Export Restrictions and Market Uncertainty: Evidence from the Analysis of Price Volatility in the Ukrainian Wheat Market

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Abstract

The impact of export restrictions on market uncertainty has not been investigated before. This paper analyses the development of price volatility in the Ukrainian wheat market characterized by export restrictions during the commodity price peaks 2007/08 and 2010/11 within a dynamic conditional correlation GARCH model. 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 political 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. The highly uncertain and unpredictable environment of wheat markets with restricted exports has dramatic consequences for the grain sector in Ukraine and prevents its further development.

1 Introduction

Since the beginning of the XXI century, agricultural prices and volatility started to increase and led to agricultural commodity price peaks in 2007/08 and 2010/11. According to forecasts, this trend will continue in the coming decades primarily driven by growing world population and global income growth. OECD/FAO (2012) projects that global demand for cereals will reach about 3 billion tons by 2050, which requires the global annual grain production to increase by 30%. The three large grain-producing countries of the former Soviet Union, Kazakhstan, Russia and Ukraine (KRU) could play a significant role for heightened global grain production and trade, given substantial investments in grain production. Liefert et al. (2013) estimates that the KRU countries could provide 22% of world grain exports by 2021. Grain yields could be increased by intensified use of fertilizer and seeds of high quality. Also, grain production might be increased by re-cultivating abandoned land. The future development and the role the grain sectors could play for global markets is strongly determined by the agricultural policy pursued by the governments of the KRU countries. In particular, Russia and Ukraine restricted their wheat exports by export taxes (Russia, 2007/2008 and Ukraine 2011/12) an export ban (Russia, 2010/2011) and export quotas (Ukraine, 2006-2008 and 2010/2011) during the recent commodity price peaks. Export restrictions aim to stabilize prices on the domestic market by preventing the transmission of dramatically increasing world market prices, and ultimately to dampen domestic food price inflation. Theoretically, by reducing the export quantity, wheat export restrictions increase the supply on the domestic market which decreases domestic wheat prices (Mitra and Josling 2009). However, by reducing the domestic price, export restrictions for wheat create disincentives for investments in the domestic grain sector, decrease the efficiency of the wheat market (Goychuk and Meyers, 2013), and hinder the mobilization of the KRU's wheat production potential. This effect will be amplified if the restrictions are introduced and managed in a discretionary and non-transparent way, as particularly in Ukraine, creating a highly uncertain and unpredictable market environment. Export restrictions also affect the world market by increasing the level and volatility of the international price.

While the effect of export restrictions on the world market (e.g. Martin 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) has been identified in various studies, their impact on domestic market uncertainty and price volatility has 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 domestic market stability in times of high and volatile world market prices.

This paper aims to analyze the influence of export controls on domestic market uncertainty and price volatility in the case of the wheat markets in Ukraine. We hypothesize that export restrictions, particularly if they are implemented on short notice and their design is changed multiple times, increases market risk and might induce additional price variations on the domestic market. 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 nature of domestic policy interventions.

Our research questions are: 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 volatility on the Ukrainian and the world wheat market? 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[1] 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. Also, the French wheat export price is considered as a measure for the world market price in our model.

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.

2 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. 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.

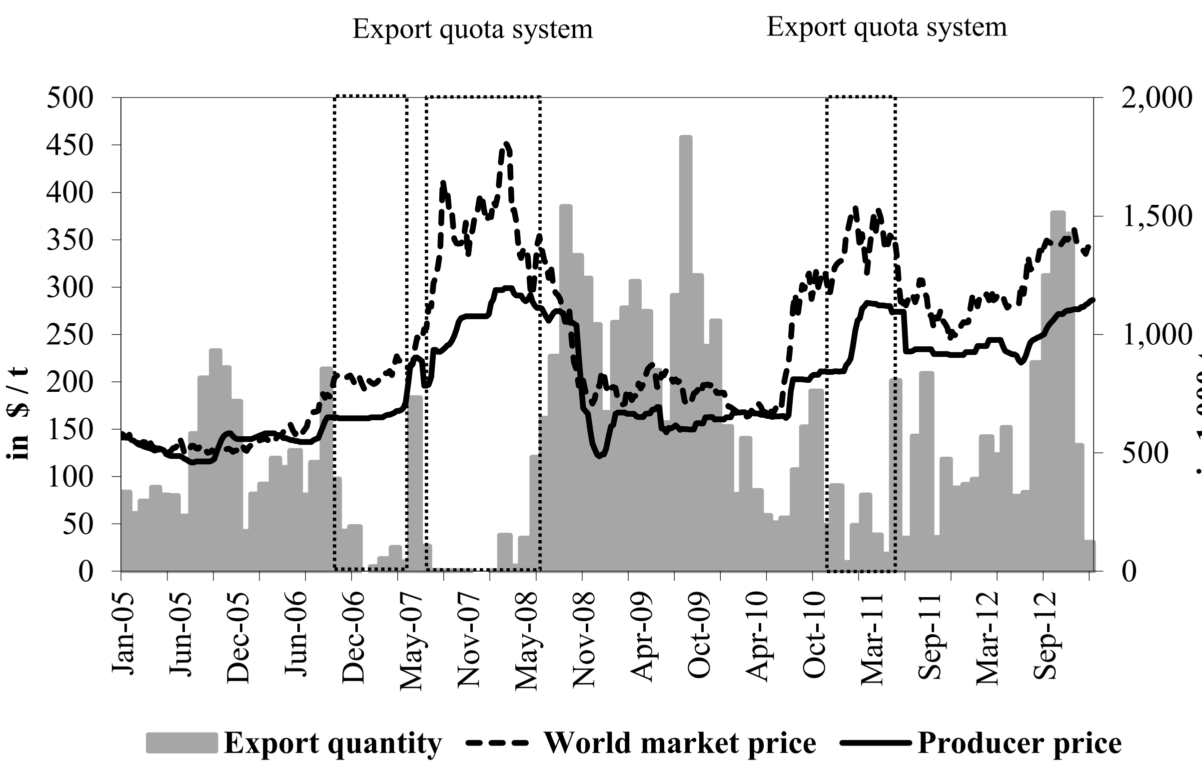
These trade policy interventions were accompanied by a dramatic increase in political uncertainty since 1) the export quotas were implemented on short notice, 2) the size of the quota was changed multiple times, and 3) their distribution came along with massive corruption, particularly in 2010/2011.

For example, the wheat export quota implemented in 2010 became effective rapidly such that ships already loaded with wheat could not leave the harbour. As a result, several hundred thousand tons of wheat sat in storage temporarily on ships in Ukrainian harbours causing high

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

additional costs to exporters (APK Inform 2010). According to traders' information, this implied that contracts could not be fulfilled, which negatively affected international reputation of traders exporting from Ukraine. Further, the export quota implemented 2006-2008 was first announced in October 2006 to amount 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).

Figure 1: **Development of Domestic Wheat Prices and Exports of Ukraine compared to the World Market**



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

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.

3 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 (HGCA 2013), which is the primary harbor through which wheat is exported by the EU, serves as the relevant world market price for the Ukraine, and Germany. All prices are absolute prices and are converted by weekly exchange rates into US $/t.

4 Methods

To capture the effects of the export restrictions on domestic market uncertainty we investigate price volatility development on the Ukrainian market and its relationship with the world market price within a multivariate GARCH approach using a dynamic conditional correlation (DCC) specification (Engle 2000). For comparison we also investigate volatility development son the German wheat market which did not experience any export controls during the commodity price peaks.

In our empirical procedure we proceed in the following steps:

1) Fit the returns data series by an ARMA(p,q)
2) Test the ARMA residuals on heteroscedasticity (ARCH effects) by the Lagrange Multiplier (LM) test
3) Fit the ARMA residuals of each series by a univariate GARCH(n,m) model if ARCH errors are confirmed

4) Use the estimated parameters of the univariate GARCH models to specify the multivariate DCC-GARCH model

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.

Consider the following VAR model:

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

where y_t is a 3x1 vector of returns price series r_{it} of the wheat market of Ukraine, Germany and the world market (France) with $r_{it} = \ln\left(\frac{p_{it}}{p_{it-1}}\right) where\ p_{it}$ is the wheat price in market i at time t, 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:

$$H \equiv D_t R_t D_t \text{ (2)}$$

where Dt = 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.

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

Rt = (diag(Qt))-1/2Qt(diag(Qt))-1/2 (4), where Qt = $\{\rho_{ij,t}\}$= $(1-\alpha-\beta)\overline{\mathrm{Q}}$ $+\beta$ Qt-1 + $\alpha(u_{t-1}u'_{t-1})$ (5).

In equation (5), Qt = {ρij,t} is a time varying covariance matrix of standardized residuals from (1), $\overline{\mathrm{Q}_t}$ 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 own series' volatility in a current period. Parameter β represents the effect of price volatility in the previous period on volatility in the current period.

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

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

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

$$L = \{-\frac{1}{2}\sum_{t=1}^{T}[n\log(2\pi) + log|D_t|^2 + \varepsilon'_t\, D_t^{-2}\varepsilon_t]\} + \{-\frac{1}{2}\sum_{t=1}^{T}[\log(R_t) + u'_t\, R_t^{-1}u_t - u'_t\, u_t]\}$$

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.

5. Empirical Results

Prior to the model estimation we determine the order of integration of the data series within the ADF, PP and KPSS unit-root test. All three tests provide evidence for unit-root presence in the series. Test results for the data series in first differences suggest that the price series for Ukraine, France, and Germany are I(1). Figure 3 shows the price series as returns data (first differences of the data in logarithm) and Table 1 gives some distribution characteristics thereof.

Figure 3: **Returns data for Ukraine, Germany and the World Market**

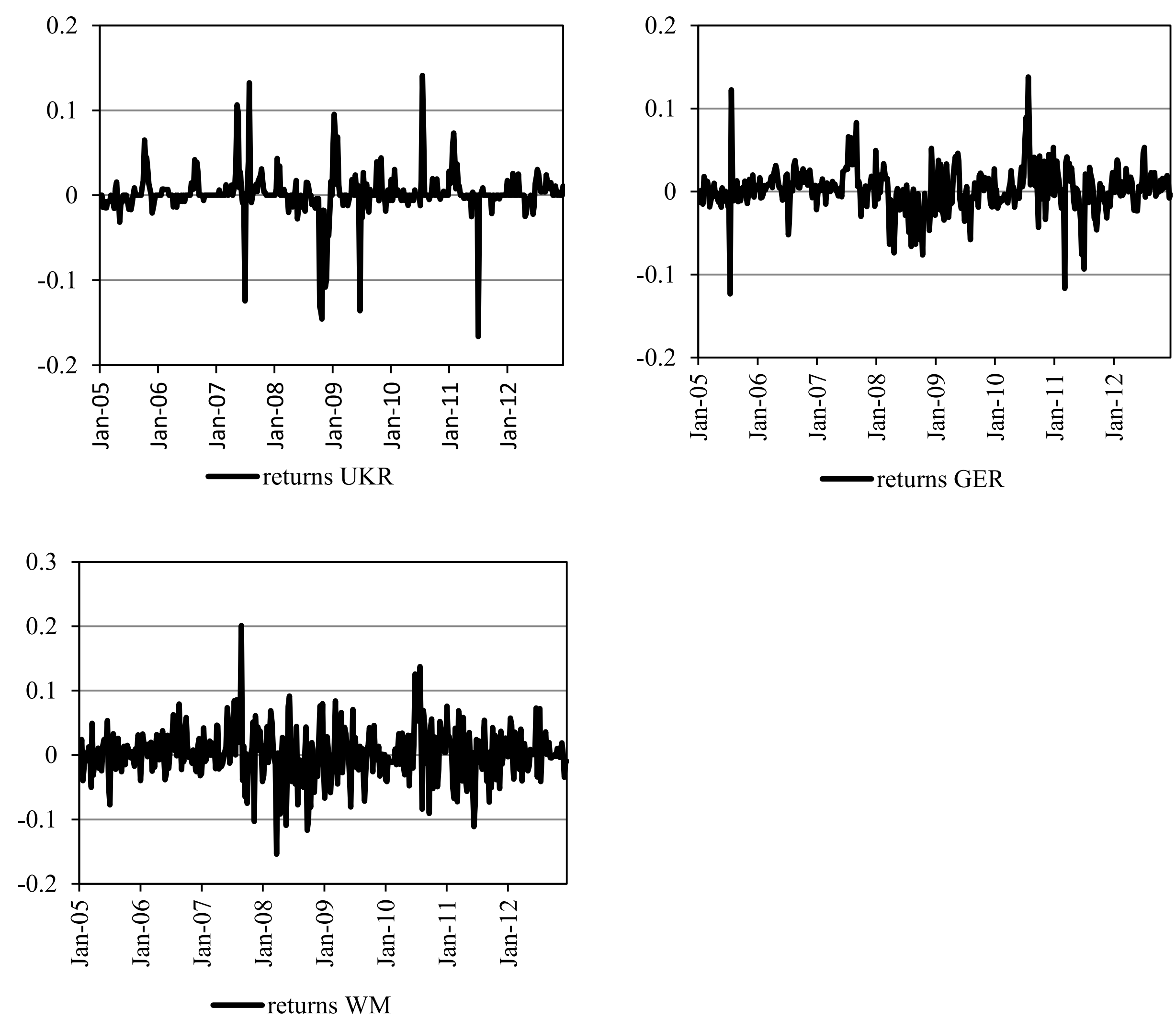


Table 1: **Characteristics of the Returns Series**

	Ukraine	Germany	World market
mean	0.0016	0.0024	0.0021
standard deviation	0.0267	0.0266	0.0384
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***

The mean of the returns series is highest for Germany, followed by the world market price and Ukraine. Though, standard deviation and the coefficient of variation indicate 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 symmetrically. Excess kurtosis is highest for Ukraine and suggests that the data series are not normally distributed.

In the next step we proceed with the Box-Jenkins methodology and find the ARIMA (1,0) model to best fit our data based on the Schwarz (SBC) criterion[2]. Table 2 displays some diagnostics of the ARIMA (1,0) residuals of the price series. The Ljung-Box test for serial correlation finds residuals not serially correlated, and therefore, the lag structure of the ARIMA models is sufficient. However, the results of the Jarque-Bera normality tests indicate all models exhibit non normality in residuals, which has to be accounted for when interpreting results.

Finally, based on the results of the ARCH-LM test, we conclude that variances of the analyzed series vary over time implying univariate GARCH (n,m) models to fit the data best.

[2] In case of the Ukrainian and world market wheat prices, SBC indicates an ARIMA (1,0) model to be optimal. For the German price series, SBC suggests an ARIMA (1,4) model. However, due to the lack of significance of the MA(q) coefficients, we select an ARIMA (1,0) model for the German series as well.

Table 2. **Diagnostic Test Results**

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

Notice: p-values are in the brackets; asterisks denote levels of significance (* for 10 percent, ** for 5 percent, *** for 1 percent)

5. 1 Development Conditional Volatility

The appropriate order of the GARCH(n,m) is selected in accordance with the minimum AIC and maximum Log Likelihood value up to order 3. The results show that for all series, a GARCH(1,1) fits our data best[3]. The model estimates are provided in Table 3.

For the three analyzed series GARCH estimates α and β are significant at least at the 5 percent level. The sum of α and β is smaller but close to one for all three series, which ensures that the GARCH process is mean-reverting, and is suggestive of a high degree of volatility persistence. More specifically, a large α coefficient means that the series is susceptible to external shocks, whereas a high β coefficient implies that there is a strong impact of the own-variance on the volatility of the series. As can be seen from the table, the volatility of the German and even more of the French world market price series is characterized by a low α and a high β coefficient, indicating a high impact of the own-variance and thus high persistence of the volatility whereas external shocks are of lower importance for the observed volatility pattern. This is, however, not the case with the Ukrainian wheat series. A relatively large α combined with a low β suggest that the volatility of the Ukrainian wheat farm prices is rather sensitive to the external shocks and that

[3] Before determining the order of the GARCH models, we select the most appropriate distribution based on the AIC, BIC and the Log Likelihood criteria. For all 3 data series the student t-distribution turned out to be the most suitable.

persistence of price volatility is low. These volatility characteristics become also evident in Figure 3, 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.

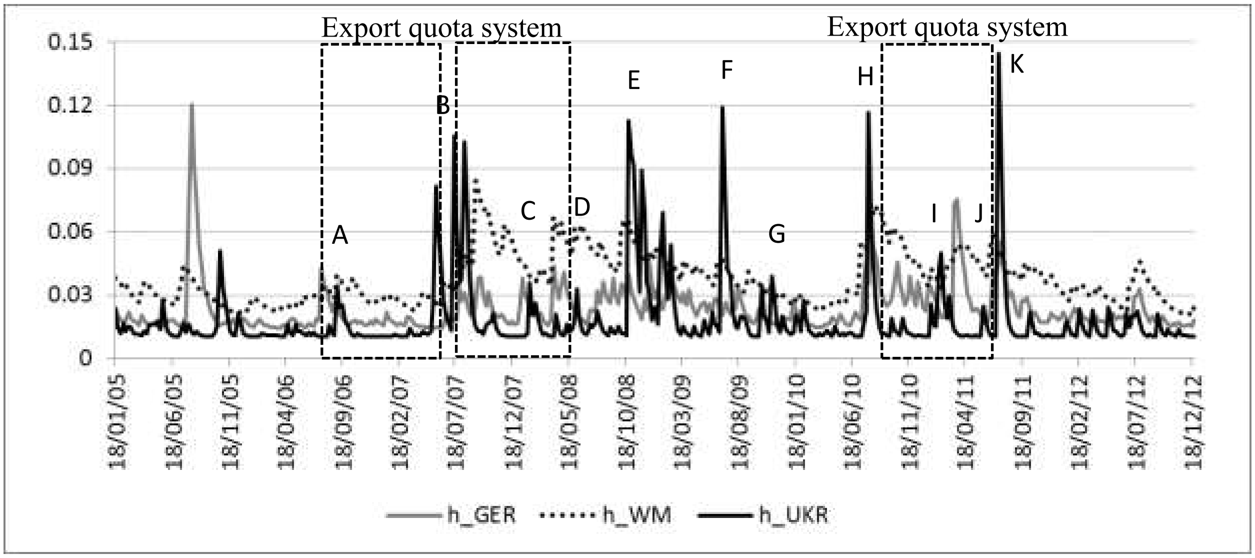
Table 3. **Parameter Estimates of the conditional variance function (univariate GARCH)**

	Germany	**Ukraine**	**World market**
$\boldsymbol{\theta_1}$	0.00 (0.04)**	0.00 (0.00)***	0.00 (0.16)
$\boldsymbol{\alpha_0}$	0.00 (0.91)	-0.00 (0.75)	-0.00 (0.95)
$\boldsymbol{\alpha_1}$	0.37 (0.01)**	0.74 (0.00)***	0.14 (0.02)**
$\boldsymbol{\beta_1}$	0.56 (0.00)***	0.25 (0.00)***	0.83 (0.00)
$\boldsymbol{\alpha_1 + \beta_1}$	0.93	0.99	0.97
Log Likelihood	1041	1270	809

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

Characteristics of the distribution of the conditional variances are provided in Table 4 and Figure 4. The mean and the coefficient of variation of the conditional variance are lowest for Ukraine and highest for the world market price. Thus, on average, volatility is lower on the domestic Ukrainian than on the German wheat market. Though, skewness is highest for the Ukrainian series, and the largest values for the conditional variance are observed for the Ukrainian price series as well. The histogram for the Ukrainian series makes evident that conditional variance is very low for many observations but that excessive conditional variance is observed at several points of time.

Figure 3: **Conditional Variances of the Ukrainian** (h_UKR), **German** (h_GER) **and World Market Prices** (h_WM)



Notice: Additional information on the political incidences (letters A to K) are given in the appendix.

Table 4: **Distributional Characteristics of the Conditional Variances**

	Ukraine	**Germany**	**World market**
mean	0.019	0.023	0.038
stand. dev.	0.018	0.011	0.012
coef. var.	1.056	2.091	3.167
skewness	3.86	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

From this it can be concluded that the domestic wheat market in Ukraine is characterized by on average low price volatility compared to the German or the world wheat market. Though, excessive price volatility prevails on the Ukrainian market in a couple of very short periods of time, exceeding the variance observed for the German and the world wheat market.

Figure 5 focuses on the difference between the conditional variance for Ukraine and Germany, and its relationship with the variance of the world market. It becomes evident that this difference is high when the conditional variance of the world market price is rather high, particularly during fall 2007 until the beginning of 2009, concurrently to the commodity price peak on the world market and in the aftermath, and again in fall 2010 until early summer 2011 during the second phase of high world market prices. This shows that contrasting to the German market, the Ukrainian wheat market did not follow volatility development on the world market and suggests that domestic factors might be of greater importance for explaining volatility development 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. The points of time of the political interventions are indicated by capital letters in Figure 3, and further explanations are provided in the appendix.

Detailed analysis of the policy environment during the analyzed period makes us 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

Figure 4: **Histograms of the Conditional Variances**

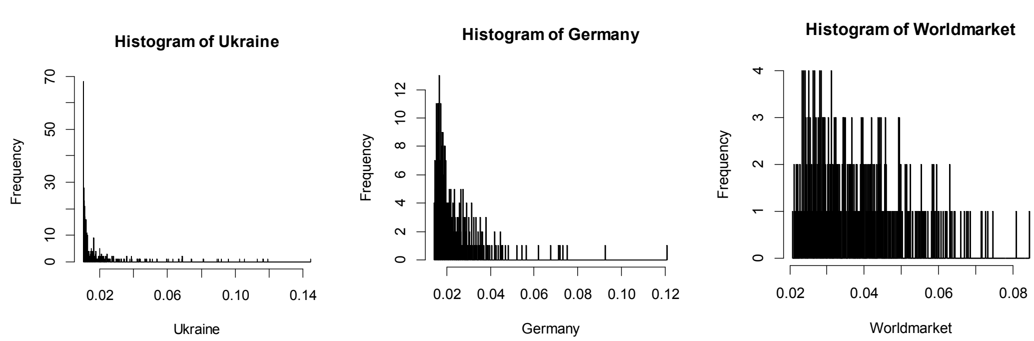
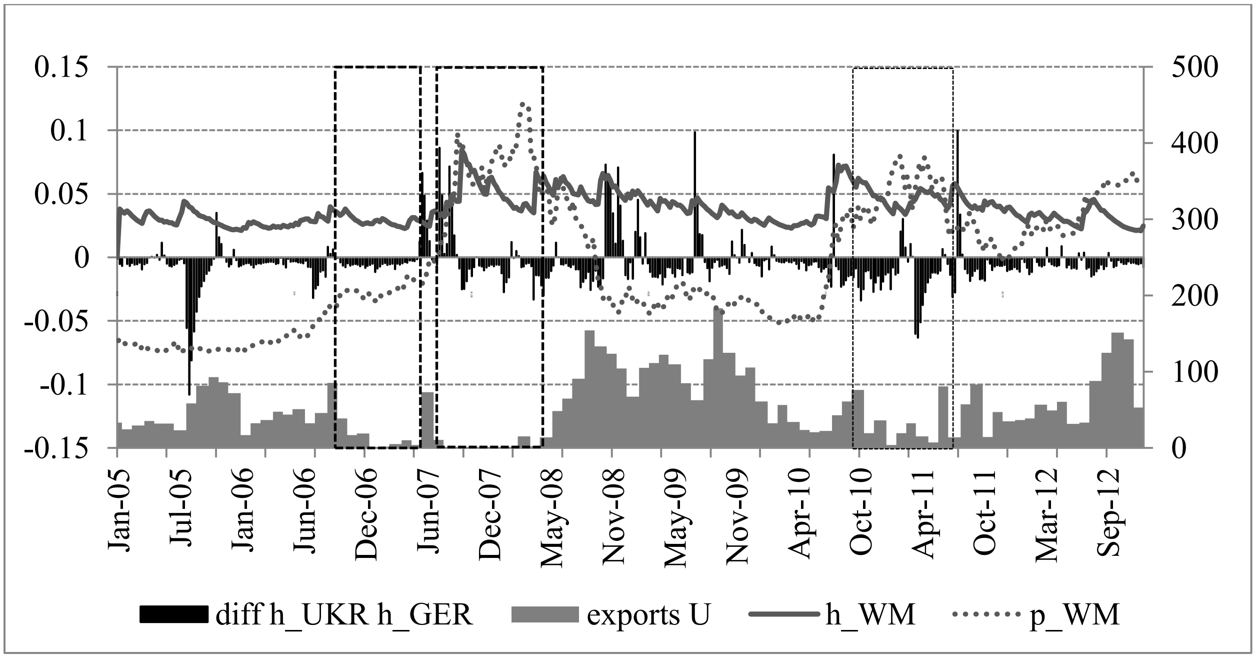


Figure 5: **Dynamics Conditional Variances for Ukraine and Germany**



Notice: diff h_UKR h_GER =difference between the conditional variance of the wheat price in Ukraine and in Germany; primary axis); world market price (p_WM) in US$/t (secondary axis); wheat exports Ukraine (exports U) in 1000 t (secondary axis).

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 in August 2010, which induced the question whether Ukraine would follow Russia in controlling its wheat exports, which was heavily discussed in the media in Ukraine.

5. 2 Development Conditional Correlations

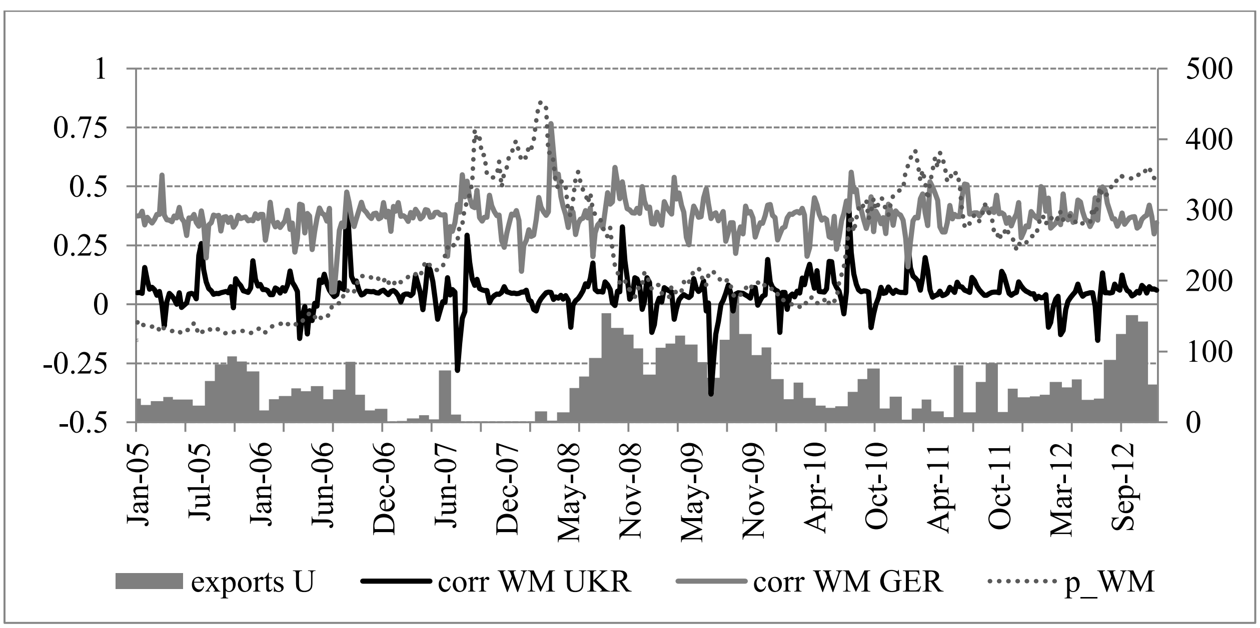
To investigate volatility interdependencies, we focus on the correlation pattern between the Ukrainian and the world market prices in comparison to the respective relationship of the German prices. To specify our model framework, we follow Engle and Sheppard (2001) to test the null hypothesis on constancy of the conditional correlations for both pairs of series. We reject the hypothesis based on the χ^2 test statistic (Table 5) at a 1% significance level which motivates us to choose a DCC-GARCH model framework allowing for time-varying conditional correlations. We use the univariate GARCH results to fit the DCC-GARCH model for the three series. The estimated parameters of the correlation equation are presented in Table 5 and Figure 6. Results suggest that the α^{DCC} parameter is significant at the 5 % level, while the β^{DCC} parameter is not found to be significant for both Ukraine and Germany. In particular, parameters α^{DCC} and β^{DCC} can be interpreted as the "news" and "decay" parameters capturing the effects of innovations on the conditional correlations and their persistence, respectively (Gardebroek et al. 2012). From this we conclude that we have a significant "news" effect for both price pairs, but that this effect is not persistent.

Table 5: **DCC-GARCH Model Estimates**

	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***

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

Figure 6: **Development of the Conditional Correlations Ukraine-World market and Germany-World market**



On average, the volatility correlation between the Ukrainian and the world market (0.05) is significantly lower compared to the German and the world market (0.37). In terms of variation of volatility correlations across time, it is comparable across both series - standard deviations of the dynamic conditional correlations are 0.06 for Ukraine-France pair and 0.07 for Germany-France pair.

Figure 6 shows the development of the estimated dynamic conditional correlations for the Ukrainian and world market as well as the German and world market pairs of prices.

6 Conclusions and Discussion

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 development on the world market 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 y 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.

The highly uncertain and unpredictable environment of wheat markets with restricted exports has dramatic consequences for the grain sector in Ukraine and prevent its further development. Business in the Ukrainian wheat market is dominated by spot market contracting with immediate delivery, whereas forward contracting is of rudimentary importance (Chamber of Commerce 2011). Forward contracts, typically with a horizon of 18-24 months, bear a high risk that they cannot be fulfilled due to temporary export restrictions. Since agricultural finance is dependent on futures contracts, the Ukrainian wheat market is underfinanced which negatively effects investments in grain production and global food security.

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Annex

Political interventions relevant to the wheat market in Ukraine (compare Figure 3).

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)