Acta oeconomica et informatica 2
Nitra, Slovaca Universitas Agriculturae Nitriae, 2012, s. 29–38

MAPPING AREAS FOR POLICY EVALUATION: AN ANALYSIS OF RURAL HUNGARY

MAPOVANIE OBLASTÍ PRE HODNOTENIE POLITÍK: ANALÝZA RURÁLNEHO MAĎARSKA

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The paper provides an analysis of the effect of the EU membership on the agricultural and rural counties of Hungary, paying particular attention to the introduction of the CAP and Cohesion Policy. Moving from the mixed case study approach introduced for the evaluation of Rural Development policies, Hungarian rural areas are mapped using multivariate statistical methodologies (principal components analysis and cluster analysis) on a set of relevant variables periodically updated and available at a disaggregated level. Comparing the Hungarian rural counties in 2003 and 2007, a divergence between the expected objectives of the EU membership and the actual outcome emerges, with rural areas by far the worse off. Marginalization increased in lagging behind counties, such as Nógrád, confirming the presence of winning and losing regions as a result of the enlargement. Moreover, this study highlights the limits imposed by lacking national statistical sources on the quality of statistical analysis, and on the possibilities to undertake further evaluations of the EU accession experiences.

Key words: agricultural and RD policy evaluation, transition, policy targeting, EU enlargement

Over the last decade, policy monitoring and evaluation surged to the attention of the European agenda, according to the internal and external challenges the European Union (EU) had to face:

- the effects of the current international financial crisis, which deeply affected the EU economies;
- the possible enlargement to the economic and political instable Western Balkans: Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, Montenegro and Serbia, and Kosovo under UNSC Resolution 1244/99, all showing a lower level of development in comparison with EU average;
- the evaluation of the Common Agricultural Policy (CAP) and Cohesion policy after the historical Eastern enlargements to ten countries from Central and Eastern Europe.

In particular, the "return to Europe" of the new member States (NMSs) was characterized by the troubled heritage of 20 years of outstanding transition: lower GDP per capita; higher share of the agricultural sector on the economy in comparison with the EU average; increase in regional inequality (Lackerbauer, 2004), mainly driven by the persisting backwardness of agricultural and rural areas. The EU membership offered them opportunities as well as challenges, given the typology and intensity of interventions required to catch up. At the same time, a redistribution of the EU budget from former beneficiaries to the NMSs was introduced to finance the Cohesion policy and the CAP, because at the time of the EU membership, all the regions of the NMSs belonged to the Convergence area, being their GDP p.c. lower than 75 % of EU average. Several discussions among the former EU members accompanied the current programming period budget, and claims for policy-renationalization in sensitive sectors, also caused by the fear of losing a large amount of the EU funds (Viesti et al., 2004). Therefore, in order to gather support for prosecution of the enlargement strategy, the European Commission awaited successful results from the evaluation of the first five years of EU membership (EC, 2009). However, these results did not happen, particularly in countries where the agricultural sector still plays an important role and drives the process of internal divergence within the EU (Monasterolo, 2008).

Considerable progress was made in assessing the impact of policies on agricultural and rural areas, and numerous indicators were introduced to evaluate the CAP and Rural Development Policies (RDPs) and their contribution to the convergence. Despite this, deficiencies remained in institutional planning and implementing abilities, together with an insufficient level of targeting policies and payments (Mantino, 2010). Amongst other reasons, previous analysis (Monasterolo, 2010) on several case studies from Central and Eastern European States (CEEs) highlighted a limited knowledge on the local reality in the areas for which the intervention was prescribed. The characteristics of the most backward areas were insufficiently analysed and addressed by the policies enacted (Csáki, 2009), and limited data availability and accountability at a sub-regional level presented an obstacle. This is particularly the case of the agricultural and rural areas in the NMSs, where the highest percentage of poverty is located (Bertolini et al., 2008): there the policies introduced barely addressed the specific problems of the composite European reality (Csáki et al., 2010).

Material and methods

Objective of the paper

Previous evaluations of RDPs introduction into EU rural areas such as the experience of Emilia Romagna, one of the most advanced EU regions in planning regional and rural policies for convergence and development, evidenced the importance of mapping the territory. This statistical technique is useful in identifying rural areas and their evolving characteristics, and therefore in drafting better policies addressing the needs of a specific territory. Mapping allows us to introduce new modes of classification, focused on the regional and local reality, which

can contribute towards the increase of the policy effectiveness, decrease of the resource dispersion (economic, physical, human), and reaching efficient results in the medium to long term.

Therefore, the objective of this paper is to:

- provide an updated overview of the methodologies used for the identification of rural areas, and to introduce an improved methodology;
- assess the transition path for agricultural and rural development in Hungary and the need for change; compare it with the answers offered by the European membership (pre-accession instruments, cohesion programs and the peculiarities of CAP introduction).
- contribute to the evaluation of the EU membership. Looking at the mixed case study approach (Terluin et al., 2011) as an evaluation alternative, changes occurred before (2003) and after (2007) the EU membership are mapped at the county level in Hungary, using multivariate statistics. The specific area's structural, dynamic socio-economic and agricultural characteristics are considered when selecting relevant variables;
- understand whether the implementation of these reforms reveals a persistent discrepancy with the goal of eliminating regional inequality, a stated objective of the European policy of cohesion (Article 158 of the Treaty establishing the European Community).

Contextualization

In search for a shared definition of rurality

Rural Development (RD) was not a priority in the EU policies for a long time, and remained overshadowed by strong CAP price support. From 1975 onwards, since the first structured interventions in the EU for mountainous and disadvantages areas were enacted, rural areas were provided partial, insufficiently funded and scarcely coordinated provisions. Only after Agenda 2000, RD was endowed with its own Fund, and become the second CAP pillar. RD policy monitoring and evaluation gained importance, and several indicators were introduced. However, the improvement in availability and comparability of relevant statistics proceeded at a much slower pace.

Several attempts were made by sociologists and economists to define rurality, focusing on the determinants of localization of economic activities. Examples can be found in the theory of growth poles (Perroux, 1955), the centre--periphery model (Friedman, 1972), the cumulative causation (Kaldor, 1970) and, more recently, the new economic geography (Krugman, 1991). All these approaches view rural areas as dependent, or residual from urban ones (Bertolini et al., 2008). Every European country has its own definition of rurality, influenced by the national perception of the elements that characterize rural areas, and affected by the difficulties in providing reliable disaggregated data.

Internationally, the most used methodology was proposed by OECD (OECD, 1994; 2005), which classifies regions (NUTS3 level) in three groups – Predominantly Urban (PU), Intermediate Rural (IR), and Predominantly Rural (PR) – according to three criteria which mainly rely on population density. Appealing features of this classification method are the simplicity in its application, in interpreting the results and their comparability between States. Its application presents several limits: according to the OECD classification (which is also adopted by the EU), PR represent 54 % of the territory (reaching 91 % together with IR), and 19 % of the population (EC, 2009). Then, OECD classification doesn't consider the historical and developmental characteristics of different regions (i.e. productive structure, specialization, etc), nor the natural influence of the presence of mountainous areas, deserts, and semi-Nordic areas on population density. Finally, it doesn't catch the heterogeneous development pattern: within the same country it is possible to identify winning (rich) or losing (poorer), agricultural based (agriculture plays still a main role in rural areas, EC, 2008) or services-oriented rural regions (Bertolini, 2009). In order to overcome these limitations, with the growing availability of indicators at sub-regional level new contributions were proposed. Based on the results of two Italian projects (the National Atlas of Rural Areas by CAIRE and Ministry of Agriculture, and the territorial agricultural systems by CNR-RAISA), a new geographical analysis of agricultural systems and rural areas was introduced by Anania and Tarsitanio in 1995, then applied to Emilia Romagna (Boccafogli et al., 1998), and used for drafting the Italian Regional Plan for Rural Development 2000 – 2006. It consists of 49 indicators available at the municipality level, divided into 4 groups and analysed through multivariate analysis:

- indicators of the structure of the economy;
- indicators of the structure of agriculture;
- indicators of the demographic structure;
- indicators of the dynamic changes.

The main advantage is represented by the possibility to identify disparities and similarities between rural areas (which emerge as a part of the dynamic changes in the economic system) belonging to the same Province, Region or Nation, and to monitor their evolution over the years.

Recently, an adjusted definition of rurality was provided by Bertolini and Montanari in 2008: it considers population density, but also introduces the concept of adjusted density 100 ab.km^{-2} (calculated as total population – population belonging to the main inhabited centre of the area in km^2) and the role of occupation in agriculture on the national average at the NUTS3 level. This approach allows us to understand if the population of a region is gathered in one town or is more equally distributed; the relevance of the primary sector on the regional and rural economy; to correct the overestimation of rurality in countries presenting few large urban centres (i.e. Ireland, Slovenia) produced by the OECD methodology.

Also, the EU has developed a revised rural-urban typology (EUROSTAT, 2010) to avoid the spatial problem represented by NUTS3 regions that are too small (<500 km^2), and the size-discrepancies between LAU2 and NUTS3. It follows OECD methodology in that it is centred on population density (population grid) and it can easily be reproduced in countries outside the EU for comparability. It is composed of a two-step approach to identifying population in urban areas:

1. population density threshold (300 ab.km^{-2}) for grid cells of 1 km^2;
2. a minimum size threshold (5 000 ab.) applied to grouped grid cells above the density threshold.

Results are, so far, not very satisfactory: this methodology classifies 68 % of EU 27 population as living in urban areas and 32 % in rural ones (5 % points higher than the original OECD definition).

Hungarian agricultural and rural areas in transition toward the EU

Hungary has been selected for a case study due to its diffused rurality (96 % of the territory according to the OECD is rural and

58 % prevalently rural) and the historical role played by agriculture, both under the Austro-Hungarian Empire and under the Socialist system. At that time, agriculture was integrated into the planned economy and considered dependent from the cities, which were invested in heavy industrialization plans.

Hungarian agriculture was a "bright spot" in the declining Communist economic system. The country was an important producer and exporter of agri-food products. The agricultural sector was the second largest contributor to the State budget in 1980; it received a low level of public support in comparison with the other ex-satellite States, and offered subsistence to thousands of farmers. The sector was also interested in the introduction of embryonic forms of market (following Lange's market socialism), which determined the full functioning of the collective system, i.e. exchange channels which allowed some private products to be sold on the public market, moving away from simple self-consumption of overproduction (Kornai, 1986). Agriculture, including processing, trade and other industrial activities on large farms, produced 17 % of GDP and employed about the same percentage of the labour force. However, since the 1990s these proportions fell, reaching 3.7 % and 4.5 % respectively in 2008 (Table 1). Nor could agriculture oppose the evident default of a system based on distorted incentives, which characterized the years of the Soviet Union (Anderson et al., 2008), affecting rural regions the most: 45 % of unemployed people lived in villages, especially in the undeveloped Eastern parts of the country. They were mainly unskilled labour previously employed in the cooperative farms and in big state companies.

The transition path toward a market economy was characterized by declining investments and productivity (some indicators were calculated in a different way before the system change, i.e. MNP for GDP, and data accountability was scarce) also due to the end of soft budget constraint (Kornai, 1980) and the disruption of the terms of trade for producers, which was caused by the loss of the former common market (Macours et al., 2000). Moreover, inequality in living conditions spread, leaving a winner and two losers: the capital and the main cities belonging to the first group, and rural areas and Eastern peripheries to the second (Iara et al., 2003).

Looking for the optimal and successful transition path (EBRD, 1997; WB, 1997), two main approaches emerged: big bang versus gradualism (Sachs et al., 1994; Roland, 2000). According to the relevant literature (Csáki et al, 2004; Liefert et al., 2002; Swinnen, 2006), reform of the agricultural systems of the transition economies has involved four main elements: market liberalization, farm restructuring, change in upstream and downstream operations, and the creation of market-friendly infrastructures. Market liberalization could foster farm restructuring, introducing new profit opportunities for farmers. Reformed supply and distribution chains could ameliorate the productive performance of participants to the food chain. Finally, modern institutions and services could help introducing clear property rights, enforcing contracts, and solving disputes.

Figure 1 Hungarian Regions
Source: KSH
Obrázok 1 Regióny Maďarska
Zdroj: KSH

Supporters of the shock therapy (the big bang approach promoted by the World Bank) asserted that the success of the reforms was deeply influenced by its timing. Therefore, all the necessary interventions had to be introduced at the same – and for the shortest – time. In the CEEs, these reforms were introduced at a different pace, and with different results, as evidenced by the World Bank (WB, 2002) which marked Hungary as the 'best reforming performer' with 8.8 points up to 10, followed by the Czech Republic and Estonia. However, this result wasn't confirmed over the years: even by 2003, right before gaining EU membership, several problems remained unsolved (Table 1). After an initial fall, the share of agriculture in GDP reached 4.3 %, while investments showed contrasting trend, rising to 6.1 % of GDP in 2003, and then declining. Today, 83 % of 9 303 000 hectares which constitute Hungary is used for agriculture, and the sector still maintained a relevant role in recent years, in comparison with EU 15 countries. In 2008, the agricultural population (all persons depending for their livelihood on agriculture, hunting, fishing, or forestry, FAO) accounted for 10.1 % of the total population of circa 10 million people, and 4.5 % of the total workforce was employed in the agricultural sector (Table 1).

The main agricultural areas of the country are Western Transdanubia, Northern and Southern Great Plains (Figure 1). In 2008, arable land covered about 6 m hectares, with 1.1 m hectares in permanent pasture. Production is concentrated in three sectors: arable crops (cereals, maize, soft wheat) and oil seeds; horticulture; animal breeding. All these sectors have been influenced by the change in agricultural policy during the

Table 1 Share of agricultural and agri-food industry on the Hungarian economy

Years (1)	Share of agriculture in (2)			Share of food industry in (3)		
	employment (4)	GDP (5)	investments (6)	employment (4)	GDP (5)	investments (6)
2003	5.5	4.3	6.1	3.9	2.7	3.6
2007	4.7	3.4	3.7	3.4	2.0	3.2
2008	4.5	3.7	4.7	3.3	1.9	2.5

Source: own elaborations on KSH data Zdroj: vlastné spracovanie údajov KSH

Tabuľka 1 Podiel poľnohospodárskeho a potravinárskeho priemyslu na maďarskej ekonomike
(1) roky, (2) podiel poľnohospodárstva na, (3) podiel potravinárstva na, (4) zamestnanosť, (5) HDP, (6) investácie

Table 2 Number of animals (thousand) and land area used by categories (thousand hectares), 1990 – 2005

	Arable land (1)	Agricultural area (2)	Productive land (3)	Uncultivated land (4)	Cattle (5)	Pigs (6)	Horses (7)	Sheep (8)
1990	4 712.8	6 473.1	8 235.7	1 067.5	1 637	8 457	76	1 865
2000	4 499.8	5 853.9	7 715.5	1 587.5	805	4 834	75	1 129
2005	4 513.2	5 863.9	7 734.8	1 568.6	723	4 059	67	1 397

Source: own elaborations on KSH data Zdroj: vlastné spracovanie údajov KSH

Tabuľka 2 Počty zvierat (v tisícoch kusov) a výmera pôdy podľa kategórie pôdy v tisícoch hektárov, 1990 – 2005
(1) orná pôda, (2) poľnohospodárska pôda, (3) produktívna pôda, (4) necultivovaná pôda, (5) hovädzí dobytok, (6) prasatá, (7) kone, (8) ovce

transition period, and achieved very different results: while crop cultivations increased notably, horticulture and animal breeding (especially pigs) dropped (Table 2).

A new identification of rural areas for better policy evaluation

Paragraph 2 shows the characteristics, and limits, of the methodologies used for the identification of rural areas. According to the application of the OECD classification to Hungary, just one county (Budapest) can be classified as PU, while 47 % of the territory emerges as PR. Different results are obtained applying the Adjusted Rurality methodology, where three counties are classified as PU (Budapest, Pest, Komárom Esztergom) and just 28 % of the territory as PR.

Therefore, this approach is applied to get two maps of Hungary. A group of 43 socio-economic-demographic and agricultural variables, which are available periodically at a county level (NUTS3) for the years 2003 and 2007, are used. The level of disaggregation NUTS3 – which doesn't allow us to mark the internal distribution of the phenomena analysed, and the presence of polycentrism – was chosen due to the lack of data at the municipality level. The variables were listed according to their relevance in shaping the evolving trend of rural areas, coherently with the EU Common Monitoring and Evaluation Framework (CMEF), with the last findings on the determinants of wealth gaps among the EU regions (EC High-Level Policy Roundtable on Human Capital in Cities and Regions), and with the new CAP visions (i.e. diversification and environment sustainability). Six variables relevant to agricultural productivity and quality of life – topography; youth unemployment rate; long term unemployment rate; number of patents; private and public funds invested in R&D; people in top business positions – were included.

The variables were listed in four groups in order to ease the interpretation of results:

1. economic and supply structure: they offer an image of the economic and productive system of the area, paying particular attention to the employment structure;
2. structural indicators for agriculture, considering the productive characteristics of the sector;
3. socio-demographic structure, to monitor the evolution of the population bearing in mind its age structure and cultural characteristics;
4. economic dynamism: indicators reflecting the dynamism of the productive system. It facilitates the analysis of the fluxes of the structural components in the agricultural sector and in the employment structure, within the national macroeconomic framework.

Principal components analysis (PCA) was applied to the selected variables. PCA is a methodology belonging to multivariate statistics which doesn't require strong assumptions on the model. Therefore, it is able to work in situations were available data and their quality are far from optimal. Moreover, it has been widely used for similar analyses (Cannata, 1998; Fanfani et al. 1999; Bogdanov, 2007; Monasterolo et al., 2010). With PCA a group of p indicators, obtained on a group of n statistical units, is transformed into a smaller group of variables, which are still able to explain a high percentage of the original data variability, to avoid important loss of information (Mazzocchi, 2008). While at the beginning of the process the indicators are highly correlated, the transformed variables we obtain (principal components, PCs), which are a linear combination of the original indicators, are uncorrelated. The PCs are computed on the correlation matrix, in order to avoid the distorting influence of different measurement units (and hence different variance scales) across indicators. The values of the components are obtained from the component matrix (components are not rotated) and the scores of every statistical unit (county) are computed for each component.

The k principal component scores of the selected components ($k < p$) comes from the following linear combinations, expressed as a matrix:

$$Y = XA \quad (1)$$

where:

- Y – the nxk matrix, containing the scores of the n statistical units in the k components
- A – the vector matrix pxk of the normalized coefficients
- X – the nxp matrix of the standardized data

The scores of the Y matrix are then used in the cluster analysis (CA) to maximize homogeneity within clusters and heterogeneity between clusters (SPSS automatically provide standardized values, which are used in the cluster analysis). This approach allows us to identify and group areas with similar features, and describe them through the PCs values.

Application of the principal components analysis and cluster analysis to rural Hungarian counties in 2003

The sample is composed of the 17 PR and IR counties. A principal component analysis (PCA) was conducted on the 46 variables. An initial analysis was run to obtain eigenvalues for each component in the data. Five components had eigenvalues above 1 (Kayser's selection criterion), and the scree plot showed inflexions that would justify retaining either 3 or 5 components. Given the sample size, and the convergence of the scree plot and Kaiser's criterion on five components, the latter number of components was retained in the final analysis. These components explain 75.2 % of the original variance, in line with the Guttman-Kaiser criterion, which suggests PCs explaining 70 – 80 % of cumulative variance.

PC1 – rurality (28 %)

This component gathers the main features of Hungarian rural areas. Positive values are associated with the presence of recipients of social support, dependency ratio, employment in public administration (PA) and in the primary sector; presence of a young population and university students; all the

unemployment indexes; presence of small farms. Coherently, negative values are shown for GDP p.c. and net earnings on the national average; employment rate; the role of secondary sector on employment and GDP; labour productivity in agriculture.

PC2 – agricultural development (16 %)

Positive values are associated overall with the primary sector: its role on GDP and employment (full-time mainly); the presence of larger farms and younger farmers; cereals, maize and pig breeding among the activities; land price and R&D expenditures. Negative values are shown in labour productivity in agriculture; population density and immigration rates; all unemployment indices, in particular long term unemployment.

PC3 – economic development (14 %)

This gathers the developmental features of rural areas: positive values are recorded for population density and population change; GDP p.c. and average earnings; employment in services, value of industrial production and university students. Instead, negative values are associated with long term unemployment; aging index; presence of older farmers; employment in the public administration (PA).

PC4 – emerging rural diversification (10 %)

This identifies areas with natural and agricultural assets (positive land price, cereals and maize, forests and livestock), and a tendency toward economic diversification (presence of tourist accommodations, employment in services, part-time work in agriculture), but persisting unemployment and low salaries.

PC5 – touristic vocation (7 %)

Positive values underline the role of natural attractions (forests, pastures, accommodation, and temporary immigration) and the primary sector in the economy (agricultural and labour productivity in agriculture). Negative values are recorded for long term unemployment, employment in the PA, presence of recipients of social support, average farm size.

The next step was the application of cluster analysis to the 5 PCs. A two-step process was adopted. First, Ward's hierarchical method was applied and a dendogram showing the nesting process was obtained. As hierarchical methods often present problems with data containing a high level of error, the final clustering was obtained by applying non-hierarchical method, the *k-means algorithm*, where *k* stands for the number of clusters chosen to start the process. In fact, this method is faster and more reliable when working with large databases. All the individual observations are assigned to the nearer cluster seed, and the researcher needs to set the initial seeds and specify the number of clusters. Furthermore, reallocation is allowed for in each iteration step.

5 clusters were finally identified:

1 – Deep rurality

This includes two counties (Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg) located at the North-Eastern border of Hungary. In former Communist period they were invested in heavy industrialization, but due to the unsolved structural problems during transition they now show high unemployment rates (+30 %, youth unemployment +50 %), presence of recipients of social support and employment in PA (+60 % and +20 %), low GDP p.c. (-30 %), in comparison with the national average. The secondary sector still plays a relevant role (thanks to the delocalization of multinational companies i.e. GE and Borsch, mainly in the food industry, manufacturing, chemical and metallurgy), while agriculture is lagging behind (farm size is the half of the national average, as full-time work in agriculture).

Figure 2 Hungarian rural Counties, 2003
Source: KSH
Legend: cluster 1: Borsod-Abaúj-Szemplén, Szabolcs-Szatmár-Bereg; cluster 2: Somogy, Tolna, Baranya; cluster 3: Fejér, Veszprém, Zala, Vas, Győr-Moson-Sopron; cluster 4: Békés, Csongrád, Bács-Kiskun, Jász-Nagykun-Szolnok, Hajdú-Bihar; cluster 5: Heves, Nógrád

Obrázok 2 Vidiecke župy Maďarska 2003
Zdroj: KSH

2 – Potential rurality

This identifies the Southern Transdanubia Region (Baranya, Somogy, Tolna), characterized by a positive PC2 due to the role of the primary sector (9 % of GDP, +20 %), with maize as main cultivation (+40 %); high natural endowments (Lake Balaton, vineyards); good services, infrastructures, and investments, which contribute to economic diversification and tourism (positive PC4 and 5, +30 % accommodation).

3 – Manufacturing sector

This is composed of five counties belonging to Western and Central Transdanubia, with good productive performance and living standards above the national average (+25 % GDP, -80 % long term unemployment). It specializes in manufacturing activities (machine industry, textiles and foods, +30 % value of industrial production), also due to the several foreign companies, especially from Austria and Germany, which invested in the area during transition (Audi, Renault, General Electrics). Moreover, it is rich in historical and natural endowments, which helps diversification (positive PC4 and 5).

4 – Agricultural activity

Composed again of five counties, located in Northern and Southern Great Plain, this is characterized by the role of the primary sector (+30 % on GDP and +22 % of employment in agriculture) and the presence of natural attractions (i.e. the famous Puszta, flood plains, spa water). In this cluster, Debrecen, the second largest Hungarian city and an important national research and university centre (+20 % expenditures in R&D), is located. These features were not able to contribute effectively to area development (-10 % GDP and net earnings, -20 % labour productivity in agriculture).

5 – The backwardness cluster includes Heves and Nógrád (Northern Hungary)

It shows negative values for all the PCs, highlighting problems in the economic (-20 % GDP), social (+20 % recipients of social support, +40 % long term unemployment) and agricultural (prevalence of small farms and old farmers) sectors, which were unsolved and even worsened during the

transition period. These counties were characterized by the presence of mining and chemistry industries, already declining before the system change: now the value of industrial production is twice as low as the national average, and expenditures in R&D and request for patents reach one third of the national average.

Application of Principal Components Analysis and Cluster Analysis to Hungarian rural counties in 2007

In order to understand the changes that occurred in Hungary with European membership, I repeated the same process (PCA and CA) using the same 46 variables on 2007 data, after the end of the first programming period 2004 – 2006 for NMSs.

5 PCs were again identified, explaining 74 % of the original variance:

PC1 – rurality (26 %)

This first component shares the same features of PC1 in 2003, but it shows worse results. Positive values are associated with the presence of recipients of social support; dependency ratio; all the unemployment indices; employment in agriculture and the role of PA. Coherently, negative values are associated to GDP p.c., net earnings and employment rate.

PC2 – age structure (15 %)

Positive values are associated with the presence of young population (youth index, university students, youth unemployment), population change and with the value of industrial production, while negative values are associated with the role of the primary sector on employment and GDP, presence of older farmers and the index of ageing.

PC3 – agricultural productivity (14 %)

This component gathers the performance indices for agriculture. Positive values are associated with occupation (mainly the presence of younger farmers), agricultural productivity, cereals and maize production; investments in R&D and patents, temporary immigration, which show the role of external investments in agriculture in less favoured areas (negative land price).

PC4 – declining agriculture (10 %)

Positive values are recorded for crops, family farming, land price, tourist accommodation and employment in PA. On the other hand, negative values are associated with farm size, farmers' age and full-time work in agriculture, agricultural and labour productivity; relevance of the secondary sector and investments.

PC5 – rural diversification (9 %)

this component is characterized by natural attractions (forests, pastures) and tourism (accommodation, employment and role of the tertiary sector on GDP), positive immigration indices, with part-time and older farmers prevailing in agriculture. Negative values are associated with the secondary sector and the value of industrial production.

Applying the *k-means*, after running the analysis with Ward's method, five clusters were again identified. They differ from the analysis provided for 2003 in composition and values:

1 – Lagging rurality

It gathers three counties located in North-Eastern Hungary which share the features of declining rurality: high rate of recipients of social support (+50 %), high unemployment (+30 %), GDP and net earnings lower than the national average (-15 %), positive demographic balance. Low productive agriculture is mainly conduced at the family level (negative PC3 and positive PC4), with the prevalence of industrial crops.

2 – Agricultural vocation

This is composed of four counties, mainly in Southern Great Plain, showing agricultural vocation (+30 % contribution of primary sector on GDP and +23 % employment, larger farm size, young farmers), high rate of expenditures in R&D (+30 %) and patents (+20 %). The natural attractions could be better exploited for diversification, creating tourism facilities.

3 – Industrial areas

Fejér and Győr-Moson-Sopron, in Central and North-Western Hungary, are the most developed of the counties examined. In fact, they have a high GDP, net earnings and population density (+30 %, +10 % and +20 % respectively), the lowest unemployment rate (-50 %) and employment in PA, a dynamic population. The economy is driven by the secondary sector (highest value of industrial production), while agriculture is conducted in a productive way (larger farms, high labour productivity).

4 – The backward cluster

is composed of just one county, Nógrád, located in Northern Hungary, presenting characteristics of deep rurality and low development perspectives. GDP p.c. is 60 % lower than the national average, long term unemployment and finances spent on social support are high (30 %). Industrial production is still declining, and investments are lagging behind, and no diversification (i.e. tourism) is offered.

5 – Diversification

This is the largest cluster, composed of seven counties on the Southern and Western Hungarian borders. The rich natural, historical, wellness (medicinal and thermal waters) sites and the eco-tourism infrastructure are an important source of attractiveness of this flat and green area, where agriculture is dominantly composed of crops and vineyards, and conducted in quite a productive way. In fact, GDP p.c. and permanent immigration are above the national average, while unemployment indices are considerably low. Apart from the tertiary sector, industry also has a good role in the economy of the area, in the energy, telecommunications and food industry sectors (PannonPower, SMT, Elcoteq, Sió).

Figure 3 Hungarian rural Counties, 2007
Source: KSH
Legend: cluster 1: Borsod-Abaúj-Szemplén, Szabolcs-Szatmár-Bereg, Hajdú-Bihar; cluster 2: Békés, Csongrád, Bács-Kiskun, Jász--Nagykun-Szolnok; cluster 3: Fejér, Győr-Moson-Sopron; cluster 4: Nógrád; cluster 5: Heves, Vas, Zala, Veszprém, Somogy, Tolna, Baranya

Obrázok 3 Vidiecke župy Maďarska, 2007
Zdroj: KSH

Table 3 Variation 2007/2003 (%) for selected variables

	GDP p.c. (1)	Net earnings (2)	Recipients of social support (3)	Long term unemp. (4)	Empl. Rate (5)	Empl. primary sector (6)	Empl. secondary sector (7)	Primary sector on GDP (8)	Secondary Sector on GDP (9)	Part time agri. (10)	Accomodations (11)
Fejér	0.6	1.4	44.9	47.9	-3.4	109.2	1.5	-7.2	10.0	1.8	-2.3
Veszprém	-4.0	-0.7	51.6	47.9	-0.2	117.4	-3.9	14.5	2.7	6.3	-11.6
Gyor-Moson-Sopron	-6.1	1.8	68.2	40.5	2.2	17.5	-1.7	-17.7	10.1	16.3	-0.7
Vas	-11.8	2.2	83.5	40.5	-4.0	89.6	-7.7	66.3	-14.0	13.9	24.3
Zala	-13.9	-0.2	115.5	40.5	5.3	122.0	-14.8	-6.2	-8.3	19.0	2.9
Baranya	-4.1	2.4	25.5	23.4	0.4	8.0	0.9	-8.3	-0.3	12.8	-2.1
Borsod-Abaúj-Zemplén	3.7	1.3	19.7	31.0	1.4	102.2	2.4	-22.2	15.4	3.7	-3.4
Heves	-2.3	2.1	42.1	31.0	-2.3	32.1	1.0	-34.4	11.6	4.6	5.7
Nógrád	-16.9	-0.8	43.4	31.0	-3.7	189.5	-4.2	-16.4	-3.4	4.1	-35.0
Szabolcs-Szatmár-Bereg	-7.1	-0.5	38.8	111.9	-0.7	16.8	-4.7	-11.6	5.8	2.7	-42.3
Somogy	-12.1	1.2	75.2	23.4	-10.4	70.0	-5.3	0.2	-7.9	14.3	-7.7
Tolna	-2.7	1.4	62.0	23.4	-4.1	55.2	2.2	1.5	12.6	7.5	-0.2
Hajdú-Bihar	-7.1	1.0	40.4	111.9	-2.9	32.1	-11.4	7.6	-17.2	10.1	4.6
Jász-Nagykun-Szolnok	-2.1	0.0	65.8	111.9	0.2	113.1	-7.4	20.2	3.7	14.2	4.7
Bács-Kiskun	-3.1	-0.5	73.3	35.6	-2.2	21.2	-9.7	-14.2	4.8	5.5	-26.7
Békés	-6.8	-0.7	59.2	35.6	5.5	30.6	-12.9	21.1	-3.1	13.8	0.6
Csongrád	-4.9	0.9	77.0	35.6	7.9	17.5	-12.3	11.9	5.1	10.2	0.8

Source: own elaborations Zdroj: vlastné spracovanie

Tabuľka 3 Indexová zmena 2007/2003 v % pre vybrané premenné

(1) HDP na obyvateľa, (2) čisté príjmy, (3) príjemcovia sociálnej podpory, (4) dlhodobo nezamestnaní, (5) miera zamestnanosti, (6) zamestanosť v primárnom sektore, (7) zamestnanosť v sekundárnom sektore, (8) HDP na primárny sektor, (9) HDP na sekundárny sektor, (10) čiastočný úväzok v poľnohospodárstve, (11) ubytovania

Results and discussion

Did it succeed? A glance at the 2003 and 2007 results

Analysis of the changes that occurred in the Hungarian rural counties between 2003 and 2007 presented in this paper follows a previous one conducted on all twenty counties, including the urban ones (Monasterolo et al., 2011). Analysis conducted on the whole Hungarian territory evidenced the following changes between 2003 and 2007:

- a decrease in the importance of the components linked to: economic development (positive values recorded for population density and GDP p.c., net earnings, university education, employment in services);
- an increased social and industrial decline (positive values for unemployment, recipients of social support, and high employment rate in the public administration);
- increased role of agriculture (full-time employment in the primary sector, small farms).

At the same time, the CA showed:

- the move from the secondary sector to agriculture in some counties (Zala and Győr-Moson-Sopron), without improvements in the economic performance and living conditions;
- diffusion of phenomenon of marginalization in the counties that are already lagging behind (Nógrád, Szabolcs--Szatmár-Bereg).

Therefore, this analysis confirmed the presence of winning and losing regions from the enlargement: the former group is represented by Budapest (able to attract initiatives in the tertiary sector and finance) and the Western border (a specialized centre for industrial production), while in the Eastern peripheries the socio-economic situation worsened, together with agricultural productivity after the land reform.

The PCA and CA analysis made on Hungarian prevalently and intermediate rural counties shows, partially, similar results. In fact, between 2003 and 2007:

- greater importance is held in the component of rurality (recipients of social support, dependency ratio, employment in PA and in the primary sector; unemployment; small farms);
- the only component related to economic performance in 2003 (population density and population change; GDP p.c. and net earnings; employment in services, value of industrial production and university students) disappears in 2007;
- a greater role is played by agriculture, with both positive (agricultural productivity) and negative (stagnant agriculture) features;
- components of economic diversification have a residual importance.

Cluster analysis in 2003 highlighted the role of rurality, both in its positive (C.2 Potential rurality) and negative features (C.1 Rurality, C.5 Backwardness). Moreover, a clear distinction emerged between counties characterized by agricultural (C.4 Agricultural activity) and manufacturing activities (C.3 Manufacturing sector). On the other hand, cluster analysis on 2007 evidenced the features of declining rurality (C.1 Declining rural area, C.4 Backward), and the decision to diversify activity (C.5 Diversification) in several counties previously concerned with manufacturing and agriculture (ex. C.3 and C.4).

The counties of Vezprém (Central Transdanubia Region), Vas and Zala (Western Transdanubia Region), for example, in 2003 belonged to cluster 3, characterized by manufacturing activities and the secondary sector. But in 2007 the role of the secondary sector in GDP and employment decreased (-7 %, -9 %), as well as GDP p.c. (-10 %), while employment in the primary sector, its contribution to GDP and agricultural productivity increased (+ 111 %, +22 %, +57 %). The number of recipients of social support doubled, and the long-term unemployment rate increased by 42 %.

The county of Heves, included in the cluster Backwardness with Nógrád in 2003, in 2007 joins the cluster Diversification: land price doubled, the amount of tourism accommodations increased (+6 %, +5.7 %), as well as temporary immigration (+28 %) and employment in the primary sector (+32 %), but not its role on GDP (-34 %). Investments in R&D grew by 55 % and the value of industrial production increased by 88 %.

In the same period, the county of Hajdú Bihar moved from the Agricultural activity cluster to the Declining rural area cluster. The number of recipients of social support and long-term unemployment increased (+40 %, +112 %) while GDP p.c and employment rate decreased (-7 %, -3 %). Employment in the primary sector and in PA increased (+32 %, +3 %), as well as part-time agriculture (+10 %) and average farm size (+22 %). Employment in the secondary sector and its role on GDP dropped (-11 %, -17 %).

Finally, Nógrád confirmed in 2007 its position as a most lagging behind county: GDP p.c and employment in the secondary sector decreased (-17 %, -4.2 %), while the number of recipients of social support, ageing index and long term unemployment increased (+43.4 %, +12 % and +31 %).

Some variables play a very important role in the characterization of clusters and their description, both for the years 2003 and 2007, and they are mainly linked to employment, living conditions, and to the primary sector (Table 3).

Conclusions

In this paper, Hungarian rural counties are identified through the application of the Adjusted Rurality methodology, in order to overcome some of the problems left unsolved by the OECD methodology. Ten Hungarian counties up to twenty are classified as intermediate rural, and the remaining seven as predominantly rural. Principal components analysis (PCA) was computed on a controlled dataset of 46 variables to understand the underlying features of the IR and PR areas. The results of the PCA were later utilized in the cluster analysis (CA), which resulted in groups of counties that are homogeneous within themselves and heterogeneous among themselves. The operation was repeated for two years, 2003 and 2007, in order to catch the changes that occurred in Hungarian rural counties after the EU enlargement in 2004, and to provide a preliminary evaluation of EU membership for the country. Five principal components and five clusters were identified both in 2003 and 2007, but presented different characteristics.

This analysis highlights the developmental features that characterize Hungarian rural counties in the long transition path, and their evolution during the introduction of required costly (from a budgetary and social perspective) reforms, CAP and RD policies. The enlargement did not maintain its growth and convergence promises. Negative trends even accentuated, as did the increase in poverty, marginalization, social exclusion, unemployment and subsistence agriculture. Therefore, as already suggested by CSÁKI et al., 2010, the EU cohesion and CAP disbursements were not able to set a strong foundation for the structural transformation required in agricultural and rural areas, decreasing the internal divergence and development gap.

The previous study on all the Hungarian counties for the same period 2003 – 2007 evidenced the decline of the industrial sector and an increased role of agriculture. The analysis conducted just on rural counties partially confirms it: the declining role of industry is true also on the Western border (Vas, Zala, Veszprém), previously characterized by growing secondary and tertiary sectors, and low productive agriculture is expanding, particularly in Eastern Hungary (i.e. Hajdú-Bihar). At the same time, natural and cultural attractiveness of Southern counties could be better valorised, also due to the presence of young and skilled people, and the increased role of the tertiary sector. Then, marginalization increased in the already worse off counties located in the Northern Great Plain and Northern Hungary (Nógrád county in particular).

A serious limitation for the policy impact analysis is represented in the persistent poor statistics. Accountable, disaggregated, and periodically updated data on farm performance, on socio-economic trends and new CAP objectives, together with easier access to information from the national paying agencies at the regional and sub-regional level would contribute to assessment of the role (if any) of an EU value added. Given these statistical limitations, future RD policy evaluations could return better results if conducted using the 'mixed approach' methodology, integrating quantitative analysis into case-study approach. Analysis of data through multivariate methodologies offers results that are easy to be read and to be interpreted by policy makers involved in policy drafting and implementation, and by project managers. In this way, it is possible to overcome the complexity of interpretation of the rural development measures and indicators proposed by the EU (DG Agri counts more than 150 indicators to assess rural development). This point fulfils the need recognized by the EC institutions to better communicate and disseminate results from RD monitoring and evaluation, and for the introduction of more targeted policies. Finally, the methodology applied here helps to understand the developmental characteristics of current EU candidate and pre-candidate countries from Western Balkans, and to avoid the "knowledge gap" (and consequent budget ineffectiveness) experienced during the previous enlargement.

Súhrn

Článok sa zaoberá analýzou efektov členstva v EÚ na poľnohospodárske a vidiecke okresy Maďarska, s dôrazom na zavedenie spoločnej poľnohospodárskej politiky a kohéznej politiky EÚ. Maďarské vidiecke oblasti sú v práci mapované použitím viacrozmernej štatistickej metodológie (analýza hlavných komponentov a zhluková analýza) s využitím relevantných premenných, periodicky aktualizovaných a dostupných na dezagregovanej úrovni. Porovnané boli maďarské vidiecke okresy v rokoch 2003 a 2007. Identifikované boli rozdiely medzi očakávanými cieľmi členstva v EÚ a dosiahnutými výstupmi vidieckych okresov ktorým sa darilo najmenej. Marginálne postavenie zaostávajúcich okresov sa prehĺbilo, napríklad v okrese Nógrád. Potvrdila sa existencia získavajúcich okresov a okresov strácajúcich v dôsledku vstupu Maďarska do EÚ. Článok zdôrazňuje limity kvality štatistickej analýzy v dôsledku chýbajúcich zdrojov v národnej štatistike a možné ďalšie hodnotenie skúseností so vstupom do EÚ.

Kľúčové slová: hodnotenie poľnohospodárskej politiky a politiky rozvoja vidieka, transformácia, cielenie politiky, rozšírenie EÚ

The author gratefully thanks Francesco Pagliacci, Prof. Mario Mazzocchi and Prof. Roberto Fanfani for their useful comments and review of the paper.

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Acta oeconomica et informatica 2
Nitra, Slovaca Universitas Agriculturae Nitriae, 2012, s. 38–42

NON-GOVERNMENTAL ORGANIZATIONS IN RURAL AREAS – A CASE STUDY OF WIR ASSOCIATION

MIMOVLÁDNE ORGANIZÁCIE VO VIDIECKYCH OBLASTIACH – PRÍPADOVÁ ŠTÚDIA ASOCIÁCIE WIR

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Non-governmental organizations usually operate in cities. This tendency results from the fact that the larger the population, the easier it is for organizations to find members. It is also influenced by accumulation of social problems in urban areas, which those organizations may attempt to solve. It does not mean, however, that rural areas lack active people who want to work towards common good. This article describes Polish non-urban organizations and presents a unique initiative called WIR Association (wir = whirl), which has gathered local administration, non-governmental organizations as well as entrepreneurs.

Key words: activity barriers, associations, bureaucracy, European funds, Leader Plus, local action group

Non-governmental organizations (NGO) in Poland started growing dynamically after 1989, though some of them existed much earlier (such as the Polish Red Cross). NGOs reflect the existence of civil society and people's belief in their ability to co-create social reality. The NGO category (referred to as creators of the so-called '3rd sector of economy') usually includes associations and foundations, but it may also encompass a variety of relations or e.g. social cooperatives. The activities of Polish NGOs are regulated by a few legal acts, mainly 1) The Association Act, which states that an association is a voluntary, autonomous and lasting organization operating on a non-profit basis whose activities mostly include civil, non-profit work of their members; 2) The Foundation Act, which regulates the establishment and operations of foundations; they may be founded by either a natural or a legal person; 3) The common Good and Voluntary Work Act, which states that an NGO cannot be an enterprise operating in a public finance domain for profit.

When listing the basic characteristics of NGOs, it must be remembered that:

1. It cannot be founded by a governmental entity (it can be established by a natural person or market entities).
2. It focuses on non-profit goals (although it may run business activity).
3. It is, as a rule, financed from non-public funds.

Polish NGOs usually focus their activities on sport and recreation (38 %), education and up-bringing (12.8 %), culture and art (12.7 %) and social help and care (11.2 %); generally speaking, they operate in the services sphere. Vast majority of organizations face a few problems: lack of funds to support their activity (the average budget of an NGO is approx. 4 861 € (20 000 PLN; 1 PLN = 0.243 €) and 11 – 12 % of NGOs operate without any resources); insufficient activity of their members or shortage of volunteers; and excessive bureaucracy. Nonetheless – as already stated – the number of NGOs is growing each year. Their professionalism increases as well, which is visible in the cooperation between them and local authorities: in 2003, 68 % of communes co-financed NGOs; in 2009 – it came up to 86 %.

The number of NGOs registered in the last 20 years has been increasing. It is estimated that at the end of 2010 there were approx. 98000 NGOs in Poland (incl. 71000 associations, 15000 voluntary fire brigade units and 12000 foundations (Figure 1).

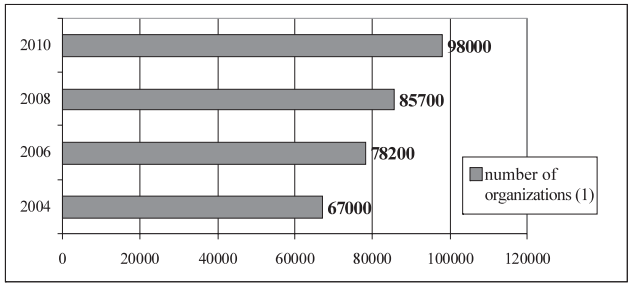

Figure 1 Number of NGOs in Poland in 2004 – 2010
Source: author's own study, based on http://civicpedia.ngo.pl/x/327345 (2012-02-10)

Obrázok 1 Počet mimovládnych organizácií v období 2004 – 2010
Zdroj: výskum autora založený na http://civicpedia.ngo.pl/x/327345 (2012-02-10)
(1) počet organizácií

General perception of NGOs' activity in Poland is positive. Gradually, Poles tend to believe that together (e.g. as an association) they can solve problems of small communities; few people, however, actively participate in such operations. E.g. in 2002, 11.1 % of adult Poles did voluntary work; in 2006 – 23 %, but in 2010 – 20 %.

There are 56800 rural communities in Poland and approx. 38 % of the society lives in the countryside. As much as 19 % of all NGOs have their offices in rural areas. Their activities mostly focus on helping local communities and stimulating them into action. To do this, they revive local tourism, promote sport or organize leisure time for senior citizens. Some of the NGOs focus on protection of local cultural heritage, ecology and animals; others organize help for disadvantaged families and provide support and equal opportunities for gifted youth.

The aim of this article is to present operations of one particular organization which operates in a rural area. Local Action Group WIR operates successfully for the benefit of the local community, actively supports local business operations, and protects the environment and cultural heritage.

The thesis proposed in this article states that the success of a rural NGO is conditioned by members' commitment, participation of the whole rural community, as well as by local authorities' ability to manage the support programs.

The figures presented in this article come from WIR Association's reports, interviews with its leaders, Klon/Jawor Association's reports (an association that monitors the development of the 3rd sector in Poland) as well as statistical data by GUS (The Polish Central Statistical Office).

Wir association – its beginning and outline of its activity

Rural Development Initiative (WIR) Association – Local Action Group was established in March 2006 on the initiative of NGOs, farmers, entrepreneurs and representatives of a few communes. It is a non-profit, voluntary, autonomous association of natural and legal persons (including local authorities and businesses). The main goals for establishing the NGO were:

1. Designing and implementing a Development Plan for the following communes: Stargard Szczeciński, Chociwel, Marianowo, Suchań, Stara Dąbrowa and Kobylanka (Figure 2).
2. Promoting rural areas.
3. Stimulating rural communities to participate in the development process of rural areas they inhabit.
4. Promoting information about initiatives connected with people's activity in rural areas.

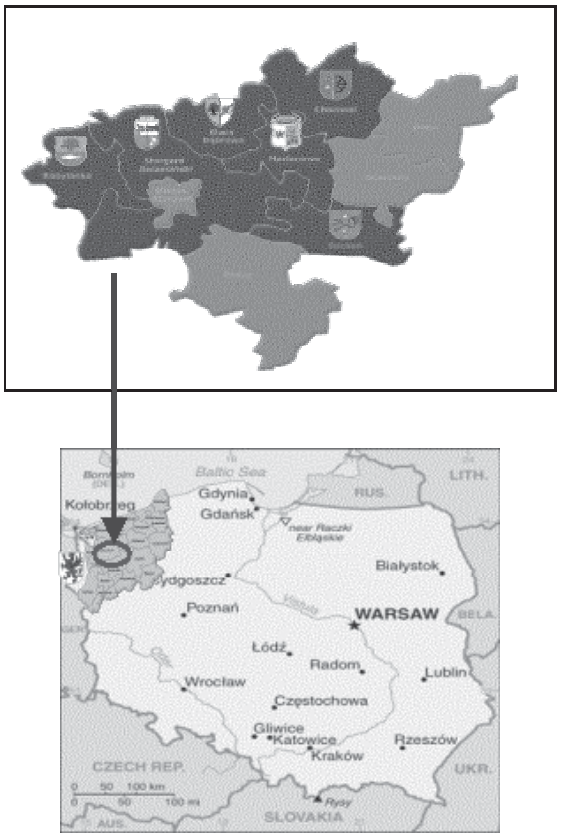

Figure 2 Territorial scope of WIR Associations operation on the map of Poland
Source: http://www.wir-lgd.org.pl/style/wir-map.gif (2012-02-24)

Obrázok 2 Teritoriálna pôsobnosť operácií WIR asociácií zobrazená na mape Poľska
Zdroj: http://www.wir-lgd.org.pl/style/wir-map.gif (2012-02-24)

The Association is led by a 7-person board (2 people from public administration sector, 5 entrepreneurs and NGO representatives). Other bodies within the Association are: a 3-person Revision Committee and a 13-person Council (5 members from the public sector, 4 from the business sector and 4 from the social sector). Board members live in the area included in the Development Plan and are knowledgeable about the development of rural areas.

At present, the Association has 97 members: 63 natural persons (mostly farmers) and 34 legal persons (6 communes, 20 NGOs, 6 entrepreneurs and 2 public libraries). As communes constitute Association members, WIR's reach is very precise and covers an area of 949 km2 (it encompasses 206 settlements inhabited by 32 500 residents). The unemployment rate in the region reaches 20 %. These 6 communes are agriculture-oriented, as farmland constitutes 63.2 % of their area (woods – 23 %, water – 4.6 %, wasteland and roads – 9.1 %). The communes feature a varied landscape (postglacial with lots of lakes) and resources such as: geothermal springs, clay, peat and gravel deposits extracted on a business scale. However, the tourism infrastructure is underdeveloped: there are only 5 hotels and B&Bs, 3 campsites, 1 resort and 8 agritourism farms.

Local development plan for 2009 – 2015 – objectives and results

The governmental Agency for Restructuring and Modernization of Agriculture is responsible for implementation of agricultural and rural programs. It prepares support plans funded by the European Agricultural Fund for Rural Development 2007 – 2013. One of such programs is Leader Plus; voivodeship authorities are responsible for its implementation.

In order to participate in the Leader Program, a Local Action Group must be established. WIR Association is an example of such a group. In 2008 WIR put forward a proposal for 2009 – 2015 that included a Local Development Plan. Project, which requested 1 169 308 €, was submitted to the Marshal's Office in Szczecin, to Rural Area Development Equalization Department (RADED). The application included 7 main objectives:

1. Creating brands for regional products.
2. Development of lake-centered tourism.
3. Improving technical condition of monuments and manor parks.
4. Promoting and displaying natural and cultural highlights of the region.
5. Building and modernizing sports facilities.
6. Creating a range of leisure activities for residents and tourists.
7. Integrating local community and improving communication.

In their application, the Association indicated that there were informal craft and handicraft groups, therefore there was potential for new local brands. However, in order to promote them, a certification process and display options would be needed (such as a local product gallery). The application also highlighted the fact that though there are 25 lakes and ponds in the area, there was an insufficient tourist base and leisure options, therefore it was advisable to create new agritourism farms and cycling routes between lakes. There was a number of historical buildings in need of renovation. These included e.g. old monastery compounds, industrial facilities (e.g. distillery) and 18th and 19th-century palaces with parks and cemeteries. All in all, the register listed 48 sacred buildings, 16 palaces and manors, 16 manor parks and 11 other items. If renovated and utilized to play a social and cultural role, they would undoubtedly increase the regions attractiveness. Despite the tourist potential of the region (e.g. well-know kayaking trail on the Ina river), the aforementioned communes had not opened a single Tourist Information Office. The application provided for creating a place to prepare and provide information for tourists, locals and potential investors. Lastly, the application listed renovating, erecting or equipping 12 sports facilities, such as gyms, sports fields or day-care rooms.

When WIR Association received the European funds, it became a grant-giver, as 78 % of their subsidy (which amounted to 280 443 €) was intended for redistribution to local institutions and organizations which would submit applications for specified objectives. As much as 22 % of the sum was allotted to covering Association's office overheads (the office handled application submission and evaluation process). Applicants needed to prove that they have 50 – 70 % of their own contribution (which was later on changed to the disadvantage of the applicants); therefore the sum of implemented projects could have reached even 2 307 230 €. In 2009 the Association's office received 11 applications for local strategic activities and 6 of them resulted in signing agreements for a total of 43 642 €. The Association has also spent 16 388 € on their overheads, which totals 60 030 €. In 2010 as many as

Table 1 Objectives set out in the Local Development Plan and their implementation – as of 31 Dec 2011

	Objective (1)	Planned until 2015 (2)	Status
1.	Creating local branded products (3)	5	0
2.	Creating a gallery to promote local artists (4)	1	under way (19)
3.	Organizing trainings in production and marketing (5)	3	2
4.	New agritourism farms (6)	6	1
5.	Creating new cycling route (7)	1	1
6.	Generating new workplaces in the tourist services sector (8)	5	1
7.	Creating Tourism Information Offices (9)	2	under way (19)
8.	Renovating historical buildings (10)	5	1
9.	Organizing events to promote monuments (11)	3	1
10.	Publishing promotional materials (12)	6	6
11.	Designing local souvenirs (13)	2	1
12.	Association's participation in promotional events (14)	7	7
13.	Erecting, modernizing or equipping sports and culture facilities (15)	12	3
14.	Organizing sports, culture and education events (16)	23	9
15.	Opening an Internet cafe (17)	1	1
16.	Organizing courses, trainings and study visits (18)	10	10

Source: Author's own processing, based on WIR Association's data
Zdroj: vlastné spracovanie autora vychádzajúce z údajov WIR asociácie

Tabuľka 1 Ciele stanovené v lokálnom plane rozvoja a ich implementácia – k 31. 12. 2011
(1) cieľ, (2) naplánované do, (3) vytvorenie lokálne značkových produktov, (4) vytvorenie galérie k propagácii loklnych umelcov, (5) organizáca školení v produkcii a v marketing, (6) nové farmy pre agroturistiku, (7) vytvorenie nových cyklotrás, (8) generovanie nových pracovných miest v tristickom sektore služieb, (9) vytvorenie turistických informačných kancelárií, (10) renovovanie historckých budov, (11) organizovanie podujatí k propagovaniu pamiatok, (12) publikovanie propagačných materiálov, (13) navrhovanie lokálnych suvenírov, (14) participácia asociácií na propagačných podujatiach, (15) vybudovanie, modernizácia alebo vybavenie športových a kultúrnych zariadení, (16) organizovanie športových, kultúrnych a edukačných podujatí, (17) otvorenie internetových kaviarní, (18) organizovanie kurzov, školení a študijných návštev, (19) v procese realizácie

41 applications were submitted (they totaled 184 602 €). None of the agreements were signed, therefore applicant received no funding. Out of 32 123 € for Association's operations, only 8 120 € was transferred (there was over 23 900 € missing). Table 1 presents the project objectives from a quantitative perspective, as well as their implementation at the halfway point of the program, and the mechanism of transferring funds is displayed in Figure 3.

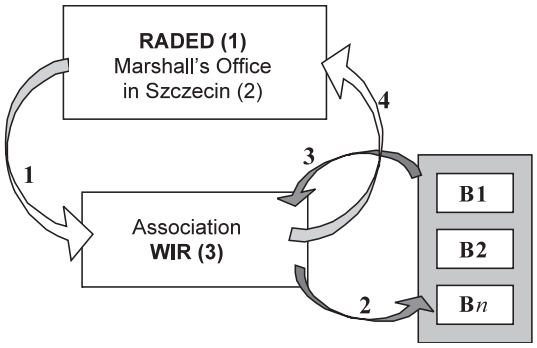

Figure 3 The mechanism of transferring funds in the Leader program
Source: author's own work
Obrázok 3 Mechanizmus transferu peňažných prostriedkov v programe Leader
Zdroj: vlastné spracovanie autora
(1) oddelenie vyrovnávania rozdielov vo vidieckych oblastiach, (2) kancelária maršálka vojvodstva v Štetíne, (3) asociácia WIR

As presented in Figure 3, WIR Association-upon signing an agreement with RADED for Leader program participation – receives subsidy tranches (1); then it opens a contest for potential beneficiaries (B1, B2 etc.) who can put forward projects in accordance with the Local Development Plan. Obviously, if a group of activists want to receive the funds for their idea, they must formally set up an association or other legal entity, and then submit their project. If it receives a positive opinion, WIR Association transfers the funds for its realization. Later on, all funds must be accounted for (3). Subsequently, all relevant information and reports are submitted to RADED, which assesses and accounts for all the expenses; then RADED transfers the last subsidy tranches.

As planned, in 2011 four contests were held, which resulted in 16 submissions. The agreements, however, were not signed, because RADED was behind on payments not only for 2011, but also for 2010. Therefore WIR Association could not fully implement its Local Development Plan, as the institution that authorized the implementation of projects and transferred the funds worked inefficiently.

Discussion

The presented case study of an organization which combines the public, private and non-governmental sectors is a living proof that inhabitants of rural areas are inventive, want to act and develop. They, however, tend to make their future plans conditional on public funding, which 1) contradicts the notion of non-governmental activity (separated from the government); 2) limits organizations' creativity in raising funds to just one source of subsidies. The WIR Association's operations show that such dependency can lead to difficulties. To prevent it, organizations should depend not only on the European Union or governmental programs, but also intensify fund-raising activity and enlist business partners who might be interested in participating in their projects, even if rural areas do not abound with such socially-aware entrepreneurs, who might support beneficial initiatives. As a result, organizations are practically forced to depend on the EU and governmental programs despite the fact that dilatory officials may – as already mentioned – hinder realization of the agreed actions. It may be illustrated by the presented Local Development Plan supervised by RADED (Marshal's Office in Szczecin). Paradoxically, RADED boasts that in 2011, as many as 183 agreements for rural project were signed in West-Pomeranian voivodeship; on average, it gives 3.5 agreements per an employee (in February 2012 RADED employed 52 persons). It seems justified to ask why – in spite of such numerous staff – RADED has a 1.5-year delay in project accounting and transferring current funds in accordance with agreements. Large delays in payments mean that organizations such as WIR Association must apply for bank loans in order to implement projects they signed for. Uncertainty connected with the funds transfer makes potential applicants (usually NGOs) withdraw their submissions because they need to wait for signing the agreement too long, and then must wait again for re-imbursement of their expenses. It also discourages other potential applicants, which is best reflected by the number of applications submitted to a contest organized by WIR Association (Figure 4).

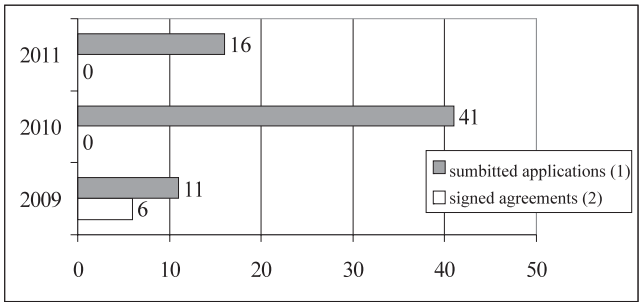

Figure 4 Number of submitted applications and signed agreements in 2009 – 2011
Source: author's own processing, based on WIR Association's data
Obrázok 4 Počet podaných žiadostí a podpísaných dohôd v období 2009 – 2011
Zdroj: vlastné spracovanie autora vychádzajúce z údajov WIR asociácie
(1) predložené žiadosti, (2) podpísané zmluvy

Problems with the institutions responsible for implementation are not the only challenge; organizations must also face complicated and changeable regulations. As already mentioned, in the middle of the Leader Program, The Ministry of Agriculture decided to change the method of refunding the costs: project executors had to spend the whole sum on their activities, and only then (following a positive assessment of clerks) the funds were reimbursed. There was no chance, then, for a partial co-funding while the project was in progress. The Ministry forgot that rural NGOs had very limited budgets and could not implement even simple and relatively cheap projects on their own. By making that decision, the Ministry forced many organizations to abandon their attempts.

Despite all the difficulties, WIR Association gradually achieves the planned objectives, mostly thanks to preferential bank loans. From the mathematical viewpoint, out of 92 planned actions, 47 (a half) has been implemented. That should be viewed as a huge success. Partially it is also a success of the Leader Program, which stimulated people to

come up with projects, increased their knowledge about NGOs and Local Action Groups, and proved that development opportunities are within their reach. It must be added, however, that all credit for the current implementation level of the program goes to Association leaders, who battle lack of funds and inactivity of rural communities.

Engaging rural inhabitants, who still know little about NGOs and do not want to participate in their activities, is an extremely challenging task. It means that the future of organizations lies in the hands of their leaders and depends on their perseverance and willingness to do something for the common good; and that requires their free time, competences and funds. It seems that accomplishing goals of a non-commercial organization that operates in rural areas is much more difficult than completing objectives of a business entity, mostly due to a dynamic and complex environment, dependency on administrative procedures and officials' decisions, aversion to bureaucracy, as well as no sense of social responsibility in people.

Each organization that comes into existence and starts operating is noteworthy. Rural NGOs are especially desired as they provide development opportunities that their local communities who – contrary to city-dwellers – would be otherwise deprived of (Sztandar-Sztanderska, 2009). Programs like The European Agricultural Fund or Leader program were created with that exact goal in mind. Associations such as Local Action Groups serve the same purpose. Regretfully, there are many barriers that separate these two spheres. When the Leader Program was being implemented, it was emphasized that entities such as Local Action Groups cannot lose sight of their goals, i.e. stimulating the internal growth potential of a given area (Hałasiewicz, 2008). The inner potential of rural areas does exist; what seem to be lacking, though, are friendly and efficient implementation institutions to help with the programs. The abovementioned digressions can be summarized as follows: the European Union programs in recent years have focused on two directions- spreading democracy within societies and building prosperity (Ramos and Delgado, 2009). It seems that most often these are only empty declarations because offices that handle funds and implement programs are ineffective or at least not as effective as they should be.

Conclusion

WIR Association has designed a Local Development Plan for its communes and received funds from Leader Plus Program. The Association's activities have focused on exploiting the potential of human, natural and cultural resources. The main beneficiaries are going to be local communities because it is their ideas that are being implemented. It turns out that a well-written action plan and good organization are not sufficient to act effectively.Activists' enthusiasm falters in the face of tardy bureaucracy in institutions that implement programs. In case of the Leader Plus Program, the delays reached 1.5 years, which discouraged potential applicants. If rural communities are to develop, there must occur an increase in professionalism and responsibility of the aforementioned institutions, as well as further attempts to engage members of local communities.

Súhrn

Mimovládne organizácie obyčajne operujú v mestách. Táto tendencia vyplýva zo skutočnosti, že čím väčšia je populácia, tým ľahšie je pre organizácie získať členov. Taktiež je táto skutočnosť ovplyvnená akumuláciou sociálnych problémov v mestských oblastiach, na ktorých riešení sa môžu podieľať práve tieto organizácie. To však neznamená, že vidiecke oblasti nemajú obyvateľov, ktorí sa usilujú o verejné dobro. Tento článok popisuje poľské mimomestské organizácie a prezentuje jedinečnú iniciatívu s názvom WIR Association – WIR asociácia (wir = whirl), ktorá spojila miestnu správu, mimovládne organizácie a podnikateľov.

Kľúčové slová: bariéry aktivity, asociácie, byrokracia, európske fondy, Leader Plus, miestna akčná skupina

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Acta oeconomica et informatica 2
Nitra, Slovaca Universitas Agriculturae Nitriae, 2012, s. 43–46

THE IMPACTS OF THE GLOBAL FINANCIAL CRISIS ON AGRICULTURE IN CENTRAL AND EASTERN EUROPE AND IN CENTRAL ASIA

DOPADY GLOBÁLNEJ FINANČNEJ KRÍZY NA POĽNOHOSPODÁRSTVO V STREDNEJ A VÝCHODNEJ EURÓPE A V STREDNEJ ÁZII

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The number of financial crises has been growing in the world according to the International Monetary Fund. The recent global financial crisis caused a considerable slowdown in many countries in the world. The results have included the collapse of housing prices, massive unemployment, and the spread of distress throughout financial markets and economies around the globe. The economic slowdown hit the agricultural sector as well. The purpose of the presented article is to evaluate the impacts of the global economic and financial crisis on the agri-food sector and to present solutions for the existing problems.

Key words: financial crisis, agriculture, Central Asia, Central and Eastern Europe

The onset of the financial crisis was evident as early as mid-2007 when a real estate bubble in the United States and parts of Western Europe imploded, triggering multiple bank failures. In a short period of time, property values plummeted, the value of retirement accounts shrank, household savings evaporated, and general consumer and producer confidence disappeared. The financial crisis expanded into an economic crisis throughout United States and Western Europe, from where it spread to developing countries that had depended on foreign direct investments, consumer and mortgage credits, trade, and remittances. Deteriorating macroeconomic conditions led to deterioratinon household welfare.

The effects of the global financial crisis were more acutely felt in the Eastern Europe and Central Asia region than in any other parts of the European continent (The World Bank, 2011b). The crisis risks reversing the region's recent gains and exposes the region to significant adverse economic and social impacts. The slowing economic growth from the economic crunch had an influence on agriculture in all countries around the world, not only in the analyzed region. The stagnant demand for agricultural commodities and declining public expenditures for agriculture lead in many states to undesirableeffects on the agro-food sector and to different responses of their governments.

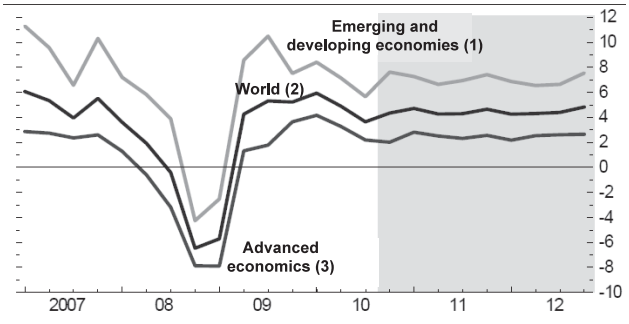

Figure 1 Global GDP Growth in percent; quarter over quarter, annualized
Source: World Economic Outlook UPDATE, 2011a
Obrázok 1 Svetový rast HDP v %; štvrťročne
Zdroj: World Economic Outlook UPDATE, 2011a
(1) vyspelé ekonomiky, (2) svet, (3) vychádzajúce a rozvíjajúce sa ekonomiky

Materials and methods

The goal of the article was to evaluate the impacts of the global financial crisis on the agricultural sector in the region of Central and Eastern Europe and in Central Asia. The aim was also to present possible solutions of the situation in this part of the world. In the paper, the methods of analysis and synthesis as well as some statistical indicators were applied. Multiple data sources were used: World Development Indicators, UnctadStat, EuroStat, IMF and FAO publications.

Results and discussion

Actual Economic Situation in the Region

Global economy is slowly recovering from the financial crisis. Figure 1 shows that global activity expanded at an annualized rate of just over 3.5 percent in the third quarter of 2010. This was caused especially by the growth of consumption in the United States and Japan. More generally, signs are increasing that private consumption is starting to gain a foothold in major advanced economies. Growth in emerging and developing economies remained also robust in the third quarter of the year 2010. During the second half of 2010, global financial conditions broadly improved – equity markets rose, risk spreads continued to tighten, and bank lending conditions in major advanced economies became less tight, even for small and medium-sized firms (World Economic Outlook UPDATE, 2011a).

The current economic situation of Central and Eastern Europe and Central Asia is described in Table 1. Real GDP growth decreased in the whole region mostly as the result of the

Table 1 Real GDP Growth in % in the Analyzed Region

Country/Year (1)	Real GDP Growth (2)			Projections in % (3)	
	2007	2008	2009	2010	2011
World Output (4)	5.3	2.8	-0.6	4.8	4.2
United States (5)	1.9	0.0	-2.6	2.6	2.3
Euro Area (6)	2.9	0.5	-4.1	1.7	1.5
Central and Eastern Europe (7)	5.5	3.0	-3.6	3.7	3.1
Kazakhstan	8.9	3.2	1.2	5.4	5.1
Kyrgyz Republic	8.5	8.4	2.3	-3.5	7.1
Tajikistan	7.8	7.9	3.4	5.5	5.0
Turkmenistan	11.6	10.5	6.1	9.4	11.5
Uzbekistan	9.5	9.0	8.1	8.0	7.0

Source: International Monetary Fund, 2010a and 2010b
Zdroj: Source: International Monetary Fund, 2010a a 2010b

Tabuľka 1 Rast reálneho HDP v analyzovanom regióne
(1) krajina/rok, (2) rast reálneho HDP, (3) prognózy, (4) celosvetový výstup, (5) Spojené štáty americké, (6) eurozóna, (7) stredná a východná Európa

Table 2 Agricultural production in % of GDP

Country/Year (1)		2005	2006	2007	2008	2009
CE	Slovak Republic	3.65	3.58	3.52	3.10	2.61
	Hungary	4.23	4.06	3.96	4.31	–
	Poland	4.53	4.29	4.33	3.74	3.64
EE	Ukraine	10.40	8.68	7.46	8.33	8.22
	Belarus	9.77	9.75	9.34	9.78	9.59
	Moldova	19.53	17.38	12.01	10.71	10.03
CA	Kyrgyz Republic	31.95	32.77	31.08	29.23	–
	Tajikistan	23.98	24.79	22.43	24.71	22.42
	Uzbekistan	27.97	26.14	23.95	21.36	19.50

x – no data, CE – Central Europe, EE – Eastern Europe, CA – Central Asia
Source: The World Bank – World Development Indicators
x – žiadne údaje, CE – stredná Európa, EE – východná Európa, CA – Stredná Ázia
Zdroj: The World Bank – World Development Indicators

Tabuľka 2 Poľnohospodárska produkcia v % na HDP
(1) krajina/rok

global economic slowdown. According to projections, the bottom was reached in Central and Eastern Europe and in most of the states of Central Asia in the year 2009. In comparison to the year 2007, the worst fall of GDP by 9.1 % in 2009 was observed in Central and Eastern Europe. The fact, that the economic growth in Uzbekistan remained stable during the analyzed period, is also interesting. The financial crisis boosted unemployment in Europe and Central Asia, especially in Latvia, Lithuania and Estonia. Due to this fact governments helped many families through a variety of initiatives, including unemployment benefits, public works programs, and in some cases, last resort social assistance programs. However, these initiatives only reached a minority of the families affected by the crisis. The inflation rate reached in Austria, Poland and the Slovak Republic less than 1 % in the year 2009.

Basic Facts about the Agricultural Sector in the Region

Central and Eastern Europe as well as Central Asia consist of countries with different level of economic development. The share of agricultural land is in many countries of this region 40 % of total land area or higher. The exception is for example the Russian Federation with 13.16 % of agricultural land in 2009. Kazakhstan, a country with a GDP per capita of 7 257 USD and 1.47 hectares of arable land per inhabitant, has around 76 % of agricultural land. But the low consumption of fertilizers in this country suggests that its agriculture is extensive. As for comparison, Austria with a 40 times higher fertilizers consumption disposes only with 0.17 hectares of arable land per person. Table 2 contains information about agricultural production as % of GDP in some states from this region.

The ratio of agricultural population in Central Asia declined from 25.7 % in the year 1998 to 20.3 % in the year 2008. The employment in agriculture was in Central Europe varying from 3.6 % in the Czech Republic to 5.7 % of total employment in Austria in 2007. This indicator was much higher only in Poland (14.7 %). As for Eastern Europe, the employment rate in agriculture was in Ukraine 16.70 % and in Moldova 32.80 % in the same year.

According to available data retrieved from the World Bank, food imports as a percent of merchandise imports rose in Moldova from 11.17 % in 2006 to 15.18 % in 2009 and in Hungary from 3.93 % to 5.25 %. In most of the other countries of the region, the development of this quotient was similar. Food exports as a percent of merchandise exports increased dramatically in Moldova from 58.95 % in 2008 to 74.19 % in 2009 and in the Kyrgyz Republic from 15.44 % in 2008 to 23.92 % in 2009. This ratio was increasing during the analyzed period also in Poland, Hungary, Austria, Belarus and Ukraine.

The Impacts of the Global Economic Crisis

Since the Russian Federation financial crisis in 1998, the economies in Eastern Europe and Central Asia have been recovering from the macroeconomic and institutional problems that characterized the region since its transition from a centrally planned to a more market oriented economy. The economy started booming, which had a positive impact on agricultural productivity and poverty. However, in 2008 crisis period hit the region. First, in the first semester of 2008, the region was confronted with rising food prices as a consequence of a worldwide food crisis. Later, in the second semester of the same year, a second shock affected the region, when the effects of the worldwide financial crisis became clear. Although these two crises have different causes, it is impossible to analyze the effects of one crisis on the agricultural sector without considering the other, because both crises interacted through their implications for financial and economic stability, food security and political security (Swinnen and Van Herck, 2010).

The food crisis and financial crisis have lead to social unrest in scores of countries, including some in Eastern Europe, Turkey and Central Asia, and have added more than 140 million people to the number of hungry and undernourished people in the world, FAO, 2010b. In addition, these two crises reduced the level of food security through combination of high food prices, high prices of inputs, lack of credit access, decline of international financial aid and government transfers to agriculture, loss of employment or reduction of wages and incomes.

The consequence could be the reduction in quantity or quality of food purchases, reduction in food production and reduction of quality or quantity of food aid.

In response to the high food prices and to reduction of the negative effects of the financial crisis on food consumption, governments in the region intervened in the supply chain of primary products to reduce retail prices of these products in order to protect the poor's consumption of primary products. In Ukraine, the government set up mark-up limits on flour prices

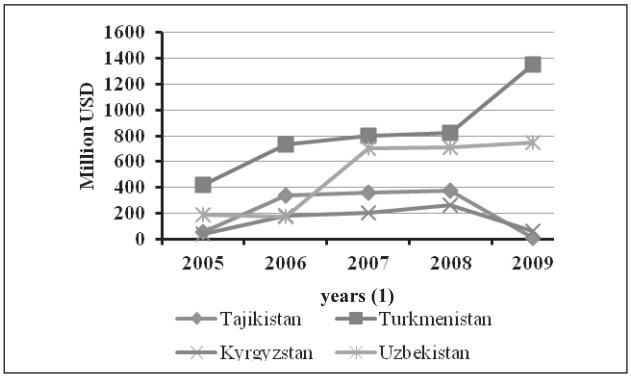

Figure 2 FDI Inflow in Central Asia (4 countries)
Source: Unctad Stat
Obrázok 2 Tok PZI (priame zahraničné investície) v Strednej Ázii (štyri krajiny)
Zdroj: Unctad Stat
(1) roky

and retail price limits on the bread. Also the Government of the Russian Federation implemented price controls on the prices of primary products, such as bread, milk, sunflower oil and eggs. In Kyrgyzstan, the Government sold bread and other primary products at lower prices to the poor (Swinnen and Van Heck, 2010).

Negative impacts of the financial crisis on the agricultural sector are the result of three main factors: reduced investment in agriculture, reduced demand for agricultural products and an increase in public intervention that could lead to a partial reversal of reforms in agriculture. One of the effects of the financial crisis was the drop or fluctuation in the inflow of foreign direct investment in the whole region after the year 2008. The only exception was Turkmenistan (Figure 2).

In times of economic instability banks are naturally less willing to provide loans. Unavailability of financial resources not only for agricultural enterprises and farmers is therefore the outcome of tougher collateral demands and higher interest rates. The fall of investment of domestic and foreign food processing companies is also important. However, it should be noted, that the crisis had no significant effect on grain production in most countries in the 2008/2009 crop year. Although it became more difficult to obtain money from banks even if credit applications were approved, wheat farmers, in general, were still able to finance their business, FAO, 2010b.

The financial crisis is also expected to lead to a decrease of domestic demand for higher value agricultural products and a switch to basic products due to a decrease of the household's disposal income. This decrease in income is caused by an increase in unemployment levels, macroeconomic instability and a decrease in remittances.

The governments in some countries, such as Kazakhstan and the Russian Federation, reacted to the crisis by increasing their expenditures on agriculture. In the Russian Federation, the Government provided RUB 25 billion to Rosselkhozbank, the Russian Agricultural Bank, at a special interest rate and RUB 4 billion to Rosagroleasing, a state owned leasing company of agricultural equipment. In addition to this, some supported banks are obliged to provide 100 percent subsidized loans for certain agricultural projects. Finally, the Government of the Russian Federation also provided RUB 60 billion for the agricultural budget in 2008 and another RUB 21 billion for the agricultural budget in 2009/2010. In Kazakhstan, the Government injected USD 1 billion into agriculture to deal with the crisis, FAO, 2010b.

Upon the request of the FAO Regional Office for Europe and Central Asia, the Research Institute of Agricultural Economics in Budapest carried out a research in four countries of this region – Hungary, Ukraine, Armenia and Kyrgyzstan (Research institute for Agricultural Economics, 2009). The study was focused on the effects of economic downturn, credit constraints and crisis impacts on the production, trade and consumption. The most important results were as follows:

- stakeholders throughout supply chain suffered from loss of confidence and sought to cut their costs and reduce their dependence on credits,
- arable farmers reduced their use of fertilizers and crop production products and purchases of machinery also declined,
- there was increased tendency to delay payments,
- input suppliers became more careful about which farmers to supply,
- most stakeholders throughout the supply chains postponed their investments,
- large enterprises acquired their weaker competitors, particularly those with attractive assets,
- less profitable stores were closed and special price offer became more frequent,
- banks cut back substantially on providing credit to the agro-food industry,
- banks prolonged the process of credit approvals, governments implemented in response a range of measures to local circumstances.

The principal causes of changes to the state of the agro-food sector were according to the research as follows:

- limited credits availability and consequent liquidity problems,
- high foreign exchange rates,
- increasing price volatility,
- decrease in consumer income and remittances.

Conclusion

Globalization has increased the frequency and spread of financial crises, but not necessarily their severity. However, the latest global financial and economic crisis exposed weaknesses in the functioning of the global economy and led to calls for the reform of the international financial architecture. Although the crisis was triggered by events in the United States housing market, it has spread to all regions of the world with dire consequences for global trade, investment and growth.

The recent financial and economic crisis naturally affected also the agriculture sector. Lower demand for food due to higher unemployment rates, decline in investment, banks averse to provide credits and loans, reduction of the use of fertilizers and obtaining of machinery were only some of the problems caused by the global economic crunch in Central and Eastern Europe and in Central Asia. Governments reacted in different ways – some decided to increase their expenditures on agriculture, others set up price mark-up limits. However, one should be careful that the increase in government intervention in the agriculture sector does not lead to a (partial) reversal of reforms in the agriculture sector, which could have a negative effect on the efficiency (FAO, 2010b).

As for policy responses to the crisis, governments should focus on social security safety nets to deal with the expected increase of poverty. They should also try to promote (foreign) investments, because investments used to be a driving force behind economic growth. Therefore it is necessary to provide a favorable institutional and policy environment for stimulating

more FDI. However, it is important to emphasize that all new policies must not conflict with the longer-term reform agenda and previous reforms should not be dismantled as part of short run policy reactions. Policies that facilitate a return to economic growth are the best strategy to reduce poverty and enhance agricultural productivity (FAO, 2010b).

Priority targets for mutual investments should be also set. Therefore it is important to improve cooperation for a healthy agricultural sector through joint knowledge and information system as well as to use chances to unite potentials for export of Belarus, Kazakhstan, Russia and Ukraine through the following investment opportunities:

- setting up a joint infrastructure for prompt response to changing conditions of agricultural markets and efficient product storage and delivery,
- development of routes (especially for grain) for the reduction of the transport component,
- establishment of a common market place of grain trade for importing countries.

In this context it is necessary to highlight that in 2010 the world including of Eastern Europe and Central Asia faced the second high food price crisis caused by the floods in Central Europe and in Australia and also by the droughts in the Russian Federation, Ukraine and Kazakhstan. Furthermore, it is rational to expect that the situation will get even worse. The consequences of the natural disaster in Japan on energy sources as well as the ongoing development in Near East could cause higher prices of energy. Regardless of these, we have to take into consideration that many governments in Europe and in other parts of the world have increased the VAT on the food products which virtually means the increase of the food prices.

Súhrn

Množstvo finančných kríz vo svete podľa Medzinárodného menového fondu rastie. Súčasná globálna finančná kríza spôsobila značnú recesiu v mnohých krajinách na svete. Výsledky hovoria o sprievodnom kolapse cien nehnuteľností, masívnej nezamestnanosti a šírení núdzových situácií na celom finančnom trhu a v ekonomikách celosvetovo. Recesia ekonomík zasiahla tiež poľnohospodársky sektor. Cieľom článku je zhodnotiť dopady svetovej ekonomiky a finančnej krízy na poľnohospodársko-potravinársky sektor a predstaviť riešenia vzniknutých problémov.

Kľúčové slová: finančná kríza, poľnohospodárstvo, Stredná Ázia, stredná a východná Európa

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Acta oeconomica et informatica 2
Nitra, Slovaca Universitas Agriculturae Nitriae, 2012, s. 47–49

ATTEMPT TO IDENTIFY THE CAUSAL RELATIONSHIPS BETWEEN THE PRICES OF MILK IN SELECTED EU COUNTRIES

POKUS O IDENTIFIKÁCIU KAUZÁLNYCH VZŤAHOV MEDZI CENAMI MLIEKA VO VYBRANÝCH KRAJINÁCH EÚ

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The causality Granger test was used to assess the causal links between the prices of milk in selected European Union countries. The Granger test is based on the vector auto regression models – VAR. The conducted research allowed identifying causal relationships between the prices of milk in the following countries: Poland, Germany, France, the Czech Republic, and Slovakia. The research shows that milk prices in Poland depend on the prices in France, Germany, the Czech Republic and Slovakia, while milk prices in Slovakia are dependent on milk prices in Poland.

Key words: Granger test, VAR model, causal relationship, milk prices

The Polish accession to the European Union has created the opportunity to develop the milk market in the form of access of our products to the markets of the EU countries. The milk market and milk product market in the EU is the most supported and regulated market. Regulation system of the EU milk market has an impact on the price of milk in individual member countries. The relations between the prices of milk in some countries seem to be inevitable.

The aim of this paper is to examine the empirical causal relationships in the milk market. The prices of milk in the selected EU countries (France, Germany, Poland, Slovakia, the Czech Republic) were taken into consideration.

Material and method

In this study, the average monthly prices of milk in €.100 kg^{-1} from May 2004 to October 2010 were used as the empirical material, which is the 78 observations in the following countries: France, Poland, Germany, Slovakia and the Czech Republic. The data were obtained from the Integrated Agricultural Market Information System (http://www.minrol.gov.pl).

In this study, the following symbols were used:

- v_1 – average monthly prices of milk in France in €.100 kg^{-1},
- v_2 – average monthly prices of milk in Germany in €.100 kg^{-1},
- v_3 – average monthly prices of milk in Poland in €.100 kg^{-1},
- v_4 – average monthly prices of milk in the Czech Republic in €.100 kg^{-1},
- v_5 – average monthly prices of milk in Slovakia in €.100 kg^{-1}.

Basic characteristics of the individual time series are presented in Table 1. The lowest average price in the period was recorded in Slovakia – 26.06 €.100 kg^{-1}, while the highest average monthly price was recorded in France – 30.95 €.100 kg^{-1}. The prices of milk in Slovakia show the greatest differentiation – the variation coefficient was 16%. Comparing the prices of milk in all analyzed countries it can be concluded that the milk prices are characterized by variability on a similar average level of about 14 – 15%.

Table 1 The basic characteristics of the individual time series

	v_1	v_2	v_3	v_4	v_5
$\bar{x}$ (mean) (1)	30.95	29.08	26.15	26.06	27.53
s (standard deviation) (2)	3.62	4.32	3.71	4.05	3.75
V (coefficient of variation) (3)	12 %	15%	14 %	16 %	14 %
Min	24.27	22.00	16.90	17.67	21.12
max	40.94	41.00	36.70	35.61	37.65

Source: author's own calculations
Zdroj: vlastné výpočty autora

Tabuľka 1 Základné charakteristiky individuálneho časového radu
(1) stredná hodnota, (2) štandardná odchýlka, (3) variačný koeficient

To verify the hypothesis about the causality between variables, the Granger test was used, constructed on VAR models. Granger Causality: x is simply granger causal to y if and only if the application of an optimal linear function leads to

$$\sigma^2\left(\frac{y_{t+1}}{I_t}\right) < \sigma^2\left(\frac{y_{t+1}}{I_t - \bar{X}_t}\right) \quad (1)$$

i.e. if future values of y can be predicted better, i.e. with a smaller forecast error variance, if current and past values of *x* are used. Compare Charemza and Deadman (1997) and Osińska (2006).

VAR models are presented in econometric literature; therefore in this paper the general characteristics of this model are presented. The VAR models are presented in work of Jusélius (2006) or Cromwel et al. (1994). Multivariate tests for time series models in Lutkepohl (2006).

The variables, which will be used in Granger test, should be stationary; therefore the rank of integration should be known. To test the stationarity of the variables augmented test Dickey-Fuller was used, it is presented in Zivot, Wang (2006) and Sarris, Hallam (2006). Then the two-dimensional VAR model was estimated, which is presented by the formula:

$$Z_t = \sum_{i=1}^{p} A_i Z_{t-1} + \varepsilon_t \quad (2)$$

where:
Z_t – an observation vector
A_i – matrix of parameters standing for the delayed variable vector Z_{t-l}, ε_t – is a disturbance term

The Schwarz criterion was used to identify the rank of delay. The BIC statistic is presented in work of Ruppert (2010). The use of VAR models requires a normal distribution and the lack of autocorrelation from the disturbance term. The LM tests are presented in works of Baltagi (2002) and Cameron (2005).

The procedure of the Granger causality test begins with the estimation of model parameters:

$$y_t = \alpha_0 + \alpha_1 y_{y-1} + \ldots \alpha_p y_{t-p} + \varepsilon_t \quad (3)$$

$$y_t = \alpha_0 + \alpha_1 y_{y-1} + \ldots \alpha_p y_{t-p} + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \ldots + \beta_q x_{t-p} + \eta_t \quad (4)$$

where:
x_t – empirical value of the variable X
y_t – empirical value of the variable Y
p – rank of delay of the variable
ε_t, η_t – disturbance term of the models

The Granger test verifies the hypotheses:

$$H_0: \sigma^2(\varepsilon_t) = \sigma^2(\eta_t)$$
$$H_0: \sigma^2(\varepsilon_t) \neq \sigma^2(\eta_t) \quad (5)$$

and the test statistic is presented by the formula:

$$F = \frac{n \cdot \left(s^2(\varepsilon_t) - s^2(\eta_t)\right)}{s^2(\varepsilon_t)} \quad (6)$$

The F statistic has chi-square distribution – $\chi^2(q)$.

Results and research

Examination of causal relationships between variables started from testing stationarity. The hypotheses of stationarity of variables were rejected on the basis of the ADF test. The correct specification of the VAR model requires stationarity of the variables. Therefore the first differences of the variables were taken under consideration Δv_i, $i = 1,\ldots,5$. The decision was made that the first differences are stationary (Table 2 and Table 3).

Table 2 The results of ADF test for variables v_i, $i = 1,\ldots5$

Variable (1)	ADF	p-value (2)
v_1	-3.23822	0.01791
v_2	-2.59625	0.09369
v_3	-2.03587	0.2715
v_4	-2.48926	0.1181
v_5	-2.36391	0.1522

Source: author's own calculations
Zdroj: vlastné výpočty autora

Tabuľka 2 Výsledky ADF testu pre premenné v_i, $i = 1,\ldots5$
(1) premenná, (2) p-hodnota

Table 3 The results of ADF test for variables Δv_i, $i = 1,\ldots5$

Variable (1)	ADF	p-value (2)
Δv_1	-6.05444	8.851e-008
Δv_2	-3.37572	0.01185
Δv_3	-4.12558	0.000876
Δv_4	-2.68761	0.007613
Δv_5	-3.37897	0.01173

Source: author's own calculations
Zdroj: vlastné výpočty autora

Tabuľka 3 Výsledky ADF testu pre premenné Δv_i, $i = 1,\ldots5$
(1) premenná, (2) p-hodnota

The next step was to estimate the ranks of delays for the VAR models which were made by means of estimating eight models:

- Model 1 describes the relationship between first differences in milk prices in France and the first differences in milk prices in Poland.
- Model 2 describes the relationship between first differences in milk prices in Poland and the first differences in milk prices in France.
- Model 3 describes the relationship between first differences in milk prices in Germany and the first differences in milk prices in Poland.
- Model 4 describes the relationship between first differences in milk prices in Poland and the first differences in milk prices in Germany.
- Model 5 describes the relationship between first differences in milk prices in Slovakia and the first differences in milk prices in Poland.
- Model 6 describes the relationship between first differences in milk prices in Poland and the first differences in milk prices in Slovakia.
- Model 7 describes the relationship between first differences in milk prices in the Czech Republic and the first differences in milk prices in Poland.
- Model 8 describes the relationship between first differences in milk prices in Poland and the first differences in milk prices in the Czech Republic.

The ranks of delays were chosen on the basis of the Shwarz criterion. Optimal rank of delay was chosen when the BIC statistic was the lowest (Table 4).

Table 4 The values of BIC statistic for chosen rank of delay models

Model	Rank of delay (q) (1)	BIC
1	1	4.411673
2	1	2.754384
3	1	2.840738
4	1	2.358229
5	1	2.434605
6	1	2.671697
7	1	2.612094
8	1	2.379952

Source: author's own calculations
Zdroj: vlastné výpočty autora

Tabuľka 4 Hodnoty štatistiky BIC pre vybranú úroveň modelov oneskorenia
(1) stupeň oneskorenia

To estimate model parameters, GRETL programme was used, giving the following results:

- Model 1: $\Delta v_{1t} = 0.162090\ \Delta v_{1t-1} + 0.295224\ \Delta v_{3t-1}$
- Model 2: $\Delta v_{3t} = 0.507051\ \Delta v_{3t-1} + 0.109462\ \Delta v_{3t-1}$
- Model 3: $\Delta v_{2t} = 0.635159\ \Delta v_{2t-1} + 0.034376\ \Delta v_{3t-1}$
- Model 4: $\Delta v_{3t} = 0.358474\ \Delta v_{3t-1} + 0.320626\ \Delta v_{2t-1}$
- Model 5: $\Delta v_{4t} = 0.505272\ \Delta v_{4t-1} + 0.335870\ \Delta v_{3t-1}$
- Model 6: $\Delta v_{3t} = 0.459952\ \Delta v_{3t-1} + 0.165223\ \Delta v_{4t-1}$
- Model 7: $\Delta v_{5t} = 0.39199\ \Delta v_{5t-1} + 0.259312\ \Delta v_{3t-1}$
- Model 8: $\Delta v_{3t} = 0.313202\ \Delta v_{3t-1} + 0.370267\ \Delta v_{5t-1}$

The study of disturbance term properties allowed adopting the hypotheses of normality and lack of autocorrelation. Next parameters of models (1) and (2) were estimated, which allowed using the Granger test. The following conclusions have been drawn on the basis of the Granger test results (Table 5):

- Δv_1 is a cause of Δv_3
- Δv_2 is a cause of Δv_3
- Δv_3 is a cause of Δv_4
- Δv_4 is a cause of Δv_3
- Δv_5 is a cause of Δv_3

Table 5 The values of Granger test statistic and critical value of χ^2

	F	$\chi^2(q)$ ($\alpha = 0.05$)	$\chi^2(q)$ ($\alpha = 0.01$)
Δv_3 is a cause of Δv_1 (1)	1.11768	3.841459	6.634897
Δv_1 is a cause of Δv_3	21.93248	3.841459	6.634897
Δv_3 is a cause of Δv_2	0.90064	3.841459	6.634897
Δv_2 is a cause of Δv_3	29.17598	3.841459	6.634897
Δv_3 is a cause of Δv_4	13.39903	3.841459	6.634897
Δv_4 is a cause of Δv_3	19.54195	3.841459	6.634897
Δv_3 is a cause of Δv_5	3.177839	3.841459	6.634897
Δv_5 is a cause of Δv_3	24.1092	3.841459	6.634897

Source: author's own calculations
Zdroj: vlastné výpočty autora

Tabuľka 5 Hodnoty štatistík Granger testu a kritická hodnota χ^2 (1) je príčinou

The obtained results allowed identifying one-way causal relationships between the analyzed variables. On the basis of the statistics F we can conclude that the variables Δv_1, Δv_2, Δv_4, Δv_5, which constitute first increment of milk prices in France, Germany, Slovakia and the Czech Republic are the causes of variable Δv_1, i.e. the first increment of milk prices in Poland. Additionally, Δv_1 variable, i.e. the first increment of milk prices in Poland is a cause for variable Δv_4 – the first increment of milk prices in Slovakia. In other cases, the differences between the models (1) and (2) are negligible, so there is no causality in Granger test sense.

Summary

VAR models are useful tools for investigation of the causal links between economic variables. In the present research the results of analysis of the relationships between changes in milk prices in the selected EU countries and the prices of milk in Poland are presented. The research shows that milk prices in Poland depend on the prices in France, Germany, the Czech Republic and Slovakia, while milk prices in Slovakia are dependent on milk prices in Poland. The identification of the causal relationships in the sense of Granger test allows forecasting efficiently short-and medium-term prices of milk.

Súhrn

Grangerov test kauzality bol použitý na posúdenie závislostí medzi cenami mlieka vo vybraných krajinách Európskej únie. Tento test je založený na vektorových autoregresných modeloch – VAR. Výsledky výskumu identifikovali kauzálne závislosti medzi cenami mlieka krajín Poľska, Nemecka, Francúzska, Českej republiky a Slovenskej republiky. Boli zistené nasledovné vzťahy: Poľské ceny mlieka závisia na cenách mlieka vo Francúzsku, Nemecku, Českej republike a Slovensku, kým ceny mlieka na Slovensku sú závislé na cenách poľských cenách mlieka.

Kľúčové slová: Grangerov test, VAR model, kauzálne vzťahy, ceny mlieka

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Acta oeconomica et informatica 2
Nitra, Slovaca Universitas Agriculturae Nitriae, 2012, s. 50–56

RESPONSE OF THE POLISH WHEAT PRICES TO THE WORLD'S CRUDE OIL PRICES

CITLIVOSŤ POĽSKÝCH CIEN PŠENICE NA SVETOVÉ CENY ROPY

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Agricultural commodities prices play crucial role both in farmers' income determination and in price relationship establishment for the whole economy. Among the factors influencing the wheat prices, crude oil prices are considered as one of the most important. The aim of this paper was to assess the character of linkage between world crude oil prices and Polish wheat prices. Results of the research confirm the existence of such linkage although the nature and the strength of this relationship changes over time. However, the long-run relationships between the crude oil and Polish wheat prices were not proven. Moreover, growing impact of crude oil prices on Polish wheat prices over time was not detected. The results suggest that exchange rates may strongly influence wheat prices. This in turn may weaken response of Polish wheat prices in relation to world's crude oil prices.

Key words: wheat price, crude oil prices, price transmission, VAR, cointegration

In the last years relationships between energy and agricultural sectors have become a very important economic issue. The most important reason for growing attention given to this problem is the growing global biofuel sector. In the first decade of this century the liquid biofuel production expanded from 18.2 to 105 billion liters (the vast majority refers to bioethanol) (Rosiak et al., 2011). Such a significant growth is an effect of high crude oil prices and implementation of policies supporting biofuel production. State support is explained by concern for energy self-sufficiency, environmental benefits and agricultural sector needs. This support includes such instruments as financial subsidies, tax reliefs, or statutory requirements of minimal biofuel use (i.e. in 2010 8.25% in the USA; 5.75% in the EU). It is worth mentioning that without financial incentives – according to present and previously observed price relations – costs of biofuel production would exceed costs of acquisition fossil fuels. Since supporting biofuel sector is quite costly, its expansion occurs mainly in the developed countries. Presently, almost 90% of global biofuel production comes from the USA, the EU and Brazil. Globally, bioethanol is mainly produced from corn and sugar cane. In the EU wheat is also an important raw material.

Biofuel use of crops in Poland is relatively small. The bioethanol production in Poland is estimated at 88, 131, 166 and 132 thousands tons in the years 2008, 2009, 2010, and 2011, respectively. The main crops used for ethanol production are corn and wheat. About 200 – 300 thousand tons of wheat are allocated for ethanol production, which is less than 4% of the whole wheat production in Poland. Production and use of biofuels in the European Union is regulated by the Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources, which determines that the minimal share of renewable energy in the transport sector in 2020 will be 20%. It was 4.63% in 2009 in Poland.

Growing importance of biofuel sector raises questions about its possible consequences. Economists analyze if and how prices of crude oil influence agricultural raw materials prices. There are three main instruments used to measure this impact: general and partial equilibrium models, optimization methods, and time series analysis. Although many researches were conducted into the biofuels impact on agricultural prices, their results were ambiguous.

Until recently the prices of agricultural products and energy were considered to be very weakly or even negatively correlated (Hertel and Beckman, 2011). According to Tyner (2010) correlation between corn and oil prices in USA in years 1988 – 2005 was -0.26. The situation changed together with biofuel market development. As agricultural commodities are increasingly being used as a raw material for biofuels, the linkage between energy and agricultural markets begins to intensify, although the nature of this relation is not clear.

Brazil was the first country to promote the use of agricultural products in biofuel production. Ethanol market emerged after governmental intervention, as a response to the petroleum shortage in 1973. Now there are many large ethanol plants in Brazil. Most of them are dual, which means that they can easily switch from ethanol to sugar production, depending on the price relations. Causal chain running from crude oil to Brazilian ethanol and finally to the sugar market in this country was shown by Serra and Zilberman (2011). They proved that oil price level influences the volatility and price level of ethanol. The growth of oil price volatility has a positive influence on variability of ethanol prices. Ethanol prices have a direct impact on level of sugar prices and indirect impact on sugar price volatility.

It was proved that spillover effect of crude oil prices volatility to agricultural markets was not statistically significant in the period November 1998 – October 2006, but this situation changed and data from October 2006 – January 2009 show the significant volatility spillover effect from crude oil prices to the corn prices. Results of research conducted by Saghaian (2010) show that although there is a strong correlation among oil and commodity prices, the nature of this linkage is mixed. Results also indicate that crude oil prices Granger-cause corn, soybeans, and wheat prices. Muhammad and Kabede (2009) argued that emerging ethanol market has integrated oil and

corn prices and agricultural sector is importing instability from the crude oil market. This conclusion was confirmed by Conley and George (2008). According to them rotational nature of crop production causes that biofuel market influences not only corn prices, but also the prices of other crops such as wheat, soybean, and even cotton. On the other side Cooke and Robles (2009) showed that among various potential causes of commodity prices growth in 2006 – 2008, intensified speculation on futures market was the only significant factor in Granger's sense, although the changes in the length of analyzed time series significantly modified results.

It is worth mentioning that linkage between energy and corn prices varies over time. Coefficient of correlation between American monthly oil and corn prices is low (0.32) during the period of low oil prices (January 2001 – August 2007) and high (0.92) when oil prices remained above $75.barrel^{-1} (September 2007 – October 2008) (Hertel and Beckemann, 2011). Harri, Nalley and Hudson (2009) found that commodity prices are linked to oil in the case of corn, cotton, and soybean, but not for wheat. Mutuc (2010) quoted list of articles confirming and disproving hypothesis about cointegrating relations among crude oil and agricultural commodity prices.

Although there is a general agreement among economists that due to development of biofuel market relation between prices of agricultural commodities and crude oil will be getting stronger, particular research results differ depending on analyzed datasets. It makes this issue even more interesting.

In this paper we focus on the linkage between crude oil and Polish wheat prices. Contrary to majority of other studies, we concentrate on the situation of small open economy, where even in the absence of strong domestic biofuel sector, the linkage between crude oil and agricultural commodities' prices would be substantial due to dependence on global processes. Since Poland has its own currency, exchange rates play an important role in forming the relation between domestic agricultural commodities and globally traded crude oil.

Material and methods

Empirical analysis was conducted with the use of various methods. Since we dealt with time series we started with decomposition approach. We decomposed time series into long term tendency (TC_t), seasonal variation (S_t) and irregular (random) component (I_t). We used X-12-ARIMA procedure implemented in Demetra Plus software. The X-12-ARIMA program contains methods developed by both the U.S. Census Bureau and Statistics Canada. These methods estimate seasonality mainly by applying moving average filters to a possibly modified version of the input series. The modifications might include adjustments for extreme values, trading day effects, or holiday effects also estimated by the program and extension of data with the use of ARIMA modeling (Findley et all 1998; X-12-ARIMA 2011).

For extraction of trend T_t linear locally weighted scatterplot smoothing (LOESS) method was applied. LOESS is a way of estimating regression surface to data through multivariate smoothing. The dependent variable is smoothed as a function of independent variables in a moving fashion (similarly, a moving average is fitted to time series data). It combines the simplicity of linear least squares regression with the flexibility of nonlinear regression and hence does not require specifying of any form to fit a model to the data (Cleveland and Devlin 1998).

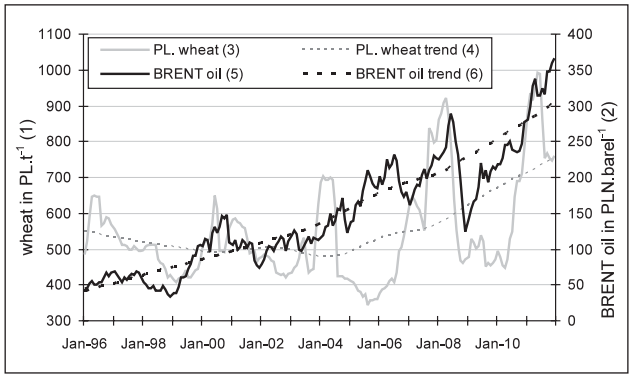

Figure 1 Monthly procurement wheat prices in Poland and crude oil (U.K. Brent 38` API, f.o.b. U.K ports) spot prices denominated in PLN (solid lines) and their trends (dashed lines)
Source: own calculation based on the Polish Central Statistical Office (GUS) and the World Bank data

Obrázok 1 Mesačný vývoj cien pšenice v Poľsku a ropy (U.K. Brent 38` API, f.o.b. U.K prístavy) v PLN (neprerušované línie) a ich trendy (prerušované línie)
Zdroj: vlastné výpočty založené na údajoch Poľského centrálneho štatistického úradu (GUS) a Svetovej banky
(1) pšenica v PLN.t^{-1}, (2) ropa Brent (PLN.barel^{-1}), (3) poľská pšenica, (4) poľská pšenica – trend, (5) ropa Brent, (6) ropa Brent – trend

As seasonality could influence results (especially when analysis is based on the first differences) the rest of calculations was performed on the basis of seasonally adjusted data. The co-movements of wheat, crude oil and exchange rates were examined with the use of rolling (moving) correlation technique. The length of the rolling window was one year (12 months). The value of correlation coefficient in a t moment for a pair of variables x, y was calculated according the following formula:

$$r_t = \frac{\sum_{t-5}^{t+6}(x_t - \bar{x})\cdot(y_t - \bar{y})}{\sqrt{\sum_{t-5}^{t+6}(x_t - \bar{x})^2 \cdot \sum_{t-5}^{t+6}(y_t - \bar{y})}} \quad (1)$$

To test stationarity of various time series, we applied Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. Null hypothesis states that time series is stationary. If it is rejected, time series is integrated of order (at least) 1. Assuming no linear trend, y_t can be formulated as follows (Lütkepohl and Krätzig 2007):

$$y_t = x_t + z_t \quad (2)$$

where:
x_t is a white noise process $x_t = x_{t-1} + v_t$, in which vt is a stationary $v_t \sim IID(0,\sigma^2_v)$, and z_t is also a stationary process in the form of $z_t \sim IID(0,\sigma^2_z)$. Stationarity is tested using two hypotheses: H_0: $\sigma^2_v = 0$ against H_1: $\sigma^2_v > 0$. *KPSS* test statistic formula is as follows:

$$KPSS = 1/T^2 \sum_1^T S_t^2 / \hat{\sigma}^2_\infty \quad (3)$$

where:
$S_t^2 = \sum_{j=1}^{T}(y_j - \bar{y})$, and $\hat{\sigma}^2_\infty$ is long-term variation estimator (Lütkepohl and Krätzig 2007)

Evaluating the nature of relation between wheat and crude oil prices, the concept of Granger causality was employed.

A variable x is said to Granger-cause y if we can better forecast y using lagged values of x than without them (Lütkepohl and Krätzig 2007). Applied Granger causality test formula is presented below:

$$y_t = A_0 D_t + \sum_{j=1}^{k} \alpha_j y_{t-1} + \sum_{j=1}^{k} \beta_j x_{t-1} + \sum_{j=1}^{k} \alpha_j \varepsilon_t \quad (4)$$

where:
A_0, α_j, β_j, are model parameters, D_t – deterministic variables, y and x are analyzed variables, k – the greatest lag length, ε_t – white noise. Null hypothesis, stating no Granger causality, assumes that $\beta_1 = \beta_2 = \ldots = \beta_k = 0$. Alternative hypothesis asserts that statistically significant lagged values of x exist. Determining number of lag length we applied VAR model

Vector autoregression model (VAR) consists of regression of every non-lagged variable on all lagged variables. VAR models are used for stationary data or data which were transformed into stationary series. Its formula is presented below (Kusideł, 2000; Tsay, 2010):

$$Y_t = \psi D_t + \Gamma_1 Y_{t-1} + \Gamma_2 Y_{t-2} + \ldots + \Gamma_p Y_{t-p} + \varepsilon_t \quad (5)$$

where:
Y_t – stochastic processes collected in $n \times 1$ vector, D_t – deterministic variables vector, ψ – matrix of deterministic variables parameters, Π_i are ($n \times n$) coefficient matrices, p means order of VAR model. These causal impacts were summarized with impulse response functions (IRF) analysis

The nonstationary time series are cointegrated if there is a linear combination of them that is stationary I(0). The linear combination is referred to as a long-run equilibrium relationship. To test existence of long-term behaviour of series a Johansen cointegration framework was applied. The cointegrating relations become evident if the levels of VAR are transformed to the vector error correction model (VECM) (Kusideł, 2000; Tsay, 2010):

$$\Delta Y_t = \psi D_t + \Pi Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + \ldots + \Gamma_{p-1} Y_{t-p+1} + \varepsilon_t \quad (6)$$

where:
$\Pi = \Pi_1 + \ldots + \Pi_p - I_n$ and $\Gamma_k = -\sum_{j=k+1}^{p} \Pi_j$, $k = 1, \ldots, p-1$. The matrix Π is called the long-run impact matrix and Γ_j are the short-run impact matrices

Since the rank of the long-run impact matrix Π gives the number of cointegrating relationships in Y_t, Johansen formulates likelihood ratio (LR) statistics for the number of cointegrating relationships as LR statistics for determining the rank of Π. Two sequential Johansen procedures used to test for the number r of cointegrating relationships are as follows:

$$LR_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \quad (7)$$

$$LR_{\max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (8)$$

where:
LR_{trace} – trace statistic, $LR_{\max}$ – maximum eigenvalue statistic, T is the sample size and $\hat{\lambda}_i$ is the i-th largest canonical correlation (eigenvalues of the matrix Π). The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigenvalue test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors

Results and discussion

Performance of the Polish wheat procurement prices and crude oil prices for the period from January 1996 to December 2011 is presented in Figure 1 together with calculated trends (T). In the first part of the analyzed period trends are not correlated contrary to the second period when wheat and oil prices increase their values.

Around trends some cyclical, seasonal and irregular variation is observed. X-12-ARIMA procedure, multiplicative model, allowed us to calculate seasonal indices for both series. X-12-ARIMA method does not assume constant seasonal pattern over the whole period and can be used in analyzing time varying seasonality. Seasonal indices for selected years (1998 and 2011) are presented in Figure 2. We can conclude that seasonal pattern in both series is time varying. In 1998, the highest wheat prices during a year were in June (1.05) whereas the highest crude oil prices were in September (1.11). In the last analyzed year (2011) seasonal patterns in wheat and crude oil series are closer to each other than they were in 1998.

The variance of the seasonal component, which is the most known type of variability in agricultural commodity markets, constitutes only around 3.3% of total variance of the wheat price series. The share of seasonal component in the oil Brent price series variance is estimated at 1.3%.

When examining the price variability we can notice that the most important part of it is connected to cyclical component. Observed cycles show recurring values of the variable of interest above or below the trend line over a multiyear time horizon. The cyclical component describes more or less regular fluctuations caused by the economic cycle. Cycles are treated by many economic analysts as a part of the long-term tendency, the so-called stochastic trend.

Cycle components of the Polish wheat and Brent oil series are shown in the Figure 3. They were calculated according to a multiplicative formula as quotient of long term tendency (TC) obtained from X-12-ARIMA and trend from LOESS. The lengths of cycles as well as their amplitudes are not constant. It all together makes the prediction of economic cycles quite

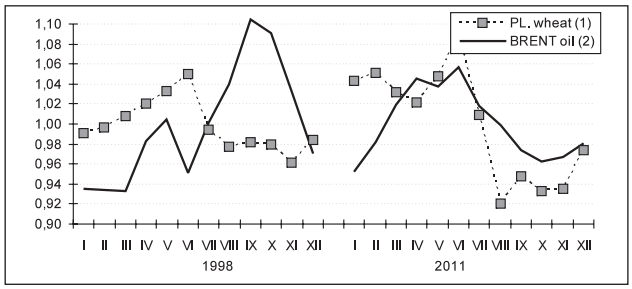

Figure 2 Seasonal indices of Polish wheat and Brent crude oil price series for 1998 and 2011 calculated with the use of X-12-ARIMA procedure
Source: own calculation according to Polish Central Statistical Office and World Bank

Obrázok 2 Sezónne indexy cien poľskej pšenice a ropy Brent v rokoch 1998 – 2011 vypočítané použitím X-12-ARIMA procedúry
Zdroj: vlastné výpočty podľa Poľského centrálneho štatistického úradu a Svetovej banky
(1) poľská pšenica, (2) ropa Brent

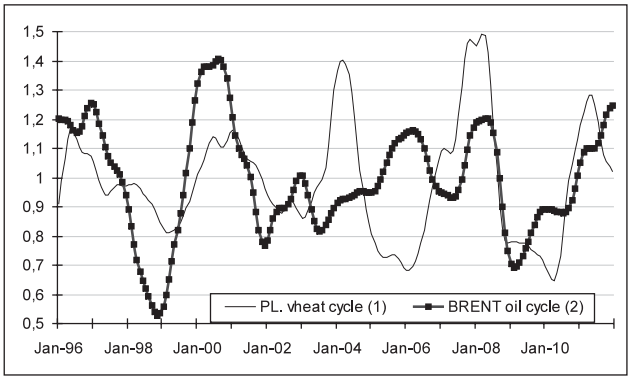

Figure 3 Cyclical indices of Polish wheat and Brent crude oil price series
Source: own calculation

Obrázok 3 Cyklické indexy cien poľskej pšenice a ropy Brent
Zdroj: vlastné výpočty
(1) cyklus poľskej pšenice, (2) cyklus ropy Brent

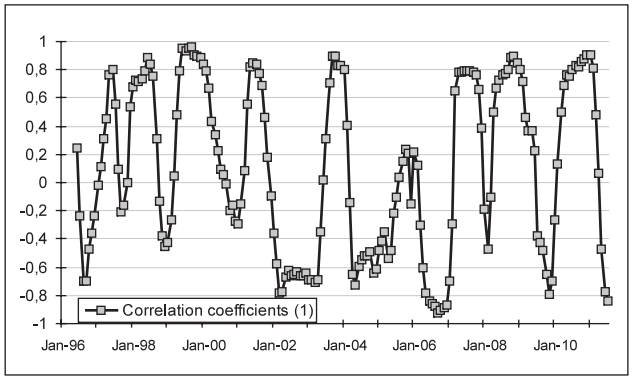

Figure 4 12-months rolling correlation coefficients between seasonally adjusted Polish wheat and crude oil prices series expressed in PLN
Source: own calculation

Obrázok 4 12-mesačné korelačné koeficienty medzi sezónne upravenými cenami poľskej pšenice a ropy, vyjadrenými v PLN
Zdroj: vlastné výpočty
(1) korelačné koeficienty

challenging. The average length of cycle of the wheat prices in Poland is around 43 months. On the other hand there are two dominant Brent oil cycles, with lengths of (according to ACF and periodogram) 50 – 60 months and around 32 months. So price cycles in the oil and wheat markets differ substantially. Neither of them is leading the other one as the highest correlation coefficient for them is for 0 lag.

Figure 3 suggests that the relation between wheat and oil price series may not be constant over time. So it will be better to use flexible method of measuring correlation between variables. We applied a 12-months rolling correlation coefficient to assess the relation between seasonally adjusted prices over time (Figure 4). Obtained result suggests that there are no clear long-term relationships between above mentioned prices. There are periods when correlation coefficient is close to 1 as well as periods when correlation is negative. Such behavior occurs due to various cycle lengths between markets.

To analyze long-term behavior of the Brent oil and Polish wheat series we used a cointegration framework. It helps to avoid spurious regression which reveals itself in determining relationships statistically significant where no such relationship exists. Such threat occurs when analyzed price series are non-stationary. All price series (logs of seasonally adjusted series) are integrated of order one (Table 1). Null hypothesis stating that log levels of price series are stationary were rejected both in the model with constant and the model with constant and trend. The first differences of all logarithms of prices are stationary (null hypothesis could not be rejected).

Two non-stationary price series are said to be cointegrated if there are linear combination between them that do not have a stochastic trend even though the individual series contain stochastic trend. In our research we used Johansen procedures (eq. 6 – 8) with two lags. The obtained statistic for trace test (LR_{trace}) and maximum eigenvalue test (LR_{max}) indicate that null hypothesis (no integration, zero integrations vectors) cannot be rejected at the 5% significance level. Similar results were obtained when US_Wheat price series were included (as well as EUR/USD exchange rate). It suggests that there is no long-run equilibrium relationship between Polish wheat prices and crude Brent oil prices.

Since logarithms of seasonally adjusted Polish wheat and Brent oil price series (whose are I(1)) are not cointegrated, further analysis was performed with the use of their first differences (*ld*). We also started with a simple 12-month rolling correlation analysis for a pairs of variables (Figure 5). According to the first plot the co-movement of Polish wheat prices and oil Brent prices is rather weak. Starting from 2004 correlation coefficients are even lower than values of these coefficients in 1996 – 2003.

Table 1 Testing unit roots for seasonally adjusted time series for years 1996 – 2011 with the use of KPSS test statistic (statistic and critical value at 5%)

Price series (1)	Levels (2)		First differences (3)
	statistic/critical value constant (4)	statistic/critical value constant and trend (5)	statistic/critical value constant (4)
l_BRENT.OIL in USD (6)	5.7802/0.464	0.288/0.148	0.066/0.464
l_US.WHEAT in USD (7)	3.20773/0.464	0.667/0.148	0.190/0.464
l_PLN/USD	2.23872/0.464	0.892/0.148	0.245/0.464
l_EUR/USD	3.32406/0.464	0.845/0.148	0.255/0.464
l_BRENT.OIL in PLN	5.71646/0.464	0.205/0.148	0.040/0.464
l_US.WHEAT in PLN	2.76044/0.464	0.328/0.148	0.079/0.464
l_PL.WHEAT in PLN (8)	1.06678/0.464	0.375/0.148	0.072/0.464

Source: own calculation Zdroj: vlastné výpočty

Tabuľka 1 Testovanie jednotkových koreňov pre sezónne upravené časové rady pre roky 1996 – 2011 s použitím KPSS testovacej štatistiky (štatistická a kritická hodnota na úrovni 5 %)
(1) časové rady cien, (2) úrovne, (3) prvé diferencie, (4) štatistická/kritická hodnota, konštanta, (5) štatistická/kritická hodnota, konštanta a trend, (6) ropa Brent v USD, (7) USA – pšenica v USD, (8) Poľsko – pšenica v PLN

Table 2 Johansen cointegration test results between logs of seasonally adjusted PL.WHEAT and BRENT.OIL series denominated in PLN (model with unrestricted constant)

H_0	Eigenvalue (1)	LR_{trace}		LR_{max}	
		statistic (2)	P-value (3)	statistic (2)	P-value (3)
r = 0	0.063	12.462	0.137	12.306	0.099
r ≤1	0.001	0.157	0.692	0.157	0.692

Source: own calculation

Zdroj: vlastné výpočty

Tabuľka 2 Výsledky Johansenovho testu kointegrácie medzi logaritmami sezónne upravených cien poľskej pšenice a ropy Brent v PLN (model s absolútnou konštantou)
(1) vlastné čísla korelačnej matice, (2) štatistika, (3) P-hodnota

It is quite surprising when we compare them with correlation coefficients between US Wheat and Brent oil prices expressed in USD. Co-movements of first differences of log prices are rising each year indicating higher and higher linkage between crude oil and wheat markets. It is interesting that we can observe increasing correlation between Brent oil prices (in USD) and EUR/USD exchange rate. It might suggest that USD exchange rates play crucial role in the oil price dynamics. The low correlation between Polish wheat prices and crude oil prices could be an effect of negative co-movement of crude oil prices and PLN/USD exchange rate.

As there is no long-run relationship between Polish wheat and Brent oil price series, VAR modeling instead VECM is relevant. According to information criteria such as Akaike information criterion (AIC), Bayesian information criterion (BIC), and Schwarz information criterion (SIC), the lag 1 is the most suitable for bivariate VAR model. As it is mentioned in the literature (i.e. Tyner 2010) starting from 2006 relationships between oil and agricultural markets could change its previous characteristics. That is why we estimated three different models: for the whole analyzed period, for years 1996 – 2005 and for years 2006 – 2011 (Table 3). The coefficients for Brent oil are relatively similar in all models. The main difference is in the coefficients signs of Polish wheat prices in crude oil equation (from negative for a whole analyzed period to positive for 2006 – 2011).

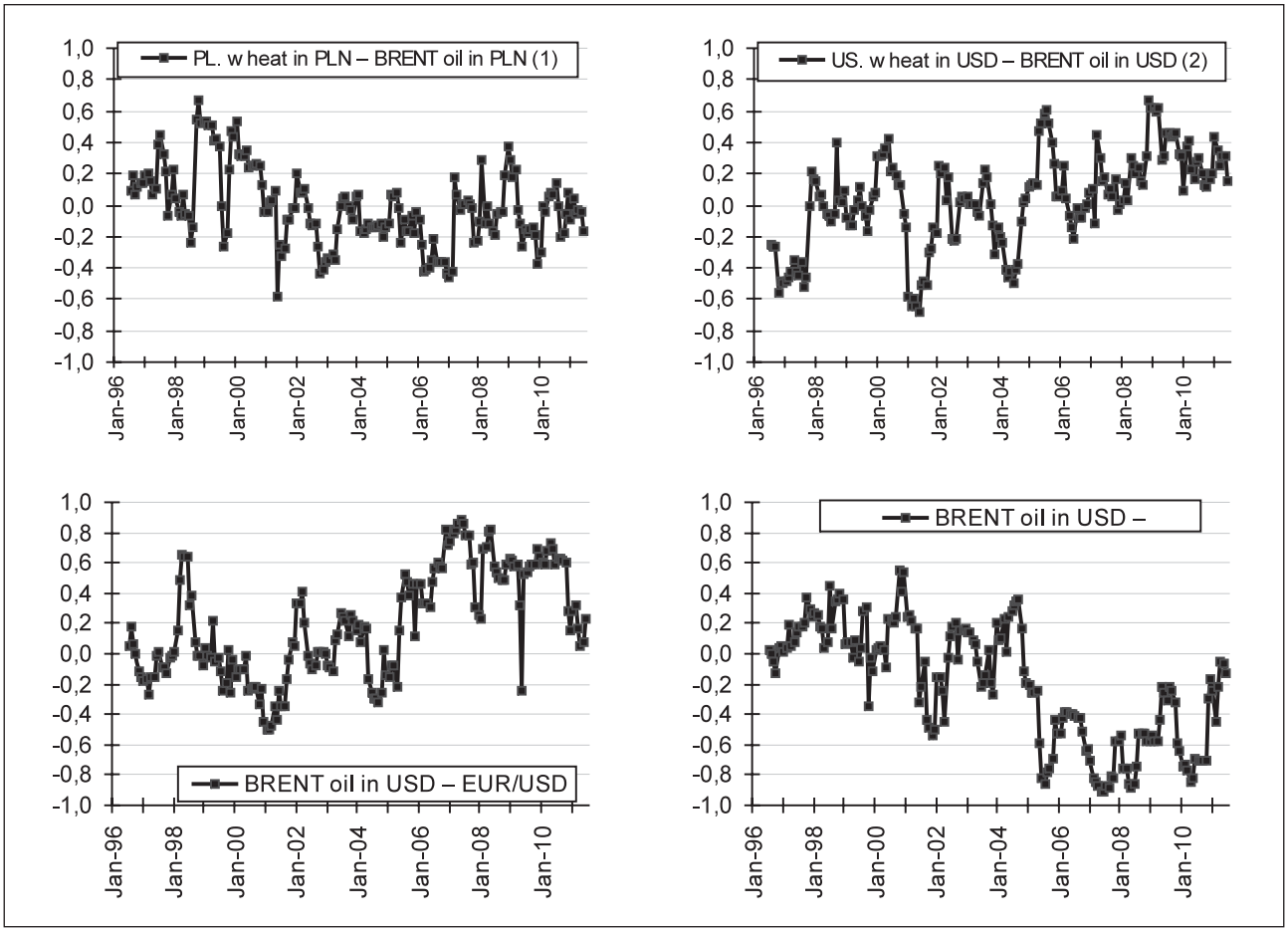

Figure 5 12-months rolling correlation coefficients between seasonally adjusted first differences of price series
Source: own calculation

Obrázok 5 12-mesačné korelačné koeficienty medzi sezónne upravenými prvými diferenciami cenových radov
Zdroj: vlastné výpočty
(1) poľsko pšenica v PLN – ropa Brent v PLN, (2) USA pšenica v USD – ropa Brent v USD, (3) ropa Brent v USD – EUR/USD, (4) ropa Brent v USD – PLN/USD

Table 3 VAR estimated results of seasonally adjusted Polish wheat prices and crude oil price denominated in PLN (first differences natural logs – ld)

Variable (1)	Coefficient (2)	P-Value (3)	Coefficient (2)	P-Value (3)	Coefficient (2)	P-Value (3)
Period (4)	1996 – 2012		1996 – 2005		2006 – 2012	
Model for Polish Wheat (5)						
Const	0.000	0.973	-0.004	0.389	0.004	0.557
ld_PL.WHEAT_PLN (-1)	0.421	0.000	0.286	0.001	0.527	0.000
ld_OIL.BRENT_PLN (-1)	0.106	0.022	0.109	0.031	0.118	0.231
Model for Crude Oil (6)						
Const	0.010	0.102	0.011	0.180	0.005	0.545
ld_PL.WHEAT_PLN(-1)	0.084	0.411	-0.100	0.538	0.260	0.033
ld_OIL.BRENT_PLN(-1)	0.065	0.371	0.048	0.607	0.127	0.275

Source: own calculation Zdroj: vlastné výpočty

Tabuľka 3 VAR modelom odhadnuté výsledky sezónne upravených cien poľskej pšenice a ropy v PLN (prvé diferencie prirodzených logaritmov -ld)
(1) premenná, (2) koeficient, (3) P-hodnota, (4) obdobie, (5) model pre poľskú pšenicu, (6) model pre ropu

Table 4 Granger causality test results, lag 1

Independent variable (1)	Dependent variable (2)	F-statistics (3)	P-value (4)
1996 – 2011			
ld_BRENT.OIL in PLN	ld_PL.WHEAT in PLN	5.308	0.022
ld_PL.WHEAT in PLN	ld_BRENT.OIL in PLN	0.678	0.411
1996 – 2005			
ld_BRENT.OIL in PLN	ld_PL.WHEAT in PLN	4.756	0.031
ld_PL.WHEAT in PLN	ld_BRENT.OIL in PLN	0.382	0.538
2006 – 2011			
ld_BRENT.OIL in PLN	ld_PL.WHEAT in PLN	1.460	0.231
ld_PL.WHEAT in PLN	ld_BRENT.OIL in PLN	4.736	0.033

Source: own calculation Zdroj: vlastné výpočty

Tabuľka 4 Výsledky Grangerovho testu kauzality, časové posunutie 1
(1) nezávislá premenná, (2) závislá premenná, (3) F-štatistika, (4) P-hodnota

Granger causality test performed for three different periods brings us quite unexpected results (Table 4). In years 1996 – 2005, as well as for the whole period, past oil price values provided statistically significant information about future values of Polish wheat. In 1996 – 2011 such an impact was statistically insignificant. Moreover, wheat prices in Poland Granger-cause Brent oil prices (PL.WHEAT was also cause for EUR/USD and PLN/USD changes but not for US.WHEAT). Interpreting such results, we have to bear in mind that Granger test may produce misleading results when the true relationship involves three or more variables. It is possible that other factors like exchange rates may distort results. Also VAR framework is very sensitive to the quality of data and fact that data comes from different sources.

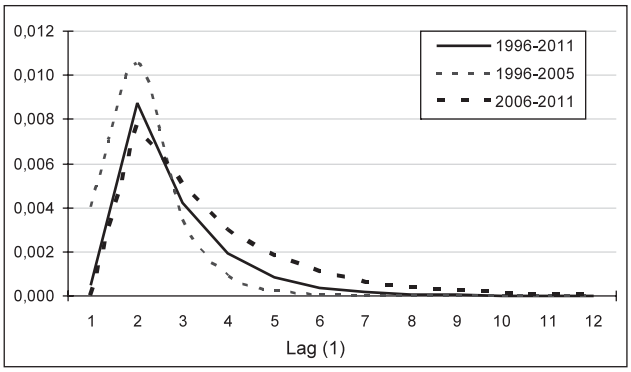

Figure 6 Impulse response functions of Polish wheat prices (ld_PL.WHEAT) to one S.D. innovation of Crude Brent oil (ld_BRENT.OIL)
Source: own calculation

Obrázok 6 Impulzné funkcie poľských cien pšenice k S.D. (smerodajná odchýlka) inováciám ropy Brent
Zdroj: vlastné výpočty
(1) časové posunutie

In the next step a impulse response function (IRF) was calculated for dependent variables to measure the magnitude of response to the impulse from one standard deviation of random disturbance term. The results presented in Table 4 were taken into account for ordering of variables. Analyzing results of IRF presented in Figure 6 we need to bear in mind that one of the drawbacks of IRF is its sensitivity to variables ordering.

Results shown in Figure 5 indicate that wheat prices respond to oil price changes. The highest value of IRF is after 2 months and it is gradually decreasing. However, the pace of decreasing in 1996 – 2005 was faster than in 2006 – 2011. Results also indicate that the direct influence of crude oil prices on Polish wheat prices is slightly lower after 2006 than it was before. That confirms conclusions drawn from simple rolling correlation analysis.

Concluding remarks

A review of literature indicates importance of oil market in the determination of agricultural commodity markets. However, conclusions about the strength of such an impact vary among the researchers mostly due to differences in the analyzed markets, data, and time periods. National biofuel policies play important role in strengthening relationship between oil sector and agricultural commodity prices. The crude oil-wheat linkage

in Poland is also evident due to rising domestic use of wheat in biofuel production and, above all, due to linkage between Polish wheat prices and the European and world wheat prices.

Results presented in this paper indicate that trends of price series of Polish wheat and Brent Oil in 1996 – 2004 are not correlated contrary to the second period (2005 – 2011) when they started to rise nearly at the same rate. Seasonal patterns in both series are time varying and of lesser importance than cyclical components. The analysis shows that the seasonal patterns of wheat and oil prices tend to be getting more similar to each other over the years. The length of cycle in the wheat prices in Poland is around 43 months while there are two dominant Brent oil cycles, with lengths of 50 – 60 months and approximately 32 months.

Due to different length of the price cycles the relation between wheat and crude oil is not constant over time. 12-Months rolling correlation coefficients for levels of seasonally adjusted data vary in a cyclical manner from -0.9 to +0.9. Johansen cointegration test did not confirm long-run equilibrium relationship between Polish wheat and crude Brent oil prices.

Rolling correlation analysis performed on first differences of prices indicates decreasing co-movement of Polish wheat prices and oil Brent prices (expressed in PLN). It is contrary to the growth of correlation coefficients between US Wheat and Brent oil prices expressed in USD. It suggests that low correlation between Polish wheat prices and crude oil prices could be an effect of negative co-movement of crude oil prices and PLN/USD exchange rate. This also reduces a risk of exposure of producers and consumers to the volatility of oil prices.

Applied IRF based on VAR models confirms that wheat prices respond to oil price changes. It is also proven that the influence of crude oil prices on Polish wheat prices has been slightly lower after 2006 than it was before. Moreover, according to a Granger causality test, in 2006 – 2011 Polish wheat prices were leading oil prices. Such behaviour could be attributed to factors like exchange rates which were not taken into account.

The performed analysis still needs to be refined. Especially deep insight into the role of exchange rates in the Polish wheat price formation is needed. Asymmetric and threshold price transmission analysis can also be employed. An extremely important issue worth consideration is the impact of oil price volatility on the volatility of the agricultural commodity prices.

Súhrn

Ceny poľnohospodárskych komodít hrajú významnú rolu jednak pri určovaní príjmov poľnohospodárov, jednak pri stanovovaní cenových vzťahov v celom hospodárstve. Za jeden z najvýznamnejších faktorov vplývajúcich na cenu pšenice sa považuje cena ropy. Cieľom tohto príspevku je zhodnotiť charakter vzájomnej previazanosti medzi svetovými cenami ropy a cenami poľskej pšenice. Výsledky výskumu potvrdzujú existenciu takéhoto prepojenia, hoci jeho charakter a sila sa v čase menia. Dlhodobé vzťahy medzi cenami ropy a poľskej pšenice sa však nepotvrdili. Naopak, rastúci vplyv cien ropy na ceny poľskej pšenice nebol v priebehu času zistený. Výsledky naznačujú, že ceny pšenice môžu byť silne ovplyvnené výmennými kurzmi. To môže oslabiť citlivosť cien poľskej pšenice vo vzťahu k svetovým cenám ropy.

Kľúčové slová: ceny pšenice, ceny ropy, cenová transmisia, VAR (vektorový autoregresný model), kointegrácia

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