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SUBJECTIVE ASSESSMENT OF FINANCIAL DISTRESS IN PURCHASING A SUFFICIENT AMOUNT OF FOOD. ECONOMETRIC ANALYSIS OF POLISH MICRODATA

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ABSTRACT

The paper analyses subjective aspects of food poverty in Poland. It deals with households' assessment of financial difficulties in purchasing a sufficient amount of food in the period 2009–2015. The study is based on *Social Diagnosis* data. Its purpose is to identify the socio-economic factors affecting financial distress among Polish households. The study also aims to test whether the probability of experiencing financial difficulties is persistent over time. In econometric analysis binary choice models for panel data are applied. The findings state that apart from equivalent incomes and owned savings, loans or debts, factors having a significant impact on the final results are places of residence and biological types of households.

Key words: financial distress, food poverty, panel data, binary output models

INTRODUCTION

There is no one single definition of poverty, but most of them are focused on the inability to meet basic needs at a satisfactory level [Drewnowski 1997, Lemmi and Panek 2016]. All traditional lists of immediate "basic needs" include food, thus, a lot of research devoted to poverty examines the access to a sufficient amount of this good. Recently, much attention in developing as well as developed countries has been paid to the phenomenon of food poverty. By this term is understood "an inability to afford, or to have access to, food to make up a healthy diet" [Maslen et al. 2013] or "the insufficient economic access to an adequate quantity and quality of food to maintain a nutritionally satisfactory, socially acceptable diet" [O'Connor et al. 2016]. There is a shortage of detailed studies on food poverty in Poland[1]. Thus, this study is carried out to get some insights into this field.

In poverty researches, two approaches are applied: the subjective and the objective one. In the analyses on subjective poverty, information on the opinion of the individuals about their situation is used. This approach deals with the subjective view that the households have of their situation as opposed to the objective one that only uses measurable variables. In other words, in the objective approach, the status of individuals can be verified by documentary evidence and is not based on subjective judgment by the respondent [Atkinson et al. 2002], while subjective poverty is defined by examining who people consider to be poor [Nandori 2011].

[1] Most of poverty researches in Poland focuses on monetary poverty [Dudek 2006, Szulc 2008, Mikuła 2011, Rusnak 2012, Lisicka 2014, Utzig 2014, Sączewska-Piotrowska 2015].

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This study tries to improve the understanding of subjective aspects of food poverty in Poland through estimation of binary choice models for panel data. More precisely, this research deals with econometric analysis of the financial difficulties of households to purchase enough food. Thus, the purpose of this study is an identification of socio-economic factors affecting financial distress among Polish households[2]. It also aims to test whether the probability of experiencing financial difficulties of households to purchase enough food is persistent over time.

EMPIRICAL DATA

This study is based on data completed in the framework of the survey *Social Diagnosis* which took place in 2000–2015 [Council for Social Monitoring 2015]. Two questionnaires are used in the survey – for individuals and for households. In this study, data from the second questionnaire is used. The survey questionnaire includes the question: Can your household afford to buy a sufficient amount of the following food items? Provide the answers for each of the following items separately: vegetables and vegetable preserves; fruit and fruit preserves; meat (including poultry); meat and poultry products; fish and fish products; butter and other edible fats; milk; dairy products; sugar; confectionary (sweets, chocolate etc.).

Respondents could choose an answer: yes or no. The aim of this work is to identify the households that could not afford to buy a sufficient amount of at least one of the ten featured group of products. Thus, in econometric models dependent variable is a binary variable taking a value 1 if household reported any financial difficulties in purchasing the food and a value 0 if the household did not indicate any problems in this assessment.

The *Social Diagnosis* research is a panel study. Each subsequent wave involves all available households from the previous wave and households from a new representative sample. So far, eight waves have been conducted: in 2000, 2003, 2005, 2007, 2009, 2011, 2013 and 2015 [Czapiński and Panek 2015]. Approximately 70% of the households surveyed in a given year, participated in the next wave of the research. In the study, the data regarding years 2009–2015 is analysed. Such choice of period is due to the fact that the sample size significantly increased from 3,000–4,000 households in 2000–2005 to around 12,000 households in 2009–2015. Moreover, in 2007, more than a half of the households did not reply to the investigated question, thus, the data with respect to this year has to be omitted in the this study.

The analysis aims to check whether the selected socio-economic factors affected the fact that a household reported financial difficulties in purchasing a sufficient amount of food in at least one of the featured group of products.

METHODS

Using a latent variable framework, the binary choice model for a panel of data would be written as [Greene 2012]:

$$y_{it}^{*} = \boldsymbol{x}_{it}^{T}\boldsymbol{\beta} + u_i + \varepsilon_{it},\ i = 1,\ldots, n,\ t = 1, \ldots, T_i$$

$$y_{it} = \begin{cases} 1 \ \ if \ \ y_{it}^{*} \geq 0 \\ 0 \ \ if \ \ y_{it}^{*} < 0 \end{cases} \tag{1}$$

where: $\boldsymbol{x}_{it}$ – a vector of values of explanatory variables representing the characteristics of i-th household in t-th year;

[2] This paper is an extension of study presented in [Dudek 2016] by taking into account a broader set of explanatory variables and considering a broader group of models.

$\boldsymbol{\beta}$ – a vector of parameters to be estimated, $\boldsymbol{\beta}^T = [\beta_0, \beta_1, ..., \beta_k]$;
y_{it}^* – a latent (unobserved) variable for i-th household in t-th year;
y_{it} – a value of observed binary variable for i-th household in t-th year;
u_i – an unobserved, individual specific effect for i-th household;
ε_{it} – an error term for i-th household in t-th year, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon)$;
i – indexes households;
t – indexes time period;
n – number of households;
T_i – number of observations for i-th households.

In econometrics for panel data there is a distinction between "random" and "fixed" effects models by the relationship between u_i and $\boldsymbol{x}_{it}$. The assumption that u_i is unrelated to $\boldsymbol{x}_{it}$ produces the random effects model, other-wise fixed effects model should be applied [Baltagi 2005, Jaba et al. 2016]. Both approaches are fraught with difficulties and unconventional estimation problems. On the one hand, estimation of the random effects model requires strong assumptions about the individual specific effects. On the other hand, the fixed effects model encounters an incidental parameters problem that renders the maximum likelihood estimator inconsistent even when the model is properly specified, moreover, there cannot be any time invariant explanatory variables in a fixed effects binary choice model [Greene and Hensher 2010]. Fixed effects models must be excluded in this study, because several explanatory variables are time invariant. Thus, random effects models are estimated. Such models assume that u_i and ε_{it} are independent random variables with [Greene and Hensher 2010]:

$$E[\varepsilon_{it} |\mathbf{X}] = 0;\ cov[\varepsilon_{it}, \varepsilon_{js} |\mathbf{X}] = \text{Var}[\varepsilon_{it} |\mathbf{X}] = 1, \text{ if } i = j \text{ and } t = s;\ 0 \text{ otherwise} \tag{2}$$

$$E[u_i |\mathbf{X}] = 0;\ cov[u_i, u_j |\mathbf{X}] = 0 \text{ if } i \neq j,\ \text{Var}[u_i |\mathbf{X}] = \sigma_u^2 \tag{3}$$

$$cov[\varepsilon_{it}, u_j |\mathbf{X}] = 0 \text{ for all } i, t, j \tag{4}$$

where: $\mathbf{X}$ indicates all the exogenous data in the sample, $\mathbf{x}_{it}$ for all i and t.

Then

$$cov[w_{it}, w_{is}] = \sigma_u^2,\ \rho = corr(w_{it}, w_{is}) = \frac{\sigma_u^2}{1 + \sigma_u^2} \tag{5}$$

where: $w_{it} = u_i + \varepsilon_{it}$.

Parameter ρ is the proportion of the total variance contributed by the panel-level variance component. When it equals zero, the binary panel model reduces to the pooled binary model[3]. The conditional probability that y equals one is given by the formula:

$$P(y_{it} = 1 | \boldsymbol{x}_{it}, \boldsymbol{\beta}, u_i) = P(y_{it}^* \geq 0 | \boldsymbol{x}_{it}, \boldsymbol{\beta}, u_i) = P(-\varepsilon_{it} < \boldsymbol{x}_{it}^T \boldsymbol{\beta} + u_i) = F(\boldsymbol{x}_{it}^T \boldsymbol{\beta} + u_i) \tag{6}$$

where: F denotes a cumulative distribution function (cdf) of $-\varepsilon_{it}$.

[3] Pooled binary model does not contain in formula (1) component u_i – individual specific effect for i-th household.

Various functions for F have been suggested in the literature. The most common ones are:

- the logistic cdf, i.e. $F(z) = \Lambda(z) = \frac{\exp(z)}{1 + \exp(z)}$, yielding the logit model;
- the standard normal cdf, i.e. $F(z) = \Phi(z)$, yielding the probit model;
- extreme-value (Gumbel) cdf, i.e. $F(z) = \exp[-\exp(-z)]$, yielding complementary log-log model[4].

The less-used complementary log-log model is an alternative to logit and probit analysis and is typically applied when one of the outcomes (the positive or negative) are rare [Cameron and Trivedi 2005].

The parameters $\beta_1, \beta_2, ..., \beta_k$ in considered binary choice models are not easy to interpret directly. One can determine the marginal effect of a change in an explanatory variable on the conditional probability that $y = 1$. According to the formula (6) the marginal effect of a given variable, say X_j, are given by:

$$\frac{\partial P\left(y_{it} = 1 \middle| \boldsymbol{x_{it}}, \boldsymbol{\beta}, u_i\right)}{\partial x_{jit}} = \beta_j F'\left(\boldsymbol{x_{it}^T \beta} + u_i\right) \tag{7}$$

where: $F'\left(\boldsymbol{x_{it}^T \beta} + u_i\right) = \frac{\partial F\left(\boldsymbol{x_{it}^T \beta} + u_i\right)}{\partial\left(\boldsymbol{x_{it}^T \beta}\right)}$

x_{jit} – a value of j-th explanatory variable for i-th household in t-th year.

Hence, the significance and the direction of the marginal effects may be analysed simply by examining the significance and sign of β_j.

The customary estimation method of random effects models is a maximum likelihood method. Applying this method, it is commonly assumed that individual specific effects u_i are normally distributed, with $u_i \sim N(0, \sigma_u^2)$. The log-likelihood is given by formula:

$$\log L = \sum_{i=1}^{n} \log \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T_i} G(y_{it}, \alpha + \mathbf{x}_{it}^T \boldsymbol{\beta} + \sigma_u v_i)\right] \varphi(v_i)\, dv_i \tag{8}$$

where: φ – a density function for standard normal distribution, $v_i = \frac{u_i}{\sigma_u}$

$G(y_{it}, \alpha + \mathbf{x}_{it}^T \boldsymbol{\beta} + \sigma_u v_i) = F\left(\mathbf{x}_{it}^T \boldsymbol{\beta} + \sigma_u v_i\right)$, if $y_{it} = 1$

and $G(y_{it}, \alpha + \mathbf{x}_{it}^T \boldsymbol{\beta} + \sigma_u v_i) = 1 - F\left(\mathbf{x}_{it}^T \boldsymbol{\beta} + \sigma_u v_i\right)$ otherwise.

Maximization of the log-likelihood (8) with respect to parameters $\boldsymbol{\beta}$ and σ_u^2 requires computation of the inner integrals, for which there is no analytical solution, thus, numerical methods have to be used. The most common approach is to use quadrature methods [Cameron and Trivedi 2005].

In poverty analysis sometimes the current state of poverty has been modeled as a function of lagged poverty [Giarda 2013, Alem et al. 2014]. This approach requires the use of a dynamic binary choice model. Such a model for a panel of data that explicitly allows for lagged effects would be written as [Verbeek 2008]:

$$\boldsymbol{y_{it}^*} = \boldsymbol{x_{it}^T \beta} + \gamma y_{i,t-1} + u_i + \varepsilon_{it} \tag{9}$$

with $y_{it} = 1$, if $\boldsymbol{y_{it}^*} > 0$ and 0 otherwise.

[4] Note that unlike logit and probit the complementary log-log model is asymmetrical, therefore formula (6) yields to $P(y_{it} = 1 \,|\, \boldsymbol{x}_{it}, \boldsymbol{\beta}, u_i) = 1 - \exp[-\exp(-\boldsymbol{x_{it}^T \beta} + u_i)]$.

In the dynamic binary choice model $\gamma > 0$ indicates positive state dependence, i.e. the *ceteris paribus* probability that $y_{it} = 1$ is larger, if $y_{i,t-1} = 1$ [Verbeek 2008]. In order to get consistent parameter estimates of the model (9), Wooldridge approach is applied [2005].

In this study, both types of models: static model given by formula (1) and dynamic model given by the formula (9) are estimated.

RESULTS AND DISCUSSION

A decrease of percentage of the households that indicated financial distress in purchasing enough food on time in question is found. In 2009 about 28% of the households had such distress, while in 2015 – only about 19%.

In order to identify households that showed financial difficulties in purchasing enough food, various socio-economic factors are taken into account: demographic structure of the households, class of the place of residence, incomes, savings and debts. Akaike and Bayesian information criteria are used to compare alternative models with various sets of explanatory variables.

Random effects models with various variants of cdf: logit, probit and complementary log-log have been estimated. No meaningful differences between values of maximum likelihood function for these models have been found. Moreover, signs of parameters β in all models indicate the same direction of impacts of socio-economic factors. Thus, the paper presents only the results for random effects probit models (Table 1). Table 2 presents description to measured variables. Computations are performed using Stata 14 statistical software package.

It is evident that most of the explanatory variables are statistically significant at 0.01 level. Moreover, the results of estimation of parameters σ_u and ρ confirm the presence of the unobserved individual specific effects u_i in formulas (1) and (9).

Based on results of estimation of the dynamic model (9) evidence of state dependence is found, that is, the probability of experiencing financial difficulties in purchasing a sufficient amount of food at time (t) positively depends upon the probability of having experienced financial fragility at time ($t-1$). As expected, higher income and having savings reduced the probability of such difficulties, while having loans or credit – increased it[5]. This finding can be explained by the fact that in most cases, savings and debts are the main liquid assets that can be used as a substitute for current income if the income level decreases or the level of spending increases [Kośny and Piotrowska 2013].

According to obtained results, living in the middle-sized towns improved a perception of own financial situation, comparing to other places of residence. Taking into account type of household, with married couples without children as a reference type, it is found that, the probability of experiencing financial difficulties in purchasing a sufficient amount of food was greater among one-person households and single-parent families and was lower among married couples with children. There are no statistical significant differences in this assessment between married couples and non-family multi-person households. These results indicate that psychological components in a subjective assessment of own financial situation are very important.

It is difficult to compare the obtained results with the findings of other research, since the literature lacks studies regarding determinants of financial difficulties in purchasing a sufficient amount of food in Poland. One can only refer to research of various authors on the subjective assessment of the financial conditions of Polish households. It should be mentioned that Kasprzyk [2016] stated that the main factors influencing such assessment are incomes and owned savings, which found confirmation in the present study. The results regarding place of residence mentioned in the literature are not unambiguous; for instance, Kasprzyk [2016] found that the place of residence is of little influence on the subjective assessment of own financial situation, whereas Dudek and Landmesser [2012] stated that the probability of higher levels of income satisfaction of households in the countryside is lower than in the case of households in towns. Taking into account type of household, findings

[5] All presented interpretation were made under *ceteris paribus* assumption.

Table 1. Results of estimation of random effects probit models

Variable	Model given by eq. (1)		Model given by eq. (9)	
	est.	*SE*	est.	*SE*
Lagged *y*	–	–	0.357***	0.047
Logarithm of income	–1.322***	0.026	–0.984***	0.035
Savings	–0.618***	0.025	–0.453***	0.032
Debts	0.146***	0.023	0.164***	0.029
Class of place of residence				
Very big town	0.330***	0.065	0.382***	0.080
Big town	0.190***	0.064	0.265***	0.077
Middle-sized town	ref.	ref.	ref.	ref.
Small town	0.215***	0.056	0.201***	0.068
Very small town	0.257***	0.059	0.258***	0.071
Village	0.259***	0.053	0.201***	0.064
Type of household				
MC without children	ref.	ref.	ref.	ref.
MC with 1 child	–0.106***	0.039	–0.065*	0.035
MC with 2 children	–0.293***	0.041	–0.162***	0.048
MC with 3+ children	–0.173***	0.050	–0.167***	0.059
Single-parent	0.216***	0.041	0.157***	0.048
Multi-family	–0.166***	0.047	–0.118***	0.057
One-person	0.411***	0.036	0.256***	0.043
Non-family	0.030	0.099	0.070	0.118
Year				
2009	0.210***	0.028	–	–
2011	0.123***	0.028	0.173***	0.031
2013	0.127***	0.027	0.156***	0.030
2015	ref.	ref.	ref.	ref.
Constant	8.114***	0.191	5.348***	0.251
σ_u	1.033***	0.021	0.759***	0.042
ρ	0.516***	0.010	0.368***	0.026

* means statistical significance at 0.10; ** statistical significance at 0.05; *** statistical significance at 0.01.
Source: Author's own computation.

Table 2. List and description of explanatory variables

Variable	Description
Income	real equivalent income over the period of study (for further explanation see Czapiński and Panek [2015])
Savings	1 if household has savings, 0 otherwise
Debts	1 if household has loans or credit, 0 otherwise
Class of place of residence	the class of place of residence is divided into urban and rural areas, with urban areas further subdivided by resident size units
very big town	1 if town over 500,000 residents, 0 otherwise
big town	1 if town with 200,000–500,000, 0 otherwise
middle-sized town	1 if town with 100,000–200,000 residents, 0 otherwise
small town	1 if town with 20,000–100,000 residents, 0 otherwise
very small town	1 if town up to 20,000 residents, 0 otherwise
village	1 if rural areas, 0 otherwise
Household type	household type is established on the basis of the number of families and biological family type
MC without children	1 if married couples (MC) with no children, 0 otherwise
MC with 1 child	1 if married couples (MC) with one child, 0 otherwise
MC with 2 children	1 if married couples (MC) with two children, 0 otherwise
MC with 3+ children	1 if married couples (MC) with three or more children, 0 otherwise
single-parent	1 if single-parent families, 0 otherwise
multi-family	1 if multi-family households, 0 otherwise
one-person	1 if non-family one-person households, 0 otherwise
non-family	1 if non-family multi-person households, 0 otherwise
Year	data regarding to 2009–2015 is analysed
2009	1 if year is 2009, 0 otherwise
2011	1 if year is 2011, 0 otherwise
2013	1 if year is 2013, 0 otherwise
2015	1 if year is 2015, 0 otherwise

Source: Author's own computation.

of this study are confirmed by other authors. Ulman and Šoltés [2015] found that the greatest risk of subjective monetary poverty affects one-person and single-parent households.

It should be emphasized that this study can be seen as a first step towards a measurement of subjective aspects of food poverty. In future research on determinants of financial distress in purchasing a sufficient amount of food, various characteristics of the members of the household should be taken into account, among others: education, age, gender and labour market status.

CONCLUDING REMARKS

The study undertakes the issue of financial distress in purchasing a sufficient amount of food. It uses the data from *Social Diagnosis* survey. This data has an important advantage: approximately 70% of the households surveyed in a given year, participated in the next wave of the research, therefore, this type of data can be treated as a panel data. A distinctive feature of panel data modelling is inclusion of unobserved heterogeneity, which is typically interpreted as the individual specific effect of latent factors on the dependent variable.

In econometric analysis binary choice models with random-effect case are estimated. It is found that apart from "financial" reasons, such as achieved incomes, having savings, loans or credit, class of place of residence and biological types of households have an important influence on the perception of financial distress in purchasing a sufficient amount of food. Moreover, the results indicate that such perception among Polish households is persistent over time.

The issue of financial distress in purchasing a sufficient amount of food should be constantly monitored. The obtained findings could be used in creating a social policy supporting vulnerable households.

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OCENA SUBIEKTYWNYCH TRUDNOŚCI FINANSOWYCH W ZAKRESIE NABYWANIA WYSTARCZAJĄCEJ ILOŚCI ŻYWNOŚCI – ANALIZA EKONOMETRYCZNA POLSKICH MIKRODANYCH

STRESZCZENIE

W pracy podjęto temat subiektywnych aspektów ubóstwa żywnościowego. Analizę przeprowadzono na podstawie oceny trudności finansowych gospodarstw domowych w zakresie zakupu wystarczającej ilości żywności. Wykorzystano dane z badania *Diagnoza społeczna* przeprowadzonego w latach 2009–2015. W analizie ekonometrycznej zastosowano statyczne i dynamiczne modele zmiennych binarnych dla danych panelowych. Stwierdzono, że oprócz sytuacji dochodowej, posiadania oszczędności lub kredytów ważnymi determinantami subiektywnego ubóstwa żywnościowego były miejsce zamieszkania oraz typ biologiczny gospodarstw domowych.

Słowa kluczowe: trudności finansowe, ubóstwo żywnościowe, dane panelowe, modele zmiennej binarnej

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GROWTH AND PRODUCTIVITY ADVANTAGES OF SPECIALIZED FARMS IN CENTRAL AND EASTERN EUROPEAN COUNTRIES IN 2005–2013

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ABSTRACT

The paper makes a comparison between specialized small (below 5 ha UAA) and non-small farms (5 ha and over) and non-specialized farms with particular respect to the EU-10 (Central and Eastern European – CEECs) countries. It analyses the structure and growth of farms in terms of 10 types of their specializations, performance, labour and land use between 2005 and 2013. The aim of the paper is to point out which type of specialized farms demonstrate advantages in terms of production growth and productivity when compared with non-specialized farms. It has been concluded that in area, labour and total productivity both small and non-small specialized farms of EU-10 have achieved higher growth in compare with related farm categories of EU-27. Within EU-10 number of specialized farms has declined less than the number of non-specialized ones. Average farm output of specialized farms (both small and non-small) have exceeded that of non-specialized farms both in 2005 and 2013. The growth and productivity of specialized farms varied according to countries and according to farm types. Comparing specialized farms to non-specialized ones within EU-10 non-specialized small farms have advantage in growth of area and labour productivity while non-small non-specialized farms have achieved higher growth in labour productivity.

Key words: small farms, specialization, CEECs

INTRODUCTION

The issue of survival for farms and especially small farms has always been on the table for discussion for the EU and Member States' national policy-makers. This paper discusses the specialization of farms in the EU-10 from 2005 to 2013 distinguishing small farm and non-small farm categories. The very definition of the term small farm became a topic of discussion among researchers aiming to achieve a clearer understanding of this farm category. Hubbard gives a good background to this debate [Hubbard 2009]. However, the performance and role of small and family farms is not always clearly interpreted. Small farms are family farms but family farms are not always small farms [Matthews 2011].

Two criteria are used for defining the size of farms in the EU. One is the size of land, although, different countries use different thresholds for small farms. Farms having less than 5 ha of utilized agricultural area (UAA) are regarded as small farms in this paper while all those farms having 5 ha UAA or over are regarded as non-small farms. Farms can also be categorized according to the economic size by the standard output (SO).

In the literature, the role, importance, development and policy aspects of small farms has been discussed [Motion for a European Parlament... 2014, Davidova 2014, Davidova and Bailey 2014, Dwyer 2014]. It has been

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emphasized that small farms have to make changes in farming methods in order to have a successful adjustment concerning their possible integration into modern food chains [Forgacs 2006, Csaki and Forgacs 2008, Gordon et al. 2014, Rabinowitz 2014]. Social capital aspects of small farms have also been investigated [Wolz et al. 2010]. Structural change of semi-subsistence farms (SSFs) in 2004 NMSs was discussed from agricultural policy point of view [Erjavec et al. 2014]. The roles and dynamics of small farms in rural development were analysed in a study focused on Romania [Popescu 2014]. However, the specialization aspect of farms in the EU-10 in general has not received much attention from researchers so far. Forgacs [2016] has carried out an analysis of specialization of small farms covering nine types of specializations. The paper analyzed the number of small farms, their land and labor use as well as farm output in CEECs between 2005 and 2013. It revealed that although both area and labour productivity were higher in non-specialized small farms as opposed to specialized ones, the growth in total productivity achieved by small specialized farms has exceeded that achieved by non-specialized ones since the EU Eastward Enlargement concluding specialization offers advantages not only for large farms but small ones, too, showing that this is a path offering better chances for survival for them.

This paper gives a comparison between the performance advantages of small (below 5 ha UAA) and non-small specialized farms (5 ha UAA and over) on the one hand, and between specialized and non-specialized farms on the other hand.

Why does analysis of the performance of small specialized farms make sense when specialization brings economic advantages mostly for large farms? There is a good deal of theoretical research both at macro and micro level about the advantages of specialization. The paper does not deal with theoretical aspects of specialization, instead, it gives an overview of specialized farms development in the EU-10 over a nine-year period. The size of farm (production) is a key factor to a specialized farm taking advantages of narrowing product structure by finding a better combination of inputs and making its market bargaining power stronger, resulting in higher profitability. However, the proportion of small farms amounts to some 80% of total farms in the EU-10 in 2005 and the proportion of specialized small farms (above 30%) did not decrease at all from 2005 to 2013. Both the high number of small specialized farms and the fact of their increasing share and higher growth in per farm output (SO/farms) as compared to non-specialized farms provide solid arguments for paying attention to the advantages of specialization for small farms, too. It is a fact that over the period 2005–2013 small specialized farms in the EU-10 declined to a lesser extent than non-specialized farms, providing evidence that the specialization of small farms also offers advantages in finding a better path for survival. In addition, a comparison of input, output and productivity indicators between small and non-small (5 ha UAA and above) specialized farms shows how farms have been trying to adjust to a changing economic environment when their size is taken into account.

The question is: to what extent could specialization help farms to achieve a better performance than non-specialized farms and what differences exist between non-small specialized farms and small specialized ones in CEEs over 2005–2013 period.

The following hypotheses will be investigated:

- Hypothesis 1: Share of number of specialized small and non-small farms do not decline in related farm category.
- Hypothesis 2: Specialization of farms has regional characteristics.
- Hypothesis 3: Growth of economic indicators of specialized farms show advantages compared to non-specialized farms.

MATERIAL AND METHODS

To obtain a deep insight into farms' performance from a specialization perspective, Eurostat data set of 2005–2013 was used for analysis (http://ec.europa.eu/eurostat/data/database). Besides the structural development of specialized farms their labour use (agricultural work unit – AWU), land use (UAA) and production (SO) were

analyzed. The performance of specialized and non-specialized farms has been compared while analysis of their growth provides insight into the pattern of farms' development among 10 specialized farm types[1], as compared with non-specialized farms.

This is the first time specialization of farms in the EU-10 has been analyzed in-depth and compared to both the EU-27 average and non-specialized farms of the EU-10 after EU Eastward Enlargement.

ANALYSIS OF SPECIALIZATION OF FARMS

Number of specialized farms

In 2005 there were 8.6 million farms in the EU-10 of which 80.3% belonged to the small farm category. Both in the small and the non-small farm categories around one third of farms are specialized; a bit more specialization can be observed in the case of non-small farms than with small ones. The number of farms declined in all EU-10 countries significantly between 2005 and 2013; this was especially true in the case of small non-specialized farms, exceeding the decrease of number of specialized small farms. However, the number of non-small specialized farms has actually increased by 9.2%. The relative share of specialized farms within the related category has increased significantly in the non-small farm category (29.3%), having a relative share of 43.4% in related category in 2013 while it was 35.8% in small specialized farms (Fig. 1). Generally, it can be seen that the specialization level of non-small farms has exceeded that of small ones, the exceptions being Romania and to an extent, Hungary and the Czech Republic.

It is therefore clear that during structural restructuring farms did their best to speed up further specialization to become more competitive in the marketplace and survive. Such developments can be observed in all EU-10

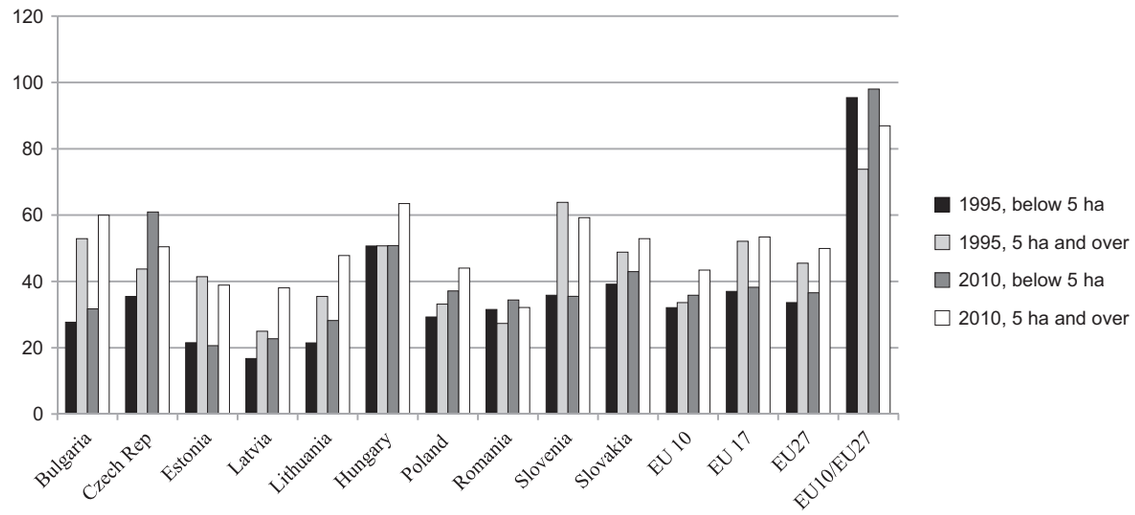

Fig. 1. Relative share of number of specialized farms within related category (2005, 2013)

Source: Author's calculations based on the Eurostat data.

[1] The following specialized farm types give the basis for analysis: 1 – specialized in cereals, oilseed and protein crops; 2 – specialized in horticulture indoor; 3 – specialized in horticulture outdoor; 4 – specialized in vineyards; 5 – specialized in fruit and citrus fruit; 6 – specialized in dairy farming; 7 – specialized in cattle-rearing and fattening; 8 – specialized in cattle rearing and fattening – dairy combined; 9 – Specialized in pig production; 10 – specialized in poultry production.

countries. The growth of share of number of specialized farms of EU-10 was above EU-27 average in both categories, reflecting the fact that the catching up of farms in CEECs has a strong specialization character but still varies by countries.

Specialization in cereals, cattle rearing and fattening and poultry were most preferred by small farms while the number of non-small specialized farms has grown in cattle rearing and fattening across all EU-10; the number of non-small farms specializing in fruits and cereals also went up in nine countries of EU-10. The number of small specialized pig farms did not decrease in three CEE Member States (Romania, Lithuania and Latvia) whereas it decreased in all CEECs in case of non-small specialized farms, thereby indicating the low competitiveness of large specialized farms.

Only in vineyards and cattle rearing and fattening did the number of small specialized farms increased over the analyzed period. Among non-small specialized farms five countries out of EU-10 can be found where number of specialized farms was higher in 2013 compared to 2005. The highest degree of growth went to cattle rearing and fattening (96.9%) followed by cereals (53.1%) and fruits (38.1%).

The highest growth of small specialized farms goes to Latvia (cattle rearing and fattening, 1,600% with low basis), to Lithuania (cereals 355% and poultry 230%). The number of small specialized farms dropped only less than 5% in Romania and less than 8% in Lithuania and Slovakia while the decline was above 50% in four CEECs (Slovenia, the Czech Republic, Estonia and Bulgaria). In 2013 there are more non-small specialized farms in six CEECs backed by highest growth in Bulgaria (61.7%) and Slovenia (53.3%). In Hungary almost two out of three are specialized farms within the related category.

The growth of share of specialized farms in CEECs exceeded that of EU-27 average, approaching EU average more among non-small farms in 2013. In 2005 the share of specialized farms of TOP 5 amounts to more than 93.2% in case of non-small farms (dairying: 37.3; cereals: 35.9; pigs: 8.9; cattle-rearing and fattening – dairy combined: 7.6% and fruit: 3.5%) while this figure accounts for 85.4% in small farms (cereals: 31.3; poultry: 25.9; dairy: 13.7; fruits: 8.8; and vineyards: 5.7%). A high concentration of farm specialization can be seen in both small and non-small farms but apart from cereals small farms specialized mostly in labor intensive farming, especially in poultry, fruits and vineyards as compared to non-small farms (Fig. 2). Only specialized farms in indoor horticulture cannot be found in TOP 5. In 2013 the same specializations can be found in TOP 5 in both farm categories, except in non-small farms where pig was OUT and cattle-rearing and fattening was IN. However,

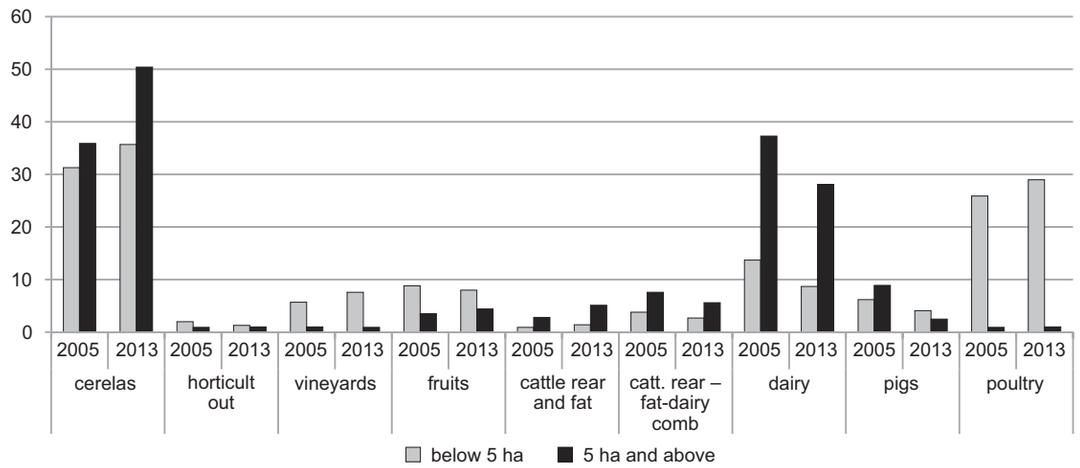

Fig. 2. Share of specialized farms in related category by farm type in EU–10 (2005, 2013)

Source: Author's calculations based on the Eurostat data.

significant structural changes have taken place. In non-small farms the share of farms in four specializations has decreased and every second one already went to cereals category. In case of small farms, the share of TOP 5 increased from 85.4% in 2005 to 89% in 2013. More farms specialized in cereals and poultry while the level of specialization was left practically unchanged among non-small farms.

Land use in specialized farms

In 2005 small farms used 9.1 million ha of UAA in the EU-10 having a share of 61.5% of the total EU-27 and this share was maintained in 2013 when 5.6 million UAA was cultivated by small farms in two countries (Romania and Poland). Land use of specialized small farms in the EU-10 amounted to 1.9 million ha in 2013, 17% more than in the EU-17, from 2.3 million ha in 2005.

The total land area used by specialized small farms went back by 16.3% in the EU-10 (21.8% in the EU-17). Non-small specialized farms cultivated 17.1 million UAA in 2005, which went up by 39.4% to 23.8 million ha in 2013. UAA of small specialized farms has declined in all EU-10 Member States within a scale of 1.9% in Poland up to 53.6% in the Czech Republic. Conversely, non-small specialized farms have increased UAA in all EU-10 countries.

In 2005 25.4% of UAA used by small farms went to specialized farms – below the average – in Baltic states and Romania, while it was at 40.3% the highest in Hungary. Average figure of EU-10 went up to 29.8% in 2013 when in three countries (the Czech Republic, Hungary and Slovakia) this figure was already above 40%. Share in UAA of non-small specialized farms accounted for 45.2% in 2005 and 56.9% in 2013 exceeding already EU average figure of the same category. It is a general picture that all specialized farms (small and non-small) took the advantage of specialization on an extended land area of 53.2% on average in 2013. Growth of UAA of specialized farms varied by countries. The highest growth has been achieved in Latvia and Lithuania while it was practically unchanged in Slovenia and decreased a bit in Bulgaria resulting in an average growth of EU-10 at 28.8% over the nine-year period (Table 1).

Table 1. Share of specialized farms with land in UAA within related category

Specification	Share of (%)						Dynamics total 2013/2005
	2005			2013			
	below 5 ha	5 ha and over	total	below 5 ha	5 ha and over	total	
Bulgaria	29.5	78.4	72.0	34.2	69.3	67.9	94.4
Czech Republic	26.5	34.8	34.7	49.3	47.1	47.2	135.8
Estonia	21.9	68.4	66.6	20.6	69.5	68.7	103.0
Latvia	16.9	41.3	39.5	25.0	62.0	60.6	153.6
Lithuania	21.2	47.0	43.6	28.8	67.3	63.9	146.7
Hungary	40.3	56.9	55.5	47.8	66.1	65.1	117.3
Poland	27.9	40.5	38.3	37.8	51.5	49.7	129.7
Romania	23.0	39.4	33.4	24.3	52.1	44.2	132.2
Slovenia	38.4	63.2	57.4	36.9	64.1	58.4	101.7
Slovakia	33.3	43.1	42.9	41.1	56.5	56.3	131.2
EU-10	25.4	45.2	41.3	29.8	56.9	53.2	128.8
EU-17	36.9	52.7	52.0	39.6	55.0	54.5	104.9
EU-27	29.8	50.9	49.1	33.6	55.5	54.2	110.4
EU-10/EU-27	85.2	88.8	84.3	88.7	102.5	98.3	116.7

Source: Author's calculations based on the Eurostat data.

In seven specialized farm types land use of both small and non-small farms developed in the same directions. There have been two specializations (cereals and cattle rearing and fattening) where all specialized farms increased land area from 2005 to 2013. The growth was significant in cattle rearing and fattening in both farm categories (63.3 and 53.5% respectively). At the same time, both small and non-small farms found five specializations (cattle rearing and fattening- dairy combined, dairy, pigs, horticulture indoor and horticulture outdoor) unattractive and land use in those types declined. The decrease was the highest in pig specialized farms in both farm types (66.6 and 68.4% respectively). In vineyards and fruits specialized small farms increased UAA while it went back in non-small farms in both cases.

Labour use in specialized farms

In 2005 AWU used in EU-27 amounted to 12.7 million of which 52.7% went to EU-10. 29.5% of AWU used in EU-10 went to specialized farms reaching three quarters of the related category of EU-27 average. Due to technological development farms on average decreased labour use by 26.6% in EU-27 and by 29.6% in EU-10. However, in EU-10 the decline of AWU in small specialized farms was only 24.1% while it has even increased by 10.7% in non-small farms indicating specialized farms have significantly increased their share in labor use between in 2005–2013 period (Table 2). It can be concluded that in a dynamic approach (in relative share) specialized farms in general offer more jobs for labor both in EU-27 and EU-10 and non-small specialized farms of EU-10 have absorbed more labour in 2013 in compare to that of 2005. Poland is the only country where small specialized farms used more labour in 2013 compared to 2005. Decline of labour use exceeded 50% in four countries with the highest figure in case of Slovakia (77.6%). Non-small specialized farms have performed a more labour intensive production in EU-10. In six countries labour use has been increased at most in Hungary (45.6%) followed by Bulgaria and Poland (17.9%). Meanwhile progress in specialization creates a basis for increasing efficiency, specialized farms use more labour than non-specialized farms across EU-27 but at the same time more in EU-10.

Table 2. Dynamics of labour use (AWU) of specialized farms by countries in EU-10 in 2013/2005

Specification	Farms, total	Spec. farms below 5 ha	Spec. farms 5 ha and over
		%	
Bulgaria	51.3	46.9	117.9
Czech Republic	69.2	49.2	107.7
Estonia	59.8	35.2	71.4
Latvia	59.8	79.9	100.7
Lithuania	65.3	82.5	90.7
Hungary	93.7	84.9	145.6
Poland	84.4	104.0	117.9
Romania	59.8	67.4	92.2
Slovenia	86.8	87.6	83.3
Slovakia	51.2	22.4	100.6
EU-10	70.4	75.9	110.7
EU-27	73.4	72.0	94.5
EU-10/EU-27	95.8	105.4	117.2

Source: Author's calculations based on the Eurostat data.

Looking at AWU used by farm types the picture is varied very much showing specialization of farms is still in transition and it is so even more in EU-10. Specialized farms in cereals the only one farm specialization type in EU-27 which needed more labour both in small and non-small farms in 2013 than in 2005 at a higher level in EU-10. There are four more non-small specialized farm types (horticulture outdoor, vineyards, fruits and cattle--rearing and fattening) where labour use went up in 2013 compared to base year; meanwhile, in small farms cattle-rearing and fattening is the only specialized farm type, besides cereals, where more labour was used in 2013 than in 2005. Decline in labour use affected more small specialized farms than non-small ones. In 2013 small specialized farms lost more than 50% of their labour of 2005 in cattle-rearing and fattening and dairy combined, dairy and pig production in EU-10, these figures are in line with those of EU-27 (Fig. 3).

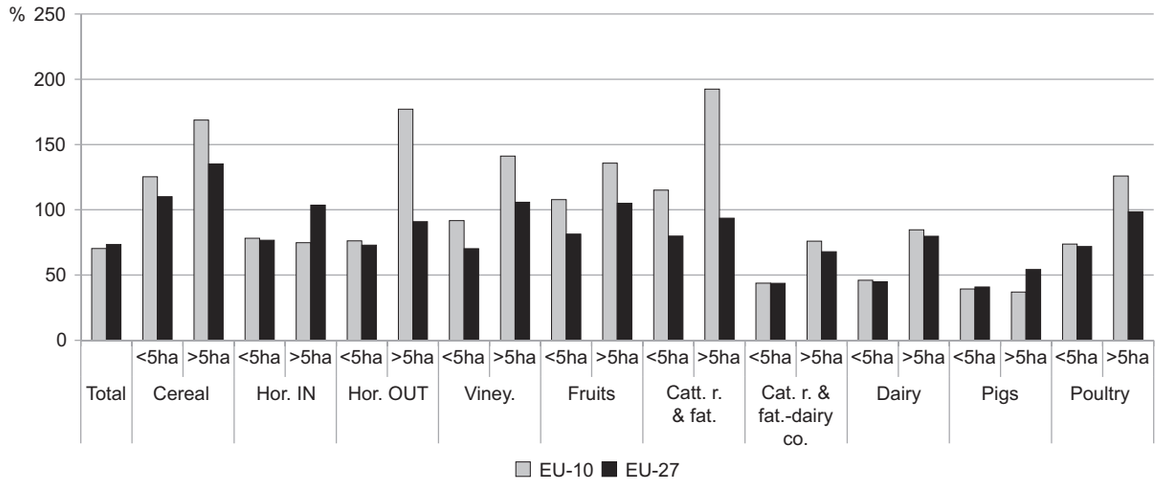

Fig. 3. Dynamics of labor use (AWU) by specialized farms in EU-10, EU-27 in 2013/2005

Source: Author's calculations based on the Eurostat data.

Production potential of specialized farms

Farms in the EU-10 produced EURO 286.2 billion of SO in 2005 of which EUR 42.3 billion (14.8%) went to EU-10. Specialized farms in EU-10 had SO of 17 billion EUR of which 25.3% goes to small farms. SO of EU-27 increased by 14.9% to 2013. The growth of SO in EU-10 amounted to 26.7%. Specialized farms in EU-10 as part of their catching up increased SO by 64.3%, exclusively backed by non-small specialized farms' performance. In 2013 more than half (52.2%) of SO comes from specialized farms but still below of that of EU-27. In five out of ten countries share of specialized farms in SO was above 60%. More than two third of SO in EU-10 came from specialized farms in three countries as Bulgaria, Latvia and Estonia (67.6–69.9%). However, this ratio remains below 40% in the Czech Republic and Romania. It can be underlined that in E-10 specialized farms were the backbone of this increase in production between 2005 and 2013 (Table 3).

Table 3. Standard output of specialized farms of EU-10 in 2005 and 2013

Specification	Farms	SO of specialized farms with land		Farms	SO of specialized farms with land	
	2005			2013		
	grand total	below 5 ha	5 ha and over	grand total	below 5 ha	5 ha and over
	million EUR					
Bulgaria	2 321	366	752	3336	249	2084
Czech Republic	3 653	74	873	4 447	38	1 564
Estonia	483	10	291	676	5	452
Latvia	585	18	227	990	20	655
Lithuania	1 550	88	538	1 919	87	1 099
Hungary	4 922	536	1 685	5 578	436	2 787
Poland	16 084	1 791	5 838	21 797	1 968	10 304
Romania	10 518	1 285	1 737	11 990	1 279	3 443
Slovenia	834	79	421	1 009	96	543

Table 3 cont.

1	2	3	4	5	6	7
Slovakia	1 321	52	356	1 812	47	799
EU-10	42 271	4 299	12 718	53 554	4 224	23 731
EU-17	243 960	31 557	127 742	275 461	26 999	155 153
EU-27	286 232	35 857	140 460	329 015	31 223	178 884
EU-10/EU-27	14.8	12.0	9.1	16.3	13.5	13.3

Source: Author's calculations based on the Eurostat data.

In 2013 more than half of SO of EU-10 comes from specialized farms, however, it varies by countries. More than 60% of SO produced by specialized farms in Bulgaria, Estonia, Latvia, Lithuania and Slovenia. Contribution of specialized farms to SO within related farm category also differs from country to country. In six countries (Bulgaria, Estonia, Latvia, Lithuania, Romania and Slovenia) share of non-small specialized farms in SO of related category exceeds that of small farms. Small farms have a higher contribution rate to SO in Czech Republic, Hungary, Poland and Slovakia (Fig. 4). In EU-27 the dairy, cereal, pig and vineyard specialized farms produced most of SO while in EU-10 cereal and dairy specialized farms have significant share in SO.

Growth of SO by farm types and by country is not homogenous at all. Standard outout grew by 86.6% in case of non-small farms, while small specialized farms produced SO less by 1.8% in 2013 than in 2005.

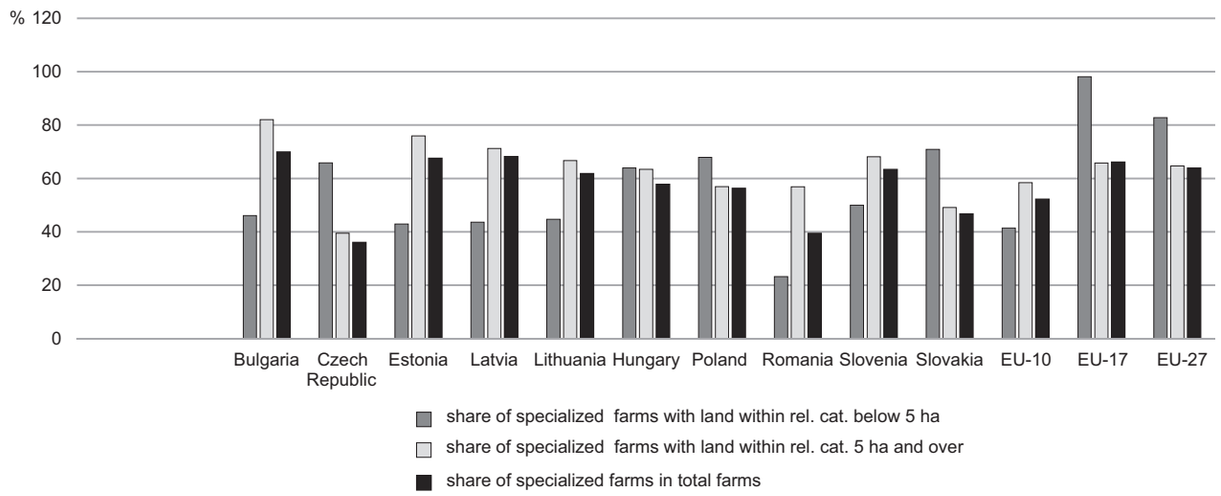

Fig. 4. Share of specilaized farms of EU-10 in SO by countries in 2013

Source: Author's calculations based on the Eurostat data.

Productivity and efficiency of specialized farms

Although, growth of average size of non-small farms of EU-10 was high reaching 44.08 ha in 2013, however, the average size of specialized small and non-small farms of EU-10 are below those of the EU-27 both in 2005 and 2010. In 2005 the highest farm size by UAA of non-small specialized farms in EU-10 went to cereals (56.8 ha), cattle-rearing and fattening (37.9 ha), poultry (30.3 ha) and vineyards (24.5 ha) keeping this ranking in 2013 with average size of 60.8, 41.2, 29.5 and 27 ha respectively. The highest growth in land use took place in fruit

and citrus fruit (45.6%), pigs (44.6%) and horticulture outdoor (43.7%) farm types. Small specialized farms used less per/farm labour in 2013 compared to 2005 while non-small specialized farms used a bit more, but labour use varied by farm types quite a bit.

Non-small specialized farms extended their UAA from 2005 to in 2013 by 27.7%, whereas this increase was only 6.9% among small farms. However, extended land area did not increase the labour in small farms while AWU increased in non-small farms only by 1.4%. Behind average figures there were four farm types in which significantly more labour was used by small farms in 2013: for instance, in cereal production (40.3%), horticulture outdoor (47.7%), and fruits (50.9%). In the case of non-small specialized farms the tendency to use more labour is partly similar in cereal production, but the increase of labour was much higher in horticulture outdoor (45.8%), vineyards (37.7%), pigs (21.5%) and poultry (10.3%). In 2013 compared to 2005 less labour worked in both small and non-small farms in cattle-rearing and fattening as well as cattle rearing and fattening-dairy combined farms. In non-small farms among the most labour intensive farm types are horticulture indoor and horticulture outdoor, fruits, dairy and pigs both in EU-10 and EU-27; however, the vineyards and poultry farms of EU-27 used much less labour compared to EU-10.

Concerning economic indicators as UAA/farm, AWU/farm and SO/farm in farms total and in specialized farms as well have been higher in EU-27 compared to EU-10 for the entire period with the exception of AWU/ /farm in non-small specialized farms (Table 4).

The key question is: to what extent could farms and especially specialized farms in EU-10 catch up over 2005–2013 period? Generally, it can be concluded that in total as well as in case of small and non-small farms (specialized and non-specialized) the dynamics of economic indicators of EU-10 were higher than those of EU-27. The only exception goes to labour productivity (SO/AWU) in non-small specialized farms which also grew in EU-10 but 1.2% below that of EU-27 average.

In EU-10 economic indicators have grown in total productivity (75.3%), labour productivity (63.4%) and area productivity (22.9%). Looking at dynamics of key economic indicators by farm groups (small and non-small) the picture is mixed. Within the related category, the growth in area and labour productivity of small specialized farms was below the average of total small farms. However small specialized farms have achieved higher growth rate in total productivity (SO/farm) due to using relatively more land and labour. In non-small specialized farms growth of both area and total productivity were higher compared to total non-small farms' average while labour productivity was well below that (16.8 and 45% respectively).

Table 4. Dynamics of selected economic indcators in EU-10, EU-27 in 2013/2005

Specification		Farms, total	Farms less than 5 ha, total	Farms 5 ha and over, total	Specialized farms below 5 ha	Specialized farms 5 ha and over
				%		
SO/UAA	EU-10	122.9	120.6	128.6	117.4	133.8
	EU-27	114.3	115.2	116.0	107.5	113.0
	EU-10/EU-27	107.6	104.6	110.9	109.3	118.4
SO/AWU	EU-10	163.4	161.9	145.0	140.0	116.8
	EU-27	146.5	149.1	132.4	137.4	118.3
	EU-10/EU-27	111.5	108.6	109.4	101.9	98.8
SO/Farms	EU-10	175.3	122.7	168.6	125.5	171.0
	EU-27	155.8	120.7	137.4	116.6	133.0
	EU-10/EU-27	112.5	101.7	122.8	107.6	128.5

Source: Author's calculations based on the Eurostat data.

Justification of hypothesis:

- Hypothesis 1: Share of number of small and non-small specialized farms did not decline in related farm category. *Justified.* Relative share of small and non-small specialized farms within total farms have increased.
- Hypothesis 2: Specialization of farms has regional characteristics. *Partially justified.* In some areas e.g. in pig production or dynamics of specialization level regional characteristics can be observed; however, in other cases it cannot.
- Hypothesis 3: Growth of economic indicators of specialized farms show advantages compared to non-specialized farms. *Partly justified*. Growth in labor productivity was significantly higher both in small and non-small non-specialized farms. Concerning area productivity non-small specialized farms have achieved higher growth but small specialized farms' growth was below the average, while total productivity of both small and non-small specialized farms exceeded that of non-specialized farms in related category.

CONCLUSIONS

Concerning area, labour and total productivity both small and non-small specialized farms of EU-10 have achieved higher growth in compare with related farm categories of EU-27 with one exception of labour productivity of non-small specialized farms. Within EU-10 number of specialized farms has declined less than the number of non-specialized farms. Average farm output of specialized farms (both small and non-small) have exceeded that of non-specialized farms both in 2005 and 2013. Non-small specialized farms have increased their production significantly. The dynamics of growth of per farm output was also higher in specialized farms. The growth and productivity of specialized farms varied according to countries and according to farm types. Comparing specialized farms to non-specialized farms within EU-10 non-specialized small farms have advantage in growth of area and labour productivity while non-small non-specialized farms has achieved higher growth in labour productivity.

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PRZEWAGA SPECJALISTYCZNYCH GOSPODARSTW ROLNYCH W ZAKRESIE ROZWOJU I PRODUKTYWNOŚCI W KRAJACH EUROPY CENTRALNEJ I WSCHODNIEJ W LATACH 2005–2013

STRESZCZENIE

W artykule porównano małe (do 5 ha UR) i większe (5 ha i więcej) specjalistyczne gospodarstwa rolne z gospodarstwami niespecjalistycznymi w 10 krajach Europy Centralnej i Wschodniej należących do UE. Analiza dla lat 2005–2013 dotyczyła struktury i wzrostu w gospodarstwach, w grupach według kierunku specjalizacji, wyników, pracy i wykorzystania ziemi. Celem opracowania jest określenie, który typ gospodarstw specjalistycznych wykazuje przewagę nad pozostałymi w zakresie wzrostu i produktywności. Z analizy wynika, że przeciętna powierzchnia i produktywność gospodarstw specjalistycznych małych i większych z 10 rozpatrywanych krajów wzrosła bardziej niż analogicznych kategoriach gospodarstw w całej UE (27 krajów). W 10 rozpatrywanych krajach liczba gospodarstw specjalistycznych spadła, ale w mniejszym stopniu niż gospodarstw pozostałych. Przeciętna produkcja gospodarstwa specjalistycznego przewyższała analogiczną w gospodarstwach niespecjalistycznych zarówno w 2005 roku, jak i 2013. Dynamika wzrostu i produktywność gospodarstw wyspecjalizowanych różniła się zarówno między krajami, jak i między typami gospodarstw.

Słowa kluczowe: małe gospodarstwa rolne, specjalizacja, kraje Europy Środkowo-Wschodniej

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FOOD SECURITY IN POLITICAL DISCOURSE OF THE COMMON AGRICULTURAL POLICY

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ABSTRACT

The aim of the article is to show how the term food security evolved in the political discourse of the Common Agricultural Policy (CAP) and how it was interpreted by actors of the decision-making process to achieve the objectives pursued. For this purpose the critical discourse analysis is used. It can be concluded that soft skills, the ability to use words are increasingly important in politics. Politicians use specific types of organisations and institutions to make ideological beliefs and discourses – they need to achieve their objectives – come true. The message, which is read in a specific way to produce very specific reactions, is thus manipulated through the media and other ideological apparatuses. The evolution of theoretical concepts in the political discourse of the CAP presented in the article indicates a high dependence on path dependency. The neo-mercantilist approach to agriculture has been present from the beginning of its existence. The concepts of multifunctionality and neo-liberalism were promoted as a result of pressure from existing external and internal conditions, but they were always to legitimise maintaining high agricultural funding from the EU budget. The food crisis of 2007–2008 and food security became a fundamental elements of the political agenda, which allowed for the return of neo-productivism, in order to defend agricultural subsidies and continue the role of the state in their maintenance.

Key words: food security, political discourse, agricultural policy

INTRODUCTION

Every now and then, the media frighten us with hunger as a threat to the further development of humanity in the years to come. According to the FAO, there are 795 million undernourished people today. However, information that their number is decreasing (down 167 million over the last decade and 216 million less than in 1990–1992) is rarely brought to light. The decline is more evident in developing countries, despite significant population growth [FAO 2015]. During the food crisis of 2008, FAO Director-General J. Diouf spread an imperative that food production must double by 2050 so that the world could feed the population of 9 billion [Address 2008]. It is puzzling why this statement has cemented itself so firmly into the public consciousness and politicians often use it to justify their actions, despite the fact that, according to Tomlinson [2011], it was based on incorrect methodological assumptions. It appears that ensuring global security has become – at least verbally – a political obsession which is reflected in the popularity of words such as food security, biosecurity, energy security, human security, border security and homeland security [Peoples and Vaughan-Williams 2015].

The term food security is currently experiencing its renaissance also in the European Union (EU), despite the fact that there has been food overproduction for many years. It can be assumed that food security was used

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in the reform of the Common Agricultural Policy (CAP) for 2014–2020 as one of its main priorities in order to legitimise agricultural production growth and the need to maintain support for the agricultural sector at the current level.

Alongside cohesion policy, agricultural policy still covers an essential part of EU budget expenditures. Although further reforms of the CAP are implemented, be it under the pressure of external factors (e.g. the World Trade Organisation) or internal factors (e.g. further EU enlargements). Nevertheless, only instruments change, while objectives have remained the same since the Treaties of Rome of 1957. Despite the fact that new actors were included in the decision-making process, a still-strong agricultural lobby has a decisive influence on the decisions made. Therefore, historically conditioned support for large capitalised and restructured agricultural holdings is further continued (a historical direct payment model). A regional model, which has been postulated for years by the European Commission, has been largely resented, as it would contribute to a significant redistribution of funds from large to medium and small agricultural holdings. The CAP's redistributive nature inhibits actual changes and the creation of more effective policy.

The aim of the article is to show how the term food security evolved in the political discourse of the Common Agricultural Policy and how it was interpreted by actors of the decision-making process to achieve the objectives pursued. The paper tries to fill the research gap in understanding mechanisms that privilege specific language in order to justify the maintenance of the CAP's finances at the present level.

For this purpose the critical discourse analysis (CDA) is used as a useful method for identifying different discourses/ideologies in political texts/speeches as well as for diagnosing how the spread of certain terms and arguments legitimises political intervention measures and instruments [Fairclough 2013]. At the same time, it takes into account a comparison of different discourses between political actors of the decision-making process during which ideas are formed and promoted as well as alter dominant paradigms. The use of the CDA may thus help to understand the process of CAP changes which, at a specific time, prefer certain discourses in order to justify decisions taken as part of EU agricultural policy.

THEORETICAL BACKGROUND OF POLITICAL DISCOURSE

Actors of the decision-making process increasingly use the language of politics not as a means of communication, but as a tool to compete and achieve specific objectives. Politics becomes such an area of social activity which consists mainly of words, while the language of participants of the communication process is an important factor contributing to their image and voters' support [Balczyńska-Kosman 2013]. T. Van Dijk [1993] believes that "management of minds" of others is what a politician's text or speech is primarily about.

In accordance with the CDA's precursor, i.e. N. Fairclough [Blommaert and Bulcaen 2000], the discourse is becoming an increasingly important element of social life and can have a constructive impact on it. The CDA's critical approach results from, on the one hand, the "critical theory" related to the French school and J. Habermas and, on the other hand, works by M. Foucault. The discourse in Habermas's concept is more an assumption than a real social fact relating to the way a specific society functions. In accordance with Foucault, however, the discourse is construed as using language to transfer ideas and influence people, being strongly conditioned by the social location of senders and recipients, objectives and needs, the level of knowledge, a set and hierarchy of values as well as the social context of communication and the specificity of communication through the mass media [Lisowska-Magdziarz 2006].

Critical discourse analysis assumptions are often associated with A. Gramsci's concept of hegemony according to which groups that rule in society must, despite applied violence and ideological deception, obtain consent of those they rule. It is therefore necessary to make the rulers respected by and legitimate to society as well as to develop a new "collective will" through various types of relations between the rulers and the ruled. The consent is given primarily by "civil society" which consists of private associations and institutions

(schools, churches, family etc.). They are counterbalanced by a narrowly defined "political society", i.e. the state [Warzecha 2014].

This approach is complemented by L. Althusser's concept which distinguishes between "repressive apparatuses" and "ideological apparatuses of the state", corresponding to Gramsci's categories. While repressive apparatuses (army, police, legal system) follow the rule of violence, ideological apparatuses (schools, religious institutions, family, media, associations) follow the rule of ideology. These are precisely specific types of organisations and institutions which make ideological beliefs and discourses come true. In this context, it is pertinent to mention Althusser's concept of subjectivity, which refers to J. Lacan's thesis, according to which an individual is constituted as an entity through identification with the reflection in the mirror (ideologies, constituting an external overall image in which individuals recognise themselves, become the source of their identity) [Althusser 2006].

All communications of political content usually have a strong emotional colouring and are addressed to a mass audience with a predominant function to persuade. A contemporary political discourse scholar, i.e. T. Van Dijk, believes that the CDA originates from the Greek tradition of rhetoric which is based on the art of persuasion. A persuasive action is one that is aimed at gaining a recipient's acceptance or at least favour as to content presented by a sender. The language of politics often uses multidimensional terms – having more than one meaning. These terms make communication much more difficult due to their vagueness [Shively 2001].

The language of the political discourse is shaped largely by the media that frame ways of presenting political topics. Like other media content, language and political communications are subject to priming and framing phenomena. As regards priming, i.e. communication positioning, certain topics are exposed in the media by their frequent repetition or reference to authoritative speeches. In turn, framing is about providing facts with consensus frames through their selection, amplification (highlighting or skipping features) and articulation which is construed as the way events are described [Balczyńska-Kosman 2013].

FOOD SECUIRTY IN THE CAP DISCOURES

Food security is a good example of a multidimensional vague term with different meanings. The most frequently quoted definition is that formulated by the FAO [2015] according to which food security exists when all people, at all times, have physical and economic access to safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. However, the complexity of the definition – which was repeatedly modified – allows for understanding it in different ways and for seeking radically different solutions. This is due to the specificity of the term which can be categorised as wicked problems. The term was first introduced to social sciences by Rittel and Webber [1973]. The scholars stressed that it is difficult to adopt a scientific and rational approach to such problems due to lack of an explicit definition and different points of view of stakeholders when formulating and solving a problem. A broader approach was proposed by Conklin [2006] who characterised wicked problems as follows:

- you don't understand the problem until you have developed a solution;
- every wicked problem is essentially unique and novel;
- wicked problems have no definitive solution and stopping rule, i.e. no decision is made as to whether continue or end the problem, taking into account the current position or facts of the past;
- solutions to wicked problems are not right or wrong;
- every solution to a wicked problem is a "one-shot operation".

Given the specificity of the term "food security", Mooney and Hunt [2009] attempted to categorise its different interpretations and identified three basic consensus frames. Each of them has specific keywords that characterise it and generate a specific type of actions taken by stakeholders: (a) hunger-related interpretation – food security perceived in terms of world hunger; (b) society-related interpretation – food security regarded as an important element in the development of society; (c) risk-related interpretation – food security as minimising

risks with respect to a food system's vulnerability to both "normal accidents" (e.g. diseases) and "intentional accidents" (e.g. agriterrorism). The categorisation referred to above is derived from the aforesaid term framing and its use in political marketing as conscious shaping and application of consensus frames to well-known social events [Pluwak 2009].

The consensus frames of food security vary between and within political discourse contexts. As a matter of fact, actors of the decision-making process have their own interests and are related to different political orientations/positions. Therefore, they ascribe different meanings to food security [Candel et al. 2014].

A clear demonstration of this is the Common Agricultural Policy which has been shaped for years by actions of the strong agricultural lobby. Therefore, the political discourse was and still is dominated by productivism whose definition may be the following statement of S. Coveney, the Irish Minister of Agriculture: "It is the EU's responsibility to produce more food – shortages have seen commodity prices rocker. The disarming of food output is a nonsense" [Agra Europe 2011]. In other words, the primary role of agriculture is food production, while the CAP should promote the stimulation of agricultural production and productivity growth in the agricultural sector. The CAP's neo-mercantilist tradition dates back to early years of the CAP, when the Community's preferences (import protection) and export subsidies were key elements of the policy of price support for agricultural products. The agricultural lobby takes the view that the transfer of public funds to farmers is fully justified by food production for society. They thus postulate protectionism and a state-assisted model according to which the state should support agriculture as a sector which is involved in the implementation of important national objectives. This approach was fully legitimised after World War II, when the stabilisation of agricultural markets and high supply of food at prices reasonable for consumers were crucial in ensuring food security in Europe. Consequently, these actions led to food overproduction and, at the same time, to the industrialisation of agriculture and environmental degradation in the 1980s.

The criticism of productivism contributed to dominating the political discourse in Europe after 1992 by two theoretical concepts, i.e. multifunctionality and neo-liberalism. Agriculture of EU turned towards post-productivism according to which agricultural activity should be based on more sustainable forms of functioning, which are economically and socially embedded in rural communities, rather than on intensive production. Agriculture came to be seen as a sector which not only provides food, but also the so-called public goods such as biodiversity, rural landscape and rural cultural heritage preservation. This argument became an important element of F. Fischler's reform of 2003. In turn, the growing importance of the neo-liberal discourse in EU institutions and Member States with highly capitalised and restructured agriculture was evident during internal (EU budget) and external (international trade) negotiations on further CAP reforms. As a result, a greater emphasis was placed on increasing the competitiveness of EU agriculture, policy instruments were liberalised and EU intervention in agricultural markets was reduced.

The concept of multifunctionality was a defence of the agricultural lobby against the neo-liberal course in Europe and the world. Proponents of neo-liberalism argued against the need for further support for agriculture, and argued for CAP liberalisation, while treating the policy as a significant cost to taxpayers and consumers, and an inefficient transfer of public funds to one sector of the economy. In turn, the traditional agricultural lobby supported maintaining a strong protection of agricultural markets and supporting agricultural families, while claiming that lower support could lead to an even greater industrialisation of agriculture together with negative consequences for rural communities and non-agricultural benefits currently received from this sector. It is also worth quoting arguments of an environmental lobby according to which support for agriculture should be continued, but the aid should be significantly redirected from the current system, in which farmers receive substantial public funds without apparent justification, to the system of payments for providing public goods to society [Midgley and Renwick 2012].

The last decade of this century is a clear return of the concept of productivism as the so-called neo-productivism. Almas and Campbell [2012] mention the following reasons: the food crisis of 2007–2008, a change

in food preferences of consumers, food waste, climate change, diminishing access to water, soil degradation, biodiversity loss, higher oil prices, designation of some part of food production for non-agricultural purposes (biofuels), a change in the functioning of the global food system. In accordance with Burton and Wilson [2012], neo-productivism is characterised by: (a) reduction of state intervention in markets, introduction of greater constraints on agriculture, ideological promotion of environmentally friendly agriculture; (b) reduction of agricultural intensification towards more environmentally sustainable agriculture, diversification of sources of agricultural income; c) promotion of environmental protection.

Neo-productivist agriculture quickly adapted to new conditions by adapting sustainable development principles. One oddity was promoting "sustainable intensification" of agriculture in recent years, i.e. agricultural production growth based on available agricultural land with minimal pressure on the environment [Future of Food 2016]. This, incidentally, right idea was used by the agricultural lobby and agri-chemical corporations to apply exactly the same model of intensive agriculture as before, but described with different words. Similarly, the food crisis of 2007–2008 became an important element of argumentation in the political discourse according to which financial support for agriculture should be continued due to its primary role which was and still is feeding the human population of the world.

DISCOURSE ANALYSIS IN CAP DOCUMENTS AND SPEECHES

The concepts presented, which occur in the political discourse of the CAP, are evident in documents and speeches by actors of the decision-making process. According to Garzon [2006], the decision-making process takes the form of non-cooperative negotiations between multiple actors (EU institutions, Member States, international institutions, agricultural organisations, agri-food industry, non-governmental organisations), hence the discourse is not homogeneous. With reference to Fairclough [2013], it can be said that politics is an arena in which different interest groups seek to introduce a particular discourse as a means of achieving their political objectives.

Given the leading role of the European Commission in initiating CAP changes, its strategic documents and speeches by commissioners for agriculture seem to be the most valuable for CDA. The aim of content presented by the Commission is to get the general public ready for the implementation and justification of specific measures. Erjavec's and Erjavec's [2009] analysis performed based on speeches by M. Fischer Boel, the Commissioner for Agriculture, between the CAP reform of 2003 and the health check of 2008 reveals that the discourse is not uniform, but varies depending on recipients and needs. Boel stressed the concept of productivism at a meeting with French farmers (in June 2005, at the beginning of her mandate) by often using terms such as productive capacity, trade or production. In turn, she referred to the concept of multifunctionality in her speeches when she spoke to communities related to nature protection, safe food or rural area preservation. The discourse was also used as a tool for negotiating with the liberally-oriented World Trade Organisation. When promoting the multifunctionality-related European model of agriculture, Boel referred, on the international arena, to "historical relationship between people, food production and the countryside" and used the following words of the multifunctionality discourse: environment, diversification, quality of life in rural areas, agriculture is "our soul" and "unique tradition". As a proponent of the concept of neo-liberalism, Commissioner Boel sought to introduce liberal solutions to the CAP by stressing that "farmers must be subjected to the market", "must continuously pick out exactly what customers want", EU agriculture should be "competitive on global market". Competitiveness, market orientation and liberalisation are often repeated in the neo-liberal discourse. Politicians then stopped using terms, such as food security, preservation of farm income, as basic elements of CAP justification, but they remained in the agricultural lobby's argumentation.

Keywords used in speeches by representatives of the European Commission make it clear how specific argumentation was used in the political discourse. Its aim was to legitimise large CAP funding from the EU budget. At that time, the World Trade Organisation's pressure necessitated changing CAP instruments to make

them less distortive to international trade. On the other hand, the agricultural lobby's pressure, which advocated for maintaining support for agriculture at the same level, made it necessary to seek agricultural policy priorities other than agricultural production, hence support for multifunctionality. Elements of neo-liberalism in speeches by Boel served as preparation for the next debate on a CAP reform, i.e. health check, which started together with the Commission Communication of 20 November 2007 [European Commission 2007]. The Commission then proposed to simplify the system of direct payments, to further liberalise intervention in agricultural markets, to make rural development policy more important, taking into account challenges such as climate change, bioenergy or water management.

In response to growing criticism of the CAP and an increasing public interest in environmental protection and food quality, new reasons for maintaining large agricultural funds in 2014–2020 appeared in the political discourse. Food security regained its importance. In the European Commission's document which presents the concept of a new CAP reform, i.e. The CAP towards 2020 of 10 November 2010 [European Commission 2010], food security is regarded as one of the most important strategic objectives in order "to preserve the food production potential on a sustainable basis throughout the EU, so as to guarantee long-term food security for European citizens and to contribute to growing world food demand". This is a clear return to the concept of productivism which supports agricultural production. Interestingly, the need to meet food needs applies not only to the EU, but it has been extended globally. Europe becomes responsible for feeding the starving world. This should be seen as a deliberate action to influence social emotions, because analyses by the FAO [2015] reveal a negative impact of food imports from developed countries on developing countries' economies. This return to the rhetoric of post-World War II times may be puzzling. According to Erjavec's and Erjavec's [2015], it is an attempt of some countries (France, Spain, the Republic of Ireland) to preserve the CAP in its traditional form, including strong EU intervention in agricultural markets. The three strategic objectives referred to in the said document of the European Commission (food security, quality, value and diversity of food and creating local employment) perfectly fit into the concept of neo-productivism. At the same time, they draw upon the concept of multifunctionality – through keywords, such as environment, climate change, greening, and neo-liberalism – competitiveness, efficient use, simplification. The argumentation used is to justify further agricultural subsidies from the EU budget, because "any significant cut back in European farming activity would in turn generate losses in GDP and jobs in linked economic sectors".

CONCLUSIONS

It can be concluded that soft skills, the ability to use words are increasingly important in politics. In accordance with L. Althusser's thesis, politicians use specific types of organisations and institutions to make ideological beliefs and discourses – they need to achieve their objectives – come true. The message, which is read in a specific way to produce very specific reactions, is thus manipulated through the media and other ideological apparatuses.

The evolution of theoretical concepts in the political discourse of the CAP, which is presented in the article, indicates a high dependence on path dependency – choices made in the past determine current choices of the shape and funding of EU agricultural policy. The neo-mercantilist approach to agriculture has been present from the beginning of its existence. The concept of multifunctionality (provision of public goods by farmers to society) and the concept of neo-liberalism (better market orientation of farmers), which are evident in the documents of the European Commission and speeches by its representatives, were promoted as a result of pressure from existing external and internal conditions, but they were always to legitimise maintaining high agricultural funding from the EU budget. The food crisis of 2007–2008 became a fundamental element of the political agenda, which allowed for the return of neo-productivism, in order to defend agricultural subsidies and continue the role of the state in their maintenance.

It is puzzling to what extent the trend will be present in the future CAP and what phenomena must occur in the increasingly unpredictable years to come in order to make it change. It might be said that the future of food production does not lie in its maximisation, even when taking into account elements of environmentally sustainable production, but in the ability to absorb sudden changes and shocks that will occur locally and globally.

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BEZPIECZEŃSTWO ŻYWNOŚCIOWE W DYSKURSIE POLITYCZNYM WSPÓLNEJ POLITYKI ROLNEJ

STRESZCZENIE

Celem artykułu jest pokazanie, w jaki sposób pojęcie bezpieczeństwa żywnościowego ewoluowało w dyskursie politycznym wspólnej polityki rolnej (WPR) oraz jak było interpretowane przez aktorów procesu decyzyjnego dla osiągnięcia zamierzonych celów. W pracy wykorzystano metodę krytycznej analizy dyskursu. Stwierdzono, że coraz większego znaczenia nabierają w polityce kompetencje „miękkie", umiejętność posługiwania się słowem. Politycy urzeczywistniają za pomocą konkretnych typów organizacji i instytucji przekonania ideologiczne oraz dyskursy potrzebne do realizacji ich celów. Dochodzi więc poprzez media i inne aparaty ideologiczne do manipulacji przekazem, który jest odczytywany w specyficzny sposób, a tym samym wywołuje ściśle określone reakcje. Przedstawiona w artykule ewolucja koncepcji teoretycznych stosowanych w dyskursie politycznym WPR wskazuje, że neomerkantylistyczne podejście do rolnictwa jest obecne od początków jej istnienia. Koncepcje wielofunkcyjności oraz neoliberalizmu były promowane w wyniku presji istniejących uwarunkowań zewnętrznych i wewnętrznych, lecz zawsze miały służyć legitymizacji utrzymania finansowania rolnictwa z budżetu unijnego na wysokim poziomie. Kryzys żywnościowy lat 2007–2008 oraz bezpieczeństwo żywnościowe stały się fundamentalnym elementem agendy politycznej, pozwalającym na powrót neoproduktywizmu w celu obrony rolniczych subsydiów i zachowania znaczącej roli państwa w ich utrzymaniu.

Słowa kluczowe: bezpieczeństwo żywnościowe, dyskurs polityczny, polityka rolna

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DETERMINANTS OF MILK PRODUCTION DIVERSITY IN THE MACROREGIONS OF THE EUROPEAN UNION*

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ABSTRACT

The paper aims to distinguish economic determinants of milk production in clusters of FADN regions with farms similar to each other in terms of total utilized agricultural area, number of milk cows and annual milk yield in the light of selected taxonomic methods, i.e. cluster and factor analysis. Observed by the analysis of standard deviations and Gini coefficients, increasing diversity of the majority of characteristics of FADN dairy farms (in 2011 relative to 2004) led to think that production in farms similar to each other in terms of the number of dairy cows, the amount of utilized agricultural area and an annual milk yield can be conditioned by similar determinants, which may differ depending on the membership in a particular group. Classification of groups of regions with similar dairy farms was made using cluster analysis, and the diversification of production determinants was illustrated on the basis of factor analysis in the distinguished clusters. In order to determine the variability distinguished determinants analysis was performed for two research periods (years 2011 and 2013).

Key words: taxonomic analysis, cluster analysis, factor analysis, diversity of milk production

INTRODUCTION

Taxonomy, as a scientific discipline, stems from the life sciences, and the concept was introduced by biologists in relation to the classification of plants and animals. The word itself is a combination of two Greek words: *taksis* – (arrangement, order) and *nomos* – law, the principle [Siudek 2006]. Objects grouping is a very complex task because of the multitude of factors that influence the obtained solution. Among these can man mention: the number of grouped units (the need to use other methods of grouping for sets of dozens of units and the other for hundreds of thousands), the number of characteristics of variables describing the unit (the problem of multidimensionality), used measurement scales for all the features, units spatial structure or the existence of missing data or extreme values (outliers). Each of these factors cause a necessity for personalized approach to the problem of clustering of the case. That diversity is also the cause of the existence of many clustering algorithms, based on different ideas. The examples of taxonomic methods can be cluster analysis and factor analysis, which are used in this paper to present the diversity of milk production in the macro-regions of the European Union.

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DISCUSSION

The European Union is characterized by diversity on many levels, among which as one of the first man mention agriculture [Matuszczak 2012]. Beside independent of man's will diversity of the soil, climate and nature factors there are also differences in the level of production and economic indicators of farms [Grontkowska 2012]. Increased values of the standard deviation and the Gini coefficient in 2011 in relation to 2004 for most variables from the field of FADN observation data base provide persistent, and even increasing diversity of economic and production indicators of FADN dairy farms in the regions of the European Union [Guth 2015]. In the case of milk production the most important role in shaping differences in economic indicators plays production scale. This is confirmed by the study of many economists specializing in the deliberations on the milk market – Parzonko [2006, 2013], Sass [2007], Ziętara [2010], Seremak-Bulge [2011], Świtłyk and Ziętara [2012], Wójcik [2012]. Another reason for diversification may be different course of structural transformations in the eastern and western parts of the European Union [Poczta et al. 2008]. These factors indicate that the determinants of milk production may vary significantly by region in the European Union. In order to find similarities between the diverse dairy farms in the regions of the European Union cluster analysis was used.

To check what factors determine the milk production in the macro-regions of the European Union in 2011 and how they changed in 2013, it was necessary to investigate the effect of a number of measures, explaining resource variability of joint matrix of observation. It significantly hinders the versatile and comprehensive synthesis of data [Czyżewski 1976], Okoń [1964] says that the phenomena in a particular area, despite the diversity and variation, are related in some way and at least in part determined by a relatively small number of functional units, parameters or factors. In multivariate analysis, finding similarities in the breaking of each variable, hence the existence of a correlation, leads to the finding that some of them overlap, and thus differentiate the cases in the same way [Stanisz 2007].

The existence of these correlations between variables allows the formulation of a hypothesis that underlying variation phenomena hides a more important structure [Czyż 1971]. In view of the foregoing considerations and the difficulty of interpretation too many pending attributes it was decided to use factor analysis. In this approach new variables, called factors, retain a relatively large part of the information contained in the original variables and each of them is a carrier other substantive content [Czopek 2013]. The issue of the determinants of the diversity of milk production in the European Union particularly in regional terms is rarely raised in scientific studies. While statistics on production, prices of milk, the amount of dairy cows and their milk yield in individual countries are generally available, the complete interpretation requires fine-tuning. The results of the research will help answer the question of which factors and to what extent influenced the production of dairy farms in the macro-regions of the European Union similar to each other in terms of utilized agricultural area, the number of cows and their average annual milk yield, and how these factors changed in the perspective of milk quota abolition in 2015.

METHODOLOGY

In connection with the statement of growth of differentiation among FADN dairy farms in macro-regions of the European Union in 2011 in relation to 2004 [Guth 2015], it was decided to conduct a study of the factors having the greatest impact on the production of milk in 2011[1] in different groups of regions with similar farms. This test procedure was then repeated for the latest published FADN data for the year 2013 in order to verify if in the perspective of the abolition of milk quotas the determinants of milk production have changed. There was

[1] Data for 2011 were the "latest" for the implementation of the project data obtained in accordance with the schedule in January 2015.

cluster analysis performed. Typology was based on three of the firstly four selected features from the FADN[2], field of observation, describing the examined farms, i.e. the utilized agricultural area, number of dairy cows and the average annual milk yield of cows. Grouping was performed using hierarchical method. Among the possible techniques there was the agglomeration procedure used. The distances between the clusters that had arisen from the combined facilities were determined using the method of Ward. Solution was checked by silhouette indicator (separability of clusters in terms of the studied traits) *SI*, which in both cases exceeded the required critical level[3]. It can therefore be concluded that the distinguished groups are disjoint from the studied traits, so the solution qualify for the correctness of the distribution made in the context of cluster analysis.

The starting point for the analysis of the determinants of production in selected clusters was to create a matrix of observation, which was a collection of 49 FADN indicators that illustrate various features of the dairy farms in the macro-regions of the European Union with a predominance of intensive and extensive production of milk in 2011 and 2013. Variables were standardized. The method of grouping variables based on the criterion of maximum correlation was used. Then, the factor analysis was performed (principal components analysis). In terms of factor analysis the determinants of milk production in both macro-regions of the European Union with a predominance of extensive and intensive production in 2011 was determined using 34 features selected from among the 49 indicators analyzed, fulfilling a condition of the size of the matrix within the factor analysis, while in 2013 the intensive production was determined by 36 indicators and extensive by 32 features out of 49 surveyed indicators. On the basis of the criterion of sufficient proportions (above 75% explained variance) and the analysis of the scree plot there were independent factors that explain more than 75% of the common resource (cumulative) variation isolated. To narrow the scope of the factors and standardize their nature, the solution was subjected to the procedure of rotation, using for further research the solution obtained by the analytical method Varimax raw version.

RESULTS

As a result of the cluster analysis of the 108 regions[4] analyzed there were three internally homogeneous groups obtained with predominance of:

- intensive milk production – I typological group, consisting of 60 regions, including the majority of regions in the EU-15 and the Czech Republic, Estonia, Malta and Hungarian Nyugat-Dunántúl (an average of 192.53 ESU, a relatively large area of agricultural land (80.43 ha) and number of dairy cows (63.91 pcs), and milk yield at an average of more than 7,560 kg per year);
- so-called milk factories – II typological group, which accounted for five regions of northern and central Germany, and Slovakia (an average of 950.07 ESU, the largest area of agricultural land 598.06 ha, and the number of cows nearly 250 cows per farm) and the highest annual milk yield – almost 8,000 kg per year (excluding Slovakia significantly underestimating the result of other regions – more than 8,500 kg per year);
- extensive milk production – III typological group, consisting of 42 regions, with predominance of regions from the EU-12 (an average of 56.40 ESU, with an area of agricultural land of 30 ha, with an average of about 25 dairy cows and annual milk yield of 4,638 kg per year) [Guth 2015].

[2] Due to too high correlation with other features the economic size of farms had been discarded from the analysis.

[3] Silhouette index – *SI*, silhouette coefficient – *SK*, index was introduced by P.J. Rousseeuw in 1987 [Migdał-Najman and Najman 2013].

[4] The presented results represent a part of a wider research resulting from the Preludium project, under which there is monograph A. Czyżewski, M. Guth, Zróżnicowanie produkcji mleka w makroregionach Unii Europejskiej z wyróżnieniem Polski, PWN, Warszawa 2016, formed.

Among the clusters of predominantly intensive milk production concentrated in large farms (group typological) and very large – milk factory (group II typological) prevailed so-called relatively prosperous regions of EU-15 countries. Among groups of predominantly extensive production of milk (III typological group) strongly dominated regions of the EU-12. For the year 2013 in the light of cluster analysis there only two clusters distinguished – numbering 59 cases concentration of predominantly intensive milk production (of farms with an average economic size of more than 261 ESU, average of 137 ha of agricultural land, with an average of more than 79 dairy cows with average milk yield 7,194 kg per year) and a cluster of 49 cases of predominantly extensive production (of farms with an average economic size almost 96 ESU, an average of almost 35 ha of agricultural land, with an average of more than 36 dairy cows with an average milk yield 5,276 kg per year), which may mean that dairy farms in the perspective of the abolition of milk quotas increased scale and production efficiency. Therefore occurred in 2011 differences between the largest farms in 2013 had become blurred, as evidenced by the lack for the period of the narrow cluster of milk factories. In view of the observed diversity of FADN dairy farms in the regions of the European Union, it was considered that the determinants of milk production may vary in the resulting clusters. Therefore, it was decided to carry out factor analysis within distinguished by the cluster analysis groups of EU macro-regions with the predominance of intensive and extensive production. The results of the factor analysis led to the emergence of the three factors determining milk production in the surveyed farms in the regions of the European Union with a predominance of intensive and two factors in the case of extensive production for both periods (2011 and 2013) – Table 1.

As the leading factor in both cases should be considered the first factor (F_1), because it explains the largest resource of common variation. The smallest resource of common variation explained the third factor for farms from regions with a predominance of intensive production and the second factor (F_2) for farms from regions with a predominance of extensive production, which means that they conditioned the production for the smallest of factors distinguished manner. Turning to the interpretation of the results it was concluded that due to the features included in it the first factor can be defined as the price – cost relationships[5] of milk farms in the EU regions with a predominance of intensive milk production in 2011 and the the financial – assets situation for farms in the EU regions with a predominance of extensive milk production (Table 2). After analyzing the indicators included in the second factor (F_2) it was found that for both – farms in regions with a predominance of intensive and extensive production – it represented the variables related to non-productive costs of running dairy farms in

Table 1. Factor solution for regions with a predominance of intensive and extensive milk production in 2011

Factor	Self-value of correlation matrix				Share in the use of variation (%)							
					common				cumulative			
	production intensive		production extensive		production intensive		production extensive		production intensive		production extensive	
	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011	2013
F_1	11.99	16.70	15.82	13.69	31.55	46.39	40.58	42.78	31.55	46.39	40.58	42.78
F_2	9.10	8.54	13.52	11.28	23.94	23.73	34.69	35.25	55.49	70.12	75.27	78.03
F_3	7.42	5.07	–		19.52	14.07	–		75.01	84.19	–	

Source: Own study based on the results of own research using FADN data for the "dairy cows" type of production by region in 2011 and 2013.

[5] In structure of features forming factor F_1 in farms from the EU regions with a predominance of intensive milk production also predominate factors related to costs (9 out of 13 traits). The author concluded that prices indirectly affect both the costs and resources in the surveyed farms, because of their height and relationship to the costs, farms take decisions on the scale and type of production, what justified the above names.

2011[6]. The third factor (F_3) included variables representing or having an impact on the income of dairy farms in the macro-regions with a predominance of intensive milk production.

The structure of features forming factor F_1 and their assigned weights indicate that the price and cost relationships in dairy farms from the regions of the European Union with a predominance of intensive milk production in 2011 were conditioned mostly by farmhouse consumption, as well as by liabilities in total, of which to more extent by long-term liabilities (Table 2). There should be the high importance of the share of feed for grazing livestock in direct costs noted and the high impact of share of home grown feed for grazing livestock in total amount of feed for grazing livestock on price-cost relationships. It can therefore be concluded that farms erode the risk of feed prices rising through their partial production on the farm. It is worth noting that the high impact on the price-cost relationships in farms from the regions with a predominance of intensive production had interest paid, including interest and financial charges paid for the loans taken for the purchase of land, buildings, machinery and equipment, animals and materials, as well as interest and financial charges for the liabilities. This may mean that the farms in the EU regions with a predominance of intensive milk production carry a lot of investment to modernize and improve its production, seeing in it a chance for further development (Table 2). Significant impact on the price – cost relations in farms in the regions with a predominance of intensive milk production next to costs had also subsidies on external factors. In 2013, more importance gained long and medium term loans, gross investment and rent paid, which can be a basis for finding that farmers preparing for the liberalization of the EU milk market did investments aimed at increasing production scale and improve its efficiency (hence the high position of interest paid, depreciation, as well as short-term liabilities).

The biggest impact on the financial and assets situation of milk farms in the EU regions with a predominance of extensive production of milk in 2011 had net worth and average farm capital[7]. Big impact on the financial--assets situation of dairy farms in regions with a predominance of extensive production had also the level of assets (of which more fixed than current assets), farm net income from and farm net value added. Also productivity, measured as the value of animal production per unit and indirectly by the impact of farmhouse consumption has become a significant indicator of the financial situation of farms in the regions with a predominance of extensive production. This is understandable, when taking into account the need to compete in the single European market with more efficient farms from the regions in which the intensive production model prevailed. An interesting phenomenon appears to be relatively high impact of crop production on the financial situation of farms in the regions with a predominance of extensive production, which also contributed to the large significance of the share of home grown feed for grazing livestock in total amount of feed for grazing livestock (Table 2). This means that the farms in the EU regions with a predominance of extensive production were able to mitigate the risk of rising prices feed through partial their production on the farm. You should be aware, however, that it was connected with the character of extensive production, which prevails grazing breeding. In the farms from the regions with a predominance of extensive production in the leading factor there were also indicators on the ability of the farm to self-finance its activities and creating savings in operating activities (cash flow I). This can be explained by the need to repay long-term loans, taken for the modernization of farms in order to meet the accession requirements by prevailing in this group farms from the regions of the EU 12. In 2013, to the set of variables determining the financial and assets situation joined the value of live cattle, other cattle, depreciation, short-term loans and decoupled payments.

[6] The author is aware that the variables included in the factor structure represent costs associated with the milk production, but not directly. Among the features forming the second factor also there are included two non-cost items, i.e. subsidies on external factors and decoupled payments, what can be the basis for the claim that subsidies had a significant impact on the cost structure of milk farms in EU regions with a predominance of extensive production.

[7] According to FADN, net worth consists of the value of the animal, permanent crops, drainage facilities, buildings, machinery, equipment and working capital. Quotas and other rights that can not be separated from the value of land are not taken into account.

Table 2. The structure of factor F_1 in FADN milk farms in the EU regions with a predominance of intensive and extensive production in 2011 and 2013

Intensive production				Extensive production			
price-cost relationships				financial and assets situation			
2011		2013		2011		2013	
characteristic	factor load	characteristic	factor load	characteristics	factor load	characteristics	factor load
Farmhouse consumption	0.86612	Rent paid	0.89874	Net worth	0.92853	Net worth	0.9237
Share of home grown in total amount of feed for grazing livestock	0.86443	Long & medium-term loans	0.89328	Farm net income	0.89926	Cash Flow(I)	0.90263
Long-term liabilities	0.84120	Gross Investment	0.88631	Cash flow (I)	0.88594	Farm Net Income	0.86113
Interest paid	0.83955	Other direct inputs	0.88561	Average farm capital	0.86680	Gross Investment	0.85730
Short-term loans	0.83071	Machinery & building current costs	0.87270	Farm net value added	0.85263	Beef and veal	0.85229
Wages paid	0.79701	Interest paid	0.86277	Fixed assets	0.83574	Other cattle	0.84182
Subsidies on external factors	0.73966	Short-term loans	0.85248	Current assets	0.81729	Depreciation	0.80094
Beef and veal	0.73277	Subsidies on intermediate consumption	0.84775	Share of home grown in total amount of feed for grazing livestock	0.80217	Other direct inputs	0.79441
Share of feed for grazing livestock in direct costs	0.72902	Depreciation	0.83875	Farmhouse consumption	0.79647	Short-term loans	0.76321
Fixed assets	0.72070	Other cattle	0.79093	Taxes	0.75570	Average farm capital	0.74789
Direct costs	0.71016	Beef and veal	0.78705	Total livestock output / LU	0.72641	Farm Net Value Added	0.74766
Farm use	0.70379	Farm Net Value Added	0.7824	Total output crops & crop production	0.72231	Total fixed assets	0.74537
Current assets	0.70177	Contract work	0.7687			Decoupled payments	0.73350

Source: Own study based on the results of own research using FADN data for the "dairy cows" type of production by region in 2011 and 2013.

After analyzing the components of the second factor it was decided that it contains features which can be defined as non-productive costs of running dairy farms in EU regions with a predominance of intensive and extensive milk production in 2011 and 2013. Among the features forming F_2 factor the biggest impact on not directly related to milk production costs of running dairy farms in the macro-regions with a predominance of intensive production exert short-term liabilities, used mainly to finance operating activities. Significant influence had also "decoupled" payments, what may mean that even in farms with intensive production subsidies have a significant impact on the level of costs. It should be noted that on the size of the costs not directly related to milk production significant impact had keeping other cattle except of dairy cows, and proceeds from the sale of cattle and veal (Table 3). Among the variables forming this factor the greatest impact on non-productive costs of running a dairy farm in the EU regions with a predominance of extensive production in 2011 exerted a long-term liabilities and current liabilities. A significant impact on operating costs had also services, machinery and building current costs, buildings and other direct inputs (Table 3). Crucial for non-productive costs of running dairy farms in the EU macro-regions with a predominance of extensive production in 2011 were costs of external factors. Especially important position appear to be interest paid, which is relatively important factor in the structure of non-productive costs of running a dairy farm with the European Union macro-regions with a predominance of extensive production in 2011. This may mean that its liabilities were a significant burden for these entities.

Table 3. Non-productive costs of running dairy farms from EU regions with a predominance of intensive production in 2011 and 2013 (construction of factor F_2)

Intensive production				Extensive production			
characteristic	factor load	characteristic	factor load	characteristic	factor load	characteristic	factor load
2011		2013		2011		2013	
Short term liabilities	0.84382	Total support for rural development	0.8888	Long & medium-term loans	0.9343	Subsidies on external factors	0.9486
Decoupled payments	0.84123	Farm use	0.8748	Short term liabilities	0.9320	Long & medium--term loans	0.9253
Other direct inputs	0.83901	Forage crops	0.8725	Services	0.9246	Interest paid	0.9073
Depreciation	0.79976	Paid labour input	0.8578	Machinery & building current costs	0.8910	Total output crops & crop production	0.8977
Other cattle	0.79651	Total output crops & crop production	0.6291	Interest paid	0.8227	Forage crops	0.8957
Services	0.75866	Energy	0.6286	Wages paid	0.7987	Farm use	0.8819
Rent paid	0.74291	Decoupled payments	0.6171	Payments for rural development	0.7839	Wages paid	0.7561
Beef and veal	0.70673	Wages paid	0.6166	Other direct inputs	0.7652	Contract work	0.7345
		×		Decoupled Payments	0.6363	Rent paid	0.7042

Source: Own study based on the results of own research using FADN data for the "dairy cows" type of production by region in 2011 and 2013.

However, this may also mean that dairy farms in the macro-regions with a predominance of extensive production perceive their chances of increasing concentration and enlarging production scale in order to reduce costs of external factors. It should also be noted that the level of the non-productive cost of running dairy farms of macro-regions with a predominance of extensive production in 2011 was significantly affected by the subsidies for rural development and "decoupled" payments (though less than in the case of farms in the regions in which the intensive production prevailed) [Guth 2016]. In 2013, on non-productive costs of running a dairy farm in the EU macro-regions with a predominance of intensive production the greatest impact have payments for rural development, variables associated with self-supply of farms in the feed for dairy cows and the cost of external factors. In importance compared to 2011 lost decoupled payments and current liabilities, which had a material impact on previously distinguished factor (price – cost relationship). In the macro-regions with a predominance of extensive production this factor was conditioned to the greatest extent by subsidies to external factors, significantly increased the importance of the interest paid on liabilities, self-supply of farms in the feed for dairy cows and the cost of external factors, what may mean that dairy farms in the face of changes in the instruments of the EU milk market tried to rationalize the cost of running farms.

The third factor (F_3) due to the criterion of sufficient proportions was established only for milk farms from EU regions with the predominance of intensive production in 2011 and 2013. The analysis of features contained in it allowed to specify that it was represented by the variables having an impact on the income of dairy farms in the macro-regions with a predominance of intensive milk production. Among the forming factor variables the biggest influence in both surveyed periods exerted farm net income, understood as a fee for the involvement of their own factors of production to the operation activity of farms and the fee for the risk taken by farmer in the financial year (Table 4).

The construction of the factor F_3 shows that a significant impact on the income of dairy farms from regions with a predominance of intensive production had also cash flow I, showing the ability of a farm to self-finance its activities and create savings in operating activities. Great importance for the income of dairy farms in the macro-regions with a predominance of intensive milk production in 2011 and to a smaller extent in 2013, had also net worth, reflecting the value of total assets reduced of the value of total liabilities. It should be noted that in the structure of this factor there had also current assets appeared, which may mean that in relation to the concluded liabilities they had a significant impact on the value of the income of dairy farms in the macro-regions with a predominance of intensive milk production in 2011 and to a smaller extent in 2013 (Table 4). An interesting phenomenon appears to be the emergence in 2013 of the variable concerning efficiency of production (the value of animal production per unit conversion), which may confirm previous findings about the need to improve production efficiency in order to maintain a certain level of farm income.

Table 4. Income of dairy farms in the macro-regions of the European Union with a predominance of intensive production in 2011 and 2013 (construction of factor F_3)

Characteristics	Factor load	Characteristics	Factor load
2011		2013	
Farm net income	0.964261	Farm Net Income	0.861126
Cash flow (I)	0.907015	Change in net worth	0.836824
Net worth	0.810942	Net worth	0.725166
Farm net value added	0.803390	Total livestock output / LU	0.653102
Current assets	0.789202	Total current assets	0.596829

Source: Own study based on the results of own research using FADN data for the "dairy cows" type of production by region in 2011 and 2013.

CONCLUSIONS

The above presented research allows to draw following conclusions:

- Among the cluster with a predominance of intensive milk production concentrated in large farms and very large – i.e. milk factories prevailed relatively prosperous regions of EU-15 countries, while among groups of predominantly extensive production of milk definitely dominated regions of the EU-12, what may confirm the thesis of existing polarization of European milk production. Trends of this polarization despite the increase in the scale of production on average in the EU maintained also in 2013.
- Production of dairy farms in regions with a predominance of intensive milk production was conditioned mainly by price-cost relationships, further non-production related costs of running dairy farms and in the least of distinguished factors, income of listed entities.
- Milk production in the macro-regions with a predominance of extensive production depended mainly on the financial assets situation of farms, to a lesser extent on non-production costs of running a dairy farm, on which the greatest influence had liabilities and costs of external factors (wages and interest), what may mean that these dairy farms from the regions with a predominance of extensive production perceive their chances of increasing concentration and enlarging production scale, in order to reduce costs of external factors.
- Meaningful indicator of the financial assets situation of farms in the regions with a predominance of extensive production was annual milk yield. This may mean that farms located there, taking into account the need to compete in the single European market with more efficient farms in regions where intensive production model prevailed, took care of increasing the efficiency of their production. An interesting phenomenon appears to be the relatively high impact of crop production on the financial situation of farms in the regions with a predominance of extensive production, what also contributed to the great importance of share of home grown feed for grazing livestock. This means that the farms in regions with a predominance of extensive production are taking an example of farms in regions with a predominance of intensive production and they were able to at least partially mitigate the risk of feed prices rising through partial their production on the farm.
- The observed changes in the constituent of factors in 2013 relative to 2011 allow to conclude that the farm acted anticipated given the impending liberalization of the EU milk market and took appropriate investment activities to increase the scale and efficiency of production and rationalize the level of costs.

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DETERMINANTY ZRÓŻNICOWANIA PRODUKCJI MLEKA W MAKROREGIONACH UNII EUROPEJSKIEJ

STRESZCZENIE

Celem artykułu jest określenie determinant produkcji mleka w skupieniach gospodarstw FADN podobnych do siebie pod względem areału wykorzystywanych użytków rolnych, liczby krów mlecznych oraz ich rocznej mleczności w świetle wybranych metod taksonomicznych, tj. analizy skupień i analizy czynnikowej. Zaobserwowane wzrastające zróżnicowanie większości cech gospodarstw mlecznych FADN (w 2011 roku względem 2004 roku) skłoniło do przemyśleń, że produkcja w gospodarstwach podobnych do siebie pod względem liczby krów mlecznych, ilości wykorzystywanych użytków rolnych i rocznej mleczności krów może być warunkowana przez podobne determinanty, różniące się w zależności od przynależności do określonych grup. Klasyfikacji grup regionów o gospodarstwach mlecznych podobnych pod względem wyróżnionych cech dokonano za pomocą analizy skupień, a zróżnicowanie determinantów produkcji zobrazowano na podstawie wyników analizy czynnikowej w wyróżnionych skupieniach. Celem określenia zmienności wyróżnionych determinant analizę wykonano dla dwóch okresów badawczych (lat 2011 i 2013).

Słowa kluczowe: taksonomiczna analiza, analiza skupień, analiza czynnikowa, zróżnicowanie produkcji mleka

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CHANGES IN FOOD WASTE LEVEL IN THE EU COUNTRIES

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ABSTRACT

Food waste is the world-wide social and economic problem, and also large and unnecessary burden for the environment. In this paper was taken the problem of comparing changes in the level of food wastage in the EU countries in 2000–2011. There were used two techniques: multidimensional comparative analysis (MCA) and grade data analysis (GDA). The second one is used for the first time in this type of issues. Based on these techniques there were built synthetic indicators, which were used as a criterion for classification of EU countries in terms of the pace of reducing the level of food waste. It appears that usage of different techniques to construction of indicators gave a divergent arrangements.

Key words: multidimensional comparative analysis, grade data analysis, synthetic index, classification of objects, food waste

INTRODUCTION

Wasting food is not just a world-wide social problem. It is also an important economic problem and a large and unnecessary burden for the environment. Typically, the wasted food product should be associated not only with the superfluous production, but also with used packaging, transport, energy and the emission of industrial waste or additional greenhouse gases which have a close relationship with decaying, wasted food.

As a result – as the Federation of Polish Food Banks alerts (http://www.ekologia.pl) – discarded food is equivalent to wasting gallons of water and energy used for its production, transport, storage and preparation. To illustrate the problem in more details, the Federation of Polish Food Banks cites the following examples: "a sandwich with cheese thrown into the trash is equal to as much as 90 litres of wasted water, while a kilogram of potatoes is up to 300 litres, and is better not to talk about beef meat, because to produce one kilogram of beef takes between 5 and 10,000 litres of water. Additionally, food production also requires energy in the form of fuel and electricity. 10 calories of fuel is required to produce 1 kcal of food. As a result of wasted food alone, Europeans emitted 170 million tons of carbon dioxide, as much as the whole of the Netherlands or Venezuela emit per year – estimates the FPFB. Methane coming from decaying food is a 20 times more dangerous greenhouse gas than carbon dioxide" – alarms Marek Borowski, President of the Federation of Polish Food Banks.

According to the European Commission, calculations in Europe in the XXI century about 90 million t of food is wasted annually [European Environment Agency 2012]. It should be emphasized that food is wasted at every stage of the food chain – 'from farm to fork', meaning that wasting food also concerns producers, processors, retailers and restaurateurs. More information on this can be found eg. in the European Commis-

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sion Report 054 (2010). The FAO (Food And Agriculture Organization Of The United Nations) provides information about food waste in plant and animal production.

The aim of this study is to rank EU countries by effectiveness in reducing the level of food wastage in the main part of the production chain – sale. Therefore, the data does not include losses related to, for example plant production that occurred before and during harvesting and food waste by consumers. An additional objective is to identify the problems connected with unambiguity of such order, which depends on employed technique of the synthetic index construction.

Methods and research tools used in this paper are chosen techniques derived from a wide collection known as multidimensional comparative analysis – MCA [Kukuła 2000] and instruments from grade data analysis – GDA [Ciok et al. 1995, Szczesny 2002, Kowalczyk et al. 2004].

MATERIAL AND METHODS

Currently, it is virtually impossible to collect detailed, long term, uniform data for the EU countries (especially for those countries that joined EU after 2000). For this reason, for the research was used information about the waste of food crops and livestock production in the European Union countries covering the period 2000–2011 and collected by FAO (http://faostat3.fao.org/home). Unfortunately, the data for subsequent periods related to the same methodology, are not available yet. This selection has also decided about reduction to the analysis of several variables describing the waste in a fairly broad groups of products. For the category of waste in plant production in the paper, the following were analyzed in terms of aggregated data in tons: X_1 – cereals (except beers), X_2 – fruits (except wine), X_3 – oil crops and legumes, X_4 – the roots of starch (including potatoes) and X_5 – vegetables. The category of waste in animal production (also in tonnes) consisted of: X_6 – animal fats, eggs, meat, offal, X_7 – milk (excluding butter).

Changes of the level of food wastage in the individual countries for the studied period can be assessed in different ways. Most methods offered by multivariate data analysis use the synthetic index which takes into account the levels of waste in the individual groups of product per capita. In addition, to reduce the sensitivity of the assessment due to the weather conditions and the associated quality of raw material, the mean values are usually compared for several years. The study covers the period 2000 to 2011, and for comparison, the average of three adjacent years were used for each variable. This allowed for the four values of the synthetic index assessing the value of waste to be obtained for each three-year periods. The difference in the value of the synthetic index for the first and last three years was assumed as one of the two ratings of changes in the level of food wastage in this period. In the case of data from the years 2000–2011 a maximum mean values for six contiguous years could be applied. The methodology of construction of the synthetic indices – used to organize the objects described by many variables – is widely known and has been mentioned in many publications, also in Polish language [Strahl 1978, Strahl 1985, Zeliaś 2000, Panek 2009, Kukuła 2014, Kukuła and Luty 2015]. For this reason this methodology will not be discussed more widely. Most of the classical techniques of construction of the synthetic indices requires normalized data. In the paper was chosen the unitarisation zeroed method, because it transforms the value of each variable to the interval [0; 1] which allows for relatively easy intuitive assessment of countries in each category. More about the advantages of this normalization technique can be found in Kukuła [2000].

However, by relying only on the difference of the classical synthetic indices, even if mean values from a selected number of years are used, there is always discussion whether the average should cover three, four or six years. It seems that before making the choice of the synthetic index it should first be considered which properties should have such an indicator. On the other hand, in cases of data yearly disposal, it would be good to use an indicator that directly uses all the data from the whole period and is not too sensitive to fluctuations between adjacent years. For this purpose, basic tools of the instruments of grade correspondence analysis

(GCA) can be used. In this paper this technique of building rankings has been used because have pointed out the efficiency in many applications, but is still relatively little known in the literature. More about the GCA can be read in papers e.g. [Szczesny 2002, Kowalczyk et al. 2004, Koszela 2016].

One of the main measuring GCA-based methods that has been used in this work is the ar (area) marker for measuring the variation of two structures. To introduce the method of the meter construction and its basic properties, having two structures, it is supposed that:

$$\mathbf{x} = (x_1, \ldots, x_n),\ \mathbf{y} = (y_1, \ldots, y_n) \in \Re_+^n : x_i, y_i \geq 0,\ \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i = 1$$

Based on them a polygonal curve $L_{[\mathbf{x},\mathbf{y}]}$ can be determined (in a two-dimensional coordinate system), which is determined by n + 1 points:

$$P_0 = (0; 0),\ P_j = \left(x_j^{\wedge}, y_j^{\wedge}\right),\ j = 1, 2, \ldots, n$$

where: $x_j^{\wedge} := \sum_{i=1}^{j} x_i,\ y_j^{\wedge} := \sum_{i=1}^{j} y_i$

and obviously:

$P_n = (1; 1)$

where: $x_n^{\wedge} = \sum_{i=1}^{n} x_i = 1,\ y_n^{\wedge} = \sum_{i=1}^{n} y_i = 1$

The curve $L_{[\mathbf{x},\mathbf{y}]}$ defines clearly, some decreasing, partly linear function $C_{[\mathbf{y}:\mathbf{x}]}(t)$, which maps each closed interval [0; 1]. This function is used to determine the differentiation measures of two considered, ordered structures **x** i **y**:

$$\mathrm{ar}(\mathbf{y} : \mathbf{x}) = \mathrm{ar}\left(C_{[\mathbf{y}:\mathbf{x}]}\right) = 1 - 2\int_0^1 C_{[\mathbf{y}:\mathbf{x}]}(t)\,\mathrm{d}t \tag{1}$$

From the formula (1) can be concluded that index ar takes values from the interval [–1, 1] and $\mathrm{ar}(\mathbf{y} : \mathbf{x}) = -\mathrm{ar}(\mathbf{x} : \mathbf{y})$. More about this indicator is explained in e.g. [Szczesny 2002, Szczesny et al. 2012, Binderman et al. 2014].

In order to indicate the interesting property of the constructed index we consider a simplified example. Let's suppose that the sequence A = (o_1, …o_i, …, o_{2m}) represents the wasted food in consecutive *2m* years in a country A. *n* o_i = 1/(2 m) for *i* = 1, …, 2m, which will be modified in such a way to get a serie of –B_i = (o_1, … o_i + *e*, …, o_{2m}) for chosen $1 \leq i \leq 2m$ and *e* > 0. In this case it is easy to show that if the series A and B_i respectively will be changed into the structure of **x** and $\mathbf{y}_i$, then $\mathrm{ar}(\mathbf{y}_i : \mathbf{x})$ takes positive values when the $(m + 1) \leq i \leq 2m$ and negative values when $1 \leq i \leq m$ and value $|\mathrm{ar}(\mathbf{y}_i : \mathbf{x})|$ increases with an increase in |*m* – i|. Therefore value $\mathrm{ar}(\mathbf{y}_i : \mathbf{x})$ increases with an increase of *i* = 1, …, 2*m*. This direction of changes in $\mathrm{ar}(\mathbf{y}_i : \mathbf{x})$ values is actual for any sequence (o_1, … o_i, …, o_{2m}). It seems to be a useful property. For this reason, it seems natural to use this indicator for the ordering the EU countries in terms of changes in the level of food waste. Index with similar properties can be obtained using the difference between the weighted average of the two parts of period *2m* years for the tested product group if the used weights will be decreasing with increasing *i* = 1, …, *m* and increasing with an increase of *i* = *m* + 1, …, 2*m*.

In the methods associated with GCA, an important role is played by the over-representation map, which is used to create a visualization of the analyzed data. To explain this concept, let's assume that the data collected on the diagnostic value of the variable for each country during the *k*-years form a matrix:

$$\mathbf{X} = \begin{bmatrix} x_{1,1} & x_{1,2} & \dots & x_{1,k} \\ x_{2,1} & x_{2,2} & \dots & x_{2,k} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n,1} & x_{n,2} & \dots & x_{n,k} \end{bmatrix} = \left[x_{i,j} \right],\ i = 1,\ \dots,\ n,\ j = 1,\ \dots,\ k \tag{2}$$

where: n – number of objects (countries),
k – number of years in the analyzed period,
$x_{i,j}$ is the value of a variable on the object O_i in the year numbered k.

The graphical form of the over-representation map (Fig. 1) is a unit square [0; 1] × [0; 1]. The square is divided by vertical and horizontal lines of rectangles filled with the shades of gray, which correspond to the values calculated according to the formula (2):

$$h_{i,j} = \frac{\frac{x_{i,j}}{x_{+,+}}}{\frac{x_{i,+}}{x_{+,+}} \frac{x_{+,j}}{x_{+,+}}} = \frac{\frac{x_{i,j}}{x_{+,j}}}{\frac{x_{i,+}}{x_{+,+}}} = \frac{\frac{x_{i,j}}{x_{i,+}}}{\frac{x_{+,j}}{x_{+,+}}} \quad \text{where } i = 1, ..., n, j = 1, ..., k \tag{3}$$

$$x_{i,+} = \sum_{j=1}^{k} x_{i,j},\ \ x_{+,j} = \sum_{i=1}^{n} x_{i,j}, x_{+,+} = \sum_{i=1}^{n} \sum_{j=1}^{k} x_{i,j}$$

Vertical lines are routed in points: $0, \frac{x_{+,1}}{x_{+,+}}, \dots, \sum_{i=1}^{j} \frac{x_{+,i}}{x_{+,+}}, \dots, 1$, and the horizontal lines at points $0, \frac{x_{1,+}}{x_{+,+}}, \dots, 1$. Figure 1 shows the map illustrating the structure of the waste of food of plant origin. Countries have been organized using ar measures. The width of the horizontal stripes show the share of wasted food of plant origin in the 28 countries during the period 2000–2011. A particularly large share are occupied by Poland, Germany and France. While the width of the vertical strips depict the temporal structure of the waste products of plant origin. Grayscale indicates the quotients values of the individual components of the time structure for each country to the corresponding structure components of the entire series (horizontal structures), and the quotients values of the individual structure components of 28 EU countries in a given year to the corresponding components of the structure of these countries, calculated for the entire period of 12 years. From Figure 1 we can conclude that out of 28 countries, Poland and Lithuania are distinguished by the fact that their time structure (horizontal) of wasted food value in relation to the time structure of the entire series shows a significant improvement in reducing waste (dark rectangles in 2000–2002 and bright in 2009–2011), while in the case of Hungary, the Netherlands and France, the situation is unfavorable. By interpreting the graphic differently (vertical structure), it can be observed that the share of wasted food in Lithuania and Poland, out of the wasted food in all 28 countries in 2000 and 2001 is significantly higher than that in the entire period of 12 years, while in each of the years in the period 2008–2011 it is significantly smaller. In Figure 1 countries are arranged in order of $\text{ar}\left[\left(\frac{x_{i+1,1}}{x_{i+1,+}}, \dots, \frac{x_{i+1,k}}{x_{i+1,+}}\right) : \left(\frac{x_{i,1}}{x_{i,+}}, \dots, \frac{x_{i,k}}{x_{i,+}}\right)\right] \geq 0$ for $i = 1, \dots, k - 1$. Therefore, it is ordered from the point of view of the country which, at that time received the biggest improvement in food waste of plant origin, to the country which has the worst results. This is the order generated by the ar index.

In this presentation of plant origin food wastage variable X was used, which is the sum (in tonnes) of waste for each product group. This is a highly simplified picture. To get a more precise view each aggregated group of products reported by FAO should be tested separately and a cumulative synthetic assessment should be made.

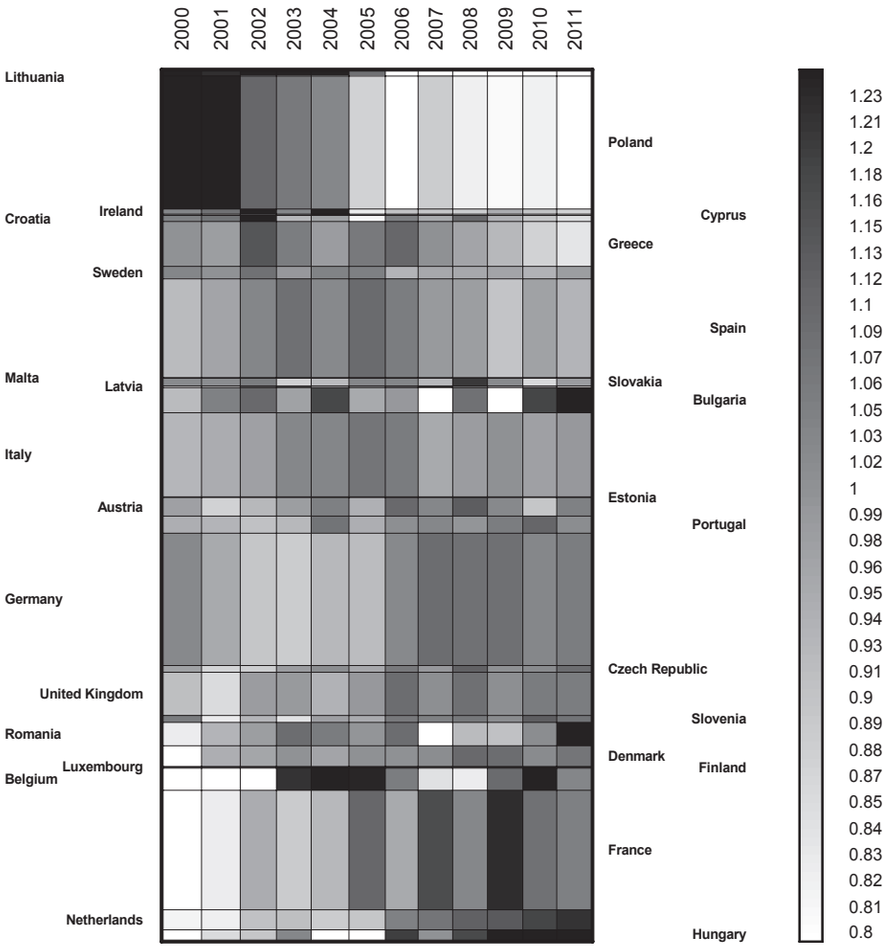

Fig. 1. Over-representation map showing the over-representation of the structure of the waste of plant products

Source: Own calculation based on FAO data.

For this purpose, it is necessary to not only have a well-sequence order but also evaluative indicator. Usage of S index is proposed, represented by the following formula:

$$S_i = \sum_{j=1}^{i} \frac{x_{j,+}}{x_{i,+}} \quad \text{for} \quad i = 1, ..., n. \tag{4}$$

The graphics of these values correspond to the extremities of the intervals on the section [0; 1] defined by horizontal stripes of map over-representation. Therefore, the value uses information on both the order of the objects and the values for those objects in each row (width of the horizontal stripes). Note that if we were not interested in the size of the waste in each country, but only in the order of the waste structures in the consecutive years, each row of the matrix **X** prior to analysis should be divided by $x_{i,+}$ (then the over-representation map would have horizontal stripes of the same width). In this case the ratio S values will be i/n for $i = 1, \ldots, n$. S_i, and values are, therefore ranks (item numbers) divided by n, the number of all objects.

RESULTS

To compare changes in the level of waste in different countries variables Y_1, ..., Y_7, were used, which were calculated by dividing the values of the variables X_1, ..., X_7 by the number of inhabitants of the country during each year of the tested period. The use of variables Y_1, ..., Y_7 also enables the comparison of the level of waste in different countries in the analyzed period. For this purpose, synthetic indices have been used widely used, which are defined as the mean value of the standardized sub-criteria. To reduce the impact of annual fluctuations to assess the changes, the analysis was performed in two variants;

- Variables U_i (i = 1, ..., 7) were created as the mean values of Y_i from 2000–2002 and variables V_i(i = 1, ..., 7) as the mean value of Y_i for the years 2009–2011, which, after standardization by zeroed unitarisation [Kukuła 2000, Kukuła and Luty 2015] were used to create synthetic indicators W_1 and W_2 as the mean values of standardized variables U_1, ..., U_7 and V_1, ..., V_7, the values of these indicators are presented in Table 1;
- Variables Z_i (i = 1, ..., 7) were created as the weighted mean values of Y_i from 2000–2005 with the following decreasing weights 0.208; 0.192; 0,175; 0.158; 0.142; 0.125 and variables T_i (i = 1, ..., 7) as the mean value of Y_i from 2006–2011 with the following increasing weights 0.125; 0.142; 0.158; 0,175; 0.192; 0.208, which, after normalization by zeroed unitarisation, were used to create synthetic indices W_3 and W_4 as the mean normalized values of the variables Z_1, ..., Z_7 and T_1, ..., T_7. The values of these indicators are presented in Table 1. Determining the weight was used a variant of individualization of the each year validity by assigning them points: 25, 23, 21, 19, 17 and 15 respectively (i.e. a point technique of creating weights in the personalized ranking), which after normalization have been rounded to three decimal places.

Table 1 also contains columns R_1, ..., R_4 containing the position of the country in the ranking of countries from those with the lowest level of waste to those with the highest level of waste (there are the ranks with values of W_1, ..., W_4). The last two columns (Gr_1 and Gr_2) contain information on the division of countries into four groups according to the thresholds for the indicators W_1 and W_2. As the thresholds was established: $\mu - \sigma$, μ, $\mu + \sigma$, where the symbol μ is the mean value W_i, and σ symbol standard deviation W_i (i = 1, 2).

Table 1 shows that the lowest level of food waste, regardless of if indicators W_i, built on the basis of three- or six-years periods was noted in Finland and the United Kingdom of Great Britain and Northern Ireland (cf. values W_1, ..., W_4 and items in columns R_1, ..., R_4). Poland occupied one of the last places in the ranking in 2000–2002, (R_1 = 26), though has improved slightly, moving only about three places up in the period 2009–2011 (R_2 = 23). In the first period Poland is among the countries with the highest level of waste together with Cyprus and Greece (Gr_1 = 4), while in the second period (2009–2011) it is up to group 3 (Gr_2 = 3).

In order to build the ranking of countries due to the changes in food waste level, the following five indicators were used:

$$\xi_1 = W_2 - W_1,\ \xi_2 = W_4 - W_3,\ \xi_3 = W_2/W_1 - 1,\ \xi_4 = W_4/W_3 - 1,\ \xi_5 = (S_1 + \ldots + S_7)/7 \quad (5)$$

where: S_i (i = 1, 2, …, 7) – ratio defined by formula (4) for Y_i (i = 1, 2, …, 7).

The calculated results are presented in Table 2. In a similar way to Table 1 in columns R_1, ..., R_5 shows ranking by reducing the level of waste and four groups of indicators, ξ_1 and ξ_5, were set up, using thresholds based on mean values and standard deviations of these indicators.

From Table 2 it can be concluded that the assessment of changes in the of waste level per capita is sensitive to the measurement method. There is a difference in this assessment when the change of the nominal waste level is considered (differences indicators assessing the level of waste in two extreme periods of three-years and two extreme periods of six-years respectively: ξ_1 and ξ_2) and different when changes take into account value for three--year periods (ξ_3), and six-year periods (ξ_4), or take into account annual changes over the entire 12 years (ξ_5). In the case of nominal changes in the level of food wastage in the analyzed period of time, the greatest progress in

Table 1. Indicators and rankings of food waste levels in 2000–2011 in the EU countries

	W_1	W_2	W_3	W_4	R_1	R_2	R_3	R_4	Gr_1	Gr_2
Austria	0,247	0,233	0,263	0,245	20	20	20	21	3	3
Belgium	0,143	0,299	0,201	0,300	10	25	16	25	2	4
Bulgaria	0,283	0,254	0,362	0,270	22	22	26	23	3	3
Croatia	0,205	0,125	0,215	0,139	18	7	17	8	3	2
Cyprus	0,521	0,349	0,547	0,371	28	27	28	27	4	4
Czech Republic	0,121	0,092	0,141	0,098	8	5	8	5	2	2
Denmark	0,289	0,287	0,313	0,288	24	24	23	24	3	4
Estonia	0,082	0,162	0,108	0,165	5	14	5	14	1	2
Finland	0,017	0,025	0,017	0,022	1	1	1	1	1	1
France	0,175	0,199	0,190	0,193	13	19	15	19	2	3
Germany	0,174	0,152	0,183	0,158	12	13	13	13	2	2
Greece	0,511	0,396	0,532	0,422	27	28	27	28	4	4
Hungary	0,177	0,143	0,172	0,149	15	11	10	10	2	2
Ireland	0,176	0,178	0,181	0,173	14	15	11	15	2	2
Italy	0,167	0,188	0,183	0,192	11	17	12	18	2	3
Latvia	0,068	0,063	0,084	0,075	3	3	4	3	1	1
Lithuania	0,186	0,145	0,225	0,151	16	12	19	11	2	2
Luxembourg	0,119	0,071	0,138	0,080	7	4	7	4	2	1
Malta	0,193	0,180	0,189	0,183	17	16	14	16	2	2
Netherlands	0,076	0,134	0,083	0,124	4	9	3	7	1	2
Poland	0,359	0,263	0,358	0,264	26	23	25	22	4	3
Portugal	0,271	0,193	0,271	0,187	21	18	21	17	3	3
Romania	0,136	0,134	0,165	0,139	9	10	9	9	2	2
Slovakia	0,209	0,129	0,221	0,155	19	8	18	12	3	2
Slovenia	0,298	0,328	0,304	0,331	25	26	22	26	3	4
Spain	0,284	0,235	0,313	0,242	23	21	24	20	3	3
Sweden	0,109	0,104	0,116	0,103	6	6	6	6	2	2
United Kingdom	0,062	0,062	0,063	0,061	2	2	2	2	1	1
Mean	0,202	0,183	0,219	0,189						
Standard deviation	0,119	0,091	0,123	0,094						

Source: Own calculation based on FAO data.

reducing the losses (both taking into account of three- and six-year periods) was recorded in countries that have wasted in the previous ranking the most food: Cyprus ($R_1 = 1$), Greece ($R_1 = 2$) and Poland ($R_1 = 3$). In comparison to the extreme three-year periods they belong to, they are the group of countries with the largest decrease in the nominal level of wasted food ($Gr_1 = 1$). When taking into account decreases and increases in food loss in relation to the launch period, the rankings of countries with the greatest improvement in reducing food losses is represented a bit differently. In comparison, when we consider the extreme three-year periods, these countries with the highest decrease in nominal food waste had a lower position (see R_3 and R_4). In this approach, with the three- and six-year periods the leader of the ranking is Luxembourg (for Poland $R_3 = 6$ and $R_4 = 8$). Major changes in ranking of the countries according to their progress in reducing food losses occur in the case of index ξ_5 [formula (5)], which is the arithmetic mean of the S_i coefficients designated by methods GCA [formula (4)]. Poland is ranked in the seventh position ($R_5 = 7$), the leader is Cyprus again ($R_5 = 1$), but when it the positions of some countries such as France ($R_5 = 8$ when $R_1 = R_3 = 24$ or $R_2 = R_4 = 22$), Luxembourg $R_5 = 17$, when

Table 2. Indicators and rankings of changes in the level of food waste in 2000–2011 in the EU countries

	ξ_1	ξ_2	ξ_3	ξ_4	ξ_5	R_1	R_2	R_3	R_4	R_5	Gr_1	Gr_5
Austria	–0,013	–0,017	–0,054	–0,065	0,665	14	16	16	18	25	3	4
Belgium	0,157	0,099	1,096	0,493	0,595	28	28	28	26	21	4	3
Bulgaria	–0,029	–0,092	–0,103	–0,255	0,500	11	4	13	9	14	2	2
Croatia	–0,080	–0,076	–0,392	–0,352	0,417	5	6	2	2	6	2	2
Cyprus	–0,172	–0,176	–0,331	–0,322	0,230	1	1	4	4	1	1	1
Czech Republic	–0,028	–0,043	–0,234	–0,303	0,570	12	11	7	6	18	2	3
Denmark	–0,002	–0,025	–0,007	–0,079	0,583	18	14	19	17	20	3	3
Estonia	0,080	0,058	0,968	0,539	0,677	27	27	27	28	26	4	4
Finland	0,007	0,005	0,431	0,271	0,643	22	23	25	25	23	3	3
France	0,023	0,003	0,134	0,015	0,439	24	22	24	22	8	3	2
Germany	–0,022	–0,025	–0,129	–0,136	0,573	13	13	12	13	19	2	3
Greece	–0,115	–0,110	–0,224	–0,206	0,402	2	2	8	11	5	1	2
Hungary	–0,034	–0,022	–0,195	–0,130	0,465	10	15	10	14	11	2	2
Ireland	0,002	–0,009	0,009	–0,047	0,515	21	19	21	19	15	3	3
Italy	0,020	0,009	0,122	0,049	0,450	23	24	23	23	10	3	2
Latvia	–0,005	–0,009	–0,068	–0,108	0,645	17	18	15	16	24	3	3
Lithuania	–0,041	–0,074	–0,218	–0,327	0,335	9	7	9	3	3	2	1
Luxembourg	–0,048	–0,058	–0,403	–0,419	0,529	8	10	1	1	17	2	3
Malta	–0,013	–0,006	–0,068	–0,030	0,324	15	20	14	21	2	3	1
Netherlands	0,058	0,041	0,763	0,499	0,780	26	26	26	27	28	4	4
Poland	–0,097	–0,094	–0,269	–0,262	0,423	3	3	6	8	7	1	2
Portugal	–0,078	–0,084	–0,286	–0,309	0,496	6	5	5	5	13	2	2
Romania	–0,001	–0,026	–0,010	–0,158	0,754	19	12	18	12	27	3	4
Slovakia	–0,081	–0,066	–0,385	–0,298	0,439	4	9	3	7	9	2	2
Slovenia	0,030	0,027	0,101	0,088	0,622	25	25	22	24	22	3	3
Spain	–0,050	–0,072	–0,175	–0,228	0,337	7	8	11	10	4	2	1
Sweden	–0,005	–0,014	–0,048	–0,120	0,486	16	17	17	15	12	3	2
United Kingdom	0,000	–0,002	–0,002	–0,034	0,524	20	21	20	20	16	3	3
Mean	–0,019	–0,031	0,001	–0,080	0,515							
Standard deviation	0,062	0,055	0,375	0,254	0,130							

Source: Own calculation based on FAO data.

$R_1 = 8$, $R_2 = 10$, $R_3 = R_4 = 1$) and Austria ($R_5 = 25$ when $R_1 = 14$, $R_2 = R_3 = 16$, $R_4 = 18$) are considered, the changes are much more major. This causes obviously significant differences in regard to the composition of established groups (Gr_1 and Gr_5).

The compliance of indicators of changes in the loss of food values and set up the rankings depending on the approach to the problem is best shown in Table 3, which present the correlation coefficients between the designated indicators and the positions occupied by the individual countries.

The greatest similarities can be seen in the case of indicators and rankings for three- and six-year-periods determined nominal losses or in terms of relative to the launch period (coefficients of correlation between the indicators ξ_1, ..., ξ_4 and rankings R_1, ..., R_4 are valued above 0.8). However, there is a dissimilarity between indicators ξ_1, ..., ξ_4 and indicator ξ_5 and also rankings between R_1, ..., R_4 and R_5 ranking, where the correlation coefficients were at a noticeably lower level. But this should not raise any objections, since the method of determining the ratio ξ_5 significantly differs from the classic created indices ξ_1, ..., ξ_4. Index ξ_5 is built based on a measure of diversity ar, which is sensitive to the so-called transfers (a term commonly used in the concentration of income

Table 3. Matrices of correlation coefficients between the indicators and rankings of countries with the largest decrease in food waste

	ξ_1	ξ_2	ξ_3	ξ_4	ξ_5
ξ_1	1				
ξ_2	0,961	1			
ξ_3	0,857	0,812	1		
ξ_4	0,828	0,840	0,969	1	
ξ_5	0,635	0,646	0,560	0,567	1

	R_1	R_2	R_3	R_4	R_5
R_1	1				
R_2	0,940	1			
R_3	0,948	0,876	1		
R_4	0,887	0,912	0,941	1	
R_5	0,652	0,564	0,563	0,511	1

Source: Own calculation based on FAO data.

field), which clearly differentiates movement of the same waste volume of between the years. A measure of diversity ar [formula (1)] has the greater value with the offset value of the waste on time takes place on a larger time interval [Binderman et al. 2014, Koszela 2016]. Therefore, the approach to the problem is much different from those considered as classical ones. What is more, the GCA instrumentation giving additional graphical interpretation in the form of over-representation maps (Fig. 1) may be an important warning before releasing the ranking built only on the basis of a synthetic index constructed with the use of well-known classical technique.

CONCLUSIONS

Food production is associated with a significant burden on the environment so the constant monitoring of changes in the level of waste food products in the EU is very important. It is crucial that changes of the level of food waste were characterized by a descending trend. One of the activities in support of the administration actions in the individual countries in this area are publications of all kinds of rankings depicting the situation in terms of food wastage. However, the construction of the rankings, especially when they are published should take care that they have a high stability (more about this issue has been widely discussed [Koszela and Szczesny 2015]. In this paper, to the construction of synthetic indicators describing the change in level of waste a simplified approach was used, and found all categories of food products as equally important (equal weights applied). As described in the introduction, examples of water demand indicate that the problem of the ranking construction is much more complicated, and the adoption of the same weight was dictated by the limited paper volume. Verification of the stability of the presented ranking should not be reduced to checking the impact of weights on the order results only (and the assessment of the level of changes using the synthetic indicators). To make sure that the published ranking is stable it should be compared with others created by different techniques. The paper compares two types of rankings of changes level obtained by two different techniques (using the change in the value of the synthetic indices assessing the level of waste and using ordering obtained by GCA tools differentiation of structures index ar). From the results presented in Tables 2 and 3 it is clear that the arrangement of objects on the index ξ_5 are more different from orders of the index values of ξ_1, ..., ξ_4 than the arrangements between them (see correlation matrices in Table 3). In particular, the positions of countries like Austria or France considerably vary (sometimes by more than 10 ranks). It is worth noting, that using techniques with GCA instruments to rank countries according these seven variables, we have a clear graphics interpretation in the form of seven overrepresentation maps.

The comparison was made on the assumption that the reduction of waste is equally valid in each of seven or eight-aggregated product groups. These rankings give an initial picture of the ongoing changes, because they do not reflect e.g. how these changes affect the change of load on the environment (greenhouse gas emissions, water consumption etc.). For this reason, it seems that more detailed periodical reports on an annual basis should be published, taking into account changes in the value of waste in the narrower product groups using weights proportional to the load on the environment in their production.

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ZMIANY POZIOMU MARNOTRAWSTWA ŻYWNOŚCI W KRAJACH UE

STRESZCZENIE

Marnowanie żywności to problem społeczny i ekonomiczny, jest także dużym i niepotrzebnym obciążeniem dla środowiska naturalnego. W pracy podjęto problem porównania zmian dotyczących poziomu marnotrawstwa żywności w krajach UE w latach 2000–2011. Posłużono się tutaj dwoma technikami: wielowymiarową analizą porównawczą oraz gradacyjną eksploracją danych. Druga z nich jest zastosowana pierwszy raz w tego typu zagadnieniach. Na podstawie tych technik zbudowano wskaźniki syntetyczne, które posłużyły jako kryterium klasyfikacji krajów UE pod względem tempa zmniejszania poziomu marnotrawstwa żywności. Okazuje się, że zastosowane do budowy wskaźników techniki dają w efekcie różniące się od siebie uporządkowania.

Słowa kluczowe: wielowymiarowa analiza porównawcza, gradacyjna eksploracja danych, wskaźnik syntetyczny, klasyfikacja obiektów, marnowanie żywności

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THE TECHNOLOGY SHOCK AND THE POLISH FOOD SECTOR MARKUPS

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ABSTRACT

The aim of the paper is to investigate an impact of a technology shock on a market power exerted in the Polish food industry, measured by monopolistic markups calculated based on a labor input margin with developments, as well as the Roeger markup, in the period 2002–2013. A structural vector auto regression model (SVAR) with productivity and hours in the Polish economy, and markups, was built. It was assumed that in the long-term only technology shock influences productivity, whereas shocks in markups make no impact on labor demand. After including labor markups developments, the technology shock seemed to increase the competition level, and the exerted market power rises over time. The positive sign of movement is opposed to results regarding unconditional cyclicality of markups in the food industry and in the whole Polish economy.

Key words: exogenous shock, monopolistic markups, business cycle

INTRODUCTION

A technology shock means a sudden change in technology. Its impact on economic activity is predominantly positive, as technology rarely moves backwards. Because during a technology shock an output for a given inputs increases, a technology shock comes down to changes in productivity. Nowadays, especially significant role technology shocks play in real business cycle (RBC) models, which after the work of Kydland and Prescott [1982], who showed that fluctuations in the US after the World War II may be explained by a neo-classical growth model with a labor – leisure choice and exogenous technology shocks, as well as its further successful empirical performances, became very popular. On the other hand, an especially big influence this type of shocks plays in regards to manufacturing companies, which are particularly dependent on technology.

One of the first ones, who highlighted the primary role of technology shocks in shaping business cycles, was Schumpeter. In his view, business cycles are caused by technological innovations. Fluctuations in innovation cause fluctuations in investment, which lead to cycles in aggregate activity. Introduction of new technologies were perceived by him as a process consisting of inventions, innovations, diffusion paths and investment activities. Inventions are rather primitive, of poor performance and higher production costs, as compared with existing technologies. When a production technology appears, inventions become innovations. Afterwards, they diffused at a speed depending on an actual and expected trajectory of a performance improvement and a cost reduction [Mansfield 1983]. As entrepreneurs perceive that risk and returns warrant innovative commitments, periods of acceleration in aggregate growth are generated [Rosenberg 1994]. Interestingly, along with the role of innova-

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tion and entrepreneurship in shaping business cycles, Schumpeter emphasized the role of market power. In his opinion an innovation-originated market power may be even more important than the invisible hand or price competition. Technological innovations are followed by temporary monopolies gaining abnormal profits, which are then taken by rivals and imitators. Nevertheless, these possessing market power monopolies are necessary to encourage firms to develop new products and processes [Pol and Carroll 2006].

In such a framework, the aim of the paper is to investigate the impact of a technology shock on the market power exerted in the Polish food industry. Particularly, as a measure of an exerted market power, monopolistic markups were utilized[1]. They were calculated based on a labor input margin with developments including: overhead labor, CES production function, marginal wage. The Roeger markups were considered too. The research hypothesis was as follows: a positive technology shock causes a short-term increase of the Polish food sector markups. This seems to be in accordance with a Schumpeter view. Thus, taking into consideration a positive reaction of the business cycle to a technology shock, markups should behave procyclical.

On the other hand, both theoretical models and empirical studies aren't unanimous regarding markups cyclicality. Countercyclical markups are present in the new-Keynesian models, being caused by sticky prices combined with procyclical marginal costs, e.g. Smets and Wouters [2003] or Christiano et al. [2005]. Also Kalecki pointed that during downturns in order to make prices sticky and save profits, firms create cartels, while prices of raw materials decrease [Lopez and Assous 2010]. There are as many studies, in which markups proved to be countercyclical [e.g. Bils 1987, Rotemberg and Woodford 1999], procyclical [e.g. Domowitz et al. 1986, Nekarda and Ramey 2013], or acyclical [Marchetti 2002]. Regarding the Polish economy, Gradzewicz and Hagemajer [2007] indicated countercyclical behavior of markups, whereas author showed that markups in the Polish food sector appeared to behave unconditionally countercyclical.

In order to achieve the goal of the paper, the material and methods will be presented. Particularly, for creating a series for a technology level, three methods may be used. The first one relies on TFP growth series, so standard Solow residuals, the second – on the utilization adjusted TFP growth series, whereas in the third, a technology series levels are created based on a SVAR model proposed by Gali [1999]. The third method was chosen as the newest and to make results comparable to the ones obtained for the US economy by Nekarda and Ramey [2013]. Afterwards, the preliminary analysis of cyclical components will be performed, what will be followed by describing and discussing the results of the SVAR analysis. Finally, the conclusions will be drawn, taking into account main limitations of the study, future research areas, as well as adequate policy recommendations.

MATERIAL AND METHODS

The SVAR model used in the analysis is the same as constructed by Nekarda and Ramey [2013], who, in order to estimate markups cyclicality, added markups to the Gali [1999] SVAR, with which he estimated shocks in technology. The Gali SVAR included two variables – labor productivity and hours, where a shock in productivity means a technology shock, whereas a shock in hours means a non-technology shock. A long-term restriction, which is satisfied by a broad range of RBC and new-Keynesian models, saying that only technology shocks may have a permanent effect on the productivity level, was incorporated. This means constant returns to scale. In other words, technology shocks are those that have permanent effects on labor productivity, whereas changes in productivity caused by changes in utilization are excluded. Moreover, in order to achieve identification, another long-term restriction was imposed, saying that the food sector markups make no impact on a labor demand.

In order to calculate productivity, quarterly indexes (2010 = 100) of a real labor productivity per hour worked were utilized. They were calculated as a real GDP (measured in chain-linked volumes with a reference year

[1] For a discussion on five economic meanings of markups, which include measuring degree of exerted market power, see Kufel [2016b].

2010) per unit of labour input (measured by the total number of hours worked). It was deducted that this measure provides a better picture of productivity developments in the economy than labour productivity per person employed, as it eliminates differences in the full/part time composition of the workforce across years. Afterwards, in order to obtain an index of hours worked, an index of quarterly real GDP (2010 = 100) was multiplied by a labor productivity index. Data series come from the Eurostat database. Markups levels were obtained from Kufel [2016]. Specifically, the Roeger markups, as well as four out of seven labor markups measures were taken, each representing a separate methodology development. Eventually, used markup measures were as follows: a baseline markups measure that is the log of inversed labor share (1), a measure excluding overhead labor (2), a measure including marginal wage (3), a measure including CES instead of Cobb-Douglas production function (4), the Roeger markup. They were calculated based on yearly data from the Central Statistical Office of Poland (CSO) and interpolated from a yearly to a quarterly frequency with the Chow and Lin [1971] procedure. Because of data availability, markups levels could be calculated only for the period 2002–2013. Consequently, also the remaining two data series were limited to that period. All three variables were seasonally adjusted with the TRAMO-SEATS procedure and logarithmized. Because an ADF test [Tsay 2010] indicated a unit root in each data series, trends were removed with the Hodrick-Prescott (HP) filter, with a parameter $\lambda = 1{,}600$[2]. Expansionary shocks were considered. The maximal number of lags was set on 5. Majority of information criteria (Akaike, Schwartz-Bayesian and Hannan-Quinn) pointed 4 lags as an optimal lag order in each of analyzed models. Therefore, for uniformity and because of markups data interpolation, 4 lags were chosen.

The causal impact of a technology shock on markups and real GDP was summarized with an impulse response functions (IRFs) analysis [Lütkepohl and Krätzig 2007]. The conclusions on markups cyclicality, conditional on technology shocks, and during discussion also conditional on non-technology shocks, were drawn. The VAR model dynamics was also assessed by both historical and forecast error variance decompositions (FEVD) [Lucchetti 2015]. The first indicated the historical contributions of structural shocks regarding each of three variables to the observed trajectory of markups. The second described the share of uncertainty of markups that can be attributed to shocks in each of three variables after 1–20 quarters. Because of taking into account series after HP filtering, the SVAR formula was as follows [Kusideł 2000]:

$$Bx_t = \Gamma_1 x_{t-1} + \Gamma_2 x_{t-2} + \Gamma_3 x_{t-3} + \Gamma_4 x_{t-4} + \xi_t$$

where: $x_t = [x_{1t}, x_{2t}, x_{3t}]'$ – a vector of observations on current values of three variables in the model,
B – a matrix by non-delayed variables of a vector,
Γ_I ($i = 1, 2, 3, 4$) – matrixes of parameters by delayed variables of a vector,
ξ_t – a () vector of random disturbances of a structural model.

RESULTS

Figure 1 illustrates the cyclical components of data utilized in SVARs. Deviations from its long-term stochastic trends in case of real GDP didn't exceed 2.5%, whereas in case of productivity and hours – 4%. Markups deviations didn't exceed 5%, apart from the third method of markups calculation, which gave markups deviated by even more than 10% from the long-term stochastic trend. Markups calculated with the first, second and third methods appeared to be the most variable – standard deviations amounted to respectively 232, 312 and 445%

[2] In Nekarda and Ramey [2013], in order to obtain cyclical components, deterministic trends and first differences were utilized. In this study however, the author chose a HP filter in order to keep heterogeneity with the previous studies on the Polish food markups [Kufel 2016].

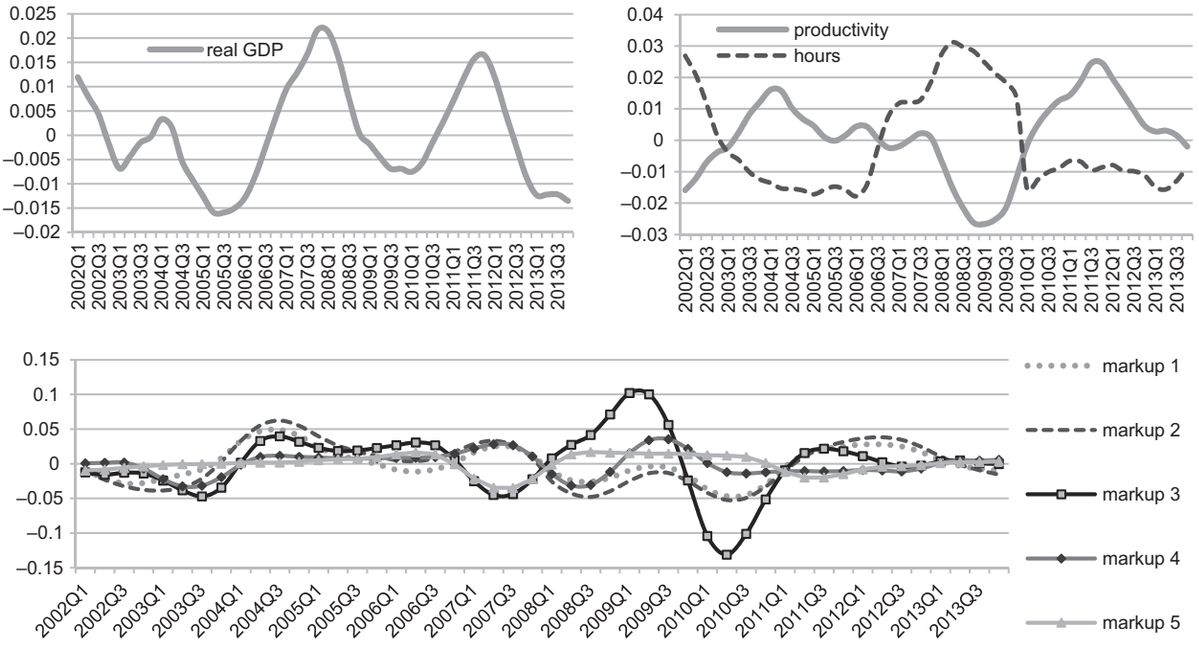

Fig. 1. Cyclical components of used variables

Source: Own elaboration.

whereas in case of other two methods it was 165 and 128%. Standard deviations for productivity and hours were quite similar and amounted to 126 and 158%, whereas for real GDP it was the lowest, amounting to 104%. Importantly, the correlation between productivity and hours was high and negative (–0.764), what is against predictions received from the basic RBC models, where macro fluctuations result from changes in the labor demand caused by technology shocks, together with an upward-sloping labor supply [Gali 1999]. This may mean that the non-technology shocks play more significant role in the Polish economy, as their role is to shift the labor supply, what induces a negative comovement between productivity and hours, as was shown by e.g. Christiano and Eichenbaum [1992][3].

Figure 2 illustrates IRFs regarding technology shocks with a size of one standard error. It might be observed that the direction of an impact of the technology shock on the market power exerted in the Polish food industry depends on the method of markups calculation. Labor markups are about to drop just after a technology shock, and increase afterwards. The magnitude of a decrease is higher when including marginal wage and CES production function than in scenarios both without developments and with overhead labor, while the magnitude of an increase is *vice versa* – higher for the first and second methods of markups calculation. The Roeger markups on the contrary firstly increase, then decrease, but the long-term effect is positive. Thus, a long-term reaction is here also positive. Eventually, taking into account the improved methodology (labor markups with developments), it might be concluded, that the research hypothesis wasn't confirmed. Market power in the Polish food sector in the period 2002–2013 after technology shocks was decreasing. Although such a result seems to be not in accordance

[3] This however is against the Gali [1999] results. Taking advantage of his new-Keynesian model including monopolistic competition, sticky prices and variable effort, he indicated a negative correlation in case of technology, and positive – in case of non-technology shocks.

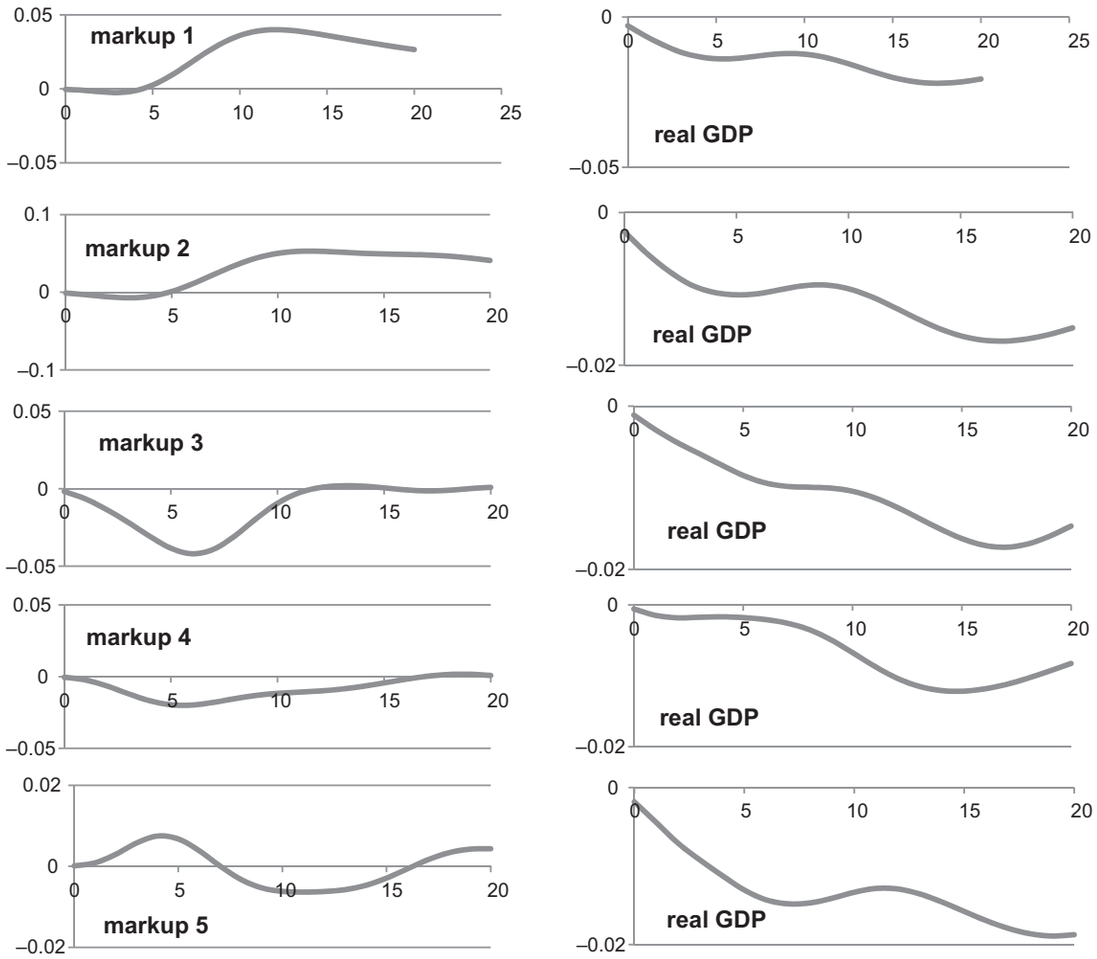

Fig. 2. Cumulative impulse response functions of markups and real GDP for the technology shock

Source: Own elaboration.

with a Schumpeter view, the character of a short term cyclicality is. Surprisingly, in each out of five models, GDP decreases in response to a positive shock in technology, what is against the results obtained by Gali [1999], as well as Nekarda and Ramey [2013]. Consequently, markups cyclicality conditional on the technology shock is positive – markups behave procyclical. Interestingly, because of the real GDP drop after the technology shock, this final result is in accordance with latest results obtained for the US by Nekarda and Ramey, where markups increase in response to this kind of shock, although the response was small and statistically not significant.

Finally, in order to assess a relative impact of shocks in productivity, hours and markups on the Polish food sector markups, the variance error decompositions were applied (Fig. 3). Regarding historical data, it appears that shocks in markups and hours played a major role in shaping the observed trajectory of markups, whereas the role of technology shocks was the smallest. In the horizon of 20 quarters the share of uncertainty on markups that can be attributed to shocks in technology is about to increase, to shocks in markups – decrease, whereas the significance of the non-technology shock seems to be quite stable apart from the scenarios with markups obtained with developments (2, 3, 4), in which it increases.

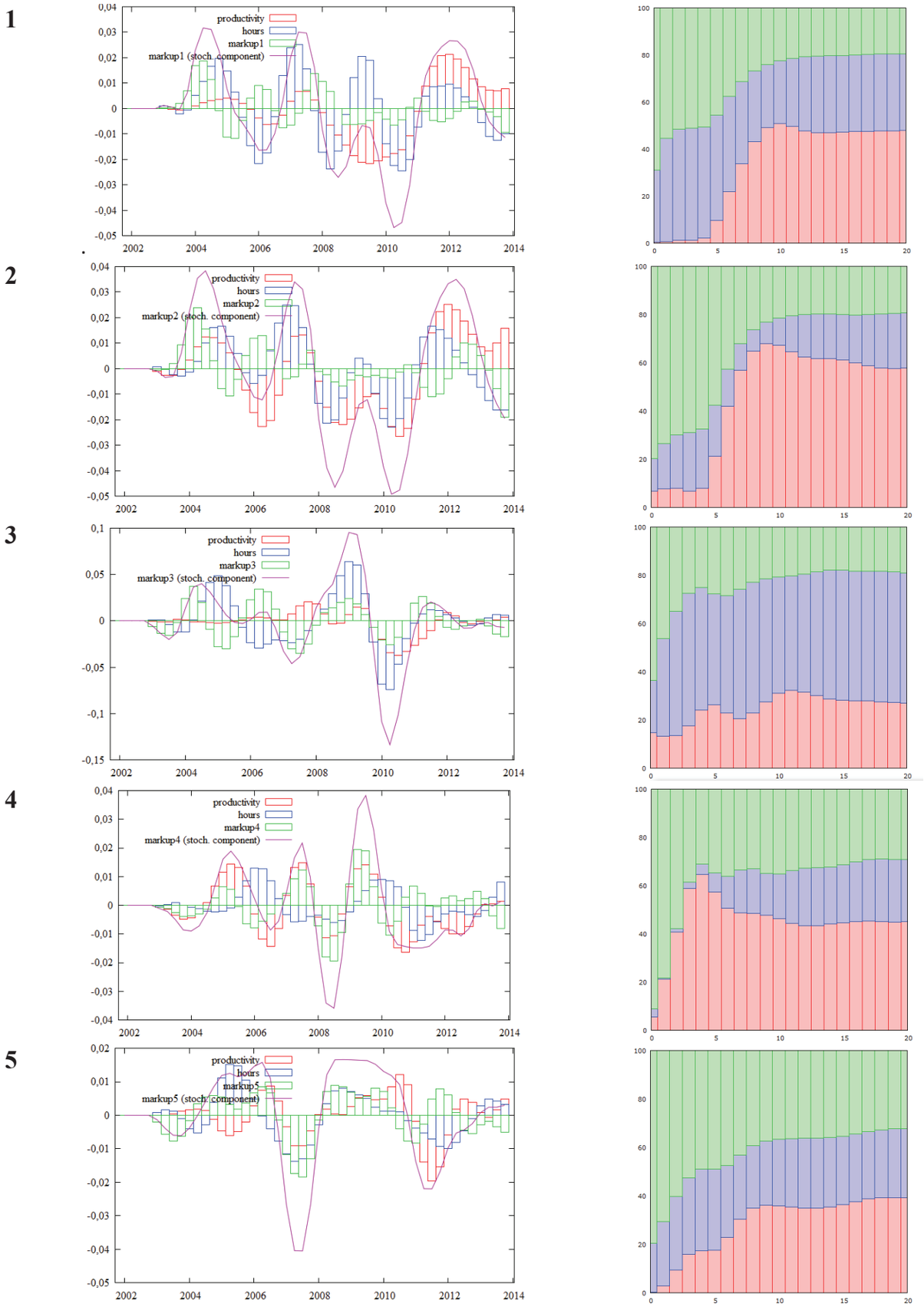

Fig. 3. Historical and future error variance decomposition – FEVD for markups (1, 2, 3, 4, 5 – scenarios, a – markups, b – hours, c – productivity)

Source: Own elaboration.

DISCUSSION

The most controversial result undoubtedly concerns the negative impact of the technology shock on real GDP. It is against the result obtained by Pater [2010] while studying the Polish labor market. This discrepancy may be caused by utilizing a traditional method of analysing shocks in technology (Solow residuals), but more likely – by the earlier studying period (1997–2008), neither embracing the full effects of entering the EU, nor effects of the financial crisis. In fact, the negative impact is an outcome of a decrease in working hours higher than an increase in productivity, which it accompanied. Moreover, technology shocks may cause a snowball effect of agents changing their business partners, what makes a negative impact on GDP [Taghawi-Nejad 2010]. On the other hand, the hours drop may be only a statistical phenomenon, as during the transition and convergence of the Polish economy flexible forms of employment are taking place of more expensive full and part-time jobs.

From the other side, markups appeared to be procyclical, what is opposed to the results regarding unconditional cyclicality of markups in the Polish food industry and in the whole Polish economy [Gradzewicz and Hagemejer 2007]. Consequently, additional IRFs for real GDP and markups in regards to a non-technology shock were generated (Fig. 4). They confirm the results regarding unconditional behaviour of food sector markups. The non-technology shock decreases markups and increases real GDP, so markups conditional on the non-technology shock appeared to be countercyclical[4]. On the contrary to the technology shock, this result

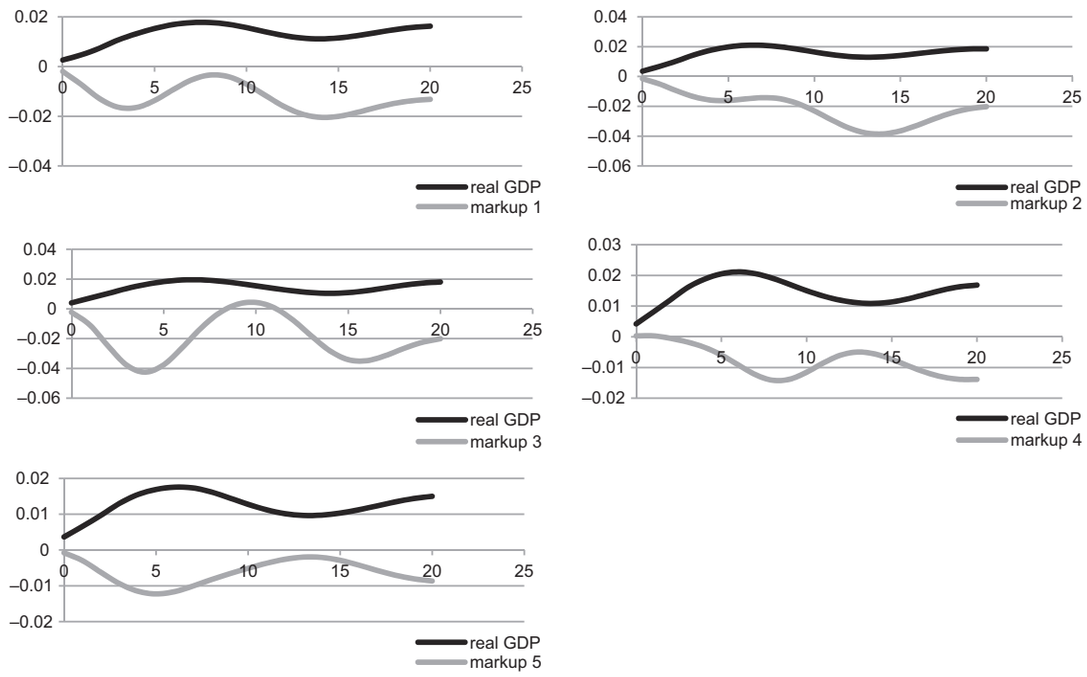

Fig. 4. Cumulative impulse response functions of markups and real GDP for the non-technology shock

Source: Own elaboration.

[4] This result is opposed to results regarding the character of the US markups conditional on monetary policy and government spending shocks performed by Nekarda and Ramey [2013], where both markups and real GDP rose in reaction to a positive non-technology shock encountering the US economy.

is robust to the markups calculation method. Moreover, as only the results for the non-technology shock confirmed the results regarding markups cyclicality, and taking into consideration the negative sign of comovement between productivity and hours, it could be concluded that non-technology shocks in the analyzed period 2002–2013 played more significant role in the Polish economy than the technology ones. Of course drawing such a conclusion is justified only after proving that the characters of cyclicality in the analyzed period were the same for the food and the whole Polish manufacturing sector, although it was so according to Gradzewicz and Hagemajer [2007] for the earlier period. Also the results of FEVDs indicated that the technology shocks contribution to the shape of the markups trajectory was lower as compared to that of non-technology shocks.

CONCLUSIONS

The aim of the paper is to investigate the impact of the technology shock on the market power exerted in the Polish food industry, which was measured by monopolistic markups calculated based on a labor input margin with developments including: overhead labor, CES production function, marginal wage, as well as taking advantage of the Roeger method. The period 2002–2013 was analyzed. Models of SVAR with impulse response functions and variance error decompositions were performed. Variables employed included logs of: labor productivity, hours worked and markups, with four lags. It was assumed that in the long-term only technology shocks affect labor productivity, and shocks in markups don't influence hours.

It was found that taking into account developments in markups calculation, markups react negatively to the positive technology shock, which decreases real GDP. Therefore, markups proved to be procyclical conditional on the technology shock. Downturns, caused by technology shocks, are accompanied by an increase in the level of competition in the Polish food industry, which however decreases over time. Such a result isn't in accordance with outcomes obtained for the US economy, where the markups reaction to the technology shock was positive and statistically not significant, although the direction of cyclicality was confirmed. On the other hand, procyclical markups are the result opposed to the results regarding unconditional cyclicality of markups in the Polish food industry and in the whole Polish economy. It appears that the reason of this inconsistence lay in the major role of non-technological shocks in shaping the Polish business cycle in the analyzed period. Moreover, the proven conditional in regards to non-technology shocks, and unconditional countercycliclity of the Polish food sector markup in regards to the Polish business cycle confirmed the basic mechanism of models in the new-Keynesian spirit, which assume that shocks are influencing the economy through affecting prices, at least for the food industry. When prices are sticky, an increasing demand causes a raise in prices smaller than in marginal costs, what results in a markups decrease. Before confirming assumptions behind the DSGE model utilized by the Polish Central Bank when making the decisions in the area of both monetary and government spending policy, such a study should be however carried out for the whole Polish manufacturing sector.

The results of FEVDs foresaw an increase in the role of technology shocks at an expanse of non-technology shocks, when some of the developments regarding markups calculation methods were taken into account. Consequently, there is a probability that the character of markups cyclicality in Poland will change, what may follow a revision of assumptions behind the DSGE model. Of course, this will be only the case when the character of cyclicality of food industry markups is in accordance of that of the whole manufacturing sector, what should be checked urgently. Further studies should be made in a search for the best way to estimate monopolistic markups. Particularly, a proper choice of the most adequate form of the production function for Poland and its food sector remains an interesting research topic. Moreover, the analysis of conditional cyclicality of markups taking advantage of branch data and panel regressions with the monetary policy, government spending and technology shock instruments will be desirable. The separate research topic is undoubtedly the impact of technology shocks on the Polish economy.

Finally, the trust in the results may be improved by overcoming limitations regarding data. The main drawback refers to a lack of access to data on the firm level and consequently a lack of possibility to clean the database. Secondly, the data frequency was to low (yearly basis) to analyze the cyclical proprieties of markups, and the interpolation to the quarterly frequency could have influenced the results. In future, instead of the interpolated, real quarterly data regarding individual entities should be utilized. Because such data couldn't be accessed from the Central Statistical Office of Poland, a proper quantitative analysis should be performed based on quarries prepared taking advantage of the representative method. Thirdly, although the study period of 12 years, which is equal to the length of approximately two business cycles, is enough to study the cyclical behavior of the food sector markups, drawing long-term conclusions would be less controversial when having a longer period. Finally, the results should be compared with the ones obtained utilizing data on hours worked also within flexible forms of employment.

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SZOK TECHNOLOGICZNY A MARŻE W POLSKIM PRZEMYŚLE SPOŻYWCZYM

STRESZCZENIE

Celem artykułu jest zbadanie wpływu szoku technologicznego na poziom siły rynkowej wywieranej w polskim przemyśle spożywczym, którą zmierzono za pomocą marż pracy z udoskonaleniami oraz marż Roegera w okresie 2002–2013. Zbudowano strukturalny model wektorowo-autoregresyjny (SVAR), w którym uwzględniono produktywność i liczbę godzin pracy w gospodarce oraz poziom marż. Założono, że w długim okresie tylko szoki technologiczne wywierają wpływ na produktywność, a marże nie oddziałują na popyt na pracę. Uwzględnienie udoskonaleń powoduje, że szok technologiczny skutkuje wzrostem poziomu konkurencji, przy czym z czasem poziom wywieranej siły rynkowej rośnie. Dodatni znak związku nie jest zgodny z wynikami badań dotyczących cykliczności bezwarunkowej marż w polskim przemyśle spożywczym, a także w polskiej gospodarce.

Słowa kluczowe: szok egzogeniczny, marże monopolistyczne, cykl koniunkturalny

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OPTIONS FOR THE DEVELOPMENT OF AN AGRICULTURAL REGION IN THE LUBLIN VOIVODESHIP ON THE BASIS OF THE CONCEPT OF BIO-ECONOMY

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ABSTRACT

This study aims to present the role of an institution in the development of Lublin Voivodeship based on the concept of bio-economy. The work covers an analysis of the structure of economy in the analysed region, institutional infrastructure, entrepreneurship, innovativeness and competitiveness in the region as well as administrative, political and economic institutions in the context of implementing the assumptions of the discussed concept of development. The source material comprises strategic documents of Lublin Voivodeship as well as reports and information made available by the analysed institutions. The results of research indicate that scientific and engineering skills, shaped by 97 schools and research and development units, are a strong point of the region as far as supporting the development of bio-economy is concerned. However, the region does not look good in terms of the number of centres for innovation and entrepreneurship.

Key words: Lublin Voivodeship, agricultural region, bio-economy, regional development

INTRODUCTION

The concepts of regional development have changed over the years, which is a result of the need to take into account new phenomena significantly affecting both the economic space, business activity location processes, and the concentration or deconcentration of production [Nowińska-Łaźniewska 2004]. At the same time, the purpose of these concepts is still to improve the innovativeness and hence the competitiveness of the regions. With regard to the specificity and diverse conditions for the development in respective regions (innovation potential, concentration of the specific type of activity), different bases can be identified for the development concepts created [Mempel-Śnieżyk 2013]. In addition, the diverse approach to the development of respective regions results from the fact that regional development is subject to various conditions. These can be grouped according to various criteria. However, most often two groups of factors – endogenous and exogenous factors – are identified. The first group of factors includes own resources of the region determining its development potential. The second group, on the other hand, relates to external factors resulting from European globalisation and national-level processes beyond the control of the region. The identification of boosters and barriers to regional development plays the basic role in determining the lines for the development of respective regions [Strzelecki 2011].

The response to looking for new, more sustainable concepts of growth is the concept of smart specialisation. It is an alternative to the policy promoting investments in multiple areas and sectors, irrespective of the industrial structure of the specific region and knowledge potential. In addition, smart specialisations help identify

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the unique features and resources of the region [Foray et al. 2009]. Smart specialisations include, among other things, bio-economy. It is defined as sustainable production and processing of biomass into a wide range of food, medicinal, industrial and power products and services. Renewable biomass consists of different biological materials for direct consumption and in the form of raw materials used for manufacturing other products [ETP 2011]. Contemporary times, in which the development of science and technology creates new opportunities, make bio-economy one of the most extensive analytical and cognitive concepts and a dynamic sector of economy being one of the largest employers with a huge potential and real grounds for development [Adamowicz 2012]. The bioeconomy concept is a merit-worthy and an innovative approach to an economy of the future, a future likely to be challenged by global population growth, climate change, declining non-renewable resources stocks, water shortages, and environmental degradation [Maciejczak 2013]. The purpose of bio-economy is mainly developing product and process improvements based on the use of biomass and recovery and other natural resources [Czyżewski and Kułyk 2015]. The region in which this concept of development was indicated as the key smart specialisation is Lublin Voivodeship. This is because the region is characterised by natural values, including bio-resources, which can form grounds for its development. It must be noted that having the potential of bio-resources is a necessary but not the sufficient condition for the development of bio-economy. Effective development of bio-economy in the regions is largely determined by the level of knowledge about renewable biological resources and their possible applications in manufacturing bio-products and producing bio-energy.

In addition, the reasons for making the development of the region dependent on the concept of bio-economy follow from the assumptions of the European Commission. The development of bio-economy can stimulate and maintain economic growth and create jobs – also in rural areas. In addition, the emergence of new markets for agriculture not connected with food production, such as bio-energy, may become an additional source of income for farmers and, as a result, they can contribute to faster development of rural areas [McCormick and Kautto 2013].

OBJECTIVES, MATERIAL AND METHODS

With regard to the specificity of Lublin Voivodeship the purpose of this study is the presentation of the role of institutions in the development of the studied region based on the concept of bio-economy. The work covers an analysis of the structure of economy in the analysed region, institutional infrastructure, entrepreneurship, innovativeness and competitiveness in the region as well as administrative, political and economic institutions in the context of implementing the assumptions of the discussed concept of development. The study, in particular, presents the activities of business institutions, scientific and research and development units, higher schools and centres for innovation and entrepreneurship, parks of science and technology, and clusters that actively participate in the process of supporting the assumptions of bio-economy in Lublin Voivodeship.

The source material consists of strategic documents of Lublin Voivodeship as well as reports and information made available by the analysed institutions, including administrative and political institutions, scientific entities, research and development units, higher schools and business environment institutions.

In order to present the agricultural nature of Lublin Voivodeship the economic structure of the analysed region was analysed and compared against the national average and the average for EU-15 member states. To this end, the structural diversity measure calculated according to the formula proposed by Kukuła [1996] was applied:

$$S_t = \frac{\sum_{i=1}^{k} |\alpha_{it} - \beta_{it}|}{2}, \quad (t = 0, ..., n)$$

where: α_{it} – share of *i*-component in the *t*-period of the structure of A (Lublin Voivodeship),
β_{it} – share of *i*-component in the *t*-period of the structure of B (national average and EU-15 member states),

The structure of economy of Lublin Voivodeship was evaluated based on the latest available data provided by the Central Statistical Office of Poland (GUS), i.e. data for 2013.

LUBLIN VOIVODESHIP AS THE AGRICULTURAL REGION

Lublin Voivodeship is an outlying region with a relatively low level of social and economic development. Gross domestic product per capita was 30,427 PLN in 2013, which corresponded only to 70.7% of the national figure [GUS 2015]. It ranked Lublin Voivodeship region last among regions in that respect. The ranking in terms of the number of business entities per one thousand inhabitants was not good as well – in 2013 the region was ranked 15th out of 16 regions of Poland.

Expenditure on R&D plays a significant role in the development of the region, and in the development of the concept of bio-economy. In 2013 expenditure per capita in the region amounted to 186 PLN and it was lower by half than the average for Poland. Lublin Voivodeship is ranked the last but one among regions even, if one take into account the average monthly per capita available income of households. In 2013 this ratio corresponded only to 85.1% of the national figure.

A characteristic feature of the region is its economic structure, since it determines options and lines for development. The economic structure was analysed based on the structure of employment and value added in the region in comparison to the structure at the national level and at the level of EU-15 member states. Measures of structural similarity assume values in the range <0; 1>. The lower the value of the ratio, the closer the structure in the analysed region in year *t* to the structure in the reference object – on average in Poland or in EU-15. For the purposes of the analysis, a three-sector structure of economy was adopted aggregating national economy divisions into three groups: sector I (agriculture – sections A–B of the Polish Classification of Activities), sector II (industry – sections C–F of the Polish Classification of Activities) and sector III (services – sections G–Q of the Polish Classification of Activities).

Figures presented in Table 1 point to clear differences in the structure of employment between Lublin Voivodeship and the member states of the so-called old 15. The measure of structural diversity in 2013 amounted to 0.347, which is a proof of large discrepancies between the structures being compared. This is mainly because the percentage of employment in the agricultural sector is 10 times higher, with a relatively low level of employment in services. While comparing the structure of employment in Lublin Voivodeship to the national structure of employment, it can be noted that the difference is lower in relation to the 15 member states of the European Union. The measure of distance in 2013 was in this case 0.213, which is also a proof of low similarity of the structures being compared. In 2013 the sector of agriculture employed 17.1% of all the workers, whereas in Lublin Voivodeship this percentage was more than twice higher. The average level of

Table 1. Measures of similarity of the employment structure in Lublin Voivodeship to the structure in Poland and EU-15 in 2013

Specification	Percentage of workers according to			Measure of employment structure similarity to	
	sector I (agriculture)	sector II (industry)	sector III (services)	national average	EU-15
Lublin Voivodeship	38.5	17.2	44.3	0.213	0.347
Poland	17.1	26.3	56.6	0.000	0.182
EU-15	3.8	21.5	74.7	0.182	0.000

Source: Own elaboration based on data from the Central Statistical Office of Poland (Gross Domestic Product. Regional Accounts in 2013) and Eurostat.

employment in industry amounted to 26.3% and in services to 55.9%. In Lublin Voivodeship this percentage was 17.2 and 44.3% respectively.

Analysing the social and economic characteristics of Lublin Voivodeship, apart from the structure of employment, attention must be paid to the structure of creating value added in the region. The analysis was carried out in a manner similar to the analysis of employment using the measure of structural similarity (Table 2).

Table 2. Measures of similarity of the employment structure in Lublin Voivodeship to the structure in Poland and EU-15 in 2013

Specification	Share of sectors in gross value added			Measure of gross value added structure similarity to	
	sector I (agriculture)	sector II (industry)	sector III (services)	national average	EU-15
Lublin Voivodeship	6.0	28.1	65.9	0.055	0.086
Poland	3.1	33.6	63.3	0.000	0.112
EU-15	1.5	24.0	74.5	0.112	0.000

Source: Own elaboration based on data from the Central Statistical Office of Poland (Gross Domestic Product. Regional Accounts 2013) and Eurostat.

According to the figures presented in the Table 2, the effect of the agricultural sector in Lublin Voivodeship on creating gross value added is almost twice higher than at the national level and four times higher than on average in the member states of EU-15. The share of sector I in the total gross value added in the region is nearly twice higher than on average in Poland and four times higher than on average in 15 member states of the so-called old Union. The measure of structural diversity of value added in Lublin Voivodeship in relation to EU-15 (0.086) indicated a greater similarity of this structure to the structure in the EU rather than the average structure in Poland. It was due to a greater share of the services sector in value added that was closer to the share of industry in the European Union.

The specificity of the analysed region, including high significance of the agricultural sector, provides reasons to search for development strategies making use of the potential of this region and making its development more dynamic. Such chances are sought, among other things, in bio-economy, a concept attempting to solve the accruing social problems and providing a chance for faster economic growth [Gołębiewski 2015]. It should be explained by the fact that agriculture and natural resources have been used in the production of food, feeds, fibres, fuels and environmental goods. The latest changes in demand refer to quantity, quality, technology, traditional energy markets as well as chemistry, which increases the demand for non-food products and services. These changes, in combination with an increase in the consumer requirement of various properties of food, contributed to the emergence of quickly developing and globally integrated bio-economy [Swinnen and Riera 2013].

INSTITUTIONS AND INSTRUMENTS SUPPORTING BIO-ECONOMY IN LUBLIN VOIVODESHIP

As confirmed by scientific studies, bio-economy develops differently in different countries and regions [Stuart and Sorenson 2003, Tödtling and Trippl 2005]. This is caused by the differentiation of biomass resources, required technologies, political situation, existing knowledge or specialisations of businesses. Hence, it is believed that no universal idea of bio-economy development exists but there are certain verified solutions that can be adequate and applicable in different places [Gustafsson et al. 2011]. In addition, the activity of local governments and proper promotion of the territorial unit play a significant role in the development of bio-economy.

The options for the development of bio-economy are largely determined by institutions and instruments supporting this concept. European innovative partnerships and shared planning initiatives are also very important in this process [Bartoszczuk 2014].

Despite Lublin Voivodeship is one of the Polish regions worst developed in terms of the number of centres for innovation and entrepreneurship (Fig.), it should be supposed that the dynamics of transformation processes and involvement of regional and local authorities will contribute to increasing the number of such entities and intensifying activities to grow the social and economic potential.

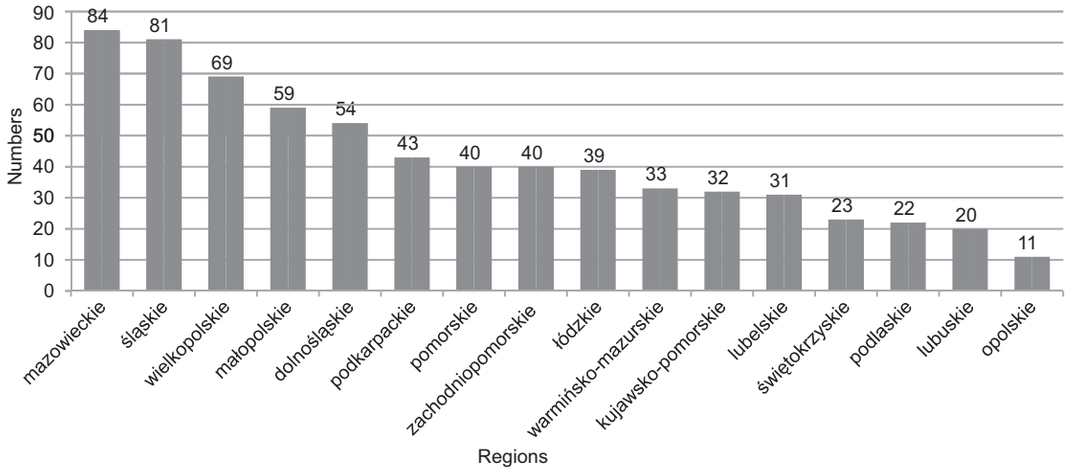

Fig. Centers for innovation and entrepreneurship in Poland according to voivodeship in 2014

Source: Own elaboration based on Bąkowski and Marzewska [2015].

Generally, institutions supporting the development of bio-economy can be classified into two groups – administrative and political institutions as well as economic institutions [Kalbarczyk et al. 2015]. Such an approach will be also applied in further analysis. The first group consisted of the Marshal Office of Lublin Voivodeship, Lublin City Hall and district authority offices (Table 3). On the other hand, the analysis of the role of economic institutions in the development of bio-economy was limited to institutions forming the business activity environment (Table 4) including scientific and development units, higher schools, centres for innovation and entrepreneurship, business organisations, agencies, foundations and associations for development [Kalbarczyk et al. 2015].

Table 3. The role of selected administrative and political institutions in Lublin Voivodeship in supporting bio-economy

Name of institution	Examples of activities supporting bio-economy
Marshal Office of Lublin Voivodeship	supports innovation, implements development programmes supporting the development of bio-economy: Regional Operational Programme of Lublin Region, Programme for the Development of Renewable Energy Sources for Lublin Region, Consolidation Works Programme for Lublin Region for the years 2014–2020
Lublin City Hall	support in creating and operating cluster structures and promoting them at the local, national and international level
District authority offices	activity based on district development strategies referring directly to assumptions set forth in regional strategic documents

Source: Own elaboration based on information provided by the above-named institutions.

The analysis of support for the development of bio-economy from business environment institutions focuses in particular on institutions forming the innovative environment. This environment is built by scientific, research and development units, higher schools and centres for innovation and entrepreneurship [Kalbarczyk et al. 2015]. Table 4 lists major units and institutions from this group and gives examples of activities fostering the development of bio-economy.

Table 4. Scientific, research and development units, higher schools, business environment institutions and centres for innovation and entrepreneurship in Lublin Voivodeship and their role in supporting bio-economy

Institution/Organisation	Examples of activities supporting bio-economy
Maria Curie-Skłodowska University in Lublin, University of Life Sciences in Lublin	Setting up a consortium for a project in the area of bio-economy
Institute of Agrophysics of the Polish Academy of Sciences	Carrying out a project in the area of bio-economy
University of Life Sciences in Lublin and Wrocław University of Science and Technology	Carrying out a project in the area of bio-economy
Lublin Development Foundation	Provider of pro-innovative advisory and training services regarding transfer of knowledge, activities within the Eastern Business Angels Network, coordinating the Cluster of Business Environment Institutions, supporting start-ups
Foundation for Lubelskie Development	Comprehensive assistance in running micro, small and medium-sized businesses, coordinating the Lublin Eco-Energy Cluster involving entities dealing with power engineering, and production and utilisation of biomass for power engineering purposes, supporting the development of business solutions
Polish Foundation of Centres for Supporting Economic Development OIC Poland in Lublin	Providing businesses, institutions and organisations with solutions for developing human resources, designing and implementing innovative training and education and consulting projects
Polski Fundusz Gwarancyjny Sp. z o.o.	Supporting private business activity by granting securities in connection with bank loans granted to micro, small and medium-sized businesses
Lubelski Park Naukowo Technologiczny Sp. z o.o.	Participating in the commercialisation of the results of scientific and technological research in economy, establishing wide relations with the scientific and business environment in Poland and abroad, creating an innovative environment in the region, stimulating local entrepreneurship, attracting foreign investors and supporting innovative projects
Centre for Innovation and Technology Transfer of the Lublin Park of Science and Technology	Supporting transfer of technologies from scientific and research institutions to businesses, stimulating local entrepreneurship and attracting foreign investors, supporting innovative projects and new innovative businesses set up by university graduates, assistance in obtaining third party financing for innovative projects
Institute of Soil Science and Plant Cultivation	Supporting the innovativeness of Polish agriculture. Studies to evaluate options for obtaining biomass and utilizing traditional crops for power engineering purposes. Building a system of geographical information for the needs of bio-economy and creating interactive web applications to acquire, model and popularize knowledge of bio-economy. Project performance under the Seventh Framework Programme of the EU, including but not limited to Delivery of sustainable supply of non-food biomass to support a "resource-efficient" Bioeconomy in Europe (S2BIOM) (2013––2017)

Source: Own elaboration based on information provided by the above-named institutions.

The condition for the development of bio-economy is a close relationship between private activity and research in the public sector. The terms of cooperation and synergy between public research institutions and industrial operations of various sizes and in various industries are important for the maximum effect of developing enterprise in the area of bio-economy. New types of associations such as clusters, networks and innovation alliances for open innovation projects and "untypical" alliances between sectors that have rarely cooperated so far will now play an important role in the development of respective industries in the area bio-economy [Chyłek and Rzepecka 2011]. Table 5 focuses on the role of selected clusters operating in the territory of Lublin Voivodeship in the development of bio-economy.

Table 5. The role of selected clusters in Lublin Voivodeship in supporting bio-economy

Institution/Organisation	Examples of activities supporting bio-economy
Lublin Eco-Energy Cluster	Coordinating cooperation between entities dealing with (solar, wind, water and geothermal) power engineering and production and utilisation of biomass for power generation purposes. The cluster is an association of entities providing employment to nearly 3 thousand people. Scientific and development operations have 233 employees. In 2014–2015 the associated entities implemented 50 innovations. The associated businesses develop their export activities
Eco-Innovation Cluster	Supporting eco-innovative solutions. The cluster associates businesses and organisations with competences, skills and experience in eco-innovative projects
Lublin Clusters (Eastern ICT Cluster, Eco-Innovation Cluster, Lublin Biomedical Cluster, Eastern Metal Processing Cluster in Lublin, Lublin Wood Association – Regional Cluster in Lublin)	The purpose of the initiative was to encourage clusters to form larger units of organisation. Such projects are based on cooperation between clusters and cluster initiatives in the area of Lublin region and autonomous businesses carrying out innovative operations as well as research organisations, business environment institutions and local governments
Biotechnology Cluster	Cluster associating 21 entities including Lublin City Hall, four universities, Lublin University of Technology, as well as the Institute o Agrophysics of the Polish Academy of Sciences. The main priority of the cluster is stimulating cooperation in the industry, which will contribute to supporting the networking of science and business and promoting innovative solutions designed in the region. Its main task will be help in establishing relations between business-people and university staff

Source: Own elaboration based on information provided by the above-named institutions.

The development potential of the region with respect to the development of bio-economy is supported by scientific and technological competences of the region. Assuming that knowledge is the core pillar of the development of bio-economy, one can assume that its development in the analysed region is largely shaped by the potential to generate and diffuse knowledge. Ninety-seven universities, colleges, and research and development units operate in Lublin Voivodeship [GUS 2011]. These entities allocate about 60% of R&D expenditure to research into agricultural, natural, medical and health sciences. Nearly half comprises expenditure on research in agricultural and natural sciences. One third is expenditure on financing engineering and technical sciences [Marshal Office of Lublin Region in Lublin, 2014]. The significance of agricultural studies in the development of bio-economy is mentioned, among others, by Krasowicz [2016], who indicated that the agricultural studies carried out for instance by the Institute of Soil Science and Plant Cultivation (IUNG) in Puławy reflect the strategic areas of bio-economy and development priorities of Polish agriculture.

In addition, the analysis of grants used by academic staff members of regional universities points to a clear specialization in sciences connected with agriculture and environmental protection. This is supported by the

activities of specialist research institutes in Lublin and Puławy [Marshal's Office of Lublin Region 2014]. In the context of options for the development of bio-economy in the region, a particular role should be assigned to educating high-skilled staff able to utilize high technologies in their work. According to data provided by the Central Statistical Office of Poland [2011], in Lublin Voivodeship the student – inhabitant ratio in 2011 was the highest among 16 regions and it was above 9%. A specific characteristic of the region is also a share of students of agricultural faculties higher than in other regions (except Warmia and Masuria), which with respect to an important role of agriculture in the development of bio-economy is a positive aspect.

Chances for the development of bio-economy in Lublin Voivodeship that is an agricultural region are large with regard to its potential bio-resources. On the one hand, bio-economy is a traditional approach (baking bread, brewing beer, preserving food etc.). On the other hand, it covers the new and the innovative (new biomaterials, bio-preparations etc.). Thus, this concept covers both classic sectors and industrial biotechnology. However, agricultural and food production and processing is a predominant element of bio-economy in terms of total production and employment [von Braun 2013]. In Lublin Voivodeship, this sector is one of the largest segments of economy. According to data provided by the Central Statistical Office of Poland, in 2013, cropland in the region accounted for 70% of its total area. This region is also one of the major national producers of cereals (9.1%), sugar beets (16.5%), vegetables (9.8%) and fruits and berries (20.4%).

CONCLUSIONS

The transformation of the theoretical concept of bio-economy into well-functioning reality requires integrated, sustainable measures to be taken by politicians, business entities, scientists, local governments, investors and other stakeholders as well as by ordinary citizens. In order to put such an intention into effect, well-functioning information systems and properly oriented educational and promotional activities, relevant support systems, availability of funds and a favourable social climate are required. In addition, a proper organisation and management system, social dialogue, monitoring system and methods of evaluation are needed.

Furthermore, bio-economy requires permanently growing public financial support and private investments, which will contribute to improving the consistency of domestic, European and global expenditure on scientific research and innovation. Often, there is a clear discrepancy between research and practical application of its results with regard to the lack of knowledge and the existence of institutional barriers between specialists: scientists, innovators, producers, end users, decision-makers and the society. This gap can be reduced by knowledge transfer networks, knowledge and technology brokers and social undertakings forming a part of wider initiatives of citizens and the parties concerned.

According to the results of research, instruments for supporting bio-economy in Lublin Voivodeship are associated with the development of industrial infrastructure and innovative bio-economy. They include scientific projects, support for innovative activities of small and medium-sized businesses, participation in national and international research and technology projects, involvement of regional authorities, developing energy production, setting up regional clusters, and creating positive attitudes of consumers to the products of bio-economy. Scientific and engineering competences shaped, among other institutions, by schools and research and development units, are a strong point of the region from the point of view of supporting the development of bioeconomy. Thus, the scientific potential of the region should be particularly utilised. The teaching activities of universities, including the choice of faculties and development of scientific research, should become an element connecting business entities and support institutions into a chain of cooperation. Big involvement of the scientific community in the implementation of the assumptions of bio-economy and designing innovative industrial solutions together with business entities will provide a chance.

Efficient utilisation of bio-resources should lead to the development of cooperation between entities in various branches of economy. The recent trend of shifting the activities supporting the assumptions of innovative

bio-economy towards parks of technology and cooperation between various entities within clusters is also worth maintaining. They play an important role in supporting science and business networking as well as promoting innovative solutions created in the region. Moreover, investments in propagation activities and wider scale activities and the development of entrepreneurship and advisory services throughout the value chain must be continued.

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MOŻLIWOŚCI ROZWOJU REGIONU ROLNICZEGO NA PODSTAWIE KONCEPCJI BIOGOSPODARKI WOJEWÓDZTWA LUBELSKIEGO

STRESZCZENIE

Celem opracowania jest prezentacja roli instytucji w rozwoju województwa lubelskiego według koncepcji biogospodarki. Praca swym zakresem obejmuje analizę struktury gospodarki badanego regionu, wyposażenia instytucjonalnego przedsiębiorczości, innowacyjności i konkurencyjności w regionie, a także instytucji administracyjno-politycznych i gospodarczych w kontekście realizacji założeń omawianej koncepcji rozwoju. Materiał źródłowy stanowią dokumenty strategiczne województwa lubelskiego, a także raporty oraz informacje udostępnione przez instytucje samorządowe. Wyniki badań wskazują, że za mocną stronę regionu z punktu widzenia wsparcia rozwoju biogospodarki należy uznać kompetencje naukowe i technologiczne, kształtowane m.in. przez 97 uczelni i jednostek badawczo-rozwojowych. Niekorzystnie wypada natomiast badany region pod względem liczebności ośrodków innowacji i przedsiębiorczości.

Słowa kluczowe: województwo lubelskie, region rolniczy, biogospodarka, rozwój regionalny

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EVALUATION OF FIRMS OF AGRICULTURE AND FOOD SECTORS QUOTED AT BORSA İSTANBUL (BİST) BY DEA-BASED MALMQUIST TOTAL FACTOR PRODUCTIVITY INDEX

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ABSTRACT

This study applies a DEA-based Malmquist index to measure technical efficiency and total factor productivity change of food and agriculture firms quoted at Borsa İstanbul (BİST) over the 2010–2015 period. We have investigated efficiency scores of firms using financial ratios. The study shows that, average Malmquist index score is 16.9% below efficiency frontier. Also, four of the twenty-three firms' (KRSAN, KENT, TUKAS and ULKER) Malmquist total factor productivity (MTFP) ratio above the efficient frontier. The results indicate that nineteen out of twenty-three firms (82.6%) experienced productivity losses in the examined period.

Key words: capital market, Data Envelopment Analysis, Malmquist total factor productivity index

INTRODUCTION

After 1980s many developing countries have regulated their financial systems and liberalised them as more market-oriented. Turkey is one of them and market economic tools have used effectively by the companies in recent decades. Among the sectors, agriculture and food sectors have quite high share in Turkish economy in the context of GDP and labour market. However, average size of companies is quite small and institutionalization of them has an important role in local and international competition.

Agriculture and food industry has a growing market share in both local and international markets [RT-PM -ISPA 2014]. Contrary to the increased competitiveness among enterprises in rural areas in farming, Turkey has not made expected progress due to the fragmentation of the labour force and limited coverage of agriculture and family undertakings in national labour legislations, limited unionization and majority of labourers working as unpaid family labour without formal contracts. This leads to the need to examine the entire industry in terms of productivity for agriculture and the food firms, food supply chain, family firms and micro enterprises etc.

There is intensive research worldwide on the effectiveness and productivity of food and agricultural firms [Hartwich 1999, Rahbar and Memarian 2010, Bahrani and Khedri 2013, Rodmanee and Huang 2013]. However, there are different stages that firms need to focus and examine separately to increase productivity and effectiveness. The main task of the agricultural and food firms are to make food and beverage products by processing agricultural raw materials. A food product is affected by many factors from production to consumption [Dios-

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-Palomares et al. 2002, Ratchford 2003, Psillaki et al. 2010]. All these factors should be examined in terms of productivity. Asset allocation strategies need to be determined like use of energy and raw materials, waste management, distribution channel management, fixed investments, amount of cash and cash equivalents etc. [Panpan et al. 2014].

Data Envelopment Analysis (DEA) is widely used as an efficiency measurement tool. These analyzes are based on linear programming. It creates a relative efficiency score chart for companies that transform input(s) into output(s). However, DEA method is a static method causes deviations because of the passage of time lead to the production frontier move. Therefore, Malmquist total factor productivity index (MTFP) has been developed and this method implemented in the study.

Borsa İnstanbul (BİST) is the national stock exchange market and brings together all the exchanges operating in the Turkish capital markets under a single roof. This study focus on the financial performance of the agriculture and food companies quoted at BİST. In order to investigate the relationship between financial structure and firms performance, efficiency scores of the companies were calculated by a linear programming technique (DEA). Beside, MTFP index was calculated to analyse how efficiency scores evolve in time.

LITERATURE

Data Envelopment Analysis and Malmquist Index have been widely used in literatutr to measure changes in technical efficiency and total factor productivity. The variables used to calculate efficiency scores for firms and enterprises may vary [Çakmak et al. 2008]. For example, some studies that examine productivity and efficiency in agriculture and food industries devoted to inputs and outputs defined by Food and Agriculture Organization of the United Nations (FAO) [Coelli and Rao 2005, Ajao 2008, Linh 2009, Souza et al. 2011]. Agricultural gross income and agricultural production calculated by FAO are most commonly used in studies as outputs. Agricultural labour force, planted area, irrigation area, the number of tractors, forage, amount of seed and fertilizer, GDP allocated to agriculture and the agricultural energy consumption is preferred as inputs [Fogarasi 2006, Kaya et al. 2011, Baliyan et al. 2015, Abukarı et al. 2016]. In addition, financial ratios are often used as input and output components in studies where firms' efficiency scores are calculated using the MTFP methodology [Özden 2010]. Yalçıner et al. [2005] argue that most of the studies examining the relationship between stock returns and financial ratios have pointed out that stocks with optimum financial ratios might have high return potential. Table 1 lists some studies that use DEA-based MTFP as method and financial ratios as input and output variables to measure firms' efficiency scores.

Table 1. Literature summary

Author(s)	Sector	Inputs	Outputs
1	2	3	4
Kula et al. [2009]	cement	Current Ratio Financial Leverage Ratio Return on Equity Short-Term Debt/Total Assets Tangible Assets/Equity Net Sales/Total Assets Net Sales/Equity	Return on Equity Return on Assets Return on Sales
Giokas et. al. [2015]	food and beverage	Total Asssets Operating Cost	Total Sales
Chen and Chen [2010]	Taiwanese wafer fabrication industry	Operating Cost Total Assets	Net Sales

Table 1 cont.

1	2	3	4
Dizkırıcı [2014]	food and beverage	Current Ratio Quick Ratio Leverage Ratio Collection Period Inventory Period	Return on Sales Return on Assets
Dinçer [2008]	textile, clothing and leather	Current Ratio Financial Leverage Ratio Equity/Total Assets Equity/Total Debt Short-Term Debt/Total Assets Tangible Assets/Equity Net Sales/Total Assets Net Sales/Equity	Net Profit Margin Operational Profit Margin Operating Margin Equity Profit Margin Asset Profit Margin
Düzakın et al. [2007]	500 major manufacturing firms	Net Assets Shareholders' Equity Debts	Profit
Geyikçi et al. [2015]	wholesale and retail trade	Current Ratio Quick Ratio Financial Leverage Ratio	Net Profit Margin Market Value
Pan et al. [2008]	IC design	Fixed Assets Number of Employees Selling and Operational Expense Research and Development Expense	Annual Revenue
Yalçıner et al. [2005]	BİST 100 Index (100 major firms from İstanbul Stock Market)	Current Ratio Quick Ratio Cash Ratio Debt/EBITDA Short-Term Debt/Total Debt Leverage Ratio Financial Debts/Equity Average Period Equity Period Current Asset Period Net Working Capital Period Price/Earnings Market Value/Book Value	Earnings per Share Net Profit Margin Return on Assets Stock Return

DATA AND METHODOLOGY

Charnes et al. [1978] was firstly introduced DEA method (CCR Model) which is a technique based on the principle of linear programming, designed to measure the relative efficiency of business or economic organizations that convert similar input variables into similar output variables. DEA is a static analysis and performs a horizontal cross-section analysis using the data of the decision units in a single period. DEA models are divided into three parts: input-oriented, output-oriented and non-directed. Input-oriented DEA models investigate the most appropriate input composition to be used in order to produce a particular output composition most efficiently. On the other hand, output-oriented DEA models investigate how much output composition can be obtained with a given input component [Bülbül ve Akhisar 2004].

Mathematical expression of the input dual CCR model for *n* decision units with *m* inputs and outputs is as follows:

- objective function

$$\max q_0 = \sum_{r=1}^{s} \mu_r y_{r0}$$

- limiting conditions

$$\sum_{r=1}^{s} \mu_r y_{rj} - \sum_{i=1}^{m} \omega_i x_{ij} \leq 0 \quad j = 1, \ldots, n$$

$$\omega_i \geq 0 \quad i = 1, 2, ..., m$$

$$\mu_r = 0 \quad r = 1, 2, ..., s$$

where: x_{ij} – total amount of input i used by the decision unit *j*;
y_{rj} – total amount of output r produced by the decision unit *j*;
ω_i – coefficient or weight assigned by DEA to input *i*;
μ_r – coefficient or weight assigned by DEA to output *r*.

In the models described above, *s* is output, *m* is input, and *n* is the number of DMUs. In the dual model, it is aimed to maximize the weighted average of each decision-maker's output. The weighted average of the inputs of the decision maker is equal to 1. Also, for each decision-making unit, weighted output averages must be smaller than weighted input averages. If these criteria are equal to 1, which indicates effectiveness for decision points and, if they are less than 1, the decision points are ineffective.

On the assumption of constant return to scale (CRS), pure technical efficiency (PTE) shows how effectively inputs are used and the scale efficiency (SE) shows whether the optimum scale size is used or not. In addition, PTE and SE multiplied by the variable return assumption gives the total technical efficiency (TE) score [Kaya and Doğan 2005].

Basic DEA models are not working with negative numbers. Therefore, the variables of the DMU's used in the analysis must be non-negative (greater than zero). This is defined as positivity requirement of DEA [Ali et al. 1990, Charnes et al. 1991, Pastor 1996]. In his study, Bowlin [1998] describes approaches to overcome the existence of negative output problem. One of them is adding a positive amount to negative input or output values so that the input or output variable becomes positive. This correction must be applied to same input or output variables for all DMUs.

Malmquist total factor productivity (MTFP) index used to measure the development of productivity over time using panel data [Caves et al. 1982]. It measures the change in the total factor productivity between two data points by calculating the ratios of the relative distances of each data point of the zone to technology.

Distance functions can be defined as both input-based and output-based distance functions. The input-based distance function refers to the production technology that takes into account the minimum proportional contraction of the input vector when the output vector is given. The output-based distance function takes into account the maximum proportional increase of the output vector when the input vector is given.

A production technology can be defined as a possible (efficient frontier) output set $P(x)$ consisting of the input vector "x" and the output vector "y" produced by the input vector "x" [Coelli and Rao 2003]:

$P(x) = \{y: \textit{producted by } x\}$

The output-based distance function is used in this study. The distance function according to the output is defined as:

$$d(x,y) = \min\left\{\delta:\left(\frac{y}{\delta}\right) \in P(x)\right\}$$

In the equation, $d(x, y)$ denotes the distance function, $P(x)$ denotes the possible production set, "x" denotes the input vector, and "y" denotes the output vector, and δ shows the maximum rate at which current output can be reached with a given set of inputs. The less the δ, the more $\frac{y}{\delta}$ is increasing in the reverse direction. Thus, the distance function measures the maximum output level that a given set of inputs can produce:

$$M_0\left(x^{t+1}, y^{t+1}, x^t, y^t\right) = \left[\left(\frac{D_0^t\left(x^{t+1}, y^{t+1}\right)}{D_0^t\left(x^t, y^t\right)}\right) \cdot \left(\frac{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^t, y^t\right)}\right)\right]^{\frac{1}{2}}$$

$D_0^t\left(x^{t+1}, y^{t+1}\right)$ refers to the distance from $t + 1$ period observation to t period technology.

The value of the M (.) function is greater than 1, indicating that growth in TFV from period t to period $t + 1$. On the other hand, if it is smaller than 1, it shows that there is a decrease in the same periods:

$$M_0\left(x^{t+1}, y^{t+1}, x^t, y^t\right) = \left(\frac{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_0^t\left(x^t, y^t\right)}\right) \cdot \left[\left(\frac{D_0^t\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}\right) \cdot \left(\frac{D_0^t\left(x^t, y^t\right)}{D_0^{t+1}\left(x^t, y^t\right)}\right)\right]^{\frac{1}{2}}$$

$$\textit{efficiency change} = \left(\frac{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_0^t\left(x^t, y^t\right)}\right)$$

$$\textit{technical change} = \left[\left(\frac{D_0^t\left(x^{t+1}, y^{t+1}\right)}{D_0^{t+1}\left(x^{t+1}, y^{t+1}\right)}\right) \cdot \left(\frac{D_0^t\left(x^t, y^t\right)}{D_0^{t+1}\left(x^t, y^t\right)}\right)\right]^{\frac{1}{2}}$$

Efficiency change gives an assessment of the process of approaching to "efficient frontier" of the DMUs. Technical change gives the change of efficient frontier over time.

Table 2. Productivity index

Malmquist productivity index	Productivity level
$\bar{M} > 1$	improvement in productivity
$\bar{M} = 1$	no change in productivity
$\bar{M} < 1$	productivity loss

Source: Adgei-Frimpong et al. [2014].

ANALYSIS AND RESULTS

In this study, financial efficiency of the food and agriculture companies quoted at Borsa İstanbul (BİST) have examined by DEA-based – Malmquist index for each year of 2010–2015 using financial ratios. Seven of thirty firms does not included in the study because they have quoted at BİST less than six years or because of missing data set. So, twenty-three of food and agriculture firms were examined. Three of these companies (ARTOG, TACTR, ALYAG) are listed in the agricultural sector, while the remaining twenty are listed in the food sector.

Decision-making units (DMUs) must be similar to each other in terms of the product they produce. They also need to convert the same input components into the same set of output. According to many researchers, the number of DMUs included in the analysis should be at least twice the sum of the input-output components, whereas for researchers such as [Boussofiane et al. 1991], it is sufficient that number of DMUs is equal to or greater than m (input variables) + s (output variables) + 1. According to these constraints, the number of decision units should be at least the number of inputs (8) + the number of outputs (4) + 1 = 13. In this study, 23 agricultural and food sector companies operating continuously in Turkey were analyzed on 8 inputs, 4 outputs. Abbreviations of the DMUs used in the analysis are shown in Table 4.

Table 3 shows the input and output variables used in this study. In this study, DEAP 2.1 package program developed by Coelli [1996] was used to calculate the activity scores.

Table 3. Input and output variables

Inputs	Outputs
Current Ratio	Gross Profit Margin
Quick Ratio	Operating Profit Margin
Cash Ratio	Net Profit Margin
Receivables Turnover	Enterprise Value/Net Sales
Inventory Turnover	
Tangible Assets Turnover	
Total Assets Turnover	
Equity Turnover	

Source: Data obtained from kap.gov.tr and queenstocks.com.

Table 4. Malmquist index summary of annual means by financial years 2011–2015

Specification	EC	TEC	PEC	SEC	TFPC
2011	0.970	0.459	0.996	0.974	0.446
2012	1.034	1.287	1.004	1.029	1.331
2013	0.982	0.716	0.999	0.983	0.703
2014	1.017	0.768	1.001	1.015	0.781
2015	0.954	1.276	0.968	0.985	1.217
Mean	0.991	0.839	0.994	0.997	0.831

Explanations: EC – Efficiency Change, TEC – Technological Efficiency Change, PEC – Pure Efficiency Change, SEC – Scale Efficiency Change, TFPC – Total Factor Productivity Change.

Source: Own research.

Table 4 summarizes the geometric means of the Malmquist index and its decomposition separately for the five years of food and agriculture firms. As seen in Table 4, firms were ineffective in terms of overall productivity in 2011, 2013 and 2014. Malmquist TFPC has increased by 33.1% in 2012 and 21.7% in 2015. The findings indicate that sectoral mean of Malmquist TFPC is at 0.831.

Pure Efficiency Change gives managerial performance to organize the inputs in the production process. Pure Efficiency Change scores of the Turkish agriculture and food sector are 0.996 in 2011, 1.004 in 2012, 0.999 in 2013, 1.001 in 2014 and 0.968 in 2015. Therefore, agriculture and food sector was effective in terms of managerial performance in 2012 and 2014 and lost its effectiveness in 2011, 2013 and 2015. Scores of SEC are 0.974 in 2011, 1.029 in 2012, 0.983 in 2013, 1.015 in 2014 and 0.985 in 2015. These results show that firms are not working at the appropriate scale in 2011, 2013 and 2015. Scores of TEC are realized as 0.459 in 2011, 1.287 in 2012, 0.716 in 2013, 0.768 in 2014 and 1.276 in 2015. These results show that there is a decrease in output produced by the same input variables in 2011, 2013 and 2014. Scores of EC are realized as 0.970 in 2011, 1.034 in 2012, 0.982 in 2013, 1.017 in 2014 and 0.954 in 2015. In 2011, 2013 and 2015, EC scores are below the efficiency frontier which indicates that DMUs have not reached the best production limit in 2011, 2013 and 2015.

Table 5. Malmquist index summary of firm means

Decision-making units	EC	TEC	PEC	SEC	TFPC
ARTOG	0.967	0.766	0.976	0.991	0.740
TACTR	0.976	0.893	0.981	0.995	0.871
YAPRK	0.962	0.806	0.975	0.986	0.775
ALYAG	1.000	0.693	1.000	1.000	0.693
BANVT	1.033	0.715	1.008	1.025	0.739
CCOLA	1.000	0.696	1.000	1.000	0.696
FRİGO	1.000	0.993	1.000	1.000	0.993
KRSAN	1.000	1.266	1.000	1.000	1.266
KENT	1.000	1.114	1.000	1.000	1.114
KONFRT	1.000	0.690	1.000	1.000	0.690
KRSTL	1.000	0.666	1.000	1.000	0.666
MANGO	0.975	0.660	0.979	0.996	0.643
MERKO	0.979	0.881	1.000	0.979	0.862
MERTGG	0.980	0.838	0.984	0.996	0.822
PENGD	0.939	0.834	0.953	0.984	0.782
PETUN	0.983	0.819	1.000	0.983	0.805
PINSU	1.000	0.908	1.000	1.000	0.908
PNSUT	1.000	0.785	1.000	1.000	0.785
SELGD	1.000	0.784	1.000	1.000	0.784
TATGD	1.000	0.783	1.000	1.000	0.783
TKURU	1.000	0.887	1.000	1.000	0.887
TUKAS	1.000	1.087	1.000	1.000	1.087
ULKER	1.000	1.019	1.000	1.000	1.019
Mean	0.991	0.839	0.994	0.997	0.831

Note: Firms are described with their ticker symbols.

Source: Data obtained from kap.gov.tr and queenstocks.com.

Table 5 shows that 19 out of 23 (82.6%) firms are below the efficient frontier. The results indicate that KRSAN 26.6%, KENT 11.4%, TUKAS 8.7%, ULKER 1.9% are above the efficient frontier. The overall decrease in the number of TFPC ratio for FRIGO is however low at 0.7%. Also, average Malmquist TFPC scores of agricultural sector firms (ARTOG, TACTR and YAPRK) are below the efficiency limit and according to the results, they haven't used their assets efficiently as well as the firms which belong to food sector. Decrease in Malmquist ratio can be explain by the decrease in the technical change as we also see in the periodic results of Malmquist TFPC ratios in Table 5. Also, ARTOG, YAPRK, ALYAG, BANVT, CCOLA, KONFRT, KRSTL, MANGO, MERTGG, PNGD, PETUN, PINSUT, SELGD, TATGD are the firms below the Malmquist TFPC sectoral mean (i.e. 0.831).

CONCLUSIONS

This study analyzed Malmquist TFPC and its decomposition EC, TEC, PEC and SEC of firms in the food and sector by means of financial ratios of firms quoted at BİST over the period 2010–2015. The frst major finding was that, Turkish food and agriculture firms quoted at BİST has 16.9% decrease in Malmquist TFPC and this decline can be explained by the decline in TEC. Farrell [1957] defines technical efficiency as the maximal commensurate shrinkage of inputs. This means, companies can reduce costs by the same financial structure.

Scores of MTFP, EC, TEC, SEC and PEC for agriculture firms (ARTOG, TACTR and YAPRK) were also below the efficiency frontier. This finding indicates that agricultural firms listed in BİST have not benefited sufficiently from technological developments. This results are also shown that these firms have been ineffective in managerial performance and have not been able to use their assets effectively.

On the other hand, four out of twenty food firms (KRSAN, KENT, TUKAS, ULKER) were operated above the efficiency limit frontier. Also, only these firm's TEC scores were above the efficiency limit. Score of EC for BANVT was 1.033, the PEC score was 1.008, and the SEC score was 1.025. This finding suggest that the most important strategy for BANVT should be to pursue more effective strategies to convert assets into profit. MANGO, MERKO, MERTGG, PENGD and PETUN are below the efficiency limits in EC and SEC scores. This indicates that these companies are inefficient in input/output configurations. In addition, PEC scores of MANGO, MERTGG and PENGD are also below the efficiency limit.

These findings reveal that the sector can not make enough use of technological developments. It is determined as an important strategic information for increasing the competitive power of companies to make a difference in the sector. Technological developments and effective use of these developments will also play a role in ensuring managerial performance. This will provide high competitive power.

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WYKORZYSTANIE METODY DEA Z ZASTOSOWANIEM INDEKSU PRODUKTYWNOŚCI CAŁKOWITEJ MALMQUISTA DO OCENY EFEKTYWNOŚCI SPÓŁEK SEKTORA SPOŻYWCZEGO NOTOWANYCH NA BORSA İSTANBUL (BİST)

STRESZCZENIE

W pracy do pomiaru zmian efektywności technicznej i produktywności całkowitej spółek sektora spożywczego notowanych na Borsa İstanbul (BİST) w latach 2010–2015 zastosowano metodę DEA z użyciem indeksu Malmquista. Do oceny efektywności poszczególnych firm wykorzystano wskaźniki finansowe. Uzyskana średnia wartość indeksu Malmquista jest poniżej granicy wydajności, jednakże dla czterech z dwudziestu trzech firm (Kršan, Kent, Tukas i Ulker) wartość tego indeksu jest powyżej granicy efektywności. Ponadto uzyskane wyniki wskazują, że w badanym okresie dziewiętnaście spośród dwudziestu trzech firm (82,6%) doświadczyło straty wydajności.

Słowa kluczowe: rynek kapitałowy, metoda DEA, indeks produktywności całkowitej Malmquista

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CONCEPTS OF INNOVATION IN TECHNOLOGY TRANSFER ON THE EXAMPLE OF SELECTED COUNTRIES

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ABSTRACT

The aim of the study was to analyse the existing concept of technology transfer and the experience of selected countries. The starting point was outlining the essence of the strategic paradigm of the innovation and technology transfer theory. The concept of the subject-territorial origin of innovation was also interpreted, emphasizing the fact that small companies, linked to one another in a network of business relationships, form structures that bind them to the environment in which they operate, This translates into effectiveness of the processes of technology transfer. The paper also analyses the dynamic and interactive models of technology transfer in selected countries with a long tradition of noticeable effects in terms of transfers of innovative technology solutions.

Key words: strategic management, technology transfer model

INTRODUCTION

Technology transfer as a system for creating effects of innovation is a process, which occurs in different ways, depends on the nature and intensity of interaction between many factors that determine it. Literature distinguishes several approaches to the analysis of the process. In theories of innovation, the strategic paradigm results from adoption of three basic assumptions regarding the functioning of enterprises. It assumes that:

- the activity of companies is based on markets and resources;
- entrepreneurs look to the future;
- entrepreneurs make decisions with regard to the operational efficiency on the market.

These conditions determine the decision on the need of formulating a strategy as a declaration of a specific behaviour, that takes into account both all its resources and external conditions. In addition, a strategic approach to innovation and technology transfer encourages companies to focus on customer needs and customer demand. Including innovation in the development strategy is an essential factor to effective competition (Table 1). An important element that entrepreneurs need to heed is the ability to turn knowledge into innovation [Wojnicka 2011].

The greatest challenge of contemporary enterprises is the perception of the role of business cooperation. It is this only, and not the traditional overtaking of the competition, that can determine market success. Open innovation stands in opposition to closed innovation, which is an innovative process unfolding entirely within the company.

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Table 1. Strategic theories of innovation

Models of innovation	Characteristic
The linear, supply-side model	According to the supply-side model, new solutions can occur regardless of the market and influence the development of certain needs [Weresa 2007]. The supply-side model is a linear one, i.e. the innovative activity follows a specific sequence of events. This sequence is simple and does not take into account the dynamics and complexity of the innovation process. The development of this model run from the 1950s to mid-1960s
The demand model (the so-called market pull)	The demand model emphasizes the role of the market in shaping innovation – it is the demand that determines the formation of new solutions. This approach saw the development of marketing and quality management to ensure that products and services meet the requirements of customers. In the mid-1970, the success of the company began to be determined by customers, therefore, the products needed to meet their needs [Mierzejewska 2008]
The supply and demand models	One of them is the chain model (mid-1970s to early 1980s), which was extended by feedbacks between the different stages of the innovation process. The formation of innovation is affected not only by the sphere of science, but also the market situation.
Models of integrated systems and networking	These models take into account the indications of the innovation system concept and how important links are to the innovativeness of the companies. Networking and creating systems are easier nowadays due to the existing electronic devices, including computer simulation modelling, the joint development of companies or departments using CAD/CAM (Computer-Aided Design/Modelling) systems. In addition, the internet has increased the efficiency of business connections with the outside world. These models deal with the importance of location for the efficiency of cross-linking – e.g. Porter diamond [Porter 1995]
The distributed model	In this model, innovation mainly creates new things and improving the existing ones, in order to create more value. Achieving this result depends on an efficient system of knowledge transfer

Source: Own study based on the presentation by Wojnicka [2011].

According to the concept of closed innovation (Fig. 1), an organization counts only on its own resources, protecting its knowledge and best employees. Closed innovation is characterised by:

- employing and retaining the company's most talented staff;
- creating new solutions only within the company, which gives the novelty advantage in the introduction on the market;
- the desire to introduce a new solution as the first company on the market;
- considerable financial expenditure on the internal R&D department;
- controlling the company's intellectual property, so that the competition wouldn't take advantage of it.

The open innovation model is thus based on the belief that companies can, and should, explore ideas and ways to conquer the market not only within their own structures, but also in the environment (Fig. 2). A part of the innovation process (whether at the level of development of the product, or its implementation) can be transferred outside the organization. It is also possible for the business to develop an idea drawn from the outside. A more open approach allows to reject at the initial stage the ideas that have no chance of successful commercialization.

The open innovation concept assumes that [Mierzejewska 2008]:

- the company can't hire all the best specialists, therefore it should seek partners from different backgrounds and disciplines;

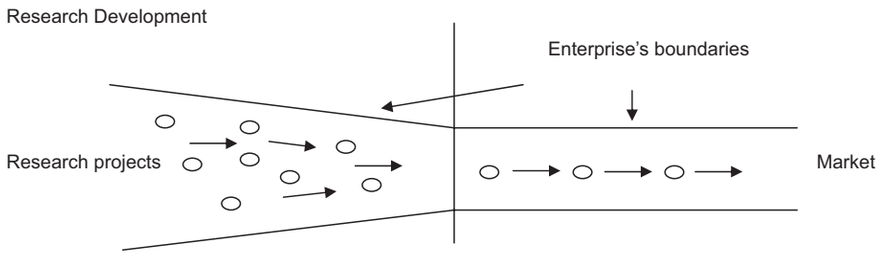

Fig. 1. The closed model approach in the innovation process

Source: Own elaboration based on the presentation by Mierzejewska [2008].

- external research and development is important;
- the company needs not initiate research itself to be able to benefit from them – it may draw from external ideas;
- building an effective business model is more important than being first;
- success can be achieved through a combination of internal and external ideas;
- one can benefit from the use of intellectual property from outside the company, as well as the use of external expertise, if it will improve business performance.

When analysing the open innovation model, one should recall the Hobcraft model (Fig. 3), indicating the use and combining the internal and external knowledge in enterprises. To implement it, it is necessary to change the thinking about innovation. In this view, innovation is seen as a process which can engage a broad group of employees.

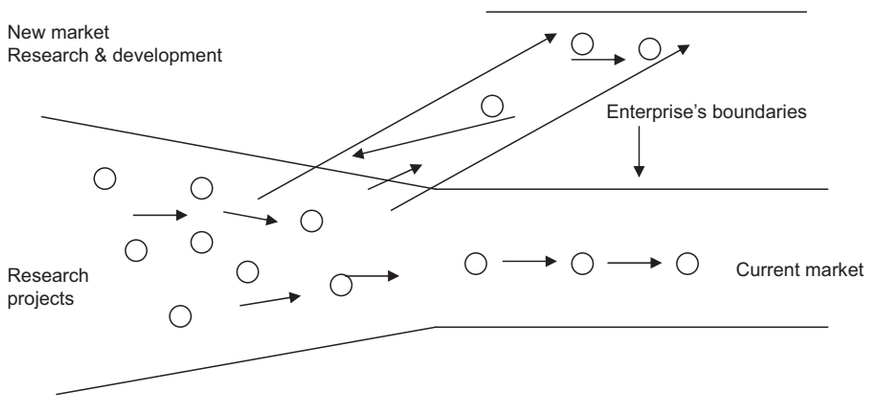

Fig. 2. The open model approach in the innovation process

Source: Own study based on Chesbrough [2003].

Therefore, enterprises must keep in mind that it is worth creating conditions favourable for the staff to engage in innovation, and that consumers should be informed about the company's activities and included in the innovation process. Here, trust and appropriate behaviour are very important, as are relationships, which help make the company open to external expertise. The advantage of using the model by P. Hobcraft [Hobcraft 2011] is not only the creation of innovation, but also the possibility of a rapid response of an organization to a changing environment [Wojnicka 2011].

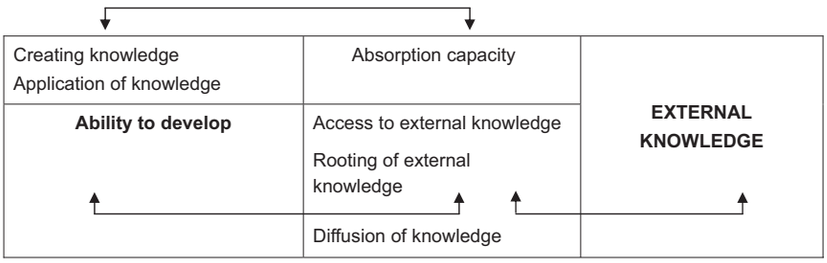

Fig. 3. Open innovation model by P. Hobcraft

Source: Own elaboration based on Wojnicka [2011].

Thus, the benefits generated by enterprises as part of an open innovation model include, in particular: the use of an underrated source of knowledge and ideas, maintaining good, effective relationships with customers, suppliers and business partners and taking swift action in the case when inefficient processes have been diagnosed.

TERRITORIAL ORIGIN OF INNOVATION

In the current economic and market conditions, innovativeness of individual companies consists of the ability to build complex relationships and network structures on the local or regional level, as well as to participate in them. This is particularly important for the sector of micro-, small- and medium-sized enterprises, which generally do not have the capital and substantial base that would allow to achieve a significant competitive advantage in international markets. The result of this phenomenon is the increasing openness of enterprises to external markets and dissemination of the provided products and services, which leads to the increase the number of places where enterprises can operate.

It determines the rivalry between different spaces (regions) as potential business locations, which have a specific set of values needed for running a business [Daszkiewicz 2004]. Regions compete to attract entities and funds that can impact the acceleration of their development in terms of innovativeness, as well as socioeconomic growth. Intertwined into a business network, small businesses form a structure of overlapping dependencies – the links that bind them to the environment in which they operate [Daszkiewicz 2004]. The resulting network effect should be interpreted as a circumstance in which the economic efficiency of enterprises depends not only on the interrelated phenomena of location or the development of demand in the network, but also on the network itself [Allaire and Firsirotu 2000].

The network allows focusing on core skills, used and activated in a coordinated way, ensuring a business entity with both survival and strengthening of the position among its competitors, thanks to multilateral relations of cooperation [Perechuda 2007]. In network structures, competitiveness and innovativeness of a company depends, on the one hand, on its own potential, and on the other, the quality of the environment in which it operates [Przygrodzki 2007].

Cooperation and networking offers many advantages and benefits to the entities cooperating on a local and regional level. Among those most often mentioned are: reducing uncertainty and increasing confidence in an unstable economic environment, risk sharing by several companies/partners, increasing flexibility, expanding the field of operation, the ability to acquire new development capacity, the possibility of easier access to scarce resources and skills [Buchholz and Werner 1998]. Networking allows to achieve the benefit of both the scale and the range [Rokoszewski 2002]. The relationships existing between enterprises can relate to various areas of their business (e.g. R&D), providing an opportunity to improve productivity and generate synergies. In the regions of knowledge, many stakeholders are related into flexibly managed structures, however the network is not limited

to the representatives of economic life, but it allows inclusion also of the social participants, e.g. universities or research institutes. Mutual cooperation and interaction of these actors of the regional scene create a base for starting a collective learning processes [Domański 2000]. Innovation and technology transfer are the main determinants of economic development in a given territory.

DYNAMIC AND INTERACTIVE MODELS OF TECHNOLOGY TRANSFER

Generally, the basis for all innovative activity of the company is the existing scientific and technical knowledge. If in a given case, this knowledge is insufficient, research and development work is undertaken in order to expand it. Therefore, the innovation process begins by determining what new products, processes and technologies can be successfully implemented in business practice within the specified time, or what improvements can be made in existing products, processes or technologies. An important role at this stage is played by market and marketing research, providing information from the market, on which the solutions will be commercialized.

With a market, technical and technological knowledge, one moves to the next stage of design analysis, i.e. devising plans for development, searching for ideas and solutions to the problem [Baruk 2006]. In the next stage of the process, the developed ideas are evaluated through the prism of defined criteria, in order to select the optimal variant for the given organizational and technical conditions. The selected concept is subject to detailed design: one can build and test a prototype, introduce adjustments, and in the final phase of the process, decide to start production. In the variant ending with the development of product innovation, it is delivered to the market through appropriate channels of distribution. The mutual relationship between knowledge, technology and innovation is shown by the model of interactive innovation process in Figure 4.

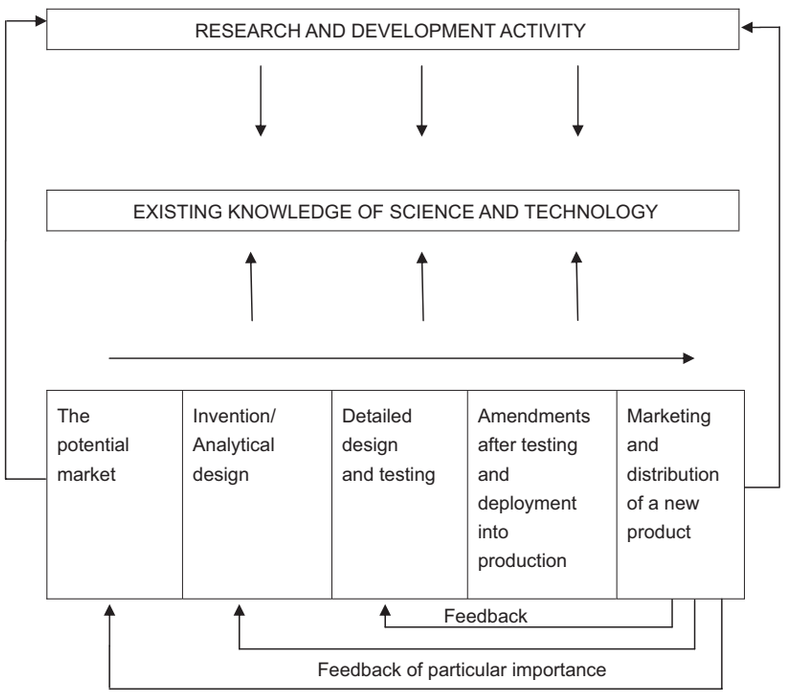

Fig. 4. Interactive model of the innovation process (the innovation chain)

Source: Own elaboration based on Baruk [2006].

Activities related to the introduction of product innovation create the so-called central chain of innovation, often requiring feedback [Baruk 2006]. If the implementation of individual stages of the innovation process requires the use of the existing scientific and technical knowledge, entrepreneurs use the available resources, e.g. through access to public technology databases. However, in certain situations, the existing state of the art may not be sufficient, therefore, research and development is taken up to expand it. In the working stage of the invention, while developing the patent and analytical design, problems may arise, which would require direct contact of the business with the research and development sphere. The company associates with R&D entities by contributing to its financial operations and providing it with equipment and technological procedures. In return, the company receives research results and knowledge used in all stages of the innovation chain.

The feedback model by Kline [1985] generally shows the innovative activity in terms of interaction between market needs and opportunities, the scientific and technical base, and the company's capabilities. This model emphasizes the complexity of the innovation process and the uncertainty of the results at each stage, which often makes it necessary to return to the previous stages. It allows, however, to overcome the difficulties. This means that there is a lot of feedback between the individual stages of the innovation process.

The success of a specific innovation project is determined by the company's ability to maintain effective relationships between the successive stages of the innovation process. Particular importance in the model is attributed to the interaction between the marketing stage and the stage of the invention's development, as well as technical aspects of the innovation process. According to this model, R&D activity is a supporting factor, a way of solving problems that arise at different stages of the innovation process. It can be applied at each of these stages, however, it is not a precondition or the sole source of innovative ideas [CSO 2002].

MODELS OF TECHNOLOGY TRANSFER IN SELECTED COUNTRIES

The largest suppliers of modern technologies around the world are big companies, which have their own R&D facilities. However, it is small- and medium-sized companies that are the authors of the most interesting and innovative implementations of technologies. And it is they that have the most flexibility in matching the innovation to the specific needs of emerging markets. Organized in clusters and networks, small- and medium-sized enterprises use the latest technology without investing millions, but with the support of local and regional instruments, such as technology transfer centres, science and technology parks and technology incubators [Madej 2006].

The basic condition for an effective technology transfer is creating favourable conditions for the scientists and businessmen to communicate [Mikolajczyk et al. 2009], primarily places where entrepreneurs can operate. Table 2 presents an overview of institutional systems supporting the process of technology transfer in selected countries.

Renowned world institutions or groups bringing together professionals in the field of technology transfer and ensuring the flow of knowledge and experience in this area are:

- Association of European Science & Technology Transfer Professionals (ASTP). Its mission is to improve and promote the transfer of knowledge and technology between the European research base and the industry.
- Association of University Technology Managers (AUTM). The main objective of the AUTM is to support and develop academic technology transfer worldwide.
- Licensing Executive Society International is a cluster of 32 associations of practitioners involved in the process of technology transfer and specialists in licenses and intellectual property rights.
- Technology Innovation International is an association of professionals promoting the support of innovation, and providing services in the field of technology transfer.
- Polish Business and Innovation Centers Association in Poland. Its mission is to support the process of business incubation through meeting the needs of those who advise and assist entrepreneurs in starting a business, business development and survival on the market.

Table 2. Overview of institutional systems supporting the process of technology transfer in selected countries

Country	GERD (Gross Domestic Expenditure on R&D)	Priority of innovation policy	Features of the system
1	2	3	4
Ireland	1.79% of GDP	The priority is technology transfer in the form of foreign direct investment (FDI) and the import of foreign technology assets in the form of patents, licenses, know-how etc. and creating favourable conditions for foreign investors: • Industrial Development Agency and Enterprise Ireland are responsible for attracting foreign investments. • The role of the Ministry of Industry, Trade and Employment, under which runs the Office of Science and Technology (OST), responsible for the operation, development and coordination of science, technology and innovation • Enterprise Ireland offers access to venture capital and grants for start-ups	• Stable science and technology policy ensures the achievement of various targets that are important for the economy • Consistent and cooperating institutional environment with clearly separated tasks within specific areas • Huge bargaining power to attract foreign entrepreneurs • The ability to support new entrepreneurs in their innovation and R&D business
Germany	2.82% of GDP	The largest number of patents in Europe per 1 million inhabitants (576 patents in 2010, worldwide leader, South Korea: 2,697 patents, Poland: 84 patents): • Territorial division of tasks related to supporting technology transfer (the federal and regional level) • As in Finland, an interministerial coordinating institution operates – the Joint Scientific Conference (Federal Ministers of Education and Research, and of Finance + ministers of separate Bundeslands)	The division of the institutions responsible for initiating and supporting R&D in schools/research institutes and enterprises: • Schools/research institutes: the Research Community • Companies: The Working Group of the Industrial Research Association 'Otto von Guericke' AiF (particularly strong support for SMEs) • The system's advantage: vast expertise accumulated in various federal and regional institutes, which bears the fruit of development and implementation of innovative technologies • The system's weakness: the degree of complexity and fragmentation resulting, among others, from a federal system of government
Finland	3.87% of GDP	• One of the best systems of technology transfer in the world • R&D in areas of particular importance to the Finnish economy, setting priorities • The first country to introduce co-ordination of the science policy at the interministerial level – the Finnish Council for Science and Technology	• Coherent institutional environment with a clear mission and specific areas of operation • Networks of cooperation between research institutes and universities and companies (enterprises allocate funds for research carried out there) • Conducting research, which is useful for the economy and having an effective system of commercialization of new technologies (innovative concepts are typically used by enterprises)

Table 2 cont.

1	2	3	4
United States of America (USA)	2.8% of GDP	Research funding sources: federal, state, private. The chief national organ for science and research is the federal Office of Science and Technology Policy. In 2010, 783 patents were filed per 1 million residents (third place in the world)	• Substantial tax incentives for institutions and private companies funding research • Guaranteed protection of patent rights • 90% of research is carried out by R&D departments of universities and private companies, based on government commissions and the system of grants • Approximately half the cost of research is covered by the government, which finances large national programs, and through contracts implemented by research institutes of universities, of the industry, and by independent research institutes • Expenditure on basic research amounts to approx. 14% of total expenditure, and on applied research and development – approx. 86%
Israel	4.3% of GDP	In the past 20 years, a spectacular growth in the sectors of high technology has been noted, placing the country among the world leaders in innovation: • Key institution – Office of the Chief Scientist at the Ministry of Economy, an institution responsible for the implementation of grant programs • Technology transfer is based on technology transfer companies (FTT), from the moment of identification of the research and inventions developed by the academia, to concluding a contract transferring the rights to their commercial application	• Priority – the ICT sector (income from the sales of ICT technologies accounts for 31% of the value of the country's export) • Dynamic development of the venture capital market in terms of VC investments in relation to GDP of the country; with the index 0.73%, Israel ranks second in the world, after the United Kingdom • One of the leaders in terms of high-tech industry start-up businesses • R&D is 80% funded by the private sector. What was the reason for the success of innovation in Israel? • The key factor is decades-old and consistently implemented actions of the Israeli government • The strategy – high-tech sector as an opportunity for the country to achieve a competitive advantage on the international arena

Source: Own study based on training materials: http://www.poig.gov.pl/konfszkol/konferencje/Documents/Prezentacja_ProfKurzydlowski.pdf (accessed 13.03.2013).

CONCLUSION

There are no easy solutions to problems associated with the creation of conditions for the development of innovation. It is most especially due to the differences between innovations: their scale, type, range or sector. However, all of them have two things in common. First, innovation is a process, and not a one-time event, and must be treated and managed accordingly. The second important characteristic of all the innovative processes, and resulting from the former, is that the interference with the factors affecting the objective of this process is possible, in order to influence the outcome.

The structure of an integrated system of procedures is closely associated with effective management of innovation. It can increase the competitive ability of enterprises, for example by swifter introduction of new products, or a better use of the new technology. Please note also that innovation needs to be managed in an integrated way; one can't just manage or improve skills in one's chosen field.

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KONCEPCJE INNOWACJI W ZAKRESIE TRANSFERU TECHNOLOGII NA PRZYKŁADZIE WYBRANYCH KRAJÓW

STRESZCZENIE

Transfer technologii, jako system kreowania efektów z innowacji, to proces, który przebiega w różny sposób w zależności od charakteru i intensywności oddziaływania wielu czynników go determinujących. W literaturze wyróżnia się wiele podejść do analizy tego procesu. Celem pracy jest analiza istniejących koncepcji transferu technologii oraz doświadczeń wybranych krajów. Punktem wyjścia było nakreślenie istoty paradygmatu strategicznego teorii innowacji i transferu technologii. Dokonano także interpretacji koncepcji podmiotowo-terytorialnego pochodzenia innowacji, akcentując fakt, że małe firmy, powiązane w sieć relacji biznesowych, tworzą struktury wiążące je z otoczeniem, w którym funkcjonują, co przekłada się na efektywność procesów

transferu technologii. W pracy dokonano także analizy dynamicznych i interaktywnych modeli transferu technologii w wybranych krajach o długoletniej tradycji o zauważalnych efektach w zakresie transferów innowacyjnych rozwiązań technologicznych.

Słowa kluczowe: zarządzanie strategiczne, model transferu technologii

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ORIGINAL PAPER

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EVALUATION OF FUNDAMENTAL STRENGTH OF FOOD COMPANIES ON THE WARSAW STOCK EXCHANGE

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ABSTRACT

The article presents the proposal to apply the (universal) method of assessing the fundamental strength of a company with an example of the Polish food sector. The proposed method belongs to the group of methods of multidimensional comparative analysis and is applicable to the directly immeasurable categories (economic and financial standing, fundamental strength). The problem to be solved is the method of measuring the fundamental strength (attractiveness) of a company. The aim of the paper is to assess the fundamental strength of the food companies in Poland and to identify areas of use the results of research in practical analyses. The article describes how to construct such a measure and how to use it practically. The empirical example included data of food firms listed on the Warsaw Stock Exchange over years 2010–2014. The article presents method for assessing the investment attractiveness of enterprises comprising the food sector in terms of their fundamental strength, namely the long-term investment in their shares.

Key words: food sector, fundamental strength of companies, fundamental power index

INTRODUCTION

Analyses and evaluation of companies may be carried out at various levels of market aggregation and using different methods. The selection of a method or method of carrying out analyses is related to the applied range of results. This problem is well reflected in the literature [Porter 1980, Bednarski 1989, Waśniewski and Skoczylas 1994, 2004, Batóg 1997, Zarzecki 1997, Gruszczyński 2002, Siemińska 2002, Tarczyński 2002, Zaleska 2002, Sierpińska i in. 2004, Tarczyński et al. 2005].

The financial analysis or more thorough fundamental analysis is one of the best known and classical methods applicable in analysis and company's evaluation. Both financial analysis and fundamental analysis facilitate the assessment of an economic entity from their area of activity perspective. At the same time quantitative and qualitative factors modelling economic and financial picture of an analysed entity are considered. According to the classical approach, such methods do not allow for evaluation of an entity by means of one aggregated value. In turn, such opportunity provides application of the non-classical approach, using the concept of fundamental strength of a company and fundamental power index to measure it. Non-classical approach requires application of taxonomic methods for such measurement. The first proposal to measure fundamental power was *TMAI* (Taxonomic Measure of Investment Attractiveness) developed by Tarczyński in 1994 [Tarczyński 1994]. The concept of measure of attractiveness evolved [Tarczyński 2002, Mikołajewicz 2010, Tarczyńska-Łuniewska 2013a] and became basis for developing the concept of metodology and methods for fundamental power meas-

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urement [Tarczyńska-Łuniewska 2013b]. This value is considered a multidimensional category, which presents results of company's operation in the economic reality. It is created as a result of processes within a company in various area of its activity. Fundamental strength encompasses a set of fundamental factors (quantitative and qualitative), what is also reflected in fundamental power index (*FPI*). The concept of the fundamental strength means that a company is "good", doing well in market conditions, is competitive and has good economic and financial condition. Structure of the index is strictly based on fundamental power methodology and leads to its quantification, as the result. Fundamental strength is measured by *FPI* value. Application of such a measure is interesting from the practical point of view. We may refer to several application areas in this respect, e.g.:

- in long-term, fundamental investment process – where, horizontal and vertical risk diversification is applied, including development of databases for portfolio analysis;
- application of the index (indices) of synthetic analysis and market evaluation at different levels of aggregation, from the market review researches point of view, e.g. determination of development level, analysis of capability;
- to assess a development level of entities (companies) included in market components or its aggregate (e.g. a sector).

Due to extensive scope of applications of fundamental strength, this article proposes limitation of research area to food sector on the Warsaw Stock Exchange (WSE). This sector is one of the most present and operates on the market for the longest period of time. It is considered to be the most stable sector but having a great impact on economic development. The aim of this article is application of the universal method of assessment of the fundamental strength of Polish food companies in practical analysis and sector evaluation as well as determination of areas to apply gathered results. Such an approach allows for answering the following question: What is the fundamental strength of companies composing the food sector? Are there any deviations in this respect? How fundamental strength of food sector itself can be described? How information about the fundamental strength can be used in the investment process? In the empirical example data of food sector companies listed on the Warsaw Stock Exchange over the period 2010–2014 were used. The article presents methods of investment attractiveness of food companies in terms of their fundamental strength, namely the long-term nature of investment in shares of these companies.

FOOD SECTOR IN POLAND

Food sector is considered the key sector for economy and industrial production. It is important from macroeconomic perspective and Polish economy point of view. According to data from the Statistical Office, food sector represents approximately 12.5% of GDP. This sector generated 19.9% of value of sold products, out of which 16.7% was food production, and 3.2% beverages.

Food sector in Poland can be defined as one of more flexible in terms of adaptability to market fluctuations. Observation of changes in this respect allows for statement that this sector did well over political transformation. On the other hand the activity of economic entities in the sector can be assessed as stable. The sector is responsible for supply with regard to food production. Supply corresponds to demand, while the risk to cease production within this area is low, and in case of some products one can make a hypothesis that it does not exist. Both sector and market is described as positively influencing the economic development. In turn, the sector competitiveness is identified with technical, technological or organizational development with regard to food production and sales. In principle, development within these areas influences the increase of competitiveness of entities operating in food sector. Flexibility of companies in this respect and possibility to implement changes to increase competitiveness of a company on the market is also important. Implementations within technical, technological or organisational fields force the companies to commit high value of funds for investments, improvements or innovations. Accession to the European Union in 2004 has significantly facilitate such activities through involvement of European funds.

Food sector covers the wide area of activities and is quite diversified in terms of structure. It is at least visible while analysing its structure according to the Polish Classification of Economic Activities (PCEA). Following the PCEA, this sector is classified under C section. This section includes manufacturers of beverages and food products (www.stat.gov.pl). It is worth to accentuate that legislation determining food quality standards is a crucial element of sector's operation. It is related to the manufacturing process of food products and beverages and their effect on health.

According to the Agricultural Market Agency (www.arr.gov.pl), the Ministry of Agriculture and Rural Development (www.mr.gov.pl) or Polish Information and Foreign Investments Agency (www.paiz.gov.pl) food industry in Poland was quite successful over the economic crisis and has optimistic development projections. Moreover, Poland is among leading food exporters within the European Union. Development of food sector should be also related to the potential of ecological food production and considering Polish food as the "healthy" one. The implemented program for Polish food brand, supported by number of promotion activities on Polish and foreign markets is also of important value. The importance of food sector for economy is mentioned in several publications in this field [Obiedziński et al. 2003, Firlej 2008, Beba and Poczta 2014, Gliwa 2015].

Strong competition exists both among food manufacturers and within trading of products area. Therefore intense consolidation processes between enterprises and food manufacturers are being noticed on the market or in the industry. Unions of food manufacturers are very common, small shops enter into franchising of trade networks or make attempts to specialize production and trading of specific group of products. All these elements aim at competitiveness of parties joining such unions and facilitate operation on the market. Following the accession to the European Union a number of food companies in Poland decreased by approximately 3,500. The main reason for such a situation might be the strong competition that followed borders' opening, inflow of cheap products from abroad, restrictive European regulations imposed on food produced and implementation of Russian embargo on Polish food products in 2014.

Specificity of food products makes this sector treated as matured and stable in terms of market functions. Changes in economic condition of consumers do not have sudden impact on the market and do not entail significant changes in this respect.

MATERIAL AND METHODS

The main goal of this elaboration is evaluation of the fundamental strength of food companies listed on the Warsaw Stock Exchange over the period 2010–2014. This is important in practical analysis and sector's evaluation as well as in determination of application areas for obtained study results. Moreover, the assessment of fundamental strength of food sector on the stock exchange is important because it allows answering the following questions: what is a development level of this sector? What is the level of fundamental strength of entities composing this sector? Are there any changes and/or differences in this respect? What is the importance of the fundamental strength to the investment process?

Comparing some information coming from the stock exchange to that from beyond the stock exchange, full picture of situation relating to food market appears.

Subject to analysis were companies from the Main Market of the Warsaw Stock Exchange. The studies covered period from 2010 through 2014. Annual data from financial reports of entities under study were used in analysis of fundamental strength of companies, including analysis of financial situation. The following, selected financial indices were factors of the fundamental strength: current ratio, liabilities rotation (days), receivables rotation in days, ROA, ROE, debt ratio. Analysis was carried out in two steps:

- The primary database of food companies including information about selected factors of fundamental strength was determined;

- The following indicators were determined out of the primary database: Dynamic Fundamental Power Indices, fundamentally stable (*WSF*) – the approach including stability of factors over time was used in building the index. *WSF* was built using the scoring method.

The other, generally available information concerning food sector/market in Poland was used in studies as well. There were data from Central Statistical Office of Poland, Ministry of Agriculture and Rural Development, Polish Information and Foreign Investments Agency.

The formal construction of the Fundamental Power Index – *WSF* (the full procedure is presented in [Tarczyńska-Łuniewska 2013b]) is determined under the following formulas:

$$WSF_{SF} = w_1 \cdot MSF_{SF} + w_2 \cdot JSF_{SF} \tag{1}$$

$$w_1 = \frac{n_{MSF}}{N} \qquad w_2 = \frac{n_{JSF}}{N} \tag{2}$$

$$w_1 + w_2 = 1 \tag{3}$$

where: WSF_{SF} – fundamental power index determined under databases of companies stable over time in terms of the fundamental strength, individual approach to factors;
MSF_{SF} – stable measure of the fundamental strength determined through one of the selected methods of linear ordering or scoring; the measure is calculated based on quantitative database of companies fundamentally stable over time, irrespective of applied method,
JSF_{SF} – stable measure of qualitative factors determined to quantify the area considered as qualitative, in which case the measure is calculated based on the same database of companies fundamentally stable over time, but is related to qualitative factors;
w_1, w_2 – weights for quantitative and qualitative measures, determined so as their sum is equal to one and individual value is non-negative;
n_{MSF} – number of quantitative fundamental factors;
n_{JSF} – number of qualitative fundamental factors;
N – number of all fundamental factors.

Dynamic fundamental power index, fundamentally stable, has been applied in this study, considering only quantitative factors, which may be presented as follows:

$$WSD_d = \sum_{t=1}^{T} v_t \cdot MSF_t$$
$$v_t = \frac{nc_{it}}{N}, \qquad \sum_{t=1}^{n} v_t = 1, \qquad v_t \geq 0 \tag{4}$$

for $i = 1, 2, \ldots, k$; $t = 1, 2, \ldots, n$;

where: v_t – weight for i-factor over t-period;
nc_{it} – number (sequence) of i-quantitative factor over the period t;
N – number of sequence of i-factors over the studied period ($t = 1, 2, \ldots, n$);
k – number of all fundamental factors;
MSF_t – measure of fundamental power over t period (sum of all scores for all factors according to Table 1).

Table 1 includes scores allocated to economic and financial indices used in the study. Most of them have general standards, commonly adopted or sector standards. For all companies subject to analysis scores can be also determined under statistical analysis of economic and financial indices. In terms of fundamental strength and development prospects over long-term investment the higher is *WSF* level the company is better.

Table 1 shows that a given company may reach maximum 36 scores. Table 2 presents assigned levels of the company's fundamental strength.

Table 3 shows *WSF* values determined according to the formula (4) for food companies listed on the Warsaw Stock Exchange over the period 2010–2014.

Table 3 shows that the fundamental strength of food companies listed on the Warsaw Stock Exchange over 2010–2014 is high. The best company is Kruszwica (21.53) and the weakest is Wilbo (6.87), what gives a difference of 213%. According to adopted classification (Table 2), the best company is at average level of the fundamental strength. The level of obtained measures may be referred to maximum (36) or simple statistical tools

Table 1. Scores allocated to the selected economic and financial indices

Index	Standard values	Scores	Max number of points
Current ratio	<1.2; 2>	below 1.2 – 0 pts <1.2 to 1.4) – 3 pts <1.4 to 1.6) – 4 pts <1.6 to 2) – 6 pts over 2–4 pts	6
Liabilities rotation in days	<30; 60> (days)	below 30 – 6 pts <30 to 40) – 4 pts <40 to 50) – 3 pts <50 to 60) – 2 pts over 60–4 pts	6
Receivables rotation in days	<30; 60> (days)	below 30 – 6 pts <30 to 40) – 4 pts <40 to 50) – 3 pts <50 to 60) – 2 pts over 60–4 pts	6
ROA	0	<0 to 0.2) – 2 pts <0.2 to 0.4) – 4 pts over 0.4–4 pts	6
ROE	0	<0 to 0.2) – 2 pts <0.2 to 0.4) – 4 pts over 0.4–4 pts	6
Debt ratio	<0.5; 0.9>	below 0.5 – 6 pts <0.51 to 0.6> – 5 pts <0.61 to 0.7> – 4 pts <0.71 to 0.8) – 3 pts <0.81 to 0.9> – 1 pts over 0.9–4 pts	6

Source: Own elaboration based on Tarczyńska-Łuniewska [2013].

Table 2. Level of the company's fundamental strength

Max 36		*SF* level
36.00	27.00	high
27.00	18.00	mean
18.00	9.00	low
9.00	0.00	very low

Source: Own elaboration.

Table 3. *WSF* and assessment of the fundamental strength of companies under studies

Company	$WSF_{2010/2014}$	*SF* level
KRUSZWICA	21.53	mean
DUDA	18.07	mean
PEPEES	16.93	low
WAWEL	14.93	low
INDYKPOL	14.87	low
GRAAL	13.80	low
SEKO	13.07	low
INVFRICA	12.80	low
MAKARONY	10.87	low
PAMAPOL	10.47	low
ZYWIEC	9.27	low
MIESZKO	8.73	very low
WILBO	6.87	very low

Source: Own calculation.

can be applied. Based on these, obtained results can be evaluated. Table 4 presents basic measures of descriptive statistics: arithmetic mean, standard deviation and coefficient of random variation.

Table 4. Basic statistical measures for *FPI* over 2010–2014

Statistical measure	Value
Arithmetic mean	13.25
Standard deviation – $S(x)$	4.10
Coefficient of random variation – V_s	31.00

Source: Own calculation.

Based on Table 4 the detailed internal analysis of fundamental strength may be carried out. The most simple are two methods. According to the first method companies that have fundamental strength over arithmetic mean are worth to invest in on the stock exchange. Theseare: Kruszwica, Duda, Pepees, Wawel, Indykpol and Graal for the period 2010–2014. According to the second method companies are divided into three groups: these worth investing, with the index value above arithmetic mean increased by standard deviation, these which are not worth investing over the long period of time and those placed between these ranges. And therefore the first, investor-attractive group includes: Kruszwica and Duda, and the third group, subject to thorough analysis includes: Mieszko and Wilbo. This approach is in line with the assessment suggested in Table 2. Thus companies recognized as attractive and featuring fundamental strength at the mean level are much more risky than those with the same recommendation but with high *SF* value (Table 2).

The suggested approach can be also employed to evaluate the market situation in the sector in terms of the whole capital market. The observation of changes in stock indices over time for the best companies (WIG20) and the sectoral index is the easiest method which supports better assessment of fundamental strength measured with *WSF* index. Primarily it allows for better evaluation of a risk relating to investment in food companies with recommendation of the mean fundamental strength. Figure represents these stock indices at the Warsaw Stock Exchange over the period 2010–2016.

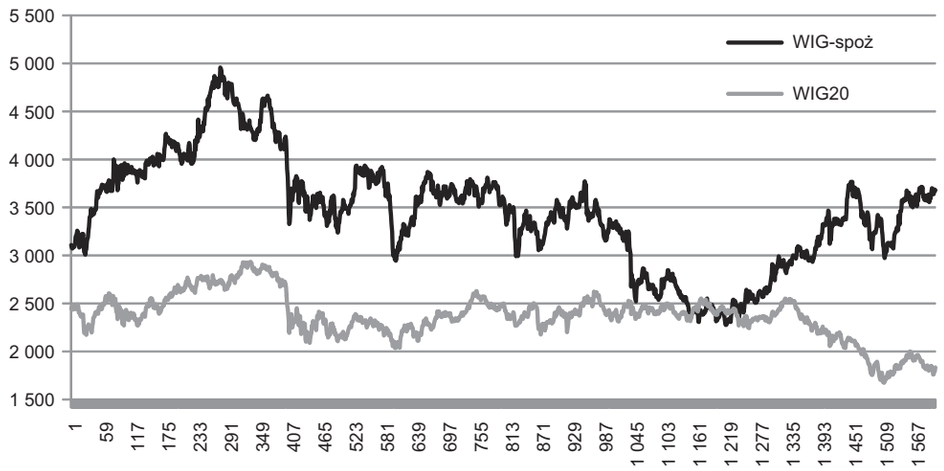

Fig. WIG20 and WIG-spożywczy (WIG-spoż) over the period 2010–2016

Source: Own elaboration.

Data analysis of Figure shows a positive trend for food sector over the recent three years (since 2014). Index of the best companies (WIG20) explicitly decreases while the value of food sector index clearly increases. Making evaluation of the situation in the sector and on the stock exchange, one may find that investment in food companies with high fundamental strength is very profitable, because compared to the whole capital market the risk is lower and there are better development trends.

CONCLUSION

The article presents the proposal to apply fundamental strength index (*WSF*) to evaluate the fundamental strength of food companies listed on the Warsaw Stock Exchange. The suggested measure is an element of the multidimensional comparative analysis and it facilitates valuation of a category which is directly immeasurable (economic and financial situation and fundamental strength), and depends on a great number of measurable and non-measurable factors. Studies on food companies on Polish capital market over the period 2010–2014 allow for verification of usability of proposed approach and on the other hand to evaluate attractiveness of investment in food companies on the Warsaw Stock Exchange over the long-term investment, following *WSF* index. Studies proved that simple statistical tools can be applied to the in-depth analysis and to limit the investment risk. This approach can be also used in inter-sector comparison, portfolio analysis and enhancement of key elements of the fundamental analysis before valuation of internal value of a stock. Based on the generally available data, in simple terms the proposed method allow for verification the economic and financial situation of a company, irrespective of the common or specialized evaluation and analyses. The strength of this method is objectiveness and possibility to make dynamic analysis including longer period of time, what allows for current monitoring of the fundamental strength of a company. Received results encourage to further studies in development of the company's fundamental strength evaluation system that will allow to reduce the investment risk on the capital market.

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OCENA SIŁY FUNDAMENTALNEJ SPÓŁEK SEKTORA SPOŻYWCZEGO NA GIEŁDZIE PAPIERÓW WARTOŚCIOWYCH W WARSZAWIE

STRESZCZENIE

W artykule przedstawiono propozycję zastosowania (uniwersalnej) metody oceny siły fundamentalnej spółki na przykładzie sektora spożywczego w Polsce. Proponowana metoda należy do grupy metod wielowymiarowej analizy porównawczej i ma zastosowanie do kategorii bezpośrednio niemierzalnych (kondycja ekonomiczno-finansowa, siła fundamentalna). Problem, jaki musi być rozwiązany, to sposób pomiaru siły fundamentalnej (atrakcyjności) spółki. Celem opracowania jest ocena siły fundamentalnej spółek sektora spożywczego w Polsce oraz wskazanie obszarów wykorzystania wyników badań w analizach praktycznych. W artykule opisano jak skonstruować taką miarę oraz jak wykorzystać w praktyce. W przykładzie empirycznym wykorzystano dane dla firm sektora spożywczego notowanych na Giełdzie Papierów Wartościowych w Warszawie w latach 2010–2014. Zaproponowano sposób oceny atrakcyjności inwestycyjnej przedsiębiorstw wchodzących w skład sektora spożywczego pod kątem ich siły fundamentalnej, czyli długookresowego charakteru inwestycji w ich akcje.

Słowa kluczowe: sektor spożywczy, siła fundamentalna spółek, wskaźnik siły fundamentalnej

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CATEGORISATION OF RURAL ACCOMMODATION FACILITIES AND ITS POPULARITY AMONG POLISH CITIZENS

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ABSTRACT

The categorization of rural accommodation facilities has been operating since 1997. Unfortunately, the popularity among farmers in rating their accommodation facilities is very low. The reason of this may be in fact that the average Polish citizen has no awareness of existence of such system. This article discusses the essence of the categorization system of rural accommodation facilities and presents the results of the research on the level of knowledge of Polish citizens about the subject. Through questionnaire research carried out on a sample of 830 respondents can be concluded, that awareness of the existence of the categorization system and knowledge about it is among the Poles very small.

Key words: rural tourism, agritourism, categorization

INTRODUCTION

Rural tourism in Poland has a long history and interest in this type of leasure is constantly growing among tourists. This process is also intensified due to active promotion and propagation of such type of tourism, made by various institutions and organizations. The effectiveness of those actions may be among other things confirmed by constantly growing number of operating objects of rural tourism, which meet the needs of the increasing number of people visiting rural areas.

The owners of many rural tourism objects have adopted quantitative strategy, believing that low price will return with high demand. However, others base on high standard with rich and attractive offer, trying to reach out to more rich clients, who demands adequately higher quality of service. The quality of services in hotels is manifested by star-rating, obtained as a result of the categorisation process. The quality of service of rural accommodation for a long time could be deduced only from the room price, owners' assurance or an opinion from a satisfied tourist. It has changed at the end of the XX century, in the second half of the 1990s, when The Polish Federation of Rural Tourism "Friendly Farms" (Polska Federacja Turystyki Wiejskiej "Gospodarstwa Gościnne") was established in the same time with the categorization system of rural accommodation facilities (WBN). This solution allowed the owners of the rural tourism farms to voluntarily submit their objects for evaluation to define the level of quality. The star-rating expressing the quality of the hotels is commonly known. However, not many people is aware that the similar grading system exist for the rural tourism facilities, which uses the sun symbol instead of stars. Therefore the aim of this article is to present information about the categorization

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system of the rural accommodation facilities. The author has carried out a research on the level of awareness and knowledge about the subject among the citizens of Poland.

MATERIAL AND METHODS

The research was conducted using a diagnostic survey method, which was carried out among 830 adult Poles. The respondents were selected randomly from the main age classes and sex structure of Polish citizens. A survey questionnaire was used as a research tool during a direct interview with respondents. The pollsters were 2nd year students of full- and part-time studies of Tourism and Recreation Faculty on Warsaw University of Life Sciences – SGGW. The survey was conducted also among their families, friends and neighbours in their family villages in spring of 2016.

ORIGIN AND DEVELOPMENT OF CATEGORIZATION SYSTEM OF RURAL ACCOMMODATION IN POLAND

Legal framework, which regulated the aspects of providing tourist services in Poland, is the Act of 29 August 1997 on tourist services [*Ustawa z 29 sierpnia*...]. This document defines eight types of hotel facilities, where accommodation is offered. However, there are no agritourism farms or others rural accommodation facilities among them. It is worthy of note that agritourist farm is not a term defined by law. Both in Act on tourist services and in Act on freedom of economic activity there is only mentioned renting rooms by farmers or places for tents in their farms. Such objects are classified as different objects providing the accommodation, after meeting the minimal requirements. Those requirements were specified in implementing note to Act on tourist services, which is Ordinance of Minister of Economy and Labor from 19 August 2004 about hotel objects and other objects, where accommodation is provided [*Rozporządzenie*... 2004]. Only minimal requirements of furnishing other objects, where accommodation is provided (rural accommodation can be classified here) were specified there. Moreover, it should be underlined that on the contrary to the hotels (except hostels) rural accommodation facilities are not subjected to an obligatory star-rating categorization. However, because of the dynamic development of rural tourism after 1989 the minimal requirements and low criteria which rural accommodation facilities should have met back than, in the second half of the 1990s of the XX century it was necessary to take some action to put in order the quality of rural accommodation.

The origins of categorization of rural accommodation in Poland should be looked for in PHARE TOURIN programs, which were realized in 1990s of the XX century and were aimed to support development of Polish tourism. PHARE TOURIN II rural tourism in rural and forest areas, realized in 1996–1997 [Seroka-Stolka 2007] had a great deal in the process. One of the program's component named "Rural tourism development" had a category of operations called "Rural accommodation development". Its main purpose was to develop and promote the accommodation system within rural tourism [*Dorobek Programu*…]. Within this program many actions were undertaken, with crucial significance in creating categorization system of rural accommodation [more: Majewski 2003, *Dorobek Programu*…]. For example:

- preparing the categorization system of rural accommodation (with the help from the experts from the western countries, and taking an example frome the systems functioning in the other European countries);
- initial categorization, carried out to collect experience;
- preparing the manual handbook *Guidelines for categorization inspections of rural accommodation facilities*;
- preparing tips for accommodation providers, registration and categorization forms;
- appointing and training the group of field inspection personnel.

Moreover, the breakthrough for rural tourism in Poland was the establishing of Polish Federation of Rural Tourism "Gospodarstwa Gościnne" (PFRT "GG") – organisation for registration, inspection and categorization

of rural accommodation objects. The organisation unites agritourism associations. The Federation was registered in 1996 and its activity has started in 1997. Thanks to support from PHARE TOURIN II program it has been provided with computers so as with the registration and categorization system of rural accommodation. In the early stage of functioning of the pilot program approximately 1,000 farms were categorized (it could categorize only one room in each farm). In 1999, by the decision of The Ministry of Physical Culture and Tourism, the categorization system of rural accommodation objects has become the property of the Federation [*Odpowiedź ministra*…].

The intention the creators of categorisation system was to keep an appropriate level of services and the positive image. In this context the categorization was and still is the warranty of proper quality of services, depending only on a given category. Its idea is to put the particular types of accommodation objects into a defined category, which refers to the quality of furnishings and proposed services, what allows to clarify the offers and set them in clear order [*Program rozwoju*…]. Accommodation providers can join to the WBN categorization system voluntarily but the verification process is payable.

At the beginning WBN categorization system was complicated, with many number of criteria and characteristics to be evaluated (since 2013 there was a change that was described further). Each category was marked with a symbol of little sun. System have four rating classes: standard, one, two and three suns. The facilities to be categorized were:

- guest rooms (rating available: standard, one, two and three little suns symbols);
- independent houses (rating available: standard, one, two and three little suns symbol);
- group rooms (rating available: standard);
- farm's camping sites (only standard rating available).

Only the facilities which met the requirements specified in already mentioned ordinance about hotel and other objects where accommodation services are provided could be categorized. Therefore, the guest rooms and independent houses had to firstly meet the minimal requirements specified there (what granted them a standard category), before they could enable them to obtain a sun symbol rating. Group rooms and farm's camping sites could obtain only a standard category. Because of the restrictions of this paper detailed specifications of particular types of rural accommodation units and categories were not discussed. Details about them may be found in "Program of development and promotion of categorization system of agritourism and rural tourism objects in Poland", which was elaborated by the team of experts under the guidance of Iwona Majewska. Each category was issued for two years and after that time it could be prolonged for the same period, after the positive opinion of the director of a local agritourism association (or someone empowered by him) or of an expert from Agricultural Advisory Centre (AAC), for the people who were not members of PFRT "GG".

To sum up the WBN categorization rules till 2013, it should be noted that the focus was set mainly on meeting basic criteria of providing the accommodation. The focus on criteria linked with preparing non-accommodation offer (e.g. possibilities of leisure activities in farm) was marginal. There was no specialization of farms depending on their additional offers or the profile of an agricultural activity performed there. Moreover, the elements related with the regionalization of the offer so as maintaining a rural character of accommodation in the field of architecture, furnishing or provided services were not taken under consideration. [*Program rozwoju*…].

Thanks to the financing from Ministry of Sport and Tourism, in 2012, the work on modifying and improving WBN categorization system had begun. The planned results of the works were [*Program rozwoju*…]:

- the project of modification, worked out by the team of experts and the people with practical experience. The project was based on the analysis of the similar systems in other countries and on works focused on improving the quality of rural tourism offer, conducted by the European Federation of Rural Tourism EUROGITES, where the PFRT "GG" is also associated;
- project tested by making categorization in selected facilities and conducting a survey among potential tourists checking their needs and expectations in this area;

- modernisation of the IT system;
- training the team of rural accommodation inspectors to conduct evaluation according to the modified system;
- promoting the system of evaluation of rural accommodation facilities among potential tourists and service providers;

The new system has started on 1 of January 2013 and it had significant changes. First, it was simplified (less criteria of evaluation and shorter scale of marks – without standard category), with group rooms and farm's camping sites no longer being categorized and two brand new categories of objects: rural lodge and lodge at farm. This allowed to distinguish clearly between agritourism farms and other facilities of rural tourism, without were practical farming was not performed. The time of validity of obtained category was extended from two to four years.

Accommodation provider, who decides to categorize his facility, gains right to publish his offer in the Federation's promotion materials and use its reserved logotype. Categorization is carried out by the inspector of PFRT "GG" at the request of the facility owner. The cost of categorisation of a facility with up to five rooms or two independent houses is 350 PLN for the members the Federation, or 700 PLN for non-associated owners. In case of categorizing more rooms, there is a surcharge of 20 PLN for each additional room and 50 PLN for each independent house. If the owner fails to prepare his lodge in the first term, he is obliged to pay 120 PLN – it is a cost of a second visitation of an inspector (www.pftw.pl). In some special situations, it is possible to cancel given category and the recommendation granted by PFRT "GG". This may take place in case of finding the severe negligence in quality of offered services, especially discrepancy between real condition of the lodge and standard expected from obtained category or legal exclusion from accommodation provider's native agritourism association. The reason may be for example guests' complaints about low quality of services.

There is a number of significant and diversified benefits from categorization. For accommodation providers, it is the reliable confirmation of particular standard of the service. Obtaining the category allows to publish the offer in promotion materials co-financed from state budget and PFRT "GG". The offer can be also displayed in the Federation's tourist information and reservation systems, as well as at the national and international tourist fairs, including official state stands co-financed from the state budget. Moreover, the category without any doubt increases the level of competitiveness of the facility on the market. The profits for the tourists should also be listed: clearly defined standards, reliable information, simplification of purchase decision and the sense of security [Wyrwicz 1998]. Operational and efficient WBN categorization system is also important factor in motivating the development of rural tourism in Poland. It guarantees an appropriate level of rural tourism services quality and creates the positive image, what brings new opportunities at the regional, national and international markets.

Between 1997 and 2006 PFRT "GG" has categorized total number of 1,432 facilities. During last few years a lower number of categorized facilities is noticeable, as well as lower popularity of the system among the owners. The details of that process are presented on Figure 1.

In 2014 there were 283 categorized rural accommodation facilities. At the time of preparing the article (November 2016) the Federation reported 1,271 lodges recommended (www.agroturystyka.pl), when 233 of them were categorized (40 with three stars, 90 with two stars and 103 with one star). What is interesting, 30 lodges were rated in standard category, which was cancelled in the beginning of 2013 and the last time when it was granted for two years, was 2012. The other 1,008 facilities were not categorized, but the quality of the services offered there was guaranteed by the Federation. Webpage of PFRT "GG" also allows looking up offers based on thematic aspects, for example there are offers for the people interested in picking mushrooms, fishing or horse riding, there also offers for families with kids, available accommodation at a farm or an eco-farm.

Declining trend may be observed not only in total number of categorised facilities, but also in the number of the facilities which are willing to prolong their category validation in the system. In 2012 only 13% of

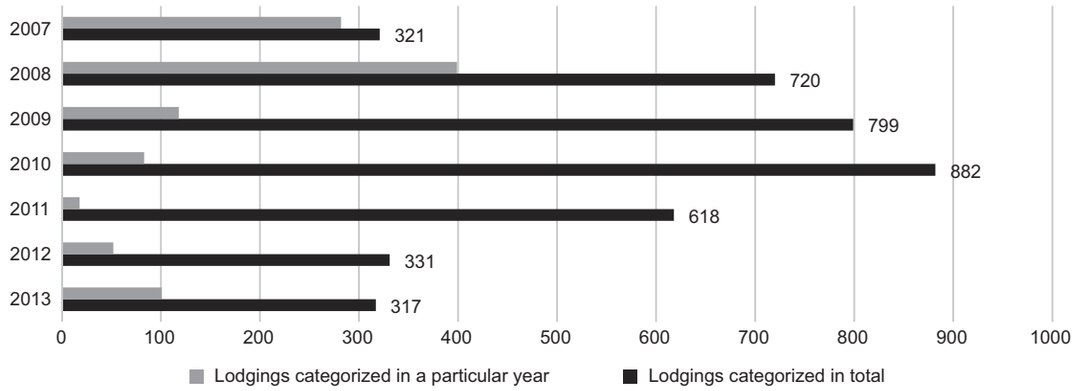


Fig. 1. All facilities with granted category and facilities with obtained categories between 2007 and 2013

Source: Author's work based on data of PFRT "GG".

399 facilities were signed up for a second evaluation, in 2013 it was just 11%. In 2014 this figure was even lower – only 9.6%. That brings the obvious conclusion that owners of those facilities have not seen any benefits from categorization.

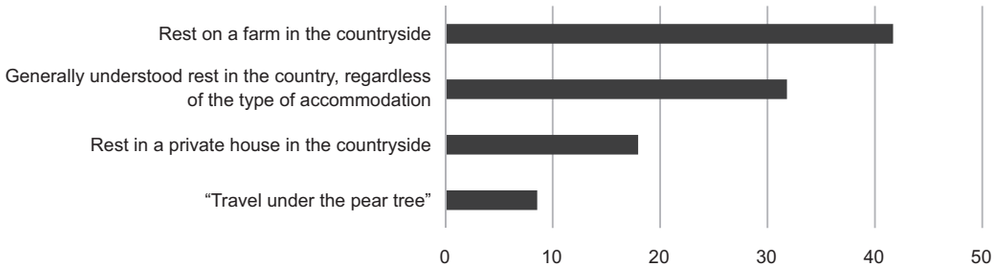
RESEARCH RESULTS

Among the respondents there were more women (50.7%). The age structure of the survey group was varied and approximately reflected real society structure in this aspect. People in the age between 18 and 24 years old were 11.1% of all the respondents. People at the age of 25–39 years were 29.8%, between the age of 40 and 59 years were 30.4% and seniors (in the age of 60 and older) were 28.8%. The respondents were well educated: 42.7% of them have graduated from university and 36% graduated from high school. The significant number of the respondents (27.5%) were white-collar workers, while other main groups were blue-collar workers (14.9%), pensioners and annuitants (18.8%) and students (10%). Among the respondents there were inhabitants of all the regions – the most numerous group of respondents were from Mazowieckie (56.5%), Lubelskie (7.2%), Łódzkie and Podlaskie (4% each). Most of them mainly were from cities (74.3%) and 32.4% of them lived in the cities with population bigger than 200 thousand people.

A Significant part of the respondents understood the term agritourism, as a holiday at the farm, in rural area. Many of them has defined it generally as a rest in the country or in private house in the country. Some respondents related agritourism with "self-arranged countryside holidays". The detailed results are presented in Figure 2.

It might be surprising that despite over 25-year-old history of agritourism in Poland, this term was defined properly only by approximately 40% of the respondents.

Only 8.6% of the respondents were aware of the system. This percentage is far from the result of research conducted in 2014 by the Federation's representatives during AGROTRAVEL fair in Kielce, picnic "Recognize good food" in Warsaw and TOUR SALON fair in Poznań, made on 206 respondents. During that research, almost 70% of the respondents had the awareness of existence and functioning of WBN categorization system in Poland. The reason of such discrepancy may be in respondents' selection – in research made by the Federation took part people, who often spend holidays in the country and pick up agritourist offer. Another reason may be in way of asking the question, which may decide about the received answer. Form "Do you even know that in Poland exists categorization system of rural accommodation?" strongly determines the type of response. Only

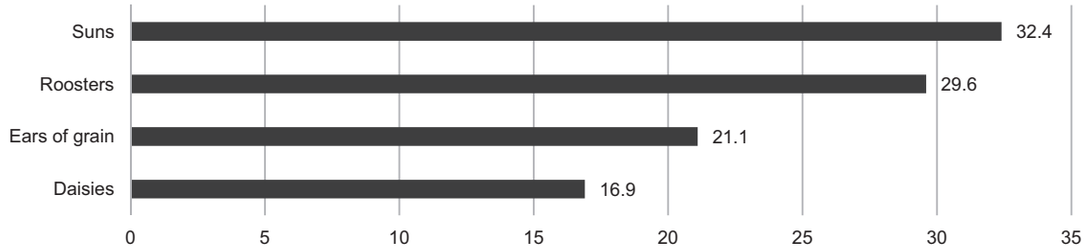


$N = 830$

Fig. 2. The respondents' understanding of agritourism

Source: Author's research.

23.3% of respondents claimed that rural accommodation in Poland is not categorized and 68.2% had no knowledge about it and has given no answer. Only one third from those declaring knowledge about WBN categorization system (3.9% of all people) could say what symbol is used for marking WBN categories (Fig. 3).



$N = 71$

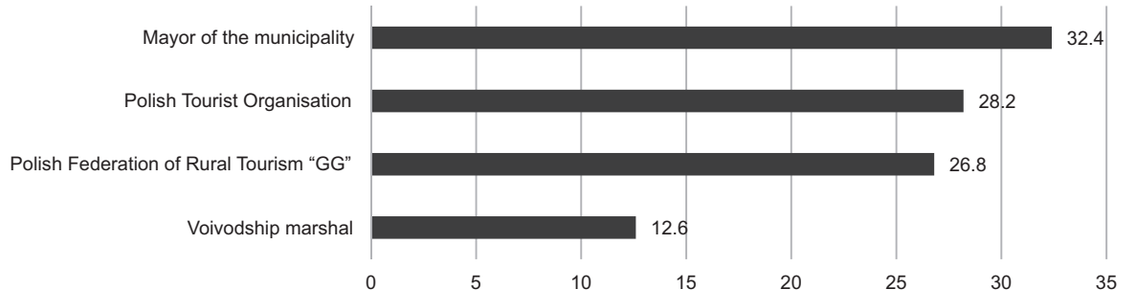
Fig. 3. Symbols used to mark WBN categories according to the respondents' choice

Source: Author's research.

It may be presumed that on giving the right answer here, except the actual knowledge the resemblance between the symbols used for categorization of the hotels and rural accommodation facilities, had some impact. Awareness about the hotel categorisation is surely much higher than about the rural accommodation facilities categorisation.

Only small number of the respondents with awareness of existence of categorization system of rural accommodation could point out proper institution, responsible for the evaluation (Fig. 4). One third of this group claimed that this is the competence of local mayor, while only one quarter (2.3% of all people) gave the right answer. There were also answers pointing Polish Tourist Organization or voivodship marshal. The second choice may be caused by the fact that he is responsible, i.a. for categorization of hotel objects.

Polish Federation of Rural Tourism "Gospodarstwa Gościnne", which logo is presented below (the first on the left), uses couple of graphics to promote rural tourism objects (Fig. 5). "Rest at a farm" ("Wypoczynek u rolnika") is reserved only for agritourism farms, "Holidays at eco farm" ("Urlop u ekorolnika") for agritourism farms with ecological cropping, while "Holidays in the country" ("Wypoczynek na wsi") is reserved for other rural tourism facilities. Acquaintance with those logotypes among the respondents was marginal. The logo of PFRT "GG" was recognised most of all, as it can be linked with almost 20-year-old activity. The detailed answers for this question are presented in the table.



$N = 71$

Fig. 4. Institution responsible for WBN categorization according to the respondents' choice

Source: Author's research.

Fig. 5. Logo of PFRT "GG" and graphics used by the Federation to mark promoted rural tourism objects

Source: Website of the Polish Federation of Agriturism (PFTW) http://pftw.pl.

Table. Respondents' acquaintance of logotypes used by PFRT "GG"

Answer given	Logo of PFRT "GG"	"Holidays at eco farm" logotype	"Holidays in the country" logotype	"Rest at farm" logotype
"I see it for the very first time"	79.2	90.5	86.5	88.7
"I've seen it somewhere, unfortunately I don't know the meaning of this graphic"	16.7	7.7	10.8	9.0
"I know the meaning of this graphic"	4.1	1.8	2.7	2.3

$N = 830$

Source: Author's own research.

Graphics used by the Federation for marking the facilities of particular types of rural tourism were totally unknown for the vast majority of the respondents. The reasons of that may lay in relatively short period of their existence (since beginning of 2013). However, this problem may also be caused by inadequate or inefficient promotion of those undertakings.

CONCLUSIONS

Polish Federation of Rural Tourism "Gospodarstwa Gościnne" is the most active and efficient organization working for developing the rural tourism in Poland. Its actions are multidirectional, however, they mainly focus on improving the quality of rural tourism offer and promoting this type of holidays. Moreover, the Federation

takes part in publishing, research, training and integrating projects. One of the qualitative tools is the system of rural accommodation categorisation, constantly improved since 1997. Basing on the research carried out, it may be concluded that effectiveness of this tool is unfortunately marginal, as tourist are not aware of its existence – less than 9% of the respondents knew it. Moreover, only one third of them could properly indicate the symbol used for marking the categories. In author's opinion, this lack of social awareness has caused declining interest of rural accommodation providers in evaluating and categorizing their facilities. If most of the interviews with potential clients would have started from the question about objects' category, for sure most of the accommodation providers would have joined the system long ago and have their facilities categorised. Unfortunately, the lack of those questions (resulting from the lack of awareness of the system) together with obligatory fee and the necessity of preparing facilities for the evaluation are successfully discouraging objects owners from obtaining the warranty of quality expressed with the symbols of little suns.

The issue of the lack of awareness of existence of the system among potential and present tourists visiting rural areas had been noticed by PFRT "GG" long time ago. An attempt to solve it was made by preparing webpage, number of printed catalogues and brochures so as the and presence during the different tourist fairs. It supposed to help promoting the system however, the effectiveness of those actions (defined mainly by the Federation's limited resources) leaves much to be desired. Chances for change should be looked for in the Federation's "Program of development and promotion of categorization system of agritourist and rural tourism facilities in Poland", within program IV named "Promotion and marketing communication", many actions were planned to promote this system among potential tourists and encourage accommodation providers to evaluate their facilities. The program will be realized between 2016 and 2020, therefore it is necessary to wait with patience for its results. However, there is a hope that such a crucial tool for improving quality of rural tourism services as the WBN categorization system is, will finally become commonly known and appreciated by tourists, as well as used by the rural accommodation providers.

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KATEGORYZACJA WIEJSKIEJ BAZY NOCLEGOWEJ I WIEDZA NA JEJ TEMAT WŚRÓD POLAKÓW

STRESZCZENIE

System kategoryzacji wiejskiej bazy noclegowej funkcjonuje od 1997 roku. Niestety, zainteresowanie usługodawców poddaniem swoich obiektów ocenie jest niewielkie. Powodem tego może być fakt, iż przeciętny mieszkaniec Polski nie ma świadomości istnienia takiego systemu. W pracy omówiono istotę systemu kategoryzacji wiejskiej bazy noclegowej oraz zaprezentowano wyniki badań dotyczące wiedzy Polaków na jego temat. Dzięki badaniom ankietowym przeprowadzonym na próbie 830 respondentów można stwierdzić, że świadomość istnienia systemu kategoryzacji i wiedza na jego temat jest wśród Polaków bardzo mała.

Słowa kluczowe: turystyka wiejska, agroturystyka, kategoryzacja

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MICROECONOMIC FACTORS OF THE DEVELOPMENT OF ENTERPRISES AS PERCEIVED BY RURAL ENTREPRENEURS OF THE MAŁOPOLSKIE PROVINCE*

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ABSTRACT

The article analyses evaluation of rural entrepreneurs concerning selected factors of development of their business. Attention was paid to the microeconomic factors relating to the resources available to the companies and the local conditions. Factors that are, in the opinion of entrepreneurs, drivers of growth included the location of the business, the availability of the Internet, the way the company is managed, access to the target recipients of services and products, technologies used, the number of customers covered by the activities of the company, as well as competencies, knowledge and skills of the owner-manager. The most frequently cited barriers limiting the development of activity of the surveyed entrepreneurs were their capital resources and the level of intensity of market competition.

Key words: rural entrepreneurship, small farms, development factors

INTRODUCTION

Development of a company is an extremely complex process which takes place over time as the level and structure of the components of the company change in such a direction that they provide increasing benefits for its owners [Szczepaniak 2007]. The literature presents various positions as to the nature of such changes, which suggest that these changes are of a qualitative nature, or both qualitative and quantitative nature [Pierścionek 1996, Penc 1997, Stabryła 2000, Wasilczuk 2005]. Regardless of the approach used, these changes are intended to adapt the company to the constantly changing environment. These adjustments can be considered effective if they allow the company to achieve and maintain a competitive advantage, which is a prerequisite for market viability [Janasz et al. 2010].

Rural areas of Poland, just like the whole economy, are dominated by the sector of small- and medium-sized enterprises (SMEs) in terms of numbers. They have the significant influence on the socio-economic processes taking place on various scales [Wiatrak 2006]. Small- and medium-sized enterprises are an important element conducive to improving the economic status of rural residents, as well as the catalyst for the development of non-agricultural activities and civilizational changes in these areas [Gospodarowicz et al. 2008, Żmija 2016].

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Small- and medium-sized enterprises are the sector of economy which is very susceptible to the influence of various factors that can help or hinder their development. The article analyses evaluation of rural entrepreneurs concerning selected factors of development of their business. Studies paid attention to the microeconomic factors relating to the resources available to the companies and the local conditions. External factors resulting from conditions of the macro-environment were deliberately omitted because of the very wide subjective scope of the discussed topics. The studies have therefore attempted to identify strengths and weaknesses and the opportunities and threats arising from the analysis of the potential of the surveyed companies and the factors in their local environment.

FACTORS OF DEVELOPMENT OF SMALL- AND MEDIUM-SIZED ENTERPRISES

The functioning of small and medium-sized enterprises is affected by various factors, which basically can be divided into two groups: internal factors over which the company has an impact, resulting from the resource conditions of companies, as well as external factors over which the company has a limited impact, related to its operating environment [Szczepaniak 2007, Matejun 2008]. These factors can be viewed as strengths of the organization (internal factors) or its development opportunities (external factors).

In another aspect, factors of development of enterprises can be divided into macroeconomic and microeconomic. R. Borowiecki and B. Siuta-Tokarska argue that macroeconomic determinants that are directly or indirectly related to the activities of small- and medium-sized enterprises include gross domestic product, inflation and unemployment, macroeconomic policy, foreign direct investments, innovativeness of the economy, globalization and other macroeconomic determinants. Microeconomic determinants which are directly related to the operations of SMEs include [Borowiecki and Siuta-Tokarska 2008, compare Ostromęcki et al. 2015]: owners-managers, management system and entrepreneurship, competition, suppliers and customers, local conditions, other microeconomic determinants.

Microeconomic factors can be thus divided into two groups associated with the person of the owner-manager and the factors related to the company [Smolarek 2015]. The basis of all entrepreneurial activities, both of founding and developmental nature, are always decisions of the owner – the company manager – his qualities, attitude and strategy. The owner-manager is the person who decides on all the most important elements of the company's existence: its establishment, location, business profile, employment or economic effects of its activities. Personality traits of the owner-manager are therefore an important factor in the development of the company. The management system and entrepreneurship contribute to the practical implementation of the vision, plans and objectives of the owner-manager [Borowiecki and Siuta-Tokarska 2008]. In turn, the competition and the associated battle for the customer is a natural driving force of technological progress, economic development of countries and societies. The existence of competing undertakings brings, in addition to competitive pressures, also benefits, such as the possibility to imitate the activities of a competitor or provide services under a sub-contract [Brzeziński and Ryśnik 2012]. Focus on the given area of competitors, customers and suppliers of the company promotes its efficiency and specialization, and serves as the stimulator of innovation [Hansen 1992].

The literature also highlights the importance of the local environment, which conditions the existence and development of small- and medium-sized enterprises. Local conditions include incentives for businesses to locate their business in a given municipality. Among others, these include local resources (especially labour resources and fixed assets), the structure and dynamics of the local economy, the place and role of the local socio-economic system in the meso- and macro-economic systems, as well as the operation and support of local public institutions. The development of SMEs in the local environment is also stimulated by the presence of a local "culture of entrepreneurship" and the creativity of local communities [Szczepaniak 2007, Gospodarowicz et al. 2008]. There is a deep interdependence among the factors of development of enterprises.

The company will not develop without the will of the owner-manager, on the other hand, the lack of other developmental factors may prevent its development.

MATERIAL AND METHODS

The empirical material for research were the results of own surveys conducted in 2015 on the issue of development of micro-, small- and medium-sized enterprises in rural areas led by owners of small farms. One of the objectives of this study was to analyse the most important macroeconomic factors in the development of rural enterprises in the opinion of the surveyed entrepreneurs. Surveys covered farmers from the Małopolskie province who owned farms with the area of 1–5 ha arable land, who, in addition to farming activity, pursued non-agricultural economic activity. Studies were carried out in several stages. During the first stage, a group of 301 farmers was surveyed. The selection of respondents was random. Then, 80 farmers engaged in non-agricultural economic activity were identified in this group, who were qualified for further stages of studies. The respondents came from 41 municipalities in 14 poviats of the Małopolskie province, which were characterized by different level of development of entrepreneurship, measured by the number of business entities registered in the REGON register per 10 thousand inhabitants of the municipality. The minimum value of this indicator in the examined municipalities according to statistical data for 2015 year amounted to 494 entities and maximum to 1,462 entities, with the average for the rural areas in Małopolskie province of 750 entities per 10 thousand inhabitants. Among the respondents, 43.75% were entrepreneurs coming from 20 municipalities with a higher than average indicator of entrepreneurship. The remaining 56.25% of entrepreneurs were operating in municipalities with a lower than average indicator of entrepreneurship.

The conducted studies analysed the age, sex, education and motivation that led entrepreneurs to carry on economic activities, and then scores given by entrepreneurs with regard to selected determinants of enterprise development. Microeconomic determinants that make up the rich list of growth factors were divided into the following groups: the factors associated with the person of the owner-manager and the factors related to the business pursued, such as enterprise resources, management system, local conditions, customers and competition. The factors were evaluated for their effect on the activity conducted by the entrepreneur. The score was on a scale of 1 to 10, where the score of:

- 1 meant a factor constituting a high barrier to the development of the business;
- 5 meant a neutral factor, having no impact on the business;
- 10 meant a very favourable factor for the development of the business.

Table 1 shows the chosen characteristics of business conducted by the respondents. The majority of the respondents (91.2%) at the time of the survey operated micro-enterprises which met the criteria of the Act on freedom of economic activities of 2 July 2004. Other respondents (8.8%) carried on agrotourism activities, which were non-registered activities[1]. Most of the respondents were entities who were service providers (67.5%). Trade or production was definitely less common. The subjects were characterized by a diverse duration of pursuing the activity. For 81.2% of respondents it was more than 2 years. It should be noted that the vast majority of respondents (78.8%) started operations in 2004 and subsequent years, i.e. after Poland joined the European Union.

Surveyed farmers rarely used additional manpower – 52.5% of them did not employ any staff for their activities. Share of 30% of the respondents hired one employee, and merely 17.5% of them hired two or three

[1] Pursuant to Art. 3 of the Act on freedom of economic activities of 2 July 2004 (Journal of Laws No 173, item 1807, as amended) a person who carries on agrotourism activities is not an entrepreneur within the meaning of the Act. However, since the agrotourism activity is without a doubt one of the most important forms of broadly understood entrepreneurship in rural areas, respondents who carried on agrotourism activities were also covered by the study.

Table 1. Selected characteristics of economic activities pursued by the respondents

Selected characteristics of economic activities pursued		Number of answers	% of answers
Sector	manufacture	9	11.2
	trade	17	21.3
	services	54	67.5
Duration of economic activities pursued	less than 2 years	15	18.8
	2 to 5 years	29	36.2
	6 to 10 years	14	17.5
	more than 10 years	22	27.5
Number of employees	no employees (self-employed)	42	52.5
	1 employee	24	30.0
	2 employees	9	11.3
	3 employees	5	6.2
Market in which economic activities are pursued	local	34	42.5
	regional	33	41.3
	national	13	16.2

Source: Own study based on the research.

employees. In the studied group, activities were carried out mostly on the local market, limited to the area of the municipality of the beneficiary and the adjacent municipalities or the regional market, i.e. the area of the entire province. Only 16.2% of respondents identified the entire country as a market for their activities. Respondents participating in the study were owners of surveyed micro-enterprises and agrotourism farms.

EVALUATION OF SELECTED MICRO-ECONOMIC FACTORS OF DEVELOPMENT IN THE LIGHT OF THE STUDY

Factors related to the person of the owner-manager comprise both personal traits as well as the system of values of individuals. According to research by different authors, relevant personal variables affecting entrepreneurial activities include the age, education, gender and previous professional experience and education [Wasilczuk 2005, Lemańska-Majdzik 2008, Czerwińska-Lubszczyk et al. 2013]. It should be emphasized that surveyed entrepreneurs were also owners and managers of the company, a classic model of the entrepreneur – the owner of the capital. As can be seen from the characteristics presented in Table 2, entrepreneurs were mainly men, who according to research by other authors, are more prone to take risks and declare their will to expand their business more often than women. According to different studies, a more dynamic development of the company is also favoured by the younger age of the owners and a higher level of education. In the surveyed group, 40% of entities were managed by relatively young persons, from 30 to 40 years old, and 37.5% by persons aged from 40 to 50 years old. Quite high education of the entrepreneurs is also noteworthy – 73.7% had secondary or higher education. The time of establishment of the company differentiated the structure of respondents by this feature. Entrepreneurs running businesses established after 2003 were better educated.

Personality traits of entrepreneurs are a key factor, but do not always lead to real development. However, they affect the motivation to undertake development activities. In analysing the motives to undertake additional

Table 2. Characteristics of respondents from the point of view of selected features

Selected characteristics of the respondent		Number of answers	% of answers
Age of the respondent	over 30 to 40 years	32	40.0
	over 40 to 50 years	30	37.5
	more than 50 years	18	22.5
Education of the respondent	vocational	21	26.3
	secondary vocational	34	42.5
	secondary general	3	3.7
	higher	22	27.5
Sex of the respondent	female	13	16.2
	male	67	83.8

Source: Own study based on the research.

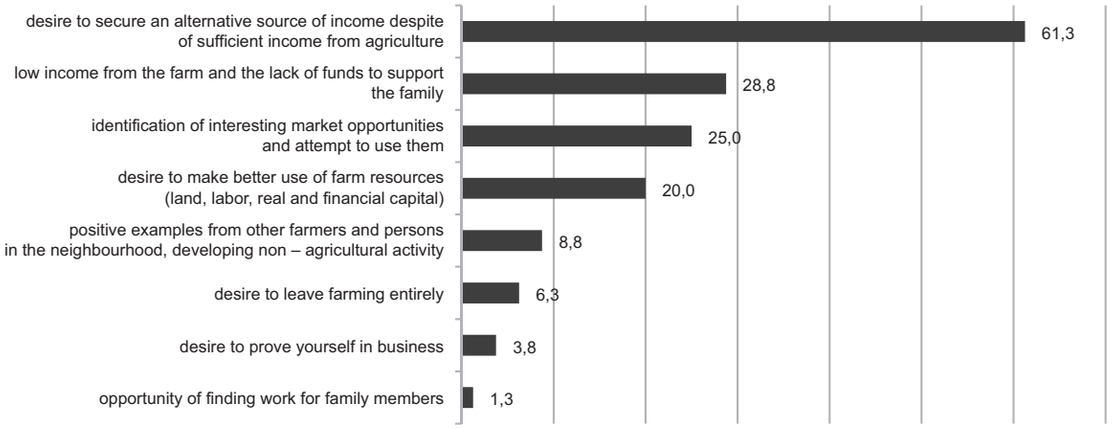

Fig. 1. Motives for pursuing economic activities [percentage of respondents]

Source: Own study based on the research.

non-agricultural activities (Fig. 1) the surveyed entrepreneurs usually indicated economic reasons connected with the desire to obtain additional source of income that would be an alternative to agricultural activities.

Economic motives related to those farmers who achieved satisfactory income, as well as those with low income from agricultural activities. It should be noted that financial considerations were indicated as the only motives to take up the activity by a staggering 48.75% of surveyed farmers. For other respondents, these motives were accompanied by other considerations which make up the individual "entrepreneurial attitude", such as the willingness to use the perceived market opportunity, more efficient use of the resources of the farm, and positive examples of other farmers-entrepreneurs. Motivations centred around business skills were only indicated by less than 53% of respondents.

Table 3 presents scores of selected surveyed microeconomic factors in the development of enterprises. Figure 2 presents the structure of responses from respondents concerning assessment of individual factors of development in terms of their impact on their business.

Table 3. Evaluation of selected micro-economic factors of development in the opinion of the respondents

Group of factors	Factor	Average score[a]	Minimum score	Maximum score	Median
Factors associated with a person of the owner-manager	competence, knowledge and qualifications of the owner-manager	5.65	4	10	6
Resources of the enterprise	size of own financial capital	4.44	3	7	4
	size of own assets (machinery, equipment)	4.65	4	8	4
	technologies used	5.70	4	8	6
	space available	5.08	4	7	5
Management system	method of enterprise management	5.83	4	10	6
Local conditions	location of business	6.34	4	9	6
	state of technical infrastructure	5.36	5	8	5
	access to the internet	6.15	4	8	6
	availability of qualified workers in the local labour market	5.30	4	8	5
	environmental conditions	5.34	4	8	5
	favourable inclination of local authorities towards rural entrepreneurs	5.23	4	8	5
	favourable inclination of local communities towards rural entrepreneurs	5.19	4	8	5
	availability of business environment institutions	5.09	3	6	5
Competitors and buyers	intensity of market competition	4.71	3	6	4
	customers remaining in the reach of activities	5.69	3	7	6
	access to the target audience of products and services	5.83	4	7	6

[a] Calculated as the arithmetic mean of scores.
Source: Own study based on the research.

The study shows that for farmers the factors that constituted a barrier to growth of their business was first their own financial capital and assets in the form of machinery and equipment, with the average score of 4.44 and 4.65 respectively. Only single respondents evaluated these factors as neutral, while 18.7 and 26.3% of the respondents respectively indicated them as factors which favoured development of the activities. It should be noted that entrepreneurs in rural areas have indeed a wide range of possibilities of obtaining EU funds for the development of their activities [Satoła and Bogusz 2016], but the constraints of financial nature and the inability to finance investments with own resources can significantly reduce the possibility of applying for grants.

A factor which is also often considered as a barrier to development of business was the intensity of competition in the market (average score of 4.71). It could therefore be concluded that many of the respondents are not able to face and win the continuous competitive struggle, which means taking more and more expensive and elaborate measures to persuade the customer to purchase products or services offered. Only for 17.5% this factor had no effect on the activities pursued, while for 27.5% of the respondents it had a positive impact that was conducive to its development. The lowest number of respondents said that factors which adversely affecting their business included the state of development of technical infrastructure in the local environment, the method of management of their enterprise, the technologies used, the location of the business, the availability of the Internet, as well as the degree of the favourable inclination of local government towards rural entrepreneurs.

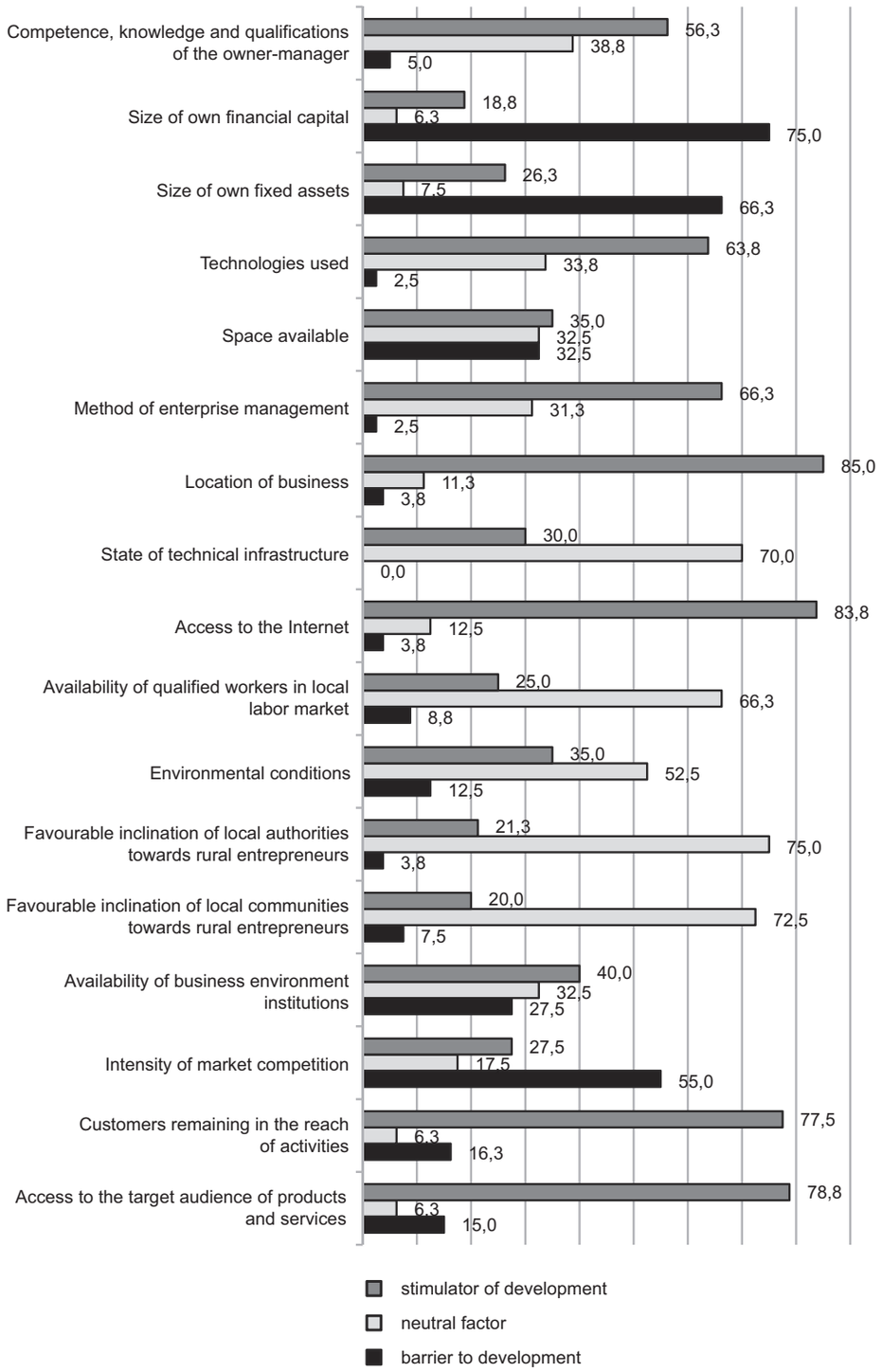

Fig. 2. Evaluation of developmental factors by respondents [percentage of indications by respondents]

Source: Own study based on the research.

Factors assessed as neutral to the business most frequently included factors from the group of local conditions, including the degree of favourable inclination of local authorities and local communities towards rural entrepreneurs, the level of technical infrastructure, the availability of skilled workers in the local labour market and natural conditions. It could therefore be concluded that a large part of entrepreneurs did not consider "soft" factors forming a friendly climate to small business in the local environment, or the hard infrastructural factors, as important to development of their enterprises. On the other hand, a large number of responses concerning the neutrality of the factor associated with the local labour market is probably related to the fact that most of the respondents who gave this answer hired no employees, and it can be expected that they do not plan to employ any staff in the near future. It should also be noted that the surveyed entrepreneurs usually operated in industries that do not require the employees to have very specialized skills, which probably affects the ease of obtaining suitable employees. The factors that were most rarely perceived as having no impact on the business included, understandably, factors relating to customers – their number and availability as well as factors related to the size of the financial resources and assets, which, as previously mentioned, were mostly evaluated as barriers to development.

The factor definitely considered by respondents as a strength of business was its location, with an average score of 6.34. Share of 85% of respondents rated this factor as conducive to development of their business. Respectively 3.7 and 11.3% of respondents found this factor negative or neutral. Opinions of entrepreneurs point to a major role of availability of Internet access as a stimulant of development (an average score of 6.15), since 83.8% of the respondents rated this factor as conducive to development of their business, 12.5% found it neutral and only 3.7% found it limiting to development of their business. It can therefore be concluded that rural entrepreneurs also see a number of benefits and opportunities that are associated with the access to the Internet, and more importantly have no problems with accessing the Internet in the area of their operation.

The surveyed said that an important stimulus to the development of business was the number of customers remaining within their reach and their availability, which for more than three-quarters of respondents were assessed as factors conducive to the development of the business. Individual respondents assessed these factors as having no impact on the business, but only a dozen or so of respondents rated these factors as a barrier to development of their business. These responses prove the existence of an absorbent market for products and/or services supplied by the surveyed entrepreneurs and the lack of problems with reaching the target audience.

An equally positive assessment related to the next factor, namely the system of management used in the enterprise – only 2.5% of the respondents found this factor as a barrier to development of their business, 31.2% found it neutral and 66.3% found it conducive to development of their business. This means that entrepreneurs consider their ways of doing business in the competitive environment effective, including those relating to organizational aspects, such as the division of tasks and responsibilities. Among business resources, the role of the technology used in the activities pursued was appreciated, which for 63.8% of the respondents was considered a factor conducive to the development of their business. However, it should be noted that respondents still operated in traditional industries such as small services, construction, wholesale and retail trade and industrial processing, namely industries with low innovation factor, which do not require the use of more advanced technologies.

Studies have shown that the respondents variously assess their competencies, knowledge and skills to carry on economic activities. 5% of respondents considered this factor as a barrier to the development of their business. Share of 38.7% of respondents considered this factor neutral and 56.3% of respondents found it conducive to development of their business. Similar diverse scores were given to space available, with 65% of respondents considering them a factor that limited or was neutral to development of their business and 35% of respondents found it conducive to development of their business. Availability of business environment institutions was found by 27.5% of respondents as a factor that negatively affected their business, for 32.5% it was an irrelevant factor and for 40% respondents it was a factor slightly conducive to development of their business.

CONCLUSIONS

Results of this study indicate that rural entrepreneurs believe that location of their business in rural areas where there is a ready and relatively easily accessible market for sale of their products or services is a development opportunity. Development of business and the access to a wider market is supported by the availability of the Internet access, which facilitates carrying on economic activities, eliminates barriers associated with the remoteness of rural businesses from the means of production and potential consumers of products and services, also provides an opportunity to establish cooperation with other companies, breaking the barrier of fewer enterprises in the rural areas. Systematic and rapid improvement in the availability of high-speed Internet in rural areas and a steady increase in the scope of services provided via this medium are therefore a great opportunity for business development as perceived by the surveyed entrepreneurs. The entrepreneurs also appreciate the way they manage their enterprises, including the method of organization that is expressed by the proper division of tasks and responsibilities, their skills, knowledge and qualifications in the field of business and the technologies they use. However, it should be noted that the surveyed respondents were owners of companies that operated in traditional industries such as small services, construction, wholesale and retail trade and industrial processing, which are characterized by a relatively low innovation factor.

A significant limitation to the development of the business are their own financial resources and fixed assets (machinery and equipment). It can be concluded that the restrictions of the financial nature and the resulting inability to finance investments in property with own funds stand in the way of further development of their business. This barrier is probably due to the lower access to financial institutions than in urban areas, which carries certain limitations to take development-oriented activities. The traditional structure of the business makes it difficult for the surveyed entrepreneurs to take actions that will affect in a significant increase in the level of competitiveness, therefore the level of intensity of competition was the third barrier most frequently indicated by respondents. Expected trends of support for enterprises in rural areas should therefore be capital injection, improvement in the access to institutions of business environment in rural areas and their operating efficiency, as well as the creation of conditions and prospects for the development of entrepreneurship in rural areas by local governments and local communities.

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MIKROEKONOMICZNE CZYNNIKI ROZWOJU PRZEDSIĘBIORSTW W OCENIE PRZEDSIĘBIORCÓW WIEJSKICH Z WOJEWÓDZTWA MAŁOPOLSKIEGO

STRESZCZENIE

W artykule dokonano analizy ocen przedsiębiorców wiejskich dotyczących wybranych czynników rozwoju ich działalności gospodarczej. Zwrócono przede wszystkim uwagę na czynniki mikroekonomiczne związane z zasobami, którymi dysponują przedsiębiorstwa, oraz uwarunkowaniami lokalnymi. Do czynników będących w opinii przedsiębiorców stymulatorami rozwoju zaliczono: lokalizację prowadzonej działalności, dostępność Internetu, sposób zarządzania przedsiębiorstwem, dostęp do docelowego odbiorcy usług i produktów, stosowane technologie, liczbę klientów pozostających w zasięgu działalności, a także kompetencje, wiedzę i kwalifikacje właściciela-menedżera. Najczęściej wymienianymi barierami ograniczającymi rozwój działalności badanych przedsiębiorców były posiadane zasoby kapitałowe oraz poziom nasilenia konkurencji rynkowej.

Słowa kluczowe: przedsiębiorczość wiejska, drobne gospodarstwa rolne, czynniki rozwoju

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