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Market integration of conventional and organic wheat in Germany

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1 Introduction

A number of severe recent food scandals have led to an increasing awareness of consumers of health and environment worldwide (ROITNER- SCHOBESBERGER et al. 2008; NIESSEN and HAMM 2006). Besides this consumer appreciate the organic production scheme for transparency and consumer orientation. Therefore, the consumption of organic food has increased and the organic food sector has experienced a strong and constant growth in many countries in recent decades (Figure 1). The demand for organic products is mainly concentrated in Europe and North America. This two regions comprise 96% of the global revenues (WILLER and KILCHER 2012).

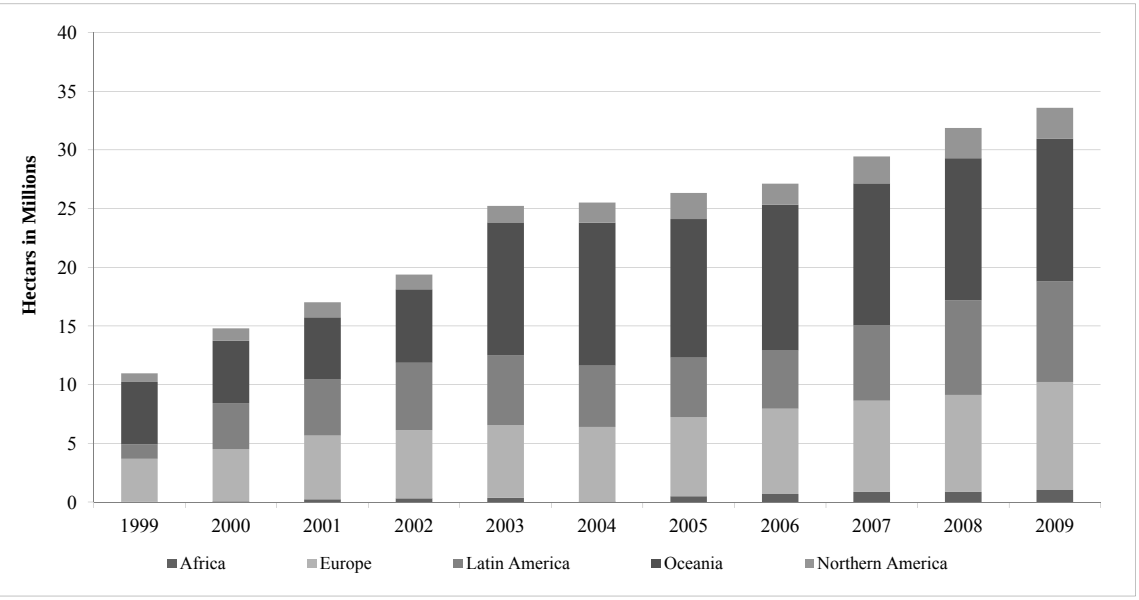

Figure 1: Organic Agricultural Land (In-Conversion and Fully Converted) by Region 1999-2009

Source: Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements IFOAM 2011

Worldwide the organic agriculture covers 37 million hectares in 2010. Oceania (12.1 million hectares), Europe (10 million hectares) and Latin America (8.4 million hectares) are the regions with the highest organic land use. Countries with the largest markets for organic products are the United States and Germany (WILLER and KILCHER 2012). The organic sector in

the United States grew to over 28.6 $ billion and grew at a rate of nearly 8% in 2010. With a growth of 7.7% during 2010, the organic food sales exceeded the total food sales by far (ORGANIC TRADE ASSOCIATION 2011). In Germany, the sector has experienced constantly high growth rates (see Figure 2). The per capita purchases of organic food in Germany have been increasing on average from 42.4 €/person in 2004 to 72.40 €/person in 2010. The number of organic producers has grown on average by 5.3 % per year between 2004 and 2009 (AMI 2010b, AMI 2011b, RIPPIN and HAMM 2007).

Since a few years organic foods are increasingly found in conventional supermarkets. In 2009 54% of total organic food sales were handled though mainstream retail establishments followed by specialized organic food stores with 40% in the US (ORGANIC TRADE ASSOCIATION 2010). In Germany, supermarkets and discount retailers have especially increased their market shares, whereas farm shops and direct marketing channels have lost market share during recent years. Specialized organic food stores, the main market actors during the 1990s, are still growing in absolute figures, but the largest part of the overall growth is due to conventional food traders (supermarkets and discounters), who started to offer and promote organic food in their stores (RIPPIN and HAMM 2007).

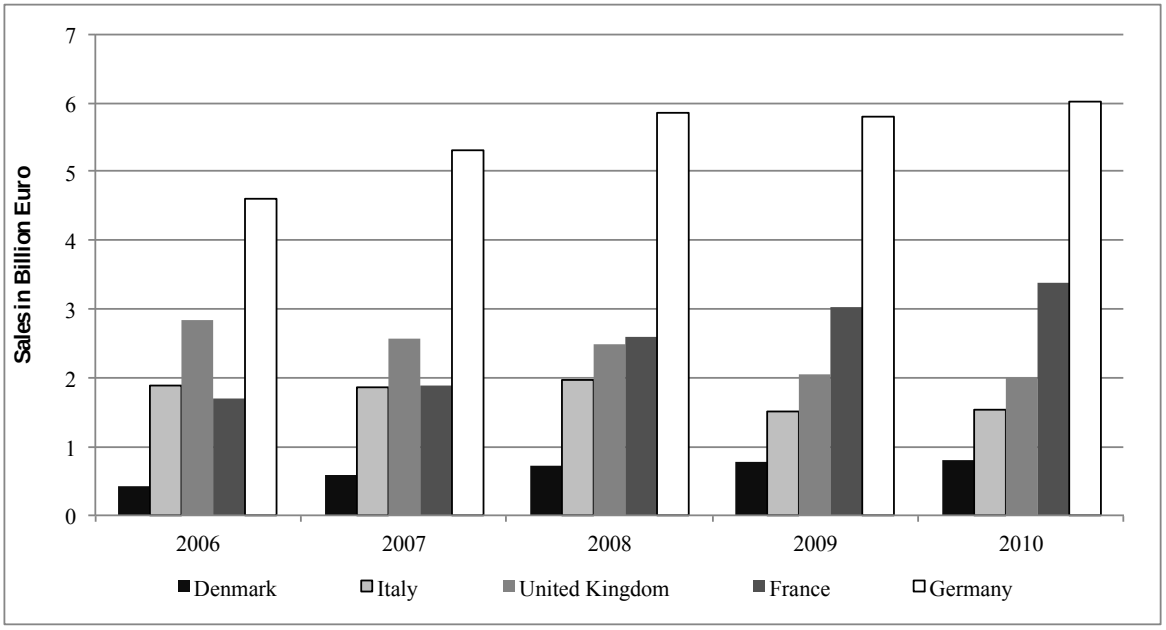

Figure 2: Development of the organic market in selected European countries (in Billion €)

Source: Data from BÖLW, different years

During the 1990s there were only small linkages between the conventional and the organic markets because the organic sector used to be quite autonomous. Consumers purchased organic products mostly in organic food stores, farmers' markets and farm shops where consumers did not have the choice between different qualities and price levels. Today many large food companies or retailer in Germany, North America an Oceania offer organic and conventional food (SAHOTA 2010). In big Asian Countries like Malaysia, Taiwan and Singapore the number of organic food shops is also rising and large food companies are coming into the market (SAHOTA 2010). In many stores, organic products are found directly next to their conventional counterparts, so that consumers can directly choose between them. Since consumers tend to be price sensitive, prices for organic products can be assumed not to exceed a certain 'top-up' margin for the organic production scheme. This top-up is likely being calculated in relation to the conventional prices, since consumer can use the conventional price as a point of comparison. Therefore, an increasing share of supermarkets and discounters in the organic sector is likely to lead to a closer link between organic and conventional prices. Since market actors have substantially changed during the last 20 years, it is appropriate to ask if the price setting behavior has also changed. Particularly the market entry of discounters could have an impact on the price formation process for organic products, because this form of retail is characterized by lowest prices.

Another important issue, which point to altered price interdependencies, is a change in the EU intervention prices. The EU has reduced its intervention prices for many markets since 1992. The degree of protection has been decreasing (OECD 2010) and since 2005 intervention in the grain sector has partly been abolished. This leads to higher price volatility on the conventional grain markets. Furthermore, the financial crisis has increased price volatility; therefore, this uncertainty also gains importance in the agricultural sector (HLPE 2011). Other studies have found that price volatility has increased, particularly for wheat in Germany (ARTAVIA et al. 2010). This might also be the case for the organic sector and might increase the tendency for prices in these markets to be oriented with conventional prices.

One additional point seems to be very important while analyzing linkages between the conventional and organic market: If seeds and feed stuff are not available, farmers can, due to the

organic producer regulations[1], use conventional products if the farmer's production association agrees to such an exception. Hence, this link might exist in cases where the supply for organic seeds and feed stuff is low. If the price for organic grain is low, organic farmers can sell their organic grain as conventional grain or as input for biogas plants.

This paper is dealing exactly with these linkages. It is concerned with interdependencies between organic and conventional wheat prices at the producer level. The analysis is carried out by means of cointegration analysis, that is, the estimation of a vector error correction model considering the two price series. With such a model, empirical evidence on the integration of both markets and the speed of transmission of price signals between them can be obtained. With respect to the transformation in the organic and conventional sector, we want to check, if we find evidences for a structural changes. We assume that an increasing share of supermarkets and discounters in the organic sector play a considerable role and lead to a closer link between organic and conventional prices. First, we present the development of the organic market before we give a description of some theory of price transmission analysis. Then we present the data, the model and estimation results. Finally, we draw conclusions.

2 The organic Market in Germany

Markets can only be integrated, if consumers are able to choose between organic and conventional products in one market-channel.

1. Such a link between both markets exists in *the supermarkets and discounters*, where consumer can compare prices and choose either an organic or a conventional product.
2. Besides that, there has been *the option for farmers to use conventional grain as feed-stuff*, if the farmer can indicate a missing supply of organic grain as feed-stuff.[2]

[1] The organic production is defined by the EU regulation EU-VO 2092/91 and EU-VO 1804/99, and since 2007 EU-VO 834/2007. The purchase of conventional inputs such as e.g. seeds and feed-stuff are limited and in some cases only allowed by permission of the controlling body or producer-association such as Bioland, Neuland or Demeter. But this option might still be possible in cases of low supply of organically produced inputs.

[2] This was done in practice by documenting that missing supply against the organic association or the control-body. The farmer had to document three offers from organic grain-traders, which were indicating a missing supply of organic grain. In such a case the farmer was allowed to buy conventional feed-grain. Actually, the EU organic regulation does not allow conventional grain as feed-stuff anymore.

3. The link between organic and conventional markets was also given, if *organic farmers had to sell their products on the conventional market*, which was reported for cases of a high supply in the organic market (ZMP [d] 2006,).

Therefore it is essential to follow the market-dynamics and the entrance of the main supermarkets and discounters in the organic market after the years 2001/2002. There is little documentation and information of the market for organic products in Germany during the 1990ies. In October 1991 the Centre for Market- and Price-Reports (Zentrale Markt und Preisberichtsstelle GmbH (ZMP)) started to collect price data of organic fruit, vegetables, potatoes and grain in three regions in West-Germany, in 1992 a weekly price and market-report was offered by the ZMP. Since 1993, the data-collection was extended overall Germany (ZMP [b] 1996). During the 1990ies, the main market channels in Germany were the specialized organic food-stores, weekly markets, healthy food stores and direct marketing (LATACZ-LOHMANN and FOSTER 1997, MICHELSEN et al. 1999). There were three supermarket-chains *tegut* (since 1982), *Tengelmann* (1986) and *Rewe* (1988), who started in the 1980ies selling organic products at all their point of sales (IÖW 2007, ÖKOLANDBAU.DE 2010, FRÜHSCHÜTZ 2010). Until the end of the 1990ies, a lot of supermarkets and discounter did not sell any organic products at all. In 1997, DIENEL (2001) cites a market-share of 23% of organic food in the supermarkets (DIENEL 2001, p. 3). OPPERMANN estimated 300 weekly markets with organic products in 1998, but also pointing at the restricted potential to extent the market share of organic products via direct marketing (OPPERMANN 2001, 88). Therefore HAMM (2000) was claiming on a stagnation of the demand for organic products due to a missing offer and no advertisement for organic products in supermarkets. Still in 2000 only in 59% of the supermarkets and in 4% of the discounter organic products were available (ZMP 2000).

In 1999, a new organic sign, the so called 'Ökoprüfzeichen' was introduced by the association of organic farming ('Arbeitsgemeinschaft Ökologischer Landbau', AGÖL) and the central marketing agency (CMA) as a measure of signaling the organic quality to the consumer. The sign was not accepted by the actors in the organic market during the two years of implementation. There were many reasons why the implementation of the first organic sign in Germany failed. According to ZENNER and WIRTHGEN (2002) the costs for using the sign were too high and there was too little advertisement for the sign in the media. Besides these management problems, a lot of market-actors criticized the unclear legal basis of the sign, which was the

'AGÖL-standard', which was a standard between the strict association regulation and the EU organic regulations.

The situation of the organic market changed after 2000/2001, when the BSE crisis appeared, a new minister for agriculture, Renate Künast from the Green-Party came into office and announced the so called 'Agrarwende', which was meant as a change in political priorities as a reaction on the BSE crisis. Besides the direct promotion of organic farming, the new minister tried to motivate the conventional supermarkets to enter the organic market. During the year 2001, a new organic sign (Bio-Siegel) in Germany was released and the supermarket *EDEKA* and the discounter *Netto, Aldi South* and *Norma* announced a new engagement in the organic market, the discounter *Plus* and *Aldi North* followed in 2002, *IKEA*, *McDonalds* and *Rossmann* followed in 2003 and 2004 (ZMP [a] 2001-2003, various issues). The organic market had to suffer from the so called 'Nitrofen-scandal' in summer, but finally the demand for organic food continued growing in autumn 2002. Figure 3 shows the market shares of the different sales channels in the organic market after 1997 in detail.

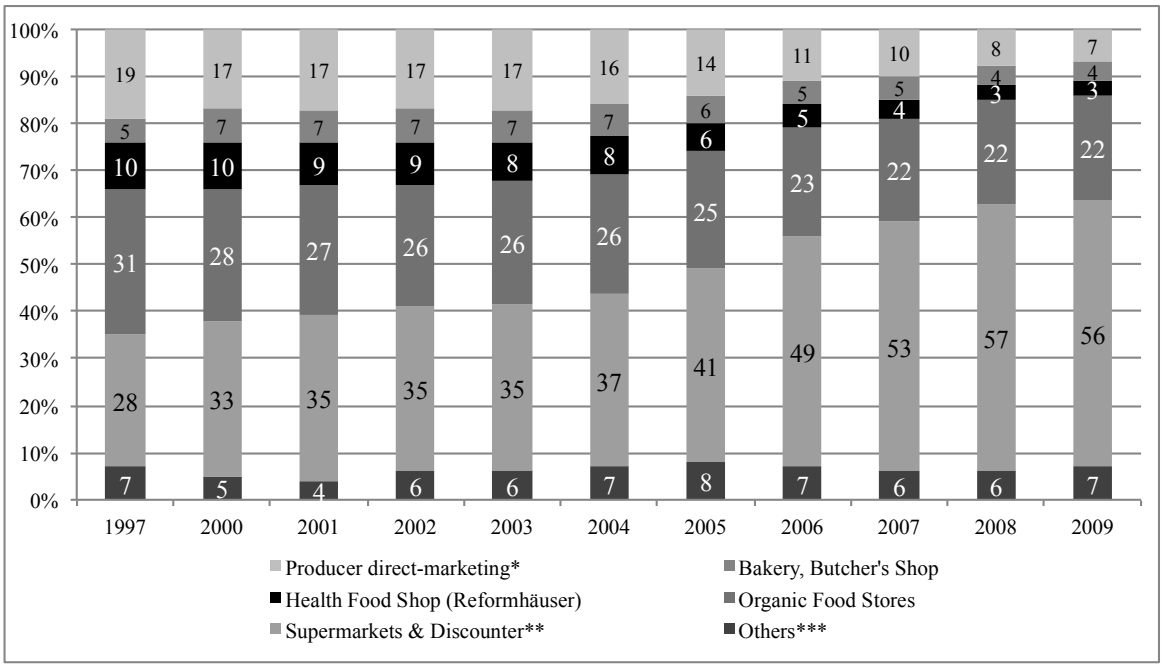

Figure 3: Market-shares of sales channels in the German market for organic food

Source: Authors' elaboration, data from IÖW (2007), RIPPIN and HAMM (2007), AMI (2011)

*: Farmers on weekly markets and farm-shops; including delivery-services from farmers

**: Including Special Fruit and Vegetable stores

***: Including drugstores, petrol-stations and other delivery services

The share of supermarkets has increased from 28% (1997) up to 56% (2009). The other sales-channels lost some of their market-share. Nevertheless, the organic food stores had increases in absolute terms, whereas the direct marketing, the Bakerys/Butchers Shops and the health food shops has also lost in absolute terms. In order to analyze the market integration of the organic and the conventional market, it is essential to describe the market-dynamics, which will be undertaken based on a document-study of the ZMP and some selected other sources. Due to a higher share of supermarkets and discounter we can assume, that the price premium for organic products could be slightly decreasing.

Due to the reform of the Common agricultural policy and the introduction of a new rural development program ELER, the organic payments were reduced most of the federal states in Germany (NIEBERG and KUHNERT 2006). This reduced the conversion-rates of farmers to organic farming in Germany (ZMP [d] 2007). Before and during the years after the EU east-enlargement (May 2004), imports of organic products coming from Eastern Europe produced some competition on the German market (ZMP [d] 2006, SCHAACK 2007). During the price peak of 2007/2008, low conversion-rates on the farm level and a high market growth also lead to a shortage of supply of organic products in 2007 and 2008 (HAMM 2007, BÖLW 2008), resulting in a higher price. Figure 11 summarizes main market events and the price development of organic and conventional wheat between 1997 and early 2010.

After the world market prices for agricultural commodities decreased in 2009, also the organic market suffered from stagnation: In August, the German Agency for Consumer Research' ('Gesellschaft für Konsumforschung'), a market research institute, gave a warning for a slight sales-decrease on the organic market (GfK 2009), which launched a huge discussion on the interaction of economic growth and development of the organic market. At that time, journalists foresaw a collapse of the organic market in Germany (see DIE TAGESZEITUNG on August, 3 and 4, 2009 and DER SPIEGEL on August 5, 2009). Finally the sales of organic products grew just in the segment of the organic food-stores, whereas the sales of organic products decreased within the segment of supermarkets and discounters, which was partly caused by restructuring of the brands of *Aldi*, *Plus* and *EDEKA*. Adding up the sales figures of the different sales channels, the organic market did not grow in 2009 (+/-0.0%, see details in RIPPIN 2010 and FRÜHSCHÜTZ 2010), but the growth was continued in 2010 (BÖLW 2011).

3 Methodology

The study of relationships between markets of one commodity in space, or of various stages of a commodity along the processing chain (e.g. wheat grain – wheat flour – bread), has attracted the interest of agricultural economists for many decades (MEYER 2004). This issue is measured by assessing market integration. The concept of market integration is not agreed upon in the literature (FACKLER and GOODWIN 2001). Admittedly there is a general agreement that market integration is related to the flow of goods and information over space, time and form; however, the determination of an accepted definition with testable components is a challenging task (GONZÁLEZ-RIVERA and HELFAND 2001). It is therefore necessary to clearly define the concept for this paper.

We understand markets as integrated if their prices share stable long-run price equilibrium. The attainment of such equilibrium can only be reached if either trade flows occur between spatially separated markets of a homogenous commodity or if information flows ensure that price information of one product plays a key role in the price formation of the other. This distinction appears to be relevant in the context of this study insofar as the focus lies on the markets of conventional and organic wheat. The varying production processes yield two types of wheat which cannot be regarded as one homogenous commodity (which is a necessary condition for horizontal price transmission analysis).

On the other hand, the given setting corresponds neither to vertical price transmission analysis which analyses the transmission of price signals between various processing stages of one agricultural product. The focus of this study lies on interdependencies of the price formation processes of qualitatively differentiated varieties of one commodity (here: organic vs. conventional), which emerge as a result of the transmission of information between both markets. While the varieties of the commodity are usually traded on separate markets, a certain degree of substitutability exists between them concerning marketing and processing. In the framework of organic vs. conventional agricultural products, this substitutability is considered asymmetric since organic wheat might be used or marketed without the label as the conventional variety, whereas the opposite is not possible. Hence, we are presented with a very interesting economic setting of which we try to explore empirically. To our knowledge, this is the first study to assess price relationships for a qualitatively differentiated commodity.

If markets are found to be integrated, the speed and magnitude of the transmission of price signals and price shocks between the markets, i.e., price transmission, is of interest. This form of price transmission analysis is criticized by some authors because it is only based on price series while transaction costs are ignored. Nevertheless, it should be mentioned that price series often represents the only sufficient quality of information for specific markets (MEYER 2004).

While market integration can be assessed by cointegration testing, price transmission can be estimated using cointegration models, in particular the vector error correction model (VECM) which takes for two price series x_t and y_t in markets *x* and *y* the form:

$$\begin{bmatrix}\Delta x_t \\ \Delta y_t\end{bmatrix} = \begin{bmatrix}\alpha^x \\ \alpha^y\end{bmatrix} [\beta_0 \quad 1 \quad \beta_1] \begin{bmatrix}1 \\ x_{t-1} \\ y_{t-1}\end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix}a_i & b_i \\ c_i & d_i\end{bmatrix} \begin{bmatrix}\Delta x_{t-i} \\ \Delta y_{t-i}\end{bmatrix} + \begin{bmatrix}u_t^x \\ u_t^y\end{bmatrix}. \quad (1)$$

where Δ denotes the first difference operator and hence quantifies the absolute price change from the previous to the current period. The coefficients β_0 and β_1 quantify the long-run price equilibrium, so that the product of the vector containing them with the following vector of prices of the previous period measures the *equilibrium error* (the deviation from equilibrium). α^x and α^y are the *loading parameters* which quantify the magnitude of the price response in the current period to the equilibrium deviations in the past period, that is, they measure how quickly the adjustment of price disequilibria takes place. The parameters a_i, b_i, c_i and d_i measure the partial influence of past price changes on the current changes and $u_t^j, j = \{x, y\}$ are Gaussian white noise errors. As mentioned in HACKL (2005), not explicit assumptions on structural characteristics have to be made in this context while Granger causality testing represents a way to evaluate this issue.

4 Data

We analyze monthly producer prices of conventional and organic soft wheat used to make bread. This data was obtained from the German Agricultural Data Service (ZMP/ AMI). The prices are monthly averages for traded quantities of at least two tons. The time frame of the analysis, between November 1997 and February 2011, was determined by the availability of

data for organic wheat. Altogether we have 160 observations for both time series. In Table 1 we give a short overview about the descriptive statistics of the observed producer prices.

Variable	Mean	Minimum	Maximum	Std. dev.
Conventional wheat (conv)	126.70	90.60	254.22	36.74
Organic wheat (org)	325.38	223.30	544.00	63.87

Table 1: Descriptive Statistics in EUR/t
Source: Authors' calculations.

As is visible in Figure , both price series possess a number of missing observations. These missing values often are present during the time before harvest, i.e., from May to July, because little or no trade took place during this period for some years. Following the WORLD BANK (2009), we impute the missing values. The imputations are carried out using an adapted version of the algorithm of KING et al. (2001) and the R-package AMELIA II (HONAKER et al. 2009). For each missing value 1000 estimates were generated and the most probable value was chosen using the mode estimator of Parzan (1962). In the remainder of this section, we elaborate on the developments of the markets of both products.

4.1 Price developments in the conventional wheat market

For conventional wheat, we present details for the years of the international food crisis between 2006 and 2008, as prices experienced a notable increase during this period in comparison with the average price level between 1997 and 2010. This was followed by a price decrease of the same magnitude (Figure 4).

In February 2006 it was speculated that the price of wheat would face an upswing. This mainly had to do with the fact that, for six years, a decline in stocks was recorded, with the sole exception of the fiscal year 2004/05. At the same time it was expected that demand would increase due to growing import demand from Asia, and especially China. Already in May 2006, the first increases of wheat prices could be seen. The suspected reasons were market assessments, which were too optimistic, and bare inventories, which were confronted with an increase in consumption and bad weather conditions. In September 2006, wheat prices rapidly increased as the situation was exacerbated by a fast deterioration of the Australian wheat crop. Market analysts expressed doubts of whether the role of these shortages was given enough

attention and whether these determinants adequately reflected reality[3]. In 2007, prices rose even more sharply and wheat prices reached the highest level in twenty years in Germany[4]. The inexorable rise in wheat prices highlighted that the most important cereal in terms of nutrition had become scarce. The estimations of the United States Department of Agriculture also forecasted that stocks would reach their lowest level in thirty years. This presumption was also reflected in the EU cereal stocks. In the fiscal year 2007/08, the stocks of wheat held in intervention fell to just 600 t (AMI 2010a). At the beginning of 2008, world cereal stocks were only sufficient to meet a demand of roughly 50 days. The consequence was the observed high volatility of grain prices as low stock levels were only to a very limited extent capable to buffer price movements. Supply and demand information obtained a much greater impact on prices than for example in the 1980s (BRÜMMER 2008).

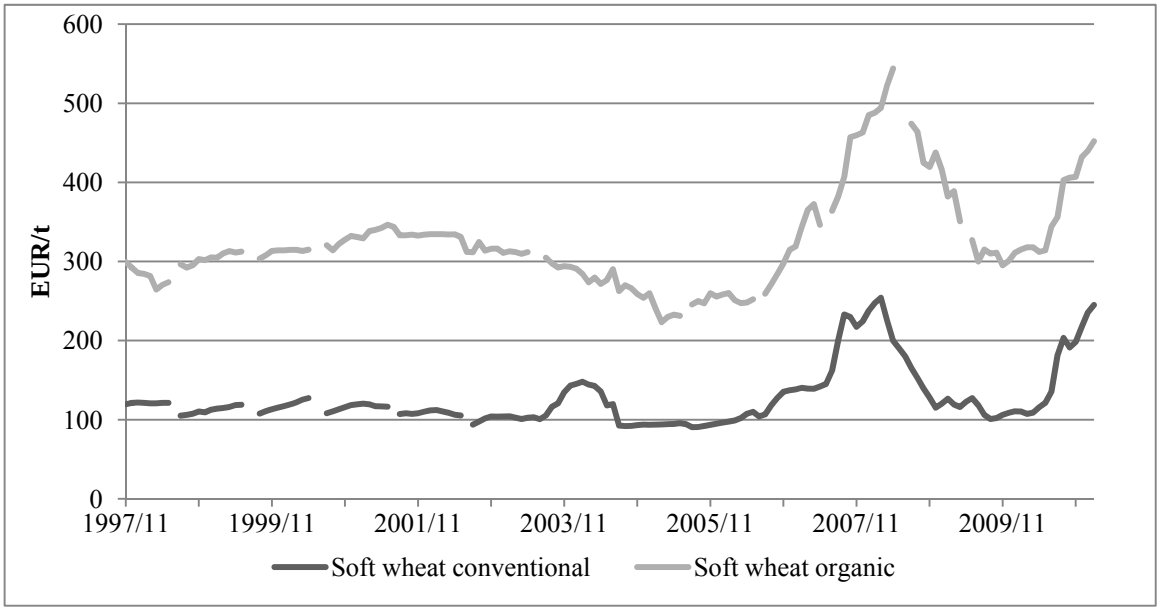

Figure 4: Producer Prices of Conventional and Organic Soft Wheat

Sources: ZMP [a]; ZMP [b]; ZMP [c]; AMI (2010a, 2010b, 2011a, 2011b).

[3] A low relation between international grain-stocks and actual grain-consumption, bad weather conditions in the major producing regions and dubious predictions.

[4] In December 1988, the German wheat prices remained on a level of more than 200.00 EUR/t for more than 6 months. In August 2008, the price rose again to 200.41 EUR/t and remained on that level above 200 EUR/t until May 2008 (data from ZMP [a], different years and AMI 2010a).

4.2 Price developments in the organic wheat market

For organic soft wheat, we summarize the developments over the last two decades because this covers the period of when the organic market obtained an economic importance and experienced a strong and steady growth in relation to the conventional wheat market. During the 1990s, the total area devoted to organic wheat farming increased just as strongly as the expansion of the total area under organic farming did. The strong rise in national demand, as well as additional favorable foreign imported organic wheat pressured the market price significantly. In contrast, conventionally produced wheat did not experience this development (ZMP [b] 1997). This has been seen as evidence that the conventional market does not affect the organic market and vice versa (ZMP [b] 1997). This suggests that the organic market, in its early years, was a niche market and hence could develop relatively independently of the conventional market. Due to weather related yield and quality losses in 1997/98, producers had the opportunity to market their grain at higher prices (ZMP [d] 2001). A balanced market situation also led to the organic boom in some of Germany's neighboring countries. In the harvest year of 2002, bad weather conditions in Germany led to a meager supply of high quality grain. However, this did not lead to a rise in prices as harvests in other countries had been sufficient and grain could be imported. Another factor that impacted the organic grain market was the fall in the prices of the conventional grain market (ZMP [d] 2003). In March 2005, the price for organic wheat fell again due to a large excess of supply (ZMP [a] 2007). In addition, conventional farmers experienced a bumper crop, so that the producer price for conventional bread wheat collapsed. In the fiscal year 2003/ 04, the price of conventional wheat had increased, while organic wheat prices did not benefit from this period of high prices and had even fallen steadily. On the other hand, the price collapse in August 2004 was transmitted to the organic market (ZMP [d] 2006).

The years 2006/07 were once again characterized by a demand for organically produced grain which had grown more than production (ZMP [a] 2007). However, the short supply at this time led to a rise in prices, as harvests across Europe had turned out badly. Similar to the conventional wheat market, prices for organic wheat reached hitherto unprecedented high levels in 2007/ 08. The maximum was reached in May 2008 at 544 EUR/ t (AMI 2010a). Similar to the conventional market, this was due to the poor harvests of previous years, to a growing demand and almost depleted stocks (ZMP [a] 2007).

5 Estimation Results

Firstly, we test for the time series properties of wheat price series and subsequently estimate a VECM. The variable *org* denotes the producer price of organic wheat and the variable *conv* denotes the producer price of conventional wheat in EUR/ t. We expect the producer price of conventional wheat to not be influenced by the price for organic wheat due to the relative importance of both markets. If prices adjust to existing disequilibria then only the organic prices are likely to show this behavior since the market for organic wheat is considerably smaller than that of conventional wheat[5].

5.1 Unit root and cointegration tests

Table 2 includes the results of the two employed unit root tests, the Augmented Dickey-Fuller (ADF) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The tests on the price levels suggest that both time series are non-stationary; therefore, both tests are applied to the first differences of the series and in order to check for the order of integration. The tests give consistent results on both price series by providing strong evidence that they are I (1), i.e., integrated of degree one.

	ADF			**KPSS**		
Time series		Optimal lags	Test statistic		Optimal lags	Test statistic
org (level)	No time trend, no intercept	0	-0.58	Level stationarity	9	0.41*
	No Time trend, intercept	0	-1.0	Trend stationarity	9	0.13*
org (first difference)	No time trend, na intercept	0	-12.52***	Level stationarity	9	0.09
	No Time trend, intercept	0	-12.53***	Trend stationarity	9	0.05
conv (level)	No time trend, no intercept	1	-0.21	Level stationarity	9	0.48**
	No Time trend, intercept	1	-2.3	Trend stationarity	9	0.1
conv (first difference)	No time trend, no intercept	0	-7.45***	Level stationarity	9	0.13
	No Time trend, intercept	0	-7.44***	Trend stationarity	9	0.05

Table 2: ADF and KPSS Stationary Tests

Source: Authors' calculations.

Notes: ADF- Test: Lag length selection according to Schwarz information criterion.
KPSS- Test: Lag length selection according to LÜTKEPOHL and KRÄTZIG (2004)
One, two and three asterisks denote significance at the 10%, 5% and 1 % levels, respectively.

[5] In 2008, the total grain production in Germany amounted to 50 Mio t. The organic segment contributed 0.61 Mio t, corresponding is a share of 1.1 % (AMI 2010b).

The results of the Johansen trace test presented in Table 3 provide strong evidence that organic and conventional wheat prices are cointegrated at the 5% level of significance, that is, the markets of organic and conventional wheat seem to share a long-run price equilibrium. This confirms the visual impression of the time series in Figure 4 which show a pronounced parallel movement. These two markets can hence be regarded as integrated. This is econometric evidence that price information between both markets is indeed exchanged. Therefore, it can be assumed that at least one producer price responds to a short term shock. We suspect that the organic price will react to such disequilibria, because the organic market is much smaller than the conventional. Additionally, this finding is economically very plausible because the two varieties of wheat share a certain degree of substitutability mainly due to linkages in marketing and usage. As we can only conclude at this step that the exchange of information exists, we go on and estimate a VECM in order to obtain detailed insights into the price dynamics and interdependencies.

Lags	Cointegration relations	p-value
2	0	<0.01
	1	0.73

Table 3: Johansen Cointegration Test
Source: Authors' calculations.
Note: Lag length selection according to the Schwarz information criterion.

5.2 Vector Error Correction Model

Based on the robust Schwarz model selection criterion, we estimate a VECM with two lags using Johansen's maximum likelihood estimator. The lag length is determined according to the Hannan- Quinn Criterion (LÜTKEPOHL and KRÄTZIG 2004). This choice is also economically reasonable since it mirrors the empirical question of which price the farmer takes in his buying and selling decisions. This points hence to the reasonable result that only the prices of the two previous months are relevant for the price formation. The prices of the two previous months are shown to play a stronger role in the price formation of the current period than months prior to it. We obtain the following estimates[6]:

[6] One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively.

$$\begin{bmatrix}\Delta org_t\\ \Delta conv_t\end{bmatrix} = \begin{bmatrix}-0.13^{***}\\ 0.02\end{bmatrix}\left[\begin{bmatrix}1 & -2.27^{***}\end{bmatrix}\begin{bmatrix}org_{t-1}\\ conv_{t-1}\end{bmatrix} - 44.17\right]$$
$$+\begin{bmatrix}-0.16^{**} & 0.12\\ 0.04 & 0.55^{***}\end{bmatrix}\begin{bmatrix}\Delta org_{t-1}\\ \Delta conv_{t-1}\end{bmatrix} + \begin{bmatrix}-0.14^{**} & 0.34^{**}\\ 0.05 & -0.12\end{bmatrix}\begin{bmatrix}\Delta \mathrm{org}_{t-2}\\ \Delta \mathrm{conv}_{t-2}\end{bmatrix} + \begin{bmatrix}u_t^{org}\\ u_t^{conv}\end{bmatrix} \quad (2)$$

The restriction of the coefficient of $conv_{t-1}$to -2 using a Wald test could not be rejected (p-value of 0.27). Hence we consider the model in its restricted version and obtain:

$$\begin{bmatrix}\Delta org_t\\ \Delta conv_t\end{bmatrix} = \begin{bmatrix}-0.137^{***}\\ 0.001\end{bmatrix}\left[\begin{bmatrix}1 & -2\end{bmatrix}\begin{bmatrix}org_{t-1}\\ conv_{t-1}\end{bmatrix} - 79.07^{***}\right]$$
$$+\begin{bmatrix}-0.15^{**} & 0.11\\ 0.05 & 0.54^{***}\end{bmatrix}\begin{bmatrix}\Delta org_{t-1}\\ \Delta conv_{t-1}\end{bmatrix} + \begin{bmatrix}-0.14 & 0.33^{**}\\ 0.06 & -0.12\end{bmatrix}\begin{bmatrix}\Delta \mathrm{org}_{t-2}\\ \Delta \mathrm{conv}_{t-2}\end{bmatrix}\begin{bmatrix}u_t^{org}\\ u_t^{conv}\end{bmatrix} \quad (3)$$

For organic soft wheat, the adjustment rate is as expected negative and significant at the 1% level. This adjustment is rather strong with almost 14% of an equilibrium deviation corrected in each period. In contrast, producer prices of conventional soft wheat do not show significantly respond to price disequilibria, that is, they appear to be weakly exogenous. Comparing the adjustment behavior of the two prices, it is only the organic price which corrects disequilibria. For the producer price for organic soft wheat, the following equation is obtained:

$$\Delta org_t = -0.14^{***}[org_{t-1} - 2conv_{t-1} - 79.07^{***}]$$
$$-0.15^{**}\Delta org_{t-1} + 0.11\Delta conv_{t-1} - 0.14\,\Delta \mathrm{org}_{t-2} + 0.33^{**}\Delta \mathrm{conv}_{t-2} + u_t^{org}\,. \quad (4)$$

For the producer price for conventional soft wheat, the following equation is obtained:

$$\Delta conv_t = 0.001\,[org_{t-1} - 2conv_{t-1} - 79.07^{***}]$$
$$+ 0.05\Delta org_{t-1} + 0.54^{***}\Delta conv_{t-1} + 0.06\Delta \mathrm{org}_{t-2} - 0.12\Delta \mathrm{conv}_{t-2} + u_t^{conv}. \quad (5)$$

The long-term price relationship, i.e., the deviations from the expected equilibrium prices, is contained in the square brackets of (4) and (5). It takes in equilibrium (that is, there are no deviations) the following form:

$$org_t^{equ} = 79.07 + 2\,conv_t. \quad (6)$$

The observed price org_t will diverge from the equilibrium price org_t^{equ} if demand- or supply side driven shocks hit the market system and yield an equilibrium error which is corrected for

by the loading parameters. Equation (6) shows that the producer price of organic soft wheat is on average almost 200 €/t higher than the producer price of conventional wheat[7]. According to the considered model, the organic price consists of an additive and a multiplicative component. Further Wald tests on the parameter of $conv_t$ showed that it cannot be restricted to unity. This provides strong evidence that absolute price changes in the conventional wheat market are amplified in absolute terms in the organic market, that is, prices of organic wheat respond stronger in absolute terms to market shocks. Obviously the organic traders rely strongly on the conventional price in their price setting behavior. This result is linked to the question of price-setting behavior on the organic market. To do the all-day price-setting, it is the questions for the trader, at which price she should orient herself. Besides that she can calculate a price-premium for the organic product in absolute terms (i.e. in monetary terms) or in relative terms (as a percentage of a buying price). This question is of high relevance in practice; nevertheless, the results have to be further tested to give final answer to address that question.

Result (3) illustrates that the organic wheat price is determined by its value of the previous month and the conventional wheat price of two months before. The conventional price only depends on its value of the previous period. The organic price has no influence on the conventional wheat market. Consequently, the price of conventional wheat appears to be the major force in the price formation of both markets.

As mentioned above, no explicit assumptions about the structural dependencies have to be made when using VEC models (HACKL 2005). Therefore, the question on the nature of the relationship between the price time series for conventional and organic soft wheat arises. For this purpose, a Granger causality test is employed. First, we check the null hypothesis that the conventional wheat price does not Granger-cause the organic wheat price. This means that future producer prices of organic soft wheat cannot be forecasted based on current prices of conventional wheat. This hypothesis is rejected with a test statistic of 15.67 corresponding to a p-value of <0.01. Second, we cannot reject the null hypothesis that the organic wheat price does not Granger-cause the conventional wheat price due to a p-value of 0.64. This confirms the finding of the VECM since only the producer price for organic wheat is Granger-caused

[7] Since the average conventional price is 126.7 EUR/t (Table 1), the expected organic price amounts on average to $org_t^{equ} = 79.07\,\text{EUR/t} + 2 * 126.70\,EUR/t$ =332.47EUR/t.

by the output price for conventional wheat. This conclusion appears to be very plausible as the conventional wheat market is much larger than the organic wheat market. Therefore, the conventional producer price appears to be not affected by the organic wheat price.

.In order to be able to obtain a comprehensive insight into the dynamics of the model estimated in (3), we estimate impulse response functions together with their 95% Efron percentile based confidence intervals plotted in **Error! Reference source not found.**5 and 6:

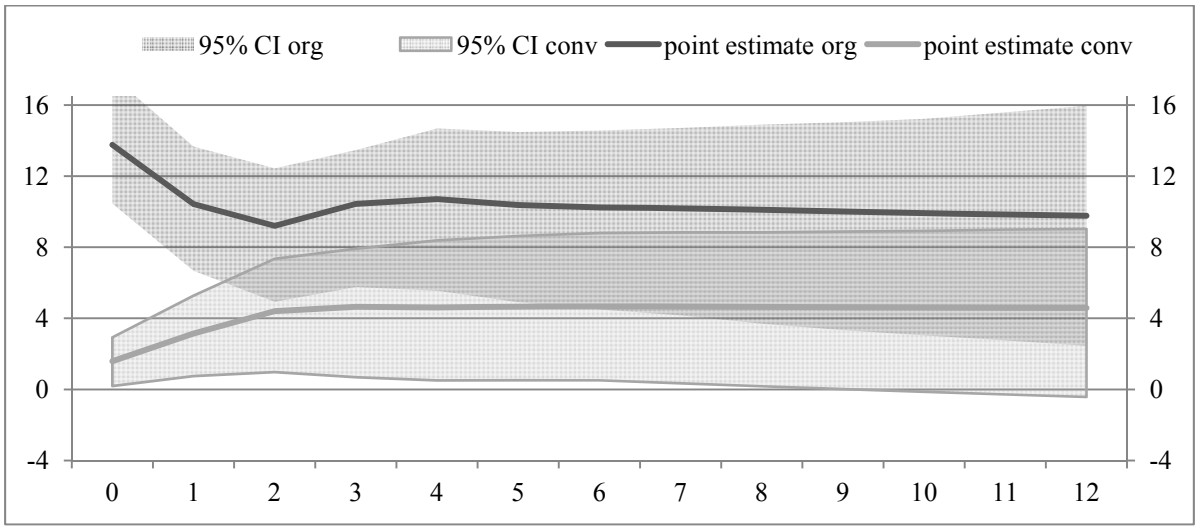

Figure 5: Price responses for a unit shock in the organic wheat price

Source: Authors' calculations.

As suggested by the results above, the organic wheat price does not play a role for price formation. A unit shock in this price does not push the conventional wheat price significantly away from zero as illustrated by the confidence interval of this price which encompasses zero for all periods considered. Although the response of the organic price turns out to be quite strong, the effect is also not permanent since it levels out after 10 months where the lower boundary of the confidence interval crosses zero.

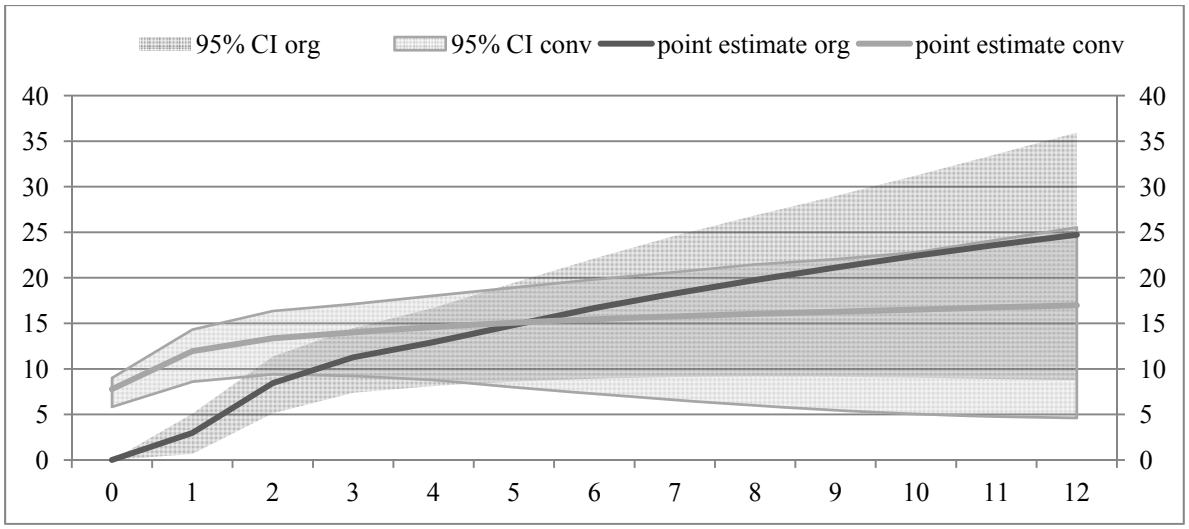

Figure 6: Price responses for a unit shock in the conventional wheat price

Source: Authors' calculations

The effect of a unit shock in the conventional price has in contrast permanent effects on both price series. While the effect in the initial months after the shock is stronger in case of the conventional price, it levels off already after three weeks. After six months, the point estimate of the response of the organic price exceeds the one of the conventional price and keeps rising until the end of the one-year forecast horizon although the effects on both prices do not significantly differ from each other.

The importance of the role of the conventional price is also demonstrated by the forecast error decompositions of both prices of which the first twelve months are plotted in Figure 7. After half a year, the conventional price explains more than 50% of the forecast variance of either price series and reaches after two years almost the same level for both.

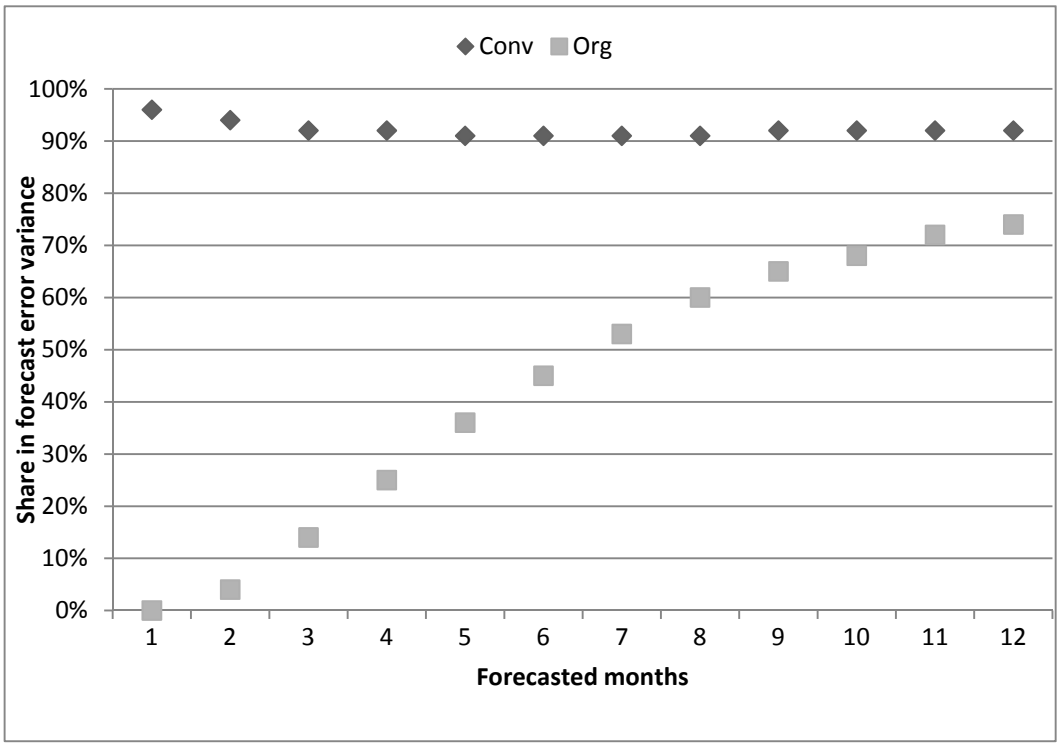

Figure 7: Share of the conventional wheat price in the forecast error variances of both prices

Source: Authors' calculations.

In **Error! Reference source not found.**8, we predict, based on the estimated long-run relationship (6), the expected organic equilibrium price based on the price series of conventional wheat and compare it with the observed organic wheat prices from Figure 4.

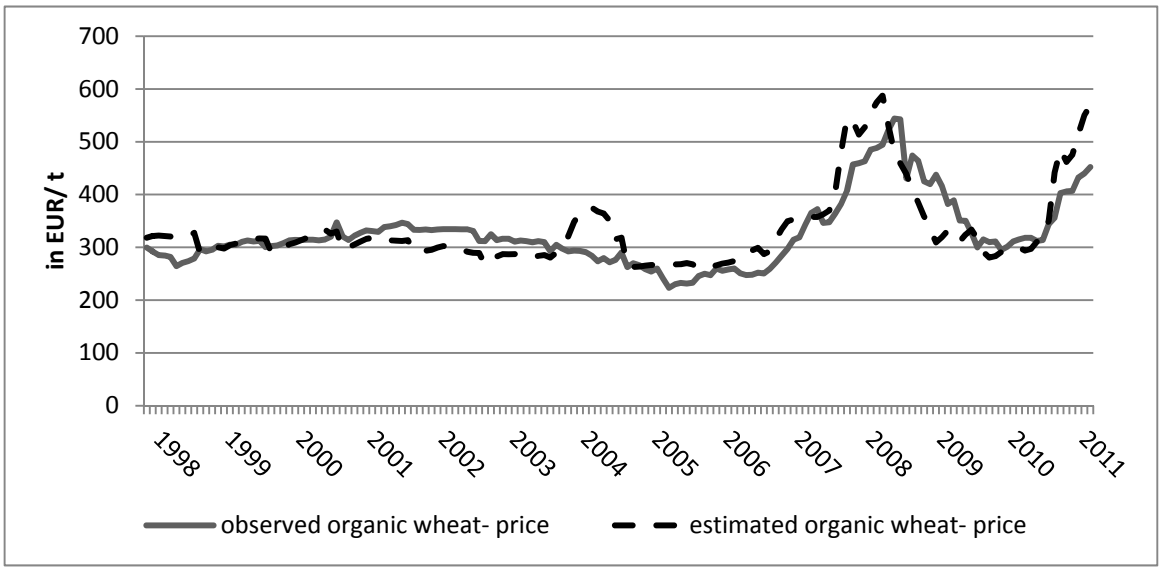

Figure 8: Observed vs. predicted prices for organic soft wheat

Source: Authors' calculations based on ZMP [a, 2007], ZMP [c, 2008] and AMI (2010a, 2011a).

In general, the predictions fit the observed prices quite well. However, the predicted equilibrium price deviates considerably from the observed price during periods of extreme price increases and decreases of the conventional wheat price (as e.g. in 2004 and 2006/07).

The misspecification tests in Table 4 show significant deviations of the model's residuals from the normal distribution and slight problems with autocorrelation and autoregressive conditional heteroskedasticity suggesting a nonlinear data generation process. Furthermore, we test for parameter stability by using a break-point Chow test on all parameters of the model because we assume that the coefficients differ over time. As mentioned in chapter 2, a number of fundamental changes impacted and formed the organic sector, so that the parameters might not to be constant over time. The Chow-test is a typical test for structural breaks and answers the question of the constancy of the regression coefficients in time. The test searches for a potential structural break over all observations by using 2000 bootstrap replications for the calculation of the p-values. Figure 9 shows that the null hypothesis of constant parameters can be rejected at any point in time between 2002 and 2008 at the 5% level, because the p-values of are below the dashed line.

Time series	**LM-test**	**Portmanteau test**	**Jarque-Bera test**	**ARCH-LM test**
org			<0.001	0.559
conv			<0.001	0.4599
Multivariate test	< 0.001	0.2123		<0.001

Table 4: Results of the residual tests
Source: Authors' calculations.

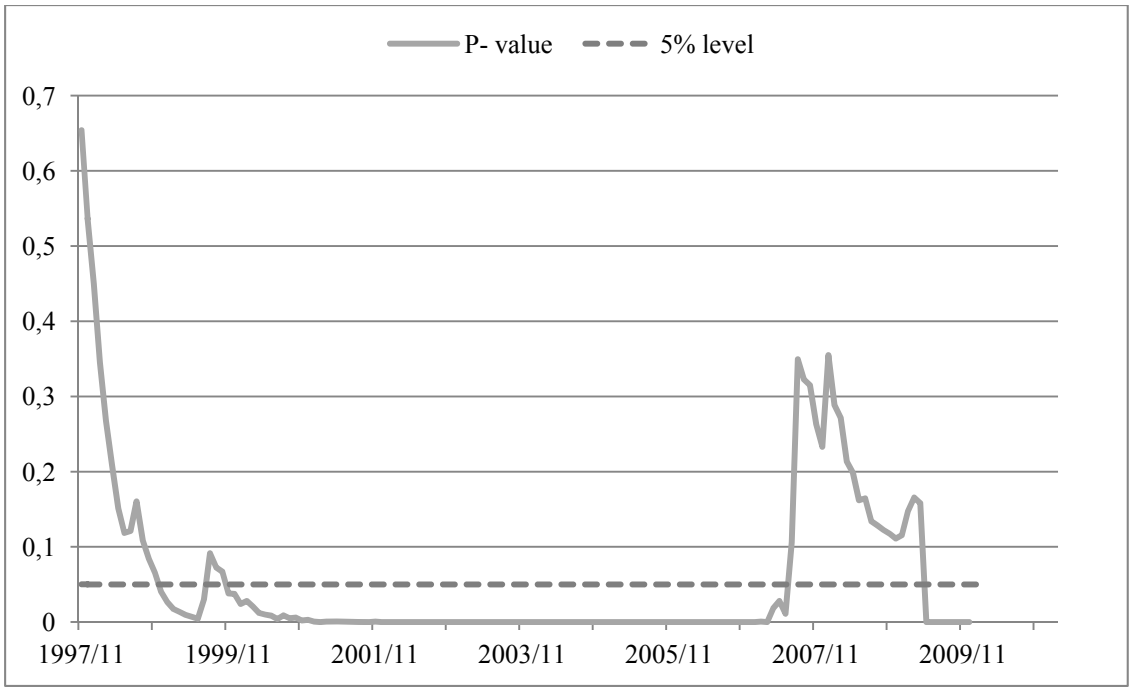

Figure 9: P-Values of the bootstrapped break-point Chow test

Source: Authors' calculations.

Furthermore, the recursive eigenvalue test is perfomed in order to obtain more robust evidence on the parameter stability (Figure 10). The null hypothesis that the eigenvalue of the model (2) is stable can be rejected 5% level of significance for the entire period between 2002 and 2006.

Both the residuals as well as the stability tests strongly point to a nonlinear data generation process which might be thought of as non-constant model parameters. Hence, the underlying structural relationships might have changed during the more than 14 years considered. As mentioned above, the situation of the organic sector changed entirely after 2000/01. Examples of the most relevant events are the BSE crisis, the release of a new organic label and at last the market entry of the first supermarket chains and discounters in the organic market (Figure 11). The test results on the adequacy of the model mirror the effects of such shocks or structural changes in market conditions on the price formation at the producer level. Both, the market context as well as the residual and stability tests suggest that a nonlinear modeling approach is more adequate that a linear model applied here.

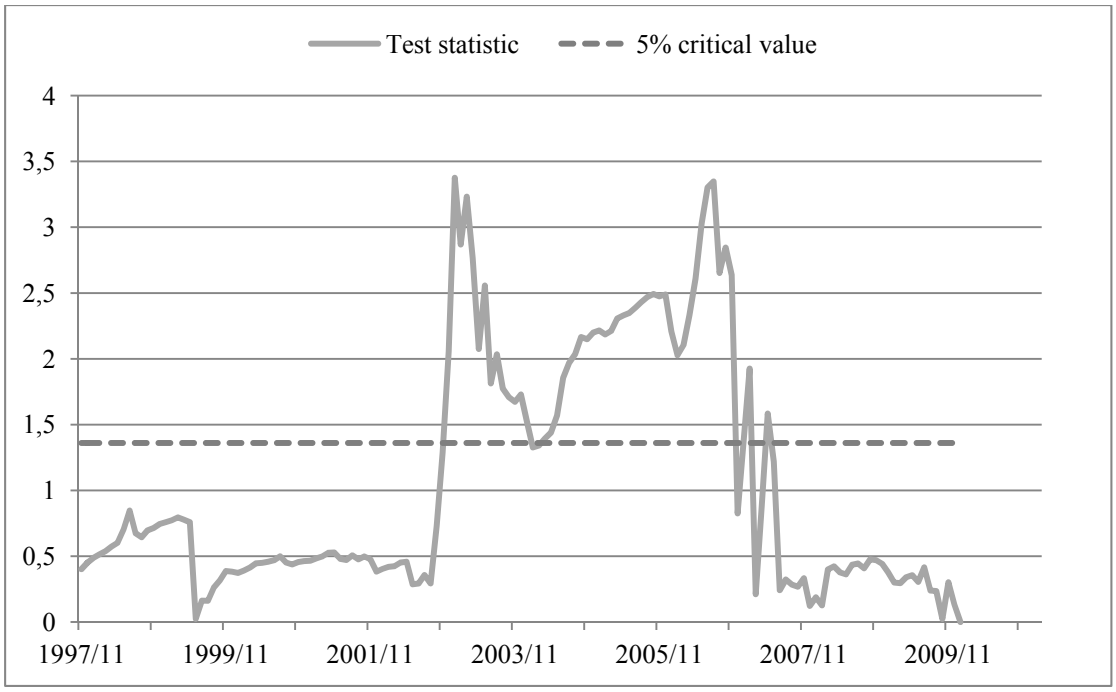

Figure 10: P-values of the Recursive Eigenvalue Test

Source: Authors' calculations.

Note: The lower (upper) dashed line marks the 5% (10%) significance level.

6 Discussion and Conclusions

The importance of organic production in the agricultural sector has increased considerably during the last two decades. During the 1990s the organic sector used to be quite autonomous. Today many supermarkets and discounters offer organic and conventional food. Therefore, an increasing share of supermarkets and discounters in the organic sector is likely to lead to a closer link between organic and conventional prices. Especially the market entry of discounters could affect the pricing of organic products. Hence, the economic analysis of this area of production is attracting growing interest. One issue not well examined is the linkages and interdependencies between the markets of organically and conventionally produced, that is, varieties of one commodity which differ by quality. We approach this question by assessing the integration between producer prices of organic and conventional wheat since it represents an important product in both spheres. We analyze monthly price series data between 1997 and 2011 for Germany which boasts one of the largest organic sectors within the European Union.

The analysis is carried out by means of cointegration analysis, that is, the estimation of a vector error correction model considering the two price series. With respect to the transformation

in the organic and conventional sector, we search for evidences for structural changes. We assume that an increasing share of supermarkets and discounters in the organic sector play a considerable role and lead to a closer link between organic and conventional prices.

We find the two series to possess unit roots and obtain strong evidence that they are cointegrated. Hence, we conclude that both markets are integrated. According to this result the markets of organic and conventional wheat share a long-run price equilibrium and it can be assumed that price information between both markets is indeed exchanged. Furthermore, it can be argued that at least one producer price responds to a short term shock. In the following step we estimated a vector error correction model of the two price series. As expected, it is the organic price which adjusts to price disequilibria while the conventional price does not respond to disequilibria. This finding is plausible since organic grain production is small and, hence, the organic market does not influence the trading behavior of conventional traders. Several further analyses carried out confirm the crucial role of the conventional wheat price for price formation of both wheat varieties while the organic wheat price does not exert a significant influence. The applied stability tests strongly point to non-constant model parameters and suggest that the structural relationships might have changed during the 15 years. This is explained by the considerable changes in the organic sector in this time. One of the most important changes is the market entry of supermarkets and discounters. Since 1997 supermarkets and discounters were able to double their market share. We also introduced the presumption that the market entry of discounters could have an impact on the price formation process for organic products, because this form of retail is characterized by lowest prices. At least, we can confirm this assumption at the producer level with the results of the stability tests.

In 2006/2007 the prices of conventional and organic wheat were reached an all-time price peak followed by a harsh price decrease in 2008. The demand for raw materials used for bio-energy was identified by MITCHELL (2008) as one of the factors that might have been responsible for the price peak in 2007. BRÜMMER et al. (2008) analyzed the fundamental factors which caused the price peak and found that although bio-ethanol had an influence on world grain prices, it was not the crucial determinant for this rise. Nevertheless, the future the bio-energy market will have an influence on agricultural commodity prices, since a lot of industrial and transforming countries have decided to increase the use of bio-energy by means of supporting policies. In Germany fuel must be mixed with biodiesel and bio-ethanol and energy

produced by biogas-plants is supported due to the Renewable Energy Act[8] (BRÜMMER et al. 2008). Other EU countries have similar policies, which are summarized and coordinated by the EU 'Biomass Action Plan' (EUROPEAN COMMISSION 2005). These policies will increase the production of bio-energy and the use of grains, and thereby also increase the demand for grains on national and EU markets (ISERMEYER and ZIMMER 2006). We conclude that the current bio-energy market can be regarded as a new safety net of the domestic EU agricultural market, which is also the case for organic production. If prices for organic wheat are low and there does not seem to be demand for organic grain, organic farmers tend to sell their grain to conventional traders for conventional prices.

In periods of increasing prices on conventional markets as observed in 2006/07, traders of organic agricultural commodities tend to follow the general market trend and increase prices for organic products too. This might happen in order to avoid an increased demand for organic products due to a decreasing price gap between both sectors or to benefit from general market developments. In the opposite case, when conventional prices fall and organic prices do not, as observed in 2008, there is no incentive for organic traders to decrease prices. Organic farmers tend to sell then their grain to traders in the market of conventional product. Alternatively, they might sell to bio-energy producers, who are interested in buying commodities regardless of their quality. It might be interesting to include such factors into the analysis of price transmission between organic and conventional wheat in future research. Therefore, we suspect that asymmetric price behavior might be a crucial issue in price formation and price interdependencies. The analysis of the transmission of price signals and further information between organic and conventional markets is thus an area in which research efforts might advance the understanding of the linkages between both markets.

We find that prices of the conventional market play a considerable role in the price formation of organic products while the opposite case does not hold. However, due to the asymmetric substitutability between the organic and conventional wheat varieties, such an asymmetric relationship appears to be plausible. Furthermore, stability and residual tests as well as the market context hint towards a nonlinear data generation process. More sophisticated cointegration models might hence be a promising area for further research. A suitable model

[8] The German renewable energy act supports the biogas by means of an increased electricity price, which has to be paid by the energy companies, who run the regional electricity grid.

class for capturing these characteristics might be regime switching models as, e.g., in BRÜMMER et al. (2009) or BUSSE et al. (2012). They relax the implicit assumption of constant parameters and are capable to model alternating regimes of price transmission. One possible reason for non-constant parameters is a change of market conditions (KROLZIG 2002). As mentioned above a number of relevant changes occurred in the conditions of both markets.

References

AMI (2010a). *AMI Marktbilanz Getreide, Ölsaaten Futtermittel*. Bonn: Agrarmarkt Informations-Gesellschaft mbh.

AMI (2010b). *AMI Marktbilanz Öko-Landbau 2010.* Bonn: Agrarmarkt Informations-Gesellschaft mbH.

AMI (2011a). *AMI Marktbilanz Getreide, Ölsaaten Futtermittel 2011*. Bonn: Agrarmarkt Informations-Gesellschaft mbh.

AMI (2011b). *AMI Marktbilanz Öko-Landbau 2011.* Bonn: Agrarmarkt Informationsgesellschaft mbH (AMI).

Artavia, M.; Deppermann, A.; Filler, G.; Grethe, H.; Häger, A. Kirschke, D. and M. Odening (2010). *Ertrags- und Preisstabilität auf Agrarmärkten in Deutschland und der EU: Betriebswirtschaftliche und agrarpolitische Implikationen*. In: Rentenbank, Auswirkungen der Finanzkrise und volatiler Märkte auf die Agrarwirtschaft. Frankfurt am Main: Edmund Rehwinkel-Stiftung der Rentenbank: 53-87.

BÖLW (2008). *Biowachstum hält unvermindert an – Rohstoffversorgung bleibt Hauptproblem*, press-release in February 21, 2008, Berlin, Bund Ökologische Lebensmittelwirtschaft (BÖLW).

BÖLW (2011). *Zahen, Daten, Fakten: Die Bio-Branche 2011*, Bund Ökologische Lebensmittelwirtschaft (BÖLW), Berlin. Available at: http://www.boelw.de/uploads/media/pdf/Dokumentation/Zahlen__Daten__Fakten/ZDF2011.pdf. Accessed in October 2011.

Brümmer, B. (2008). *Ursachen der aktuellen Preisentwicklungen und die Perspektiven der Lebensmittelnachrage*. In: Lokkumer Protokolle 04/ 08: Mehr als nur ein Strohfeuer? Der Boom auf den Agrarmärkten und die Folgen für die Agrarpolitik. Ed.: J. Lange. Rehburg-Loccum: Evangelische Akademie Loccum: 11-27.

Busse, S., B. Brümmer and R. Ihle (2012). Price Formation in the German Biodiesel Supply Chain: A Markov-switching Vector Error Correction Modeling Approach. Agricultural Economics (accepted).

Dienel, W. (2000). Organisationsprobleme im Ökomarketing – eine transaktionskostentheoretische Analyse im Absatzkanal konventioneller Lebensmittel, Dissertation, Münster-Hiltrup, Landwirtschaftsverlag.

European Commission (2005). *Biomass action plan.* Document of the European commission no SEK (2005) 1573, Brussels.

Fackler, P. L. and B. K. Goodwin (2001). *Spatial Price Analysis*. In: Handbook of Agriculture Economics, Vol. 1, Ed.: Garder, B. and G. Rausser. Amsterdam: Elsevier Science B. V.: 971-1024.

Frühschütz, L. (2010): *Bio-Höhenflüge im LEH vorbei*, Biohandel, issue 6, p.10-15.

Gesellschaft für Konsumforschung (GfK) (2009). *Bio-Produkte leicht rückgängig*. Pressrelease on August 7, 2009, Available at: http://www.gfk.com/imperia/md/content/presse/070809_bio-produkte_dfin.pdf. Accessed in March 2011.

Gonzalez- Rivera, G. and S. M. Helfand (2001). *The Extent, Pattern, and Degree of Market Integration: A Multivariate Approach for the Brazilian Rice Market*. American Journal of Agricultural Economics 83: 576-592.

Hackl, P. (2005). Einführung in die Ökonometrie. Pearson Verlag. München.

Hamm, U. (2000). *Der Markt für Öko-Lebensmittel – Ein lohnenswertes Betätigungsfeld für Marktforscher und Marketing-Experten*. Agrarwirtschaft 49, 8, p. 277-279.

Hamm, U. (2007). *Wird Bio-Ware knapp? –Pro.* Biohandel, March 2007, p. 5.

HLPE (2011). Price volatility and food security. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2011.

Honacker, J., G. King and M. Blackwell (2009). *AMELIA II. A Programm for Missing Data*. Version 1.2- 13, August 12.

Institut für ökologische Wirtschaftsforschung (IÖW) (2007). *Regionale Bio-Vermarktung in Berlin-Brandenburg Potenziale und Perspektiven im selbstständigen Lebensmitteleinzelhandel (SEH).* Berlin IÖW. Available at: http://www.bio-berlin-brandenburg.de/fileadmin/Bilder/Rubriken/Projektvielfalt/Regionale_Bio-Vermarktung_Berlin-Brandenburg__screen_.pdf. Accessed in October 2011.

Isermeyer, F. and Y. Zimmer (2006). *Thesen zur Bioenergie- Politik in Deutschland*. Braunschweig: Bundesforschungsanstalt für Landwirtschaft,

Krolzig, H.- M. (2006), *Regime- Switching Models*, Department of Economics and Nuffield College, University of Oxford.

Latacz-Lohmann, U. and C. Foster (1997). *From "niche" to "mainstream" – strategies for marketing organic food in Germany and the UK*, British food journal 99/8 (1997): 285-282.

Lütkepohl, H. and M. Krätzig (2004). Applied Time Series Econometrics. Cambridge University Press. Camebridge

Meyer, J. (2004). *Methoden zur Analyse von Preistransmissionsprozessen*. Dissertation, Georg-August-Universität Göttingen.

Meyer, J., and S. von Cramon-Taubadel (2004). *Asymmetric Price Transmission: A Survey.* Agricultural Economics 50: 581-611.

Michelsen, J., U. Hamm, E. Wynen and E. Roth (1999). *The european Market for Organic Products: Growth and Development*, Organic farming in Europe: Economics and Policy, Vol. 7, Stuttgart, University Stuttgart-Hohenheim.

Nieberg, H. and H. Kuhnert (2006). *Förderung des ökologischen Landbaus in Deutschland: Stand, Entwicklung und internationale Perspektiven*. Landbauforschung Völkenrode, special issue 295 (2006), pp. 1-236.

Niessen, J. and U. Hamm (2006). *Tiefenanalyse der realisierten Nachfrage nach Öko-Lebensmitteln auf der Basis von Paneldaten*, research report for the federal research-program for organic farming, document no. 03OE274, University of Kassel. Available at: http://www.orgprints.org/10394/. Accessed in February 2011.

OECD (2010). *Agricultural Policies in OECD Countries at a Glance 2010*. Paris: Organization for Economic Co-Operation and Development (OECD).

Ökolandbau.de (2010). *Biohandelsmarken*. Website from July 27, 2010. Available at: http://www.oekolandbau.de/verbraucher/kaufen/bio-im-supermarkt/biohandelsmarken/. Accessed in October 2011.

Oppermann, R. (2001). Ökologischer Landbau am Scheideweg. Dissertation at the Technical University Braunschweig, Agrarsoziale Gesellschaft, Göttingen

Organic Trade Association (2010). Food Facts. Available at: http://www.ota.com/organic/mt/food.html . Accessed in Feburary 2012

Organic Trade Association (2011). U.S. Organic Industry Overview. Available at: http://www.ota.com/pics/documents/2011OrganicIndustrySurvey.pdf . Accessed in February 2012

Parzen, E. (1962). *On Estimation of a Probability Density Function and Mode*. Annals of Mathematical Statistics, 33(3): 1065-1076.

Rentenbank (2010). *Auswirkungen der Finanzkrise und volatiler Märkte auf die Agrarwirtschaft.* Frankfurt am Main: Edmund Rehwinkel- Stiftung der Rentenbank.

Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements IFOAM (2011). Organic Agricultural Land (In-Conversion and Fully Converted) by Region 1999-2009. Organic-World.net, maintained by FiBL, Frick, Switzerland. Available at: http://www.organic-world.net/statistics-data-tables-excel.html?&L=0#c6167 . Accessed in February 2012

Rippin, M. and U. Hamm (2007). *Umsatzsteigerung für Öko-Lebensmittel bei fast 20%.* In: ZMP Ökomarkt-Forum, Nr. 29, 20. July 2007.

Rotner- Schobesberger, B., Darnhofer, I., Somsook, S. and C. R. Vogl (2008). Consumer perceptions of organic foods in Bankok, Thailand. Food Policy 33 (2008): 112 -121

Sahota, A. (2010) The Global Market for Organic Food and Drink. In: Willer, H. and Kilcher, L. (Eds.) (2010) *The World of Organic Agriculture - Statistics and Emerging Trends 2010*. IFOAM, Bonn, and FiBL, Frick: 54 - 58Schaack, D. (2007). *Umsatz wächst schneller als Produktion*. Ökomarkt Forum, No. 45, November 09, 2007, p.2/3.

Willer, H. and L. Kilcher (2012). The World of Organic Agriculture – Statistics and Emerging Trends 2012. IFOAM, Bonn and FiBL, Frick

World Bank (2009). *Eastern Africa: A Study of the regional Maize Market and Marketing Costs*. Report No. 49831- AFR. Washington: The World Bank.

Zenner, S. and Wirthgen, B. (2002). *Das Ökoprüfzeichen – Warum war eine erfolgreiche Einführung nicht möglich?* Berichte über Landwirtschaft, 80, 1, p. 5-39

ZMP (1999). *Strukturdaten zum ökologischen Landbau.* Zentrale Markt und Preisberichtsstelle, Bonn

ZMP (2000). *Bioprodukte im Einzelhandel – Verfügbarkeit, Marken, Preise*. Zentrale Markt- und Preisberichtsstelle Gmbh, Bonn.

ZMP [a]. *Marktbilanz Getreide, Ölsaaten, Futtermittel.* Issues 1996-2007. Bonn: Zentrale Markt- und Preisberichtstelle für Erzeugnisse der Land-, Forst- und Ernährungswirtschaft GmbH.

ZMP [b]. *Verkaufspreise im ökologischen Landbau.* Issues 1995-1997. Bonn: Zentrale Markt- und Preisberichtstelle für Erzeugnisse der Land-, Forst- und Ernährungswirtschaft GmbH.

ZMP [c] (2008). CD- ROM: *Ökomarkt Jahrbuch-Verkaufspreise im ökologischen Landbau.* Bonn: Zentrale Markt- und Preisberichtstelle für Erzeugnisse der Land-, Forst- und Ernährungswirtschaft GmbH.

ZMP [d]. Ökomarkt Jahrbuch - Verkaufspreise im ökologischen Landbau. Issues 2000- 2006. Bonn: Zentrale Markt- und Preisberichtstelle für Erzeugnisse der Land-, Forst- und Ernährungswirtschaft GmbH.

Newspaper Articles:

Der Spiegel, August 5, 2009, *Deutsche zeigen Öko- Müdigkeit*, available at: http://www.spiegel.de/wirtschaft/0,1518,druck-640627,00.html, Accessed in 26.10.2011.

Die Tageszeitung, August 3, 2009, *Bio-Markt bricht ein*, available at: http://www.taz.de/!38529/ Accessed in 26.10.2011.

Die Tageszeitung, August 4, 2009, p.3, *Öko nicht mehr im Trend*

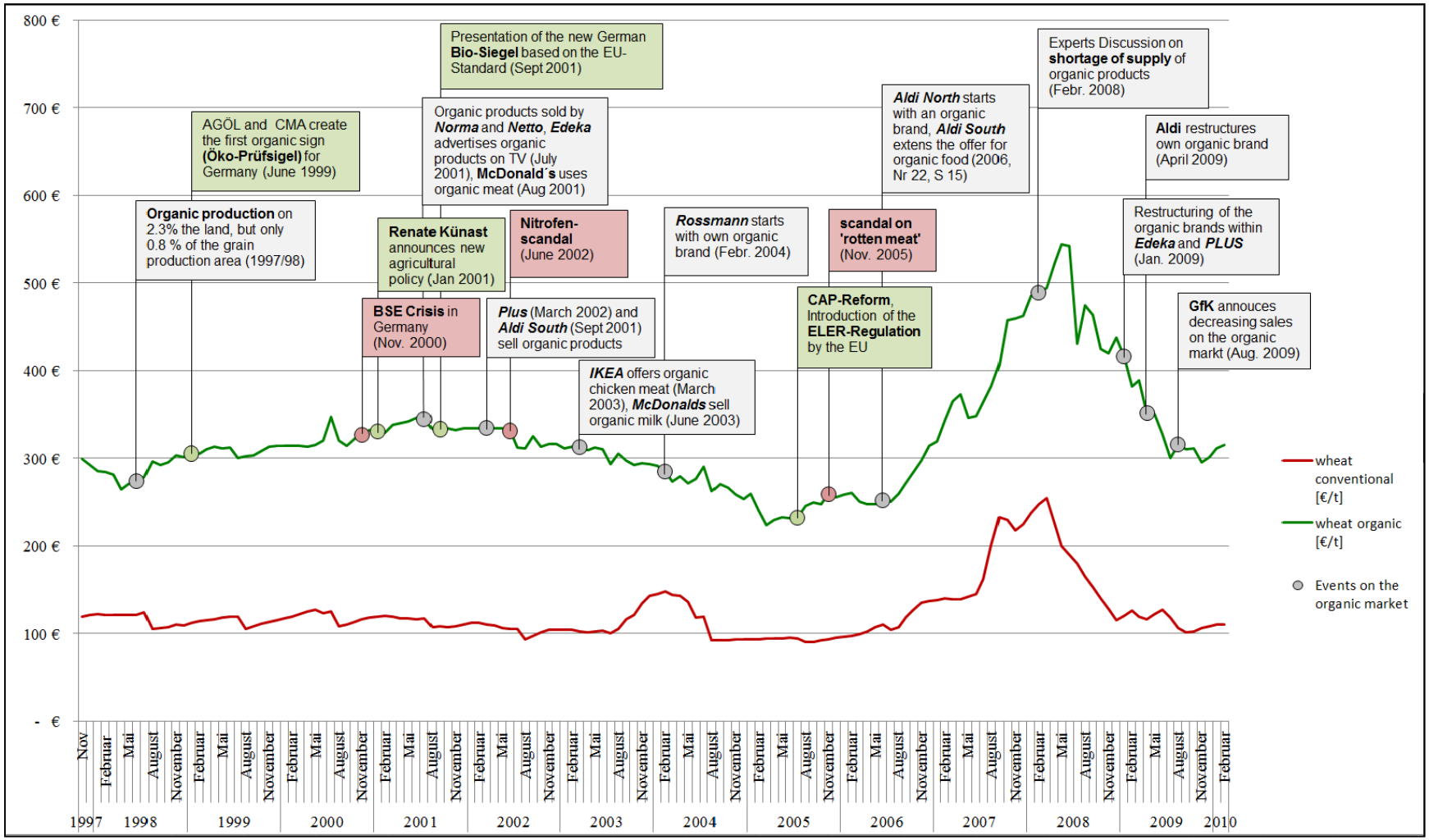

Figure 11: Main events on the organic markets between 1997 and 2010

Source: Authors' elaboration

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1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Professuren mit folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

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