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THE IMPACT OF THE EUROPEAN UNION'S INTERVENTION SYSTEM ON THE HUNGARIAN MAIZE AND WHEAT MARKET

titled dissertation (Phd)

THESIS BOOK

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1. THE IMPORTANCE AND TOPICALITY OF THE ISSUE

During my research I was looking for an answer to the question, that how did the EU grain intervention system affect Hungary, especially looking at the prices, as well as how could the producers participate in the intervention.

Hungary's grain industry (especially wheat and maize production) of 3 million hectares (Ministry of Agriculture and Rural Development, 2009) and with a yield of approximately 14 million tons of grain (Central Statistics Agency, 2009) is small on a world scale, but it is a medium-sized market player in the EU-27. It has a predominant role in the agriculture of Hungary reaching 27 and 26% of the value of agricultural output in 2004 and 2005 (Central Statistics Agency, 2009). Considering that various industries (animal husbandry, milk- and meat industry, milling industry etc.) build on the grain industry, changes in the grain industry have a multiplying effect on other sectors as well.

The EU's grain intervention scheme has been applied since 2004, following Hungary's accession to the EU. In accordance with the grain industry's major significance in agriculture regulation of the industry is of high priority in the Common Agricultural Policy of the EU. One of the principles of market regime is the intervention buying of grain. The objective of intervention schemes is to stabilize the grain market as well as to provide an approporiate standard of living for agricultural producers of the grain industry. Significant quantities of grain are withrawn from the market provisionally, and sold after the discontinuance of market disorders. Intervention prices are announced by the EU. Farmers can offer their grain without any limit if the market price falls below the intervention price. Intervention prices announced for a long period of time have a significant impact on the internal market prices (www.euvonal.hu; MVH announcement).

Between 2004 and 2006, in the first two years after the introduction of the EU's grain intervention scheme, the intervention prices announced by the EU were above the average internal market prices in Hungary. As a consequence, over 7 million tons of grain were bought for intervention in these two financial years. Intervention complemented by direct payments has made domestic grain production a lot safer as compared to the accession to the EU.

At the same time, as a consequence of enlargement, the EU was facing the problem of financing the management of intervention grain – primarily maize – stocks of a quantity, which laid a burden on the community. Furthermore the EU believed, that the huge maize stocks (the total of EU maize stocks were 2.4 million tons in 2005, of which 1.96 million tons were stored in Hungary, and in 2006, 5 million tons from the EU's 5.56 million tons were stored in the country) can negatively affect the stability of the maize market.

Although the EU will keep operating the intervention system in the 2014-2020 budget period, it is also considering to end the measures for grain intervention purchases, in addition to the restrictions imposed. A strategy needs to be worked out, in order to define the way of the cereal sector when the intervention system will not serve as a safety net.

2. AIM OF THE RESEARCH, HYPOTHESISES

The basic objective of my research is the evaluation and analysis of the influence of EU´s cereal interventional system on Hungary.

During my research I´m looking for answers to following questions:

To evaluate the EU´s wheat and maize intervention and to find adequate proposals for the future regulation, it must be defined, which factors do influence the cereal trade respectively the market prices.

The pricing of the local wheat and maize will sighted from a lot of parties: from the producers, from the trader and from the end users of cereals such as the mills and refiner. The most of them rate the future prices based on the quantity of the harvest and constitute her buying or selling stragegy based on these facts. In fact the market price for wheat and maize do only partly depend from the quantity of the produced harcest. After the accessing to the EU the local hungarian price will determinate by the world market price. To detect the existant market correlations I start to found the answers to following questions:

Market price trends for wheat and maize and presentation of the variability.
Following the basic exploratory analysis, what can be said about some of the basic variables?
How to predict the market prices for wheat and maize?

In order to develop a buying/selling strategy based on supply and demand prices I will try to make a model which helps price estimation. The aim is for the producers to be able to predict more safely when to sell their produce.

1. *Hypothesis: A model can be define to predict market price movements of wheat and maize on the Hungarian market.*

How did the EU grain intervention system affect the domestic market prices of wheat and maize?

By Hungary's admission to the EU, the EU's grain intervention system was introduced, the fixed priced buying-in, where a 101.31 EUR/t purchase price have been guaranteed by the EU. Hereby, the system doesn't let the prices fall below the intervention level.

The prices of the domestic market could have been affected by Hungary's accession to the European Union, the EU regulations themselves, and also by the interest of protecting the EU. Introducing the EU's intervention system, the market price of grain became more predictable. As the price of the wheat and maize (meeting the EU quality requirements) can not fall below 101.31 EUR/t, it can be assumed that the minimum prices will be higher than before the introduction of the EU intervention.

To answer this question, both the monthly avaerage prices throughout the year, and the annual average price will be taken into account.

2. *Hypothesis: Following Hungary's EU admission, the volatility of the domestic market price of wheat and maize decreased, and the minimum prices are at a higher level due to the intervention system.*

Who are the beneficaries of the grain intervention buying-in?

In the grain market the increase of prices is the farmer's interest, while fall in prices favours the vendors. Using market intervention for price stablization mainly privileges the farmers, but serves also the vendors and end users by providing a predictable market environment.

Without further analysis of data I imply, that the larger proportion of cereals offerings was made by the vendors, rather than the farmers, as thes mall farmers seemingly could not guarantee the solid, homogeneous quality measure, provided by the intervention regulations, also most of the farmers were not able to undertake the huge administrative load generated by the intervention system. Market participants' involvement in grain intervention also depends on the fact whether they have storage capacity or not, and if they can finance the four month-long storaging period between the offering and the actual buying-in. Storage capacity owners got their yield transferred in place (in-situ), while participants without storage capacity got their yield transferred via delivery.

Hypothesis: The grain intervention measures will increase the sales security of the producers.

Did the storage methods change since the introduction of EU intervention?

In 2004 and 2005, the available storage capacities proved to be scarce in the course of intervention buying-in, therefore investments were made to enlarge storage capacities. Considering the fact that agricultural farmers are significantly exposed, all efforts have to be made to decrease their exposure. In Hungary, enormous storage capacities have been established, storage capacities have increased from 12 million tons to 16 million tons. As a consequence, farmers' exposure has decreased as compared to the previous term, and their bargaining power has also improved.

3. *Hypothesis: Intervention storage capacities create potential bargaining position for the producers.*

Is there a difference between counties and regions regarding the sales of the intervention stocks?

Given that Hungary is one of the EU Member States, which has no sea port, transportation costs make the sale of grain more expensive and difficult. Sales of intervention stocks for export can only happen based on Commission Regulations. In order to be possible in all Memeber States to carry out the export on an equal footing, the EU will pay the shipping costs to a point when an export exit point available at the lowest cost (seaport).

The question is, whether there is a notable difference in the storaged intervention stocks sales prices in Hungary. Hence I analyze the following hypothesis:

4. *Hypothesis: The grain producers of the areas being further away from export transport routes are in a more disadvantageous situation.*

What are the future prospects of the intervention system, following the 2014. CAP reform?

The ongoing changes in the global market made the EU intervention system's reform mandatory. The question of developing a proper intervention system arises: how to make a system, which can serve as a safety net, but is not dependant on subsidized sales (whether it's internal or external). I'm looking for an anwer to this as well in my analysis.

The European Commission has taken a position to keep the intervention system but with less responsibility. The detailed elaboration of the future form of intervention has not happened, yet, thus I'm making suggestion in my dissertation regarding the issue.

3. RESEARCH METHODS

By chosing the topic of the thesis I attempt to showcase a very important measure of the EU's agricultural provisions, the grain intervention, which determined the operation of the grain sector in the past few years.

Based on the literature and satistical data, I presented the world's, EU's and Hungary's grain market characteristics, regarding supply, demand and trade. Following this, I tried to find out, how the different agricultural policy aims relate to the market regulation methods regarding price regulations, and if there is a need to stabilize prices on governmental level. There's a great division among experts regarding this question. In the next part of the thesis I introduced the pre-accession and post-accession intervention measures.

During the analysis I highlighted the cereals offered with most significance to Hungary: common wheat and maize.

3.1. USED DATA, DATABASE

The analysis consists of secondary data collection and processing, detailed below.

In order to present the world's, EU's and Hungary'sgrain market I collected the statistical data needed from FAOSTAT, EUROSTAT, IGC, OECD, KSH, MNB, AKI, FVM/VM. For the introduction of the intervention system I mainly used the AIK/ARDA database.

During the analysis I highlighted the cereals offered with most significance to Hungary: common wheat and maize.

For the analyses I used the ARDA database of buying-in, storaging and selling (regarding years 2004/2005, 2010/2011), also the „Brussels price information" published in the AKI Market Price Information System, as well as the global market and petroleum prices provided by AKI.

3.2. DATA ANALYSIS METHODS

Using Microsoft Excel, I systematized the data obtained from the databases, and then plotted it to transparently present the trends and changes. I explored the correlation between factors using statistics methods with the help of Microsoft Excel, IBM SPSS Statistics, Eviews7 programs, following the instructions of Sajtos and associates (2007) and Ramanathan (2003).

- Comparative analysis of the pre- and post-accession situation
- Making model calculations.
- Formulation of conclusions to the decision makers, regarding the special aspects and future prospects of grain intervention.

The databases, datas, methods used for analysis were reviewed based on the hypothesises I made earlier.

3.3.1. MARKET PRICE FORECAST FOR WHEAT AND MAIZE

Research target is do define a model for the market price performance for the hungarian wheat and maize, which model relieve the selling and buying decisions for the market operators.

Database:
For the modelling used data are collected from the period January 1998 to April 2011. All price data were calculated in HUF in consideration of the actual valid foreign exchange rates.

1. Market price: AKII market price information system (following: PAIR) database: https://pair.akii.hu;
2. World market price: Mexican Bay FOB price http://www.indexmundi.com/; I used the Mexican Bay price equal to the World Market price, because the major quantity of maize will embark in the Mexican Bay.
3. Crude oil price: http://www.oil-price.net/?gclid=CLCsuODsq6gCFVUj3wodQ0C8HQ;
4. Harvest quantity: AKII database
5. EUR/HUF price: by the EKB defined price.
6. Area based subvention: MVH internal database.
   Even thogh the area based subvention is calculated per hectare I´ve also calculate the subvention in the scale unit tons for the area dimensions and harvest averages. For one hectare calculated subvention increase each year with 5%.
7. Buying-in price: MHV internal database.
   During the research the real payed interventional net aquisition price was defined as the aquisition price. The data were researched from the period November 2004 to April 2011.

Analysis method:
By the definition of the applicable price forecast model for the hungarian wheat and maize at first I tried to use the stepweis regression, but whose insertion was bad and the parameters were also in disagreement to the assumptions. Additional I´ve detected an extreme multiple collinearity and therefor I´ve tried to use the ARMA model. In consideration of the non constant distribution of the wheat and maize results and because in the ARMA model the conditional distribution in the time is constant it was necessary to introduce the GARCH process which correlate to a conditionally parameterised ARCH(∞) model.

3.3.2. THE EU GRAIN INTERVENTION SYSTEM'S AFFECT ON THE MARKET PRICE OF WHEAT AND MAIZE IN HUNGARY

The target of the research was to confirm the assumption, that with the introduction of the EU´s interventional system the local market price volatility decrease. Based on the fact that the installed system make sure that the interventional price for wheat and maize do not underprice the 101.31 EUR/ton, it is to assume that the minimal prices should be higher as in the time before the EU accession. To clarify this assumption I did continue my analysis and research as following described.

Database:

In order that the reference analysis is symmetric I analysed the six years before and after the hungarian accession to the EU according to the local market price (following: market price) and the world market price. Due to this fact I´m looking for the data from the period January 1998 to March 2011. All price data were changed to HUF or EUR considering the actual valid foreign exchange rate.

1 Market price: AKII market price information system (following: PAIR) database: https://pair.akii.hu;
2 EUR/HUF price: by the EKB defined price
3 Intervention price: 101,31 EUR/ton

Analysis method:

The calculation model for testing the price fluctuations was carried out according to the following: Price fluctuation analysis: I have examined, whether the amplitude of price fluctuationshas been reduced by the introduction of EU intervention measures. Subsequently I compared the evolution of market prices to the 101.31 EUR/ton intervention price. During the analysis between years I compared the range of prices, while during the yearly analysis I compared the negative and positive deviations from the intervention price, analyzing whether there is a significant difference between them.

3.3.3. BENEFICIARIES OF THE CEREAL INTERVENTION AQUISITION

During the adaptation of the EU's intervention system, the ministry made some serious effort to determine the conditionalities in a way, so that the hungarian farmers or at least the large-scale producers can take part in the intervention system directly. To this end, the minimum offering quantity had been set to 80 tonnes.

My assumption in that the conditionalities were favouring the producers in vain, as most of the cereals was sold by the vendors (to the producers).

The aim of the analysis is to define the participation rate of vendors and farmers in the intervention buying-in of cereals.

Database:

1. Intervention buying-in data: ARDA internal database
2. Data of intervention sales: ARDA internal database
3. Area based subvention: MVH internal database.

Analysis method:
The data from several database were prepared and arranged via Microsoft Excel, than for screening of changes and tendencies they were illustrated by graphs.

Because the interventional aquisition period is between November 1. and May 31. I did the reasearch by fiscal years, so both involved years were described.

1. Specifying producers and vendors in the buying-in database:

Given the above, I am assuming, that the offerer of cereals:
a) who recieved area-based payment, is the **producer**
b) who is a natural person and during the sales of grain intervention stocks bought goods over 5000 tons of weight, is the **vendor**.

It may also happen, that the producer produces the cereals personally, that's why I examined the overlap between the two categories: if the common part
a) is less than 10%, there's no need for a separate category,
b) is over 10%, the third category should be created (the **producer-vendor**).

I also examined the area not fitting into either category: if the common part
a) is less, than 10%, no separate category is needed for the comparison
b) is over 10%, a fourth category should be created (**not a producer and also not a vendor**).

2. Specifying the involvement of producers and vendors in the intervention buying-in

I would like to find out, that in which proportion have the producers participated in the buying-in of intervention cereals.

Regarding the categories specified above I observed the changes of numbers of participants and the offered amount for each cereal. During the headcount it's important to feature a registration number only once, as the applicants were allowed to make several offers, but in terms of the analysis, they are vendors, producers or producers-vendors only once.

The data were presented by graphs: the number of participants and the offered quantities were also analysed on fiscal year, on cereal brand and on summary basis.

3.3.4. CHANGES IN STORAGE, DUE TO THE INTRODUCTION OF EU'S INTERVENTION SYSTEM

During my research, I have tried to find out whether there is any correlation between the way the offered grain is delivered and that of the offerer is a producer or vendor. My assumption is that a higher proportion of producers are using delivery, while the vendors will sell their grain in-situ. I assumed, that larger proportion of the vendors has storage capacities, and resources required for the storage of grain are more available. I also examine if due to the expanding storage capacities there is a change in the method of delivery, so did the newly established storage capacities reduce the vulnerability of producers.

Database:
I used the following databases for my analysises:

1. Data of intervention buying-in: ARDA internal database
2. Data of intervention sales: ARDA internal database
3. Data of AVOP aid payments: ARDA internal database

Analysis method:

Given the fact, that the intervention buying-in period is between November 1 and May 31, the analysis was conducted on a yearly basis, so thus when indicating economic years, both years are represented.

I have considered if there is any connection with the storag method that a vendor or producer offered the crop. I conducted analyses by financial year, taking into account the three offerer groups which were designated in the previous section (producer, vendor, producer-vendor).

3.3.5. SALES OF INTERVENTION STOCKS

Given that Hungary is one of the EU Member States, which has no sea port, transportation costs make the sale of grain more expensive and difficult. Sales of intervention stocks for export can only happen based on Commission Regulations. In order to be possible in all Memeber States to carry out the export on an equal footing, the EU will pay the shipping costs to a point when an export exit point available at the lowest cost (seaport). In my analysis

I will examine, whether the distance to the export transport route adversely affects the grain producers in Hungary, or not. I presume that at the areas being further away from the export transport routes, the bid price can be up to 10 euros/tonne lower than at the areas closer to the route.

Databases:
I used the following databases for my analysises:

Data of intervention buying-in: ARDA internal database
Data of intervention sales: ARDA internal database
Data of intervention storages/stocks: ARDA internal database

Analysis methods:

I reviewed the sales by year and type, finally comparing the sales volume and bid prices by region. I used the classification below for regions (Table 1.).

1. Table: NUTS 2. level Regions

County	Region	County	Region
Borsod-Abaúj-Zemplén	Észak-Magyarország (Northern Hungary)	Veszprém	Közép-Dunántúl (Central Transdanubia)
Szabolcs-Szatmár-Bereg		Komárom-Esztergom	
Nógrád		Fejér	
Hajdú-Bihar	Észak-Alföld (North Great Plain)	Zala	Nyugat-Dunántúl (Western Transdanubia)
Jász-Nagykun-Szolnok		Vas	
Heves		Győr-Moson-Sopron	
Békés	Dél-Alföld (South Great Plain)	Somogy	Dél-Dunántúl (Southern Transdanubia)
Csongrád		Tolna	
Bács-Kiskun		Baranya	
Főváros és Pest	Közép-Magyarország (Central Hungary)	-	

Source: Regulation (EC) No 1059/2003 of the European Parliament and of the Council

4. CONCLUSIONS, SUGGESTIONS

4.1. MARKET PRICE FORECAST FOR WHEAT AND MAIZE

How to predict the market prices for wheat and maize?
Hypothesis: A model can be define to predict market price movements of wheat and maize on the Hungarian market.

I set up a GARCH (1,1) model on the basis of results, which fits very well, and serves as a price prediction tool for domestic market price of wheat:

$$Yt= 30123.96+1.022517*Yt-1+\varepsilon+0.182353\varepsilon(t-1)$$
$$GARCH=97623902+ 0.123467*\varepsilon^2(t-1)-0.997702\sigma^2 (t-1)$$

I set up a GARCH (0,3) model on the basis of results, which fits very well, and serves as a price prediction tool for domestic market price of maize:

$$Yt= 42571.83+ 0.982295*Yt-1+\varepsilon+ 0.185554*\varepsilon(t-1)$$
$$GARCH= 65284433-1.003803\sigma^2*(t-1)-0.983242*\sigma^2 (t-2)-0.969621*\sigma^2 (t-3)$$

Short description of the models above:
The usual ARMA models can not catch the volatility and the clustering due to volatility (heteroskedasticity), so models need to be built in a way to take this into account, and therefore more accurate image of the price changes can be given. Of course this kind of attribute needs to be tested first (ARCH test by Engler).

The ARMA model can be generally noted down in the following way:

Where:
are the autoregressive components
is the error component
are the MA components

It's a condition used at linear models, that the error components should be non-autocorrelated and homoskedastic, also the explanatory variables need to be independent and exogenous. Another strong criteria is that when using ARMA models the scatter needs to be permanent, this model is about stationary processes. Using ARCH models, this criteria is lifted, thus the error components do not need to have a constant scatter.

The error component can be noted down using the following formula:
where follows iid distribution.

In case of GARCH(p,q) „p" stands for the series of conditional variances/number of delays (GARCH components), „q" stand for the numbers of delays of (ARCH components).

Based on the above, a model can be set up to predict the wheat and maize price movements in Hungary, using the GARCH model.

Creating prediction models is of great importance, as it can help the market participants making their choices by facilitating the development of buying and selling strategies.

4.2. THE EU GRAIN INTERVENTION SYSTEM'S AFFECT ON THE MARKET PRICE OF WHEAT AND MAIZE IN HUNGARY

How did the EU grain intervention system affect the domestic market prices of wheat and maize?
Hypothesis: Following Hungary's EU admission, the volatility of the domestic market price of wheat and maize decreased, and the minimum prices are at a higher level due to the intervention system.

Examining the market price range of what and maize the results showed, that in the years after the EU accession, when the intervention worked, the market price range was smaller. Thus the assumption, that the introduction of the EU's intervention system decreases the domestic market price volatility, is correct.

Second half of my assumption is correct as well, based on the results: as the intervention system won't let the price of wheat and maize (intervention quality) fall below 101.31 EUR/t, the minimum prices will be higher, than prior to the introduction of EU intervention. In the period following the accession, the wheat and maize produced by small farmers and the stocks which could not meet the intervention requirements have been forced out of the intervention.

Based on the above, further operation of the intervention system is recommended, in order to stabilize market prices. When stating Hungary's position on the issue, and creating the national measures it is worth to note that the intervention measures can be a good way to strenghten price stabilization.

4.3. BENEFICIARIES OF THE CEREAL INTERVENTION AQUISITION

Who are the beneficaries of the grain intervention buying-in?
Hypothesis: The grain intervention measures will increase the sales security of the producers.

During the entire examined period (between 2004-2011) 5238 operators participated in the intervention buying-in. I conducted my analysis based on 3 categories (producer, vendor and producer-vendor).

The results have proven my hypothesis, that the intervention measures had a positive impact on the producers. According to the results, a higher rate of producers than the vendors participated in the intervention grain buying-in, regarding quantities as well, but regarding the quantity sold per offerer, an average of nearly 40% higher volume has been sold by the vendors, as the producers. Participation of more than 50% of the producers of intervention measures prove that they could use the opportunities of buying-in.

The farmers could enter the system by smaller offerings (over 80 tonnes), and they have done so, which proves that the intervention system protects the farmers. It is very important that, contrary to the previous domestic practice in the EU intervention system the intervention price is announced prior to the sowing, therefore the EU guarantees that if operators wish to sell their cereals at this price point, it will be bought. This guaranteed price makes the market more predictable, reducing the vulnerability of farmers.

4.4. CHANGES IN STORAGE, DUE TO THE INTRODUCTION OF EU'S INTERVENTION SYSTEM

Did the storage methods change since the introduction of EU intervention?
Hypothesis: Intervention storage capacities create potential bargaining position for the producers.

At the beginning of intervention buying-in, grain was predominantly procured in situ (on site), whereas the proportion of grain delivered to intervention storage facilities has increased in the subsequent following years. There is no significant difference in the behaviour of market participants regarding the deliveries during marketing years.

The reason for the large proportion of buying grain in situ was that the available storage space was insufficient to store the enormous quantity of yield in the country. One of the reasons resulting in this situation was that the requirements for intervention storages established by the MARD were unreasonable as compared to the technical conditions of the available storage facilities. Consequently, storage facilities appropriate for grain storage could not participate in the intervention scheme, which resulted in a temporary, artificial shortage of storage space.

As a result of rationalizing the requirements for storage facilities, the significantly lower levels of yields, the storage building program, and the sales of substantial quantities of intervention stocks solved the storage capacity problems in the subsequent financial years.

Farmers' exposure to traders, storage operators and integrators has decreased due to the fact that as a result of the storage improvement program, new storage capacities could be established as well as existing out-of-date storage facilities could be refurbished and modernized. As a result, the storage base owned by the farmers has improved, the established storage capacities have decreased farmers' exposure. Considering the fact, that the requirements of intervention storage were stricter than those applied for grain storage previously, taking part in the intervention scheme has provided an advantage for producers in the storage industry as compared to traditional storage. Intervention storage capacities create potential bargaining position for the producers.

4.5. SALES OF INTERVENTION STOCKS

Is there a difference between counties and regions regarding the sales of the intervention stocks?
Hypothesis: The grain producers of the areas being further away from export transport routes are in a more disadvantageous situation.

The results have proven my hypothesis. The difference between the lowest and highest bid price was more than 10 EUR/tne. It can be seen, that at the areas being further away from the export transport routes, the average bid price was lower, despite the EU transport cost reimbursement.

Given that Hungary is one of the EU Member States, which has no seaport, transportation costs make the sale of grain more expensive and difficult. Although the EU will pay the shipping costs to a point when an export exit point available at the lowest cost (seaport), but the freight costs in Hungary still appear in the bid offers.

From the above, it can be seen that the bid differences are present mainly due to the logistically disadvantaged storage places and export complicating factors. Hungary's rail network is out of date, most of the warehouses do not have a wagon-laying technology and industrial railtrack. The backbone road network is underdeveloped and is not prepared to move larger amounts of grain. Water transport is the cheapest, but the majority of the warehouses is located nowhere near ports, making road transport necessary, increasing freight costs.

Taking into account the above, it is recommended to establish logistics centers, which can ensure the temporary storage of cereals, as well as they participate in the grain transit traffic by securing loading capacities from road to ship or from railway to ship and assisting various administrative tasks (eg. Food health services).

4.6. THE FUTURE PROSPECTS OF THE INTERVENTION SYSTEM

What are the future prospects of the intervention system, following the 2014. CAP reform?

It was presented earlier, that between 2004-2011 Hungary bought-in and storaged significant amounts of intervention stocks, however by the end of 2011 the stocks will apparently reduce to zero, and there are no expected buying-ins in the marketing year 2011/2012.

During the creation of 2013 CAP there are sever options to choose from, but all of them require considerable resoursec from the EU and the Member States. The EU's intervention system has been significantly transformed quite a few times in the recent past (e.g. stricter quality criterias were introduced, EU did not open the buying-in for maize, rather introducing a bidding system). The intervention system will be kept by the EU after 2014 as well, but I think by transferring more responsibility to the market participants, thus the system is expected to change accordingly.

I worked out five proposals on how to regulate the area, which was covered by grain intervention measures in the past.

1. restoring the original intervention system (without any quantity restrictions)
2. adjustments to the current system
3. standardizing an improved private storage system as a market regulation tool, rather than the intervention
4. abolishing all grain market regulations
5. other solutions

For Hungary, maybe a combined system would be the best solution, including the possibilities of private storage and the corrected version of the current system. Thereby, it would establish a system, which can serve as a safety net, but is not dependant on subsidized sales.

5. NEW AND INNOVATIVE SCIENTIFIC RESULTS - THESISES

I. Thesis: a model can be set up, which helps to predict the Hungarian market's wheat and maize price movements.

Wheat: I set up a GARCH (1,1) model, which fits very well, and serves as a price prediction tool for domestic market price of wheat:

$$\mathbf{Yt= 30123.96+1.022517*Yt-1+\varepsilon+0.182353\varepsilon(t-1)}$$
$$\mathbf{GARCH=97623902+ 0.123467*\varepsilon^2(t-1)-0.997702\sigma^2\ (t-1)}$$

Maize: I set up a GARCH (0,3) model, which fits very well, and serves as a price prediction tool for domestic market price of maize:

$$\mathbf{Yt= 42571.83+ 0.982295*Yt-1+\varepsilon+ 0.185554*\varepsilon(t-1)}$$
$$\mathbf{GARCH= 65284433-1.003803\sigma^2*(t-1)-0.983242*\sigma^2\ (t-2)-0.969621*\sigma^2\ (t-3)}$$

Short description of the models above:

The ARMA model can be generally noted down in the following way:

Where:
are the autoregressive components
is the error component
are the MA components

It's a condition used at linear models, that the error components should be non-autocorrelated and homoskedastic, also the explanatory variables need to be independent and exogenous. Another strong criteria is that when using ARMA models the scatter needs to be permanent, this model is about stationary processes. Using ARCH models, this criteria is lifted, thus the error components do not need to have a constant scatter.

The error component can be noted down using the following formula:
where follows iid distribution (Independent and identically distributed).

In case of GARCH(p,q) „p" stands for the series of conditional variances/number of delays (GARCH components), „q" stand for the numbers of delays of (ARCH components).

Creating prediction models is of great importance, as it can help the market participants making their choices by facilitating the development of buying and selling strategies.

II. Thesis: Following the EU admission, the relative volatility of wheat and maize domestic prices has decreased, and the minimum price level is higher due to the operation of the intervention system.

III. Thesis: The grain intervention measures will increase the sales security of the producers. Participation of more than 50% of the producers of intervention measures prove that they could use the opportunities of buying-in.

IV. Thesis: Farmers' exposure to traders, storage operators and integrators has decreased due to the fact that as a result of the storage improvement program, new storage capacities could be established as well as existing out-of-date storage facilities could be refurbished and modernized. As a result, the storage base owned by the farmers has improved, the established storage capacities have decreased farmers' exposure. Considering the fact, that the requirements of intervention storage were stricter than those applied for grain storage previously, taking part in the intervention scheme has provided an advantage for producers in the storage industry as compared to traditional storage. Intervention storage capacities create potential bargaining position for the producers.

V. Thesis: The grain producers of the areas being further away from export transport routes are in a more disadvantageous situation. At these areas, the average bid price was up to 10 EUR/t lower, despite the EU's transport cost reimbursement.

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