INVESTIGATING RAPESEED PRICE VOLATILITIES IN THE COURSE OF THE FOOD CRISIS

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Abstract

This paper investigates the development of volatilities in agricultural commodity prices during and after the food crisis with a focus on rapeseed future prices at the MATIF. We apply a dynamic conditional correlation model belonging to the class of multivariate GARCH models on price returns for rapeseed, crude oil and related agricultural commodity prices. Volatility developments on a daily basis between 1999 and 2009 are investigated with a focus on the period during the 2007/08 food crisis. An increasing correlation between the returns in rapeseed and crude oil price is found. Additionally, this correlation did not only increase during the food crisis but further rose afterwards. This implies that rapeseed prices react in an increasing manner to the same information as crude oil prices. Furthermore, rapeseed prices show high sensitivity to shocks and low persistency in volatilities and thus, bear the risk of overreactions in volatile phases. The increased correlation introduces the potential of even more pronounced volatilities in agricultural commodity prices during the next price boom since crude oil prices exhibited a higher volatility level versus agricultural commodity prices in the past. Furthermore, due to the difficulty in distinguishing commodity price trends, caused by changes in supply and demand, from volatilities, stemming from expectations and speculations, optimal production schemes are difficult to set up. Therefore they bear the risk of more pronounced price level changes in the long-run.

Key words: Multivariate GARCH, MATIF, rapeseed, crude oil, volatilities, food crisis

JEL Classification: C32, E44, G1, Q11, Q13, Q49

Introduction

In course of, as well as after, the price boom in 2007/08 the level of agricultural product prices and their increasing volatility raised concerns of many policy makers and interest groups. The WORLD BANK (2009) declared that “High volatility in food prices, combined with the impact of the financial crisis, threatens to further increase food insecurity […]”. Increased volatilities imply higher uncertainty and therefore influence production and consumption decisions. Price changes should usually reflect supply or demand shifts to which markets adjust. In phases of high and persistent volatility, it is, however, difficult to distinguish between market instability and higher price levels (FAO, 2009).

The discussion about the integration of agricultural markets with energy markets already took place before the price boom and could be shown for several commodities using different econometric techniques (c.p. BALCOMBE AND RAPSOMANIKIS (2008), SERRA ET AL. (2008), DE GORTER (2008)). The topic of volatilities in agricultural markets is, on the contrary, rather new. A number of recent applications exist which study price volatilities in agricultural and energy markets. MEYERS AND MEYER (2008) investigated the causes and implications of price increases between 2005 and 2008. The impact of biofuels was particularly discussed. While it could be easily concluded about its impact on the agricultural price levels, no clear conclusions could be drawn about the effects on price volatility. However, DU ET AL (2009) were able to show volatility spillovers from crude oil to corn prices in the US using a stochastic volatility model. Multivariate GARCH models were used by BEKKERMAN AND PELLETIER (2009) who study the effect of ethanol demand on corn and soybean in the US using a dynamic conditional correlation model (DCC). TEJEDA AND GOODWIN (2009) used similar data applying a regime switching dynamic correlation model. They found positive dynamic correlation between corn and soybeans, and discussed the impact of ethanol demand.

KANAMURA (2008) used a DCC model and found changing correlation between petroleum and agricultural commodity prices.

The methods commonly used to analyze volatilities in time series are General Autoregressive Conditional Heteroskedasticity Models (GARCH- Models). These allow for rich insights into the volatility structure of time series. The multivariate versions additionally provide information about conditional correlation between the volatilities of different price series (for a survey on this model class see BAUWENS ET AL 2006). The strongest drawback of multivariate GARCH models (MGARCH) is their data requirement since they demand a number of observations which is usually hard to obtain for agricultural commodities.

We contribute to this literature with an analysis of the volatility developments in the European market. Rapeseed prices quoted at the Marché A Terme International de France (MATIF) in Paris are used and their volatility structure is compared to commodity spot market prices of vegetable oil at trading place in Rotterdam and Brent crude oil prices. The MATIF is nowadays the most important trading place for rapeseed but the volatility behavior of these prices during and after the food crisis has up to now not been analyzed in detail. We aim to fill this gap and provide some insights into the volatility behavior. This should help understand price developments, and especially volatility developments, during the past years. Furthermore, correlation in the price volatility of the different commodities as well as their development over time is investigated. This allows for conclusions about how closely different price pairs follow the same market information and, hence, how closely volatilities in different markets are related. The DCC model is chosen since it yields the dynamic correlation in volatilities between different series and, hence, allows for conclusions about changes of these.

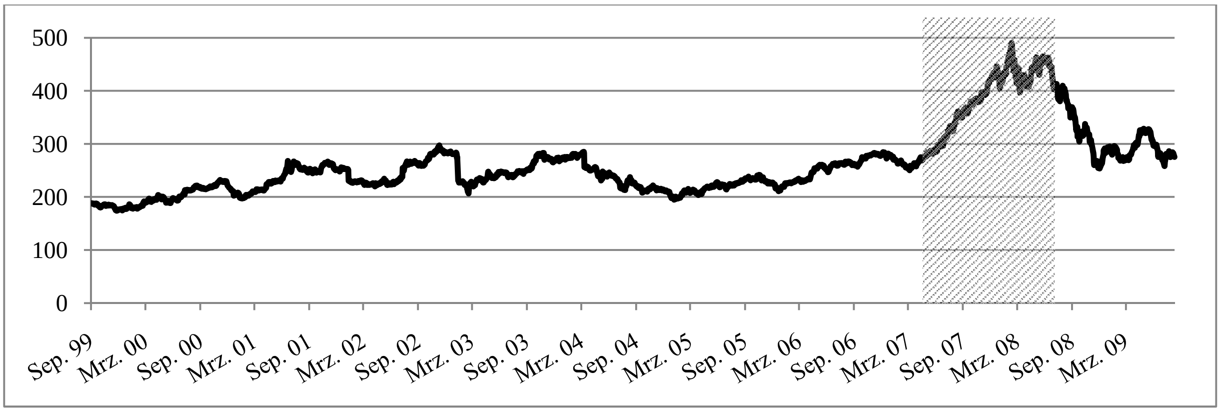
The following chapter describes the market development during the last years and outlines the role of the MATIF. The third chapter gives the model theory and the following chapter, the empirical results. These will be discussed in detail in the fifth chapter before conclusions close the paper.

Market overview

Although, the cultivation of rapeseed has a long tradition in Europe, the crop especially gained importance with the rise of the biofuel industry in the first decade of the new millennium. Biodiesel developed during this time and was transformed from being a niche product into an important player in the rapeseed oil market. The rapeseed area as well as production within the European Union (EU) increased strongly from 4.4 million ha (1998) to 8.1 (2007), raising production from 12.0 to 20.4 Mt. On the global scale, the rapeseed production area increased from 25.8 million ha to 30.8 million ha, production rose during this period from 35.7 to 50.6 Mt. While rapeseed is the most important oilseed in the EU, it plays a much smaller role on the world market. Globally, soybean (90 million ha / 221 Mt) is the most important oilseed but was outperformed by palm oil in terms of vegetable oil quantity produced some years ago (FAOSTAT 2009).

Figure 1 shows the rapeseed price development over the past decade. In the food crisis of 2007/08, rapeseed prices, as most other agricultural commodity prices, increased strongly reaching a peak in early 2008. The price level was the highest within this decade and the peak price of 500 €/t reflects a doubling of prices within a year’s time. The data shown here was obtained from the MATIF which is the most important stock exchange for rapeseed worldwide (for details see www.euronext.com). Figure 2 shows the increase in volume traded at the MATIF during the past ten years. The MATIF offers different contracts with the expiration dates of February, May, August and November for six consecutive contract months. The most important, and, hence, those with the highest volume are the nearest (first) and the second nearest front month which are plotted in Figure 2. The series are constructed in such a way that with the expiration of one contract, the system is shifted towards the next date. The same principle will be used later on for constructing the price series.

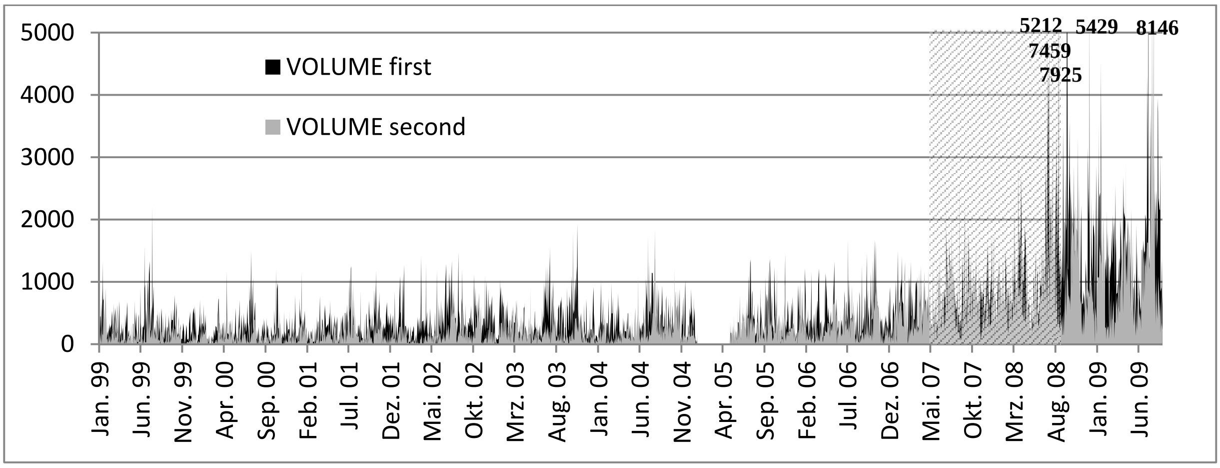
Fig.1: Rapeseed price notation at the MATIF in €/t, food crisis period (shaded area)



Source: Own elaboration based on MATIF (2009).

The MATIF's increasing importance is illustrated by the increasing volume reaching a level of up to 8,000 contracts per day. The average daily volume of the nearest contract was 1,562 contracts in 2008/09 compared to 945 during the food crisis in 2007/08 and 536 in the pre-crisis period (2006/07). The average daily volume in 2008/09 is almost six times higher than in 1999/2000. The maximum observed volume on the first contract represents about 0.73 %, all six contracts combined almost 1 % of annual world rapeseed production traded on a single day. This rise in volume is not solely a phenomenon for rapeseed at the MATIF but was observed also for other agricultural commodities at stock exchanges around the world (ROBLES ET AL. 2009). The importance of rapeseed price notation at the MATIF grew not only for global traders but also for wholesalers and framers. These do not necessarily participate at the MATIF but use these price trends for their own production and trading decisions.

Fig.2: Volume of contracts traded during one day at the MATIF nearest (first) and second nearest expiration (truncated)



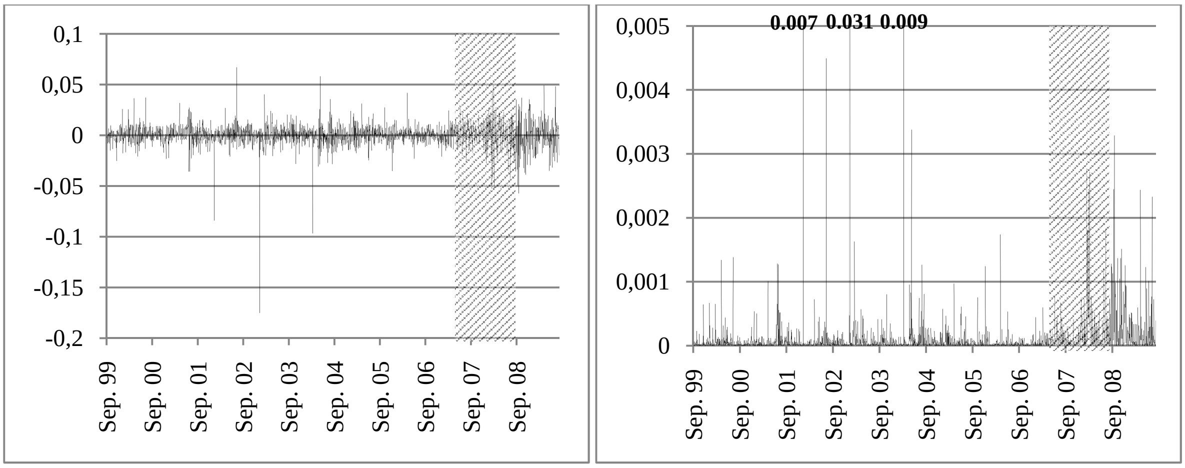
Source: Own elaboration based on MATIF (2009).

The price increase in 2007/08 was, in many markets, accompanied by strong price fluctuations. The daily returns[1] in rapeseed prices are shown in the left part of Figure 3. The right part shows the squared returns in order to give a clearer picture of the development of volatility over time. A change in volatility over time can be observed here. More important than the range of the price changes, is the volatility persistency. The right panel shows clearly

[1] The returns are calculated as $r_t = ln\left({}^{p_t}/_{p_{t-1}}\right)$, where p indicates the price and t the point in time.

a much higher persistency of price fluctuations in 2008, compared to e.g. 2006. It should be noted that the price increase in 2007 was obviously not accompanied by increased volatility but rather took place steadily. The volatility rose as late as in December 2007 and became especially high in summer 2008. The most interesting point to note is that volatility in rapeseed prices did not decrease substantially during the months after the food crisis. A more detailed analysis of this behavior will be provided when discussing the empirical results of the estimated model.

Fig.3: Returns (left Fig.) and squared returns (right Fig./ truncated) of rapeseed prices



Source: Own elaboration based on MATIF (2009).

Methods and data

Theoretical framework

The model used to analyze the price behavior belongs to the class of multivariate GARCH models. MGARCH models allow for investigation of volatilities in markets as well as the correlation of volatilities between markets. These can occur as certain news might affect not only the price volatility on a specific market but might affect the volatility of different commodity prices simultaneously. The model used in this analysis is the Dynamic Conditional Correlation model (DCC) in the specification of ENGLE (2002) which BAUWENS ET AL (2006) categorized as a nonlinear combination of univariate GARCH models. It can be seen as a generalization of the Constant Conditional Correlation model (CCC) model proposed by BOLLERSLEV (1990). The strength of the DCC is that it allows for changes in the conditional correlation. These can occur under changing market conditions as those observed in the rapeseed market which has been increasingly influenced by international commodity markets and, via the biodiesel sector, also by the energy market.

The data used is calculated in "returns" and r_t describes the return of one commodity at time index t. The conditional mean (μ_t) and conditional variance (${\sigma^2}_t$) of the series r_t given the information set available at time $t-1$ denoted by F_{t-1} with:

$$\mu_t = E(r_t|F_{t-1}) \quad (1)$$

$${\sigma^2}_t = Var(r_t|F_{t-1}) = E[(r_t-\mu_t)^2|F_{t-1}] \quad (2)$$

It is assumed that r_t follows an ARMA(p,q) process so that:

$$r_t = \mu_t + a_t \quad (3)$$

$$\mu_t = \phi_0 + \sum_{i=1}^{k} \beta_i x_{it} + \sum_{i=1}^{p} \phi_i r_{t-i} - \sum_{i=1}^{q} \theta_i a_{t-1} \quad (4)$$

k, p and q are non-negative integers and x_{it} are explanatory variables. a_t is the innovation of the commodities return at time *t*. In the context of GARCH models, this equation is often referred to as the *mean equation* for r_t. Combining (2) and (3) gives,

$$\sigma^2{}_t = Var(r_t|F_{t-1}) = Var(a_t|F_{t-1}) \quad (5)$$

The analysis focuses on the evolution of $\sigma^2{}_t$ in the so called *volatility equation* for r_t.

A GARCH(1,1) process can be described as

$$a_t = \sigma_t \epsilon_t \quad (6)$$

$$\sigma^2{}_t = a_0 + a_1 a^2{}_{t-1} + \beta_1 \sigma^2{}_{t-1} \quad (7)$$

with

$$0 \leq \alpha_1, \beta_1 \leq 1, (\alpha_1 + \beta_1) < 1 \quad (8)$$ (TSAY, 2005).

We are using the ENGLE (2002) specification, where the single univariate processes are estimated in the first step and the multivariate part in the second step. ENGLE (2002) uses h_t to denote the conditional variance. $h_{i,t}$ is therefore described as:

$$h_{iit} = \omega_i + \alpha_i \varepsilon^2{}_{i,t-1} + \beta_i h_{ii,t-1} \quad i = 1, \ldots, N \quad (9)$$

The α-coefficient represents here the influence of the lagged error, and hence, the role of shocks to the market. The β-coefficient indicates the impact of lagged volatility and therefore the persistency of volatility in the market. $\varepsilon^2{}_{i,t-1}$ are the residuals of the ARMA(*p*,*q*) process which are assumed to be *iid*.

ENGLE (2002) defines the covariance matrix of the DCC model as:

$$H_t = D_t R_t D_t \,, \quad (10)$$

where $D_t = diag\{\sqrt{h_{i,t}}\}$, (11)

R_t is the correlation matrix containing the conditional correlations. The correlation estimators $\rho_{i,j,t}$ in this matrix are allowed to be time varying. R_t can be described by

$$R_t = diag\,\{Q_t\}^{-1} Q_t \{Q_t\}^{-1} \quad (12)$$

where

$$Q_t = S\,(1 - \alpha - \beta) + \alpha(u_{t-1}u'{}_{t-1}) + \beta Q_{t-1} \quad (13)$$

S is the unconditional correlation matrix of *u* which is defined as

$$u_t = D_t^{-1} r_t \quad (14)$$

α and β have to be non-negative and satisfy the condition $\alpha + \beta < 1$ (ENGLE 2002). If this latter condition is violated, the correlation is not mean-reverting. Of particular interest are the conditional correlation estimates ($\rho_{i,j,t}$) which can take values between plus and minus one.

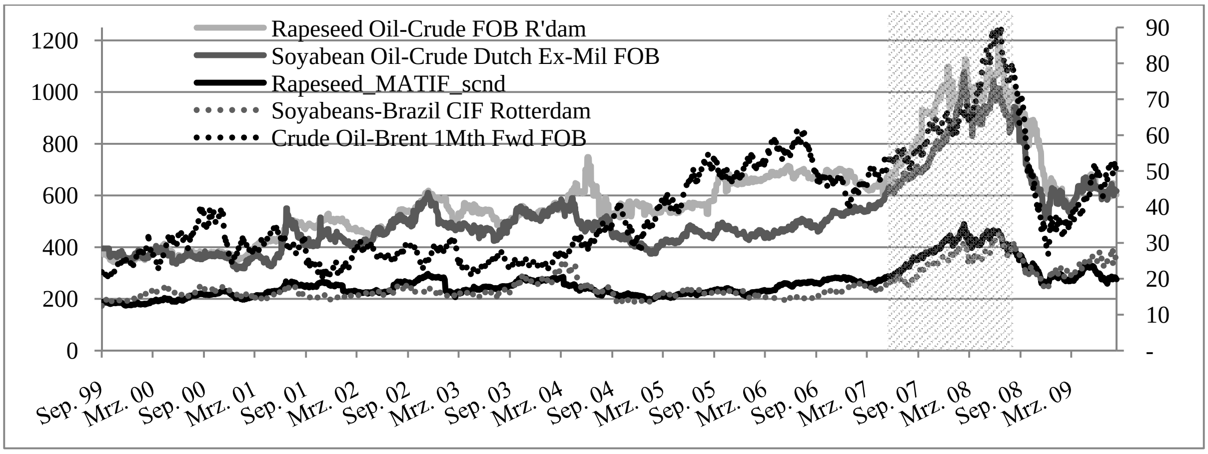
Data

The data used in this analysis are daily observations (5 obs./week) of commodity prices over the period 1999 to 2009 (2,537 obs.). Rapeseed prices were obtained from the MATIF in Paris, nowadays the most important stock exchange for rapeseed worldwide. Prices of the second nearest contract are used since prices of the nearest contract tend to fluctuate heavily when the contract expires. Later contracts show a substantially lower level of activity. The other commodity prices were obtained from THE PUBLIC LEDGER (2010). Soybean oil and rapeseed oil prices are collected in Rotterdam (Netherlands) as FOB (Free on board) prices for crude vegetable oil. The soybean prices are import prices CIF (cost, insurance and freight) Rotterdam for beans imported from Brazil[2]. All agricultural prices presented in Figure 4 are in Euros per ton without VAT. The crude oil prices are Brent prices one month forward for crude oil FOB (presented in Euros per barrel).

[2] The usage of CIF and FOB prices in one model has the disadvantage that developments of e.g. transportation costs are not taken into account. However, we argue that these prices best reflect the market prices and determine the crushers and buyers choice in the EU market.

The dataset has been chosen in order to obtain comparability. Rotterdam is currently the most important trading place for agricultural commodities in Europe. Vegetable oil prices from Rotterdam are assumed to represent EU prices. Import prices for soybeans are chosen since almost no soybeans are grown within the EU. Rapeseeds as well as soybeans are crushed within the EU and very little extra-European trade of soybean oil and rapeseed oil takes place. Palm oil and sunflower oil prices are not used for the analysis since the latter has a small market share and serves a specific segment of the food oil market. Palm oil is usually crushed in the exporter countries and imported as oil. While a competition to rapeseed oil appears on the food oil market, the competition on fuel oil markets is much lower and no competition to rapeseed appears in the processing industry. In favor of a more parsimonious model setup, the focus is laid on the most important commodities in relation to rapeseed.

Fig.4: Price development 1999- 2009 in €/t (crude oil €/ barrel)



Source: Own elaboration .

Empirical results

For the empirical analysis, the prices are used as daily returns to ensure stationarity. The ADF test reveals non-stationarity in levels where the null hypothesis of the existence of a unit root cannot be rejected for any series (Table 1). However, the returns series show stationarity. From Table 2 it can be seen that all series show excess kurtosis in levels as well as returns. The standard deviation of crude oil prices in levels is much higher than that of the agriculture commodities, where it is approximately one quarter of the average value.

Tab.1: ADF test for unit roots in levels and returns

	levels		returns	
	Test statistic	lags	Test statistic	lags
Rapeseed	-1.62	1	-47.55***	0
Soybeans	-1.98	1	-52.60***	0
Rapeseed oil	-1.64	5	-42.17***	1
Soybean oil	-1.54	8	-42.17***	1
Crude oil	-1.63	0	-21.13***	5

Note: (*) indicates 10 % significance level, (**) 5 % and (***) 1 %; lags according to AIC.

Source: Own elaboration.

Next, the DCC model (ENGLE, 2002) is estimates in two steps. The univariate part is defined as a ARMA(1,1)-GARCH(1,1) process including a constant in the mean and variance equations. The underlying ARMA(1,1) process captures serial correlation in the residuals, while the GARCH(1,1) process accounts for serial correlation in squared residuals. The second step consists of a maximum likelihood estimate based on the assumption of a t-distribution. The model specification is chosen according to the Akaike information criteria and to the residual behavior, i.e. correlation in residuals and squared residuals. The results of the univariate models are displayed in Table 3. The rapeseed as well as crude oil model seems over specified since none of these shows significant autoregressive or moving average behavior in the returns series. However, both show a significant positive drift indicated by the constant in the mean equation. Since the other three models show significant autoregressive and moving average behavior, the ARMA specification is maintained for all models in order to keep the residuals free from serial correlation.

Tab.2: Distribution characteristics

	levels	returns	levels	returns	levels	returns
	Mean (Standard deviation)		Skewness		Kurtosis	
Rapeseed	261.58 (62.57)	0.00015 (0.0107)	1.51	-2.19	5.02	37.66
Soybeans	250.39 (56.21)	0.00029 (0.0188)	1.42	-0.29	4.20	14.06
Rapeseed oil	595.19 (176.20)	0.00017 (0.0159)	1.04	0.51	3.92	30.52
Soybean oil	517.49 (150.98)	0.00018 (0.0177)	1.52	0.44	5.03	15.88
Crude oil	39.41 (15.14)	0.00031 (0.0226)	0.98	-0.12	3.45	5.31

Source: Own elaboration.

The GARCH estimates α and β appear to be significant at the 1 % level in nearly all equations. The conditions on α and β holds for all processes, hence, all GARCH processes show mean reverting tendencies. The sum of α and β is close to unity, a phenomenon commonly observed when using high frequency data. This implies a high volatility persistency after shocks to the prices since the sum of α and β defines the decay factor of the exponentially declining auto correlation function. High β's furthermore indicate a strong impact of own variance on the volatility development. This can be interpreted as the general volatility development in the market. Rapeseed prices show a comparatively low volatility persistency (β) and a high sensitivity to external shocks (α). A large α combined with a low β as observed here for rapeseed prices, indicates the tendency to overreact in volatile phases.

Tab.3: Estimation results for the univariate part of the MGARCH model

	Rapeseed	Soybeans	Rapeseed oil	Soybean oil	Crude oil
Cst (M)	0.0007 (0.0002)***	0.0003 (0.0002)	0.0003 (0.0003)	0.0005 (0.0002)**	0.0007 (0.0004)*
AR (1)	0.161 (0.316)	0.773 (0.102)***	-0.846 (0.044)***	0.371 (0.078)***	0.110 (0.178)
MA (1)	-0.014 (0.324)	-0.838 (0.089)***	0.828 (0.039)***	-0.495 (0.073)***	-0.149 (0.143)
Cst (V)	0.000019 (0.000007)***	0.000001 (0.000004)	0.000002 (0.000001)*	0.000001 (0.000002)	0.000007 (0.000003)**
ARCH (α)	0.368 (0.147)***	0.018 (0.024)	0.022 (0.009)***	0.028 (0.011)***	0.041 (0.011)***
GARCH (β)	0.551 (0.082)***	0.978 (0.036)***	0.972 (0.010)***	0.968 (0.016)***	0.944 (0.016)***
$\alpha + \beta$	0.918	0.996	0.994	0.997	0.986
Log like	8142.82	6580.63	7135.74	6842.12	6144.09

Note: (*) indicates a 10 % significance level, (**) a 5 % level and (***) a 1 % level. Standard deviation ().

Source: Own elaboration.

Table 4 displays the estimated conditional correlations of the DCC model. Furthermore, an α of 0.0025 (0.0004) and a β of 0.9973 (0.0005) are estimated. The significance of both parameters gives strong evidence for the superiority of the DCC model over the CCC model. The high β coefficient indicates that the conditional correlation between the residuals is highly persistent. Although the conditional correlation is time-varying, the coefficients presented in Table 4 are often interpreted as their average. At first glance, soybeans show a comparatively high correlation with rapeseed, rapeseed oil and soybean oil while all commodities show a low correlation with crude oil. Our focus will lie on rapeseed price volatilities and these show, as expected, highest correlation with soybeans and rapeseed oil. The correlation between rapeseed and crude oil is not significant. This is due to the dynamics in correlation, which will later be discussed when analyzing the development over time.

Tab.4: Estimated conditional correlations

	Rapeseed	Soybeans	Rapeseed oil	Soybean oil
Soybeans	0.386 (0.098)***			
Rapeseed oil	0.255 (0.087)***	0.400 (0.092)***		
Soybean oil	0.141 (0.070)***	0.371 (0.085)***	0.107 (0.068)***	
Crude oil	0.095 (0.065)	0.152 (0.069)***	0.097 (0.049)***	0.005 (0.080)

Note: (*) indicates 10 % significance level, (**) 5 % and (***) 1 %. Standard deviation ().

Source: Own elaboration.

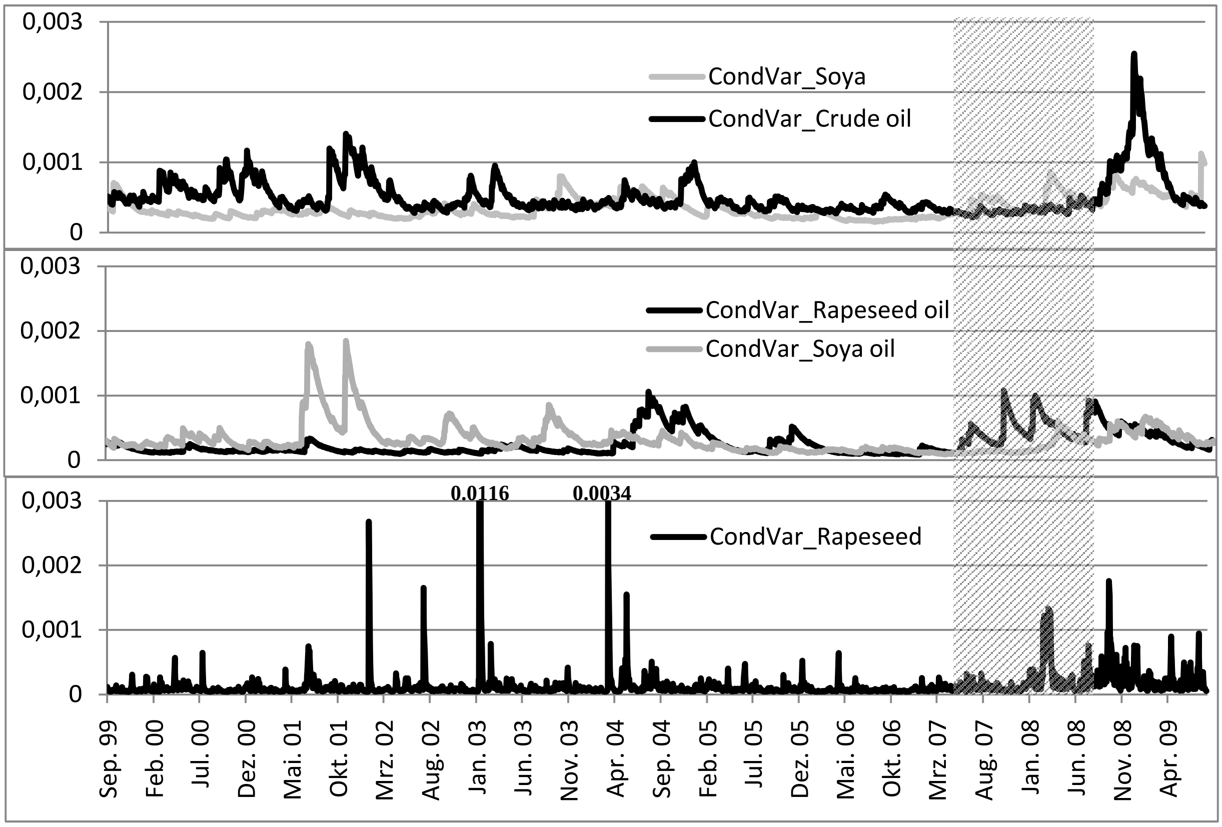
Discussion

The empirical results will now be discussed in detail with a focus on rapeseed price volatilities. Figure 5 shows the development of the conditional variances over time. The figure had to be truncated since the variance of rapeseed price returns peaked at 0.012 in January 2003. Rapeseed prices exhibited a lower conditional variance during most of the period studied in comparison to the other series; and all series besides rapeseed show a relatively high persistency in the conditional variance.

The variance in soya oil was higher than that of other agricultural commodities during most of the first half of the sample period but was in line with the others thereafter. All series show a comparatively low conditional variance between summer 2005 and summer 2007 but the appearance of volatility also clusters. The agricultural raw materials show similar patterns except that for the soybean price, variance is on a higher level. This might be due to the fact that soybeans are imported from more unregulated countries. The vegetable oil prices show comparable variances in levels, however frequently increased variances appear to be more pronounced for soya oil in the first half of the sample period. Until 2008, rapeseed prices show a very low level of variance. The variance of the crude oil price also increased the most in 2008. Both prices were at their lower levels throughout the year 2007 while soybean and rapeseed oil prices had already started displaying increased variance. During this period agricultural prices started increasing sharply.

The conditional covariances should show a similar pattern if constant ratios to the variances are assumed. Instead of discussing the issue of covariances, we proceed directly to discuss the topic of conditional correlation estimates. These display the ratio between the covariances and the variances of price pairs. Most of the conditional correlations presented in Figure 6 show a significant time varying behavior. While the correlation of rapeseed with rapeseed oil was decreasing, the correlation with crude oil reached a level that had not been observed before during the sample period. This indicates strong structural changes in the pricing behavior as both prices do increasingly react to the same market signals and their volatility develops concurrently. The model neither allows for conclusions about causal mechanisms of volatility spillovers nor measures the effect of influence of one market on the other. Correlations in volatility can occur from similar impacts of market signals but also from direct transmission. Since the role of crude oil in the world economy is disproportionally higher than that of any agricultural commodity and gained importance for many agricultural commodities, it can be assumed that a part of this correlation is due to reactions in rapeseed prices to volatilities in crude oil prices.

Fig. 5: Conditional variance of different commodity price returns

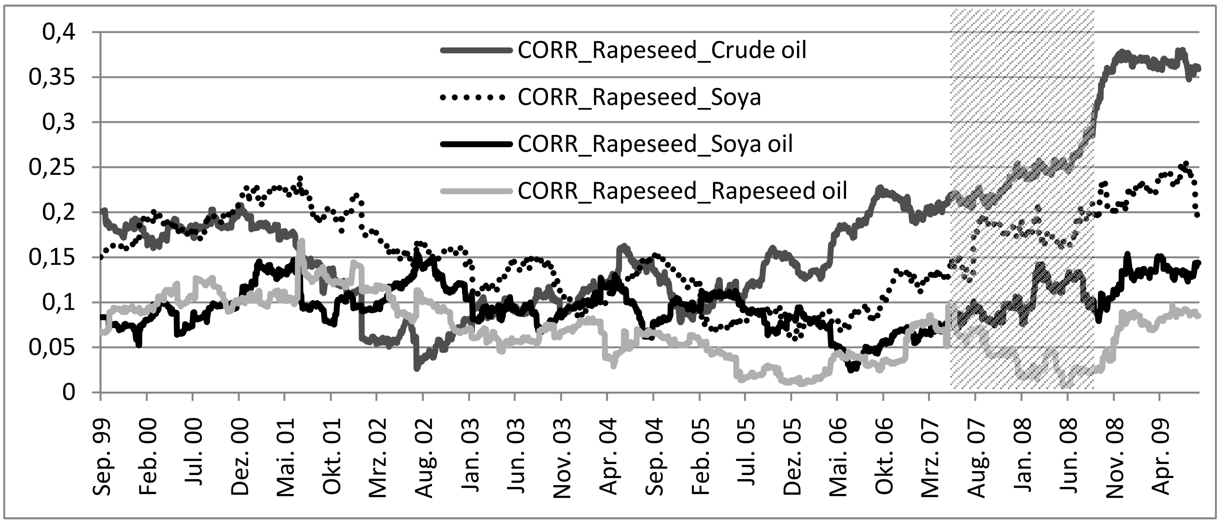


Source: Own elaboration.

Crude oil prices showed higher volatility during most of the sample period compared to rapeseed. Furthermore, rapeseed prices at the MATIF are shown to be very sensitive to external shocks and tend to overreact if shocks occur in volatile phases. The conditional correlation is higher with crude oil prices than with the corresponding spot market prices. This shows that rapeseed price volatilities do not follow the same market signals as those of the commodities on the spot markets, but rather follow the same market signals as crude oil.

Figure 7 shows this development over time separately and also highlights the dynamics of the conditional correlation. The dotted line represents the average correlation where the shaded area indicates the 95 % confidence interval. It becomes apparent that the constant conditional correlation model would not describe the process adequately. The conditional correlation estimate was not significantly different from zero under most of the period between 2001 and 2005. This was already reflected by the non-significant correlation estimate for rapeseed and crude oil presented in Table 4. Furthermore, the correlation moved around the average until the end of 2007. In 2006 and 2007 it reached the level of the pre 2001 period. Most notably is, however, the strong increase after the food crisis in summer 2008. A conditional correlation between 0.35 and 0.40 is observed in 2008/09 which is considerably higher than during the crisis and significantly different from the estimated average correlation. The high persistency which was estimated for the conditional correlations can be seen here. This further indicates that this correlation will not reduce quickly in the future.

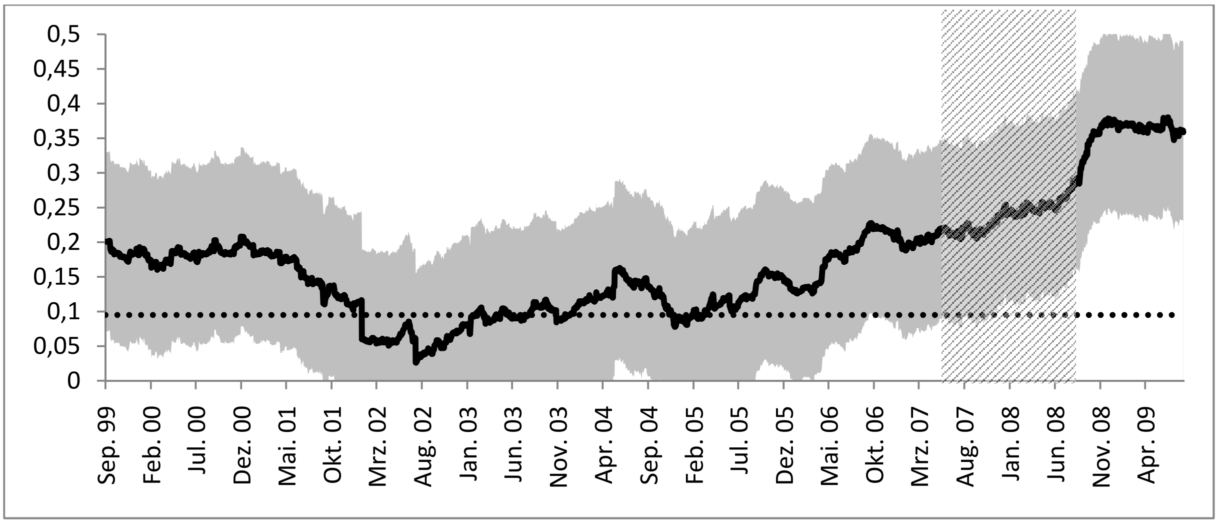
Fig. 6: Dynamic conditional correlation of rapeseed price returns and other commodities



Source: Own elaboration.

Price fluctuations alone are not problematic since they display market adjustments to changes in supply and demand. However, overreactions and high volatilities in the short-run might not only represent market adjustments but also speculation. If market signals are blurred by those effects, it becomes difficult to distinguish the effects from another. It is therefore difficult to adjust production and processing processes in an appropriate way. Furthermore, market actors have to adjust their behavior in order to cope with the increased price risk. The observation that rapeseed prices react increasingly to the same signals as crude oil prices, and little to the same developments as commodities on spot markets, might be indicative of spillovers from investors behavior on oil markets.

Fig. 7: Conditional correlation rapeseed and crude oil, straight line indicates constant correlation, shaded area +/- 2 standard deviations



Source: Own elaboration.

This behavior might be mainly influenced by the expectations about biodiesel production and policy. Crude oil prices determine the profitability of biofuels and any increase (or decrease) in crude oil prices improves (worsens) the competitiveness of biofuels which leads to increasing (decreasing) demand for rapeseed as the main biofuel feedstock. Hence, volatility in crude oil prices might increasingly lead to volatility in rapeseed prices since prices are adjusted towards changing expectations caused by crude oil price changes. The reactions, hence, do not reflect actual changes in the markets but rather expectations towards changes in the medium-term. Whether, and to what extent, volatilities originate from changes in crude oil prices or from other market signals is difficult to distinguish from each other. Vegetable oil prices on the spot market seem thereby to be less affected by these market signals.

The MATIF has gained importance during the past years not only for traders but also as a price and trend indicator for farmers and wholesalers. Ambiguous price signals due to volatility make it more difficult not only for traders to define their business strategies but also for farmers to make their production decisions. Our empirical findings raise suspicion on how strongly returns of rapeseed prices at the MATIF reflect changes on agricultural markets. The sensitivity of the rapeseed prices to shocks and the increased volatility correlation with crude oil prices points into another direction. However, it should be noted that we do not argue about whether the levels of the rapeseed prices are determined by crude oil prices. The market interdependencies seem to be restricted to volatility spillovers.

The variance of rapeseed price returns as well as that of crude oil price returns has increased substantially in 2008 and 2009 compared to previous years (+59 % for crude oil, +179 % for rapeseed). Furthermore, the variance in crude oil price returns was higher than that of the agricultural commodities, and in the case of rapeseed more than five times higher. Based on the increased and persistent conditional correlation with crude oil price returns, a higher volatility for rapeseed prices can be expected to also continue in the future. Since the analysis is conducted on price returns, and price levels are currently considerably lower than in 2008, the effects will become more apparent if prices start to increase again. The discussion about volatility in agricultural commodity prices and the influence of crude oil prices widened during the food crisis. It however calmed down in 2008 when agricultural prices returned to the levels which were observed before, even though the relative volatility did not decline. It becomes, hence, obvious that up to now, long-term price fluctuations were much more of concern than short-term changes, so long as these occur on a low price level. However, an inefficient utilization of production capacities and risk-averse behavior of market actors, which are caused by high (short-run) volatilities, might well contribute to more pronounced fluctuations of price levels in the long-run.

Conclusions

In this study we investigated the volatility behavior of rapeseed prices noted at the MATIF. We found an increasing correlation between the volatilities in rapeseed and crude oil prices. Furthermore, it could be shown that the rapeseed prices at the MATIF are sensitive to shocks and show tendencies to overreact in volatile phases. The correlation in returns of MATIF rapeseed prices with vegetable oil and soybean price on the spot market is much lower than that with crude oil and did only increase moderately. This indicates that rapeseed price volatilities react increasingly to the same market signals as crude oil prices, if not even directly to these. Since the MATIF gained importance for the rapeseed market during the past years, our findings concern not only participants at the stock exchange but also traders and farmers who follow these price signals. Since volatilities, if they do not reflect market adjustments, blur the signals of supply and demand changes, the optimization of production schemes at each stage of the processing chain becomes more difficult.

We argue that the increased rapeseed price volatilities are influenced by speculation. Additionally, the increased correlation with crude oil indicates that these are not based on market adjustments. The potential for a further increase in volatilities in the future is therefore high. The concerns about agricultural price levels and the influence of crude oil prices on these were much larger than those concerning short-term fluctuations. The impact of the latter on the former should, however, not be underestimated. Our findings further imply that in the discussion on how to deal with increased volatilities, the role of the stock exchange should not be neglected. The volume increase at the MATIF shows how its importance for the global agricultural markets rose during the past years.

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