shocks. As can be seen from the table, the volatility of French and German prices have large own-variance impacts, i.e. high β and low α coefficients, which is even more pronounced for the French export price data. This is, however, not the case with the Ukrainian wheat series. A relatively large α combined with a low β suggests that the volatility of Ukrainian wheat farm prices is rather sensitive to the external shocks and that persistence of price volatility is low. These volatility characteristics become also evident in Figure 4, which displays conditional variances of the three series. The high susceptibility of the Ukrainian prices to external shocks is reflected in the many pronounced spikes of the conditional variance. However, since persistence of this volatility is low, the conditional volatility quickly returns back to its mean in the aftermath. In contrast, the high persistence of volatility of the world market prices is reflected in the two long-lasting downward paths after the volatility spikes in August 2006 and in July 2010, respectively.

Table 4 provides statistics for the distribution of the conditional variances. The mean of the variances is lowest for Ukraine and highest for the world market price[7]. At the same time, the standard deviation of the conditional variance is highest for Ukraine, whereas it is lowest for the world market price.

Further analysis of the conditional variances provides interesting insights into the development of volatility in the Ukrainian domestic market. Figure 4 focuses on the differences among the conditional variances for Ukraine, Germany and France that were retrieved from the univariate GARCH models.

It becomes evident that Ukrainian price volatility is characterized by a number of volatility spikes throughout the analyzed period that exceed the volatility variances of both France and Germany. Figure 5 places Ukrainian and world volatility in the context of world price and Ukrainian exports in the analyzed period. It can be seen that world price volatility is rather high during the commodity price booms, particularly during fall 2007 until the beginning of 2009, and again from fall 2010 until early summer 2011 during the second phase of high world market prices. However, from visual examination, the Ukrainian wheat market did not follow volatility on the world market, rather the majority of volatility spikes happened in between the world price booms. This suggests that possibly domestic rather than external factors might be decisive for volatility developments on the Ukrainian market.

To investigate the possible domestic factors relevant for the wheat price volatility in Ukraine, we identify all political incidences regarding the wheat market in Ukraine for the time periods characterized by excessive price volatility (see Figure 4).

Detailed analysis of the policy environment during the analyzed period leads us to conclude that the spikes in volatility of the Ukrainian series coincide with (and are possibly caused by) several types of political events in the domestic market. It should be pointed out that market interventions as such do not necessarily lead to increased volatility. Rather, increased volatility prevails in times of increased market risk which is often caused by political statements and announcements which imply a change in the market conditions. For example, when export quotas are introduced in October 2010, increased volatility cannot be observed in the Ukrainian market. However, a variance spike is observed a few weeks before, when Russia introduced a wheat export ban, which induced the question whether Ukraine would follow Russia in controlling its wheat exports, which was heavily discussed in the media in Ukraine.

The final step of our analysis was to obtain conditional correlations from the DCC-GARCH model. The results are provided in Table 5 and allow us to gain the insights on the magnitude of interdependence among the analyzed markets.

. Based on the results of the correlation equation of the DCC-GARCH model (Table 5), we can conclude that on average, German wheat prices show a comparatively high correlation with French prices, which is not the case for the pair of Ukrainian-French series, which dynamic conditional correlation averages at 0.05. This is suggestive of the low level of interdependence between Ukrainian and world price volatilities.

Additionally, results suggest that only dccα parameters are significant at 5 percent level for both Ukraine and Germany, while dccβ parameters are found to be not significant. In particular, parameters dccα and dccβ can be interpreted as the “news” and “decay” parameters capturing the effects of innovations on the conditional correlations and their persistence, respectively (Garderbroek et al. 2012).

Conclusions and discussions

The empirical results of this study indicate that contrasting to the German and the French world market price, volatility on the wheat market in Ukraine exhibits high susceptibility to external shocks and low impact of own-variance and thus low persistence. This leads to a couple of short periods of time in which excessive volatility prevails, and is reflected in relatively high skewness of the distribution of the conditional variance. Contrasting to the German market, the Ukrainian wheat market did not follow volatility developments on the world market in 2007/08 and 2010/11, which suggests domestic factors to be of greater importance for observed volatility in this market.

Detailed analysis of the policy environment provides strong evidence for the accordance of phases of high volatility with the occurrence of rumors and the announcement of changes in wheat market trade policy by the Ukrainian government, especially the implementation and extension of the temporary export restrictions.

Further, our empirical results suggest on average lower conditional correlation between volatility in Ukraine and the world market compared to Germany and the world market. We also provide strong statistical evidence for the non-constant, dynamic development of these correlations. The relatively low correlation between the Ukrainian and the world market price volatility compared to Germany can be explained by the high non-tariff trade barriers and high marketing costs in Ukraine. In particular, to export wheat to the world market, a trader has to receive many different certificates which cost money and time. Also, due to outdated and insufficient transport and storage facilities, marketing costs are rather high. This implies that the margin between the export and the farmers’ price is substantially higher than in Germany, and thus the farmers’ price level and volatility is less closely related to the world market price. However, our analysis does not provide evidence for significantly lower correlation of the Ukrainian with the world market price volatility in times of export restrictions compared to free trade, as suggested by economic theory.

We conclude that the export controls in Ukraine have not significantly reduced price volatility on the domestic wheat market. On the contrary, our findings suggest that the multiple and unpredictable interference of the Ukrainian government on the wheat export market has substantially increased market uncertainty which led to pronounced additional price volatility in the market.

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Endnotes

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[1] French wheat export price is considered as a measure for the world market price in our models.

[2] Though, the EU suspended wheat import taxes from January to October 2008 and again from February to June 2011.

[3] The chronology of ***officially implemented*** export quotas in 2006-08 period is the following: October, 2006 – December, 2006: 400,000 tons; December, 2006 – February, 2007: 3,000 tons. February, 2007 – May, 2007: 228,000 tons. In May 2007 the export quota was lifted, however, only till July 1, 2007 when it was reintroduced in light of a severe drought in Ukraine. July, 2007 – March, 2008: 3,000 tons; March, 2008 – April, 2008: 200,000 tons; April, 2008 – May, 2008: 1,200,000 tons. In August 2010, following the Russian ban on wheat exports, Ukraine implemented a new export quota in the amount of 500,000 tons which was increase to 1 million tons in December 2010. In March 2011, the government announced the extension of the 1 million quotas till July 2011. However, in May 2011, export quotas were substituted with export tariffs that remained in place till October 2011.

[4] See Bauwens et al. (2006) for a survey on multivariate GARCH models

[5] The order of ARIMA model was selected based on Schwarz (SBC) criterion. In case of Ukrainian and world wheat prices, SBC was the lowest for the ARIMA (1,0) model. For the German series, the lowest SBC corresponded to the ARIMA (1,4) model, however, due to the lack of significance of the MA(q) coefficients, we found ARIMA (1,0) model to be the most suitable for the German series.

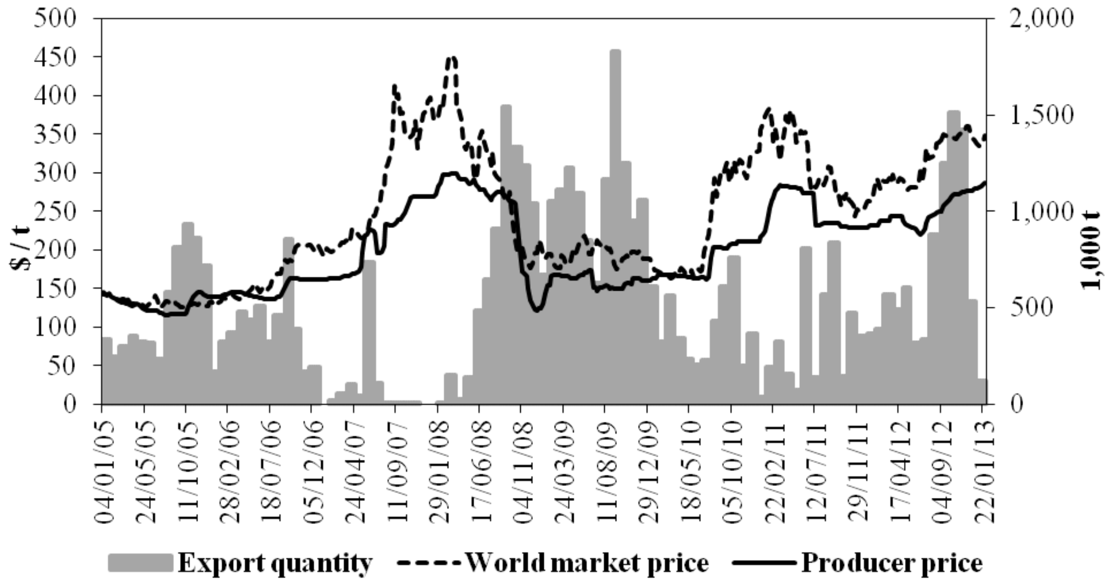
[6] Before determining the order of the GARCH models, we selected the most appropriate distribution based on the AIC, BIC and LogLikelihood criteria. In all the case, Student t-distribution turned out to be the most suitable.

[7] In our opinion, this result is rather surprising and could possibly be attributed to some deficiencies of the Ukrainian data that has a number of zero returns in it.

[8] Conditional correlation estimate is time-varying in the DCC model, however, the correlation coefficients presented in table 3 can be interpreted as their averages

[9] We used Engle and Sheppard (2001) test to check the null hypothesis that the conditional correlations for each analyzed pair is constant. χ^2 in Table 3 suggest that we reject this hypothesis at 1 percent level and conclude that DCC model fits data better.

Figure 1. Development of the domestic wheat price and wheat exports of Ukraine compared to the world market



Sources: GTIS (2013), APK-Inform (2013), HCGA (2013)

Figure 2. Flowchart of DCC-GARCH estimation (adapted from O'Connor and Keane, 2011)

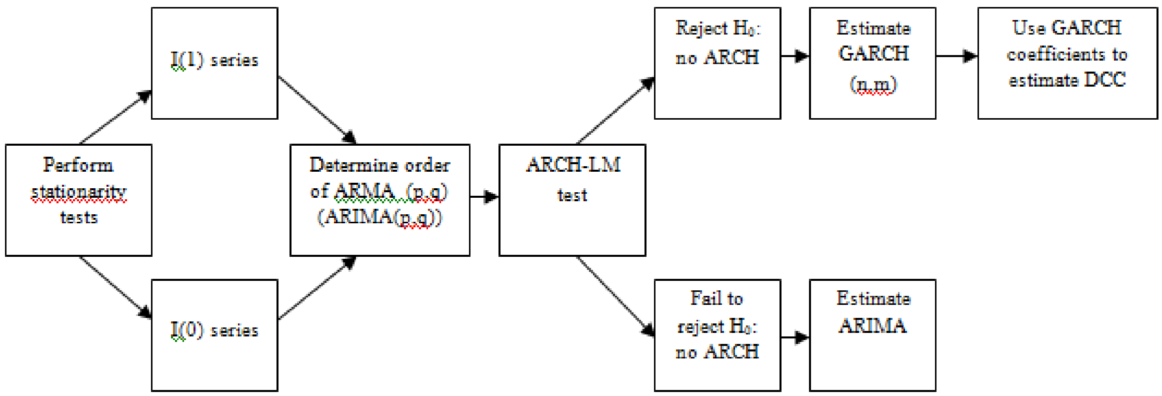


Figure 3: Returns of the price series for Ukraine, Germany and the world market (France)

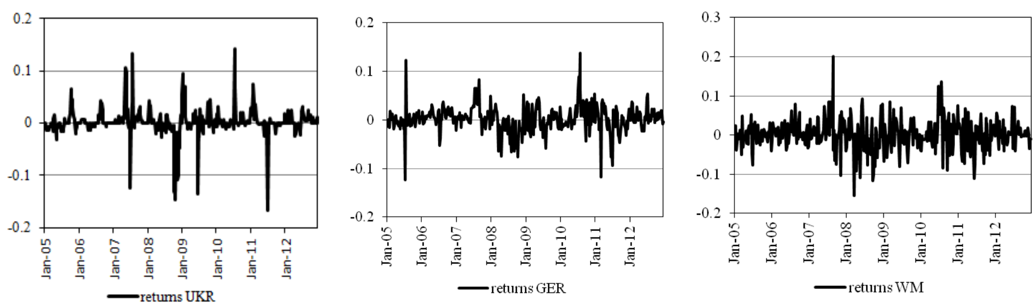


Table 1. Characteristics of the data series in returns[a]

	Ukraine	Germany	World
Mean	0.002	0.002	0.002
Standard deviation	0.027	0.027	0.038
Coef. of variation	16.277	11.260	18.625
Skewness	-1.238	-0.141	0.1000
Kurtosis	15.530	4.899	2.715
DF statistic	-6.53***	-5.354***	-6.009***

[a]Asterisks denote levels of significance (* for 10 percent, ** for 5 percent, *** for 1 percent)

Table 2. Diagnostic test results[b]

	Ljung-Box Q(15) Autocorrelation test	Jarque-Bera Normality test	ARCH (12) LM Heteroskedasticity test
World	17.85 (0.27)	103.81 (0.00)***	27.42 (0.007)***
Ukraine	14.01 (0.52)	5731.15 (0.00) ***	21.91 (0.016)**
Germany	21.07 (0.13)	1521.42 (0.000)***	29.61 (0.003)***

[b]p-values are in the brackets. Asterisks denote levels of significance (* for 10 percent, ** for 5 percent, *** for 1 percent)

Table 3. Results for the univariate part of the MGARCH model[c]

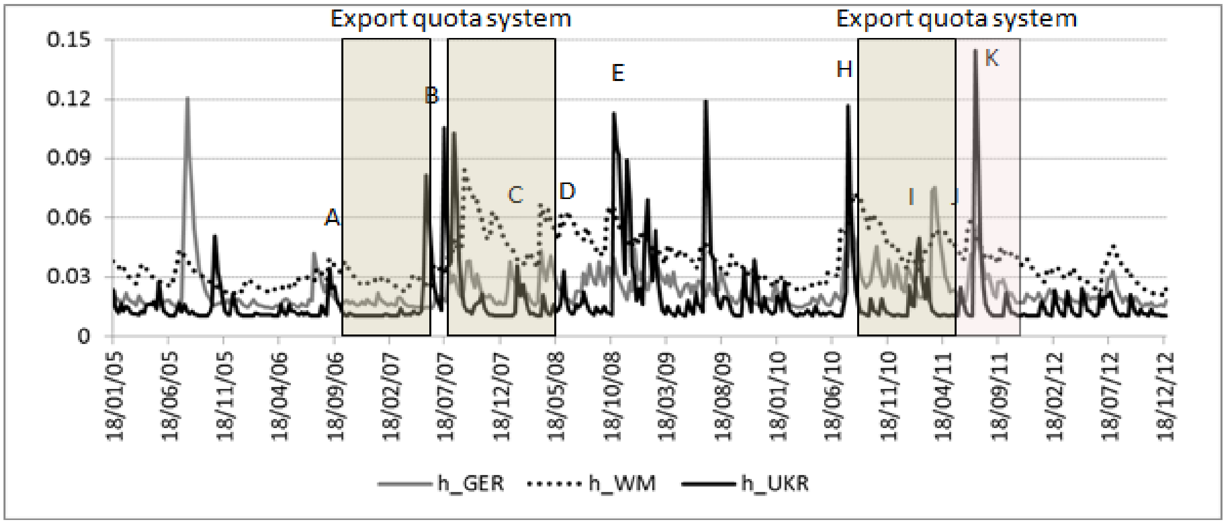
	World	Ukraine	Germany
	Volatility equations		
θ_1	0.00 (0.16)	0.00 (0.00)***	0.00 (0.04)**
α_0	-0.00 (0.95)	-0.00 (0.75)	0.00 (0.91)
α_1	0.14 (0.02)**	0.74 (0.00)***	0.37 (0.01)**
β_1	0.83 (0.00)***	0.25 (0.00)***	0.56 (0.00)***
$\alpha_1 + \beta_1$	0.97	0.99	0.93
Log Likelihood	809	1270	1041

[c]Asterisks denote levels of significance (* for 10 percent, ** for 5 percent, *** for 1 percent). p-values are given in parentheses.

Table 4. Characteristics of the conditional variances

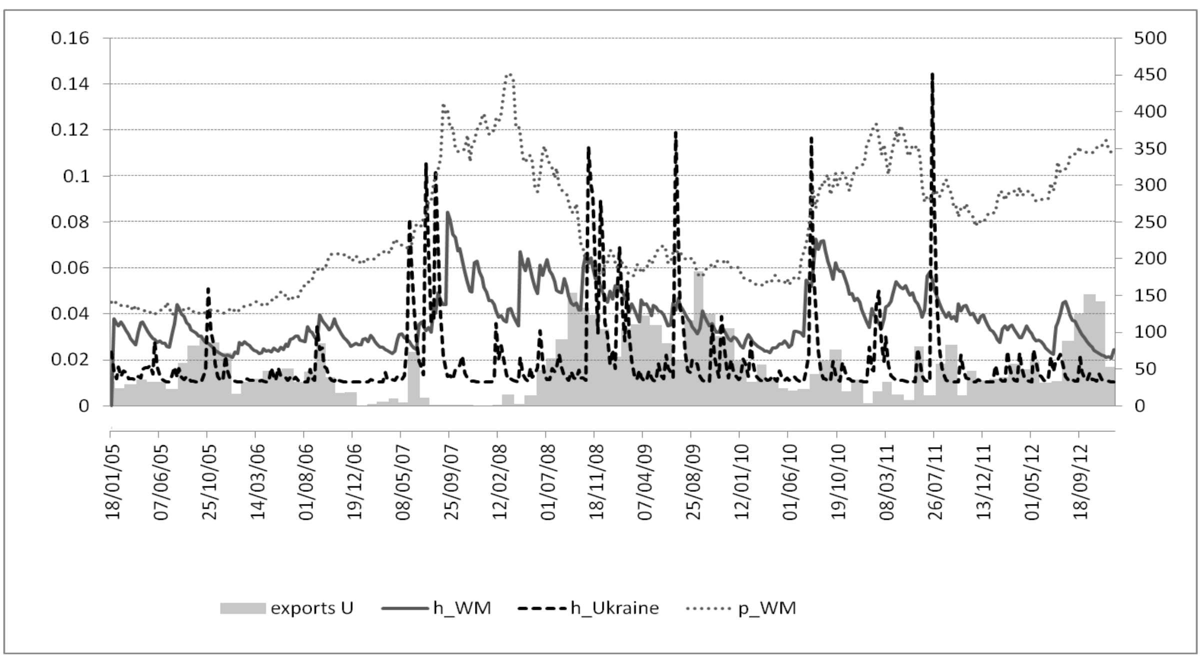
	Ukraine	Germany	World
Mean	0.019	0.023	0.038
Standard deviation	0.018	0.011	0.012
Coef. of variation	1.056	2.091	3.167
Skewness	3.860	3.559	0.928
Kurtosis	16.814	19.725	0.424
Minimum	0.011	0.015	0.021
Maximum	0.145	0.121	0.084

Figure 4: Conditional variances of the Ukrainian, German and world wheat market prices



Note: Explanations for letters A to K are given in the appendix

Figure 5. Comparison of the Ukrainian and world dynamic conditional variances



Note: dynamic conditional variances are shown on the primary axis; world market price (p_WM) in US$/t (secondary axis); wheat exports Ukraine (exports U) in 1000 t (secondary axis)

Table 5. DCC-GARCH model estimates[e]

	Ukraine-France	Germany-France
Dccα	0.07(2.45)**	0.05 (2.17)**
Dccβ	0.00 (0.00)	0.32 (0.61)
P_{hat} (DCC)[8]	0.05	0.37
χ^2-test: $R_t = R$[9]	305.5***	442.9***

[e]Asterisks denote levels of significance (* for 10 percent, ** for 5 percent, *** for 1 percent). t-values are given in parentheses.

Annex

List with political interventions relevant to the wheat market in Ukraine

A: September 2006: Ukrainian government announces the introduction of export quotas in October 2006, but the size of the quota remains unclear; market experts talk a lot about this in the media.

B: The export quota is lifted on some grains in May (e.g. barley) and for wheat in June 2007; the export quota is reintroduced on July 1, 2007 in light of a severe drought

C: The Ukrainian government announces the increase in the size of the export quota on February 4, 2008 but this is not realized; on Feb 4, the Ukrainian commission on distributing export quotas meets and makes decisions on the exports quotas until March 31

E: Towards the end of 2008, the GASC (governmental import company of Egypt) complains about quality issues regarding wheat originating in Ukraine and removes wheat originating in Ukraine from its list (meaning that Ukrainian exporters cannot participate in the wheat tenders)

H: Russia introduces a wheat export ban at the beginning of August; this induces discussions in the media whether Ukraine will follow Russia and impose export quotas (so it is the changing market conditions which induce price volatility)

I: The Ukrainian government announces the extension of the wheat export quota until the end of June 2011

J: On June 10, the Ukrainian President signs a law to introduce a wheat export tax on July 1

K: Towards the end of July, the GASC announces that it considers allowing wheat originating in Ukraine to be included in the next wheat tender (after it has been off the list for 3 years); this was realized for the wheat tender at the end of October (so this increased volatility is not caused by the removal of the export quota)