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Full Length Research Paper

Evaluation of Correlations between Natural and Organizational-Production Factors in Bulgarian Agriculture

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The article evaluates the regional differences in the interaction between natural and production organization factors in Bulgarian agriculture. The analysis ranged over the South Central Region and the whole country in the period 2007-2013. The indicators for the South Central Region were compared with the average indicators for Bulgaria, which played the role of a reference system. In addition to the descriptive statistics, GIS was also used to outline the specific soil and climatic areas that were to be examined. Based on this, the Index of Agro-environmental Potential (ISAP) was estimated both for the region and the country. A methodology based on specialized software was specifically designed for this purpose by regions and the country as a whole. The conducted study showed that the interaction direction and strength between the natural and production organization factors differed for the South Central Region and the country as a whole. The observed national trends and interdependencies of the examined factors do not always correctly reflect the scale and change effect in one region and the country, respectively. Due to the multifactorial determinants of agricultural production (natural and organizational-production), the effects of their impact on the region and the country differed. The latter was proved by the realization of different models of agricultural production, characterized with different levels of organization and intensity. The analysis showed the necessity of principle change - from sectoral to territorial, i.e. regionalization of the national agricultural policy. This approach should contribute to tool change for achieveing the policy objectives - moving away from subsidies to investment.

Keywords: natural factors; factors of production organization; regional differences; agri-environmental potential; regionalization; agricultural policy

INTRODUCTION

In recent years there has been an increased interest in the geographic aspects of development. There is nothing surprising about this interest — or perhaps the surprise is that it took so long for this interest to become a main concern within economics (Krugman, 1999).

The new interest of the economic geography is usually related to one of two approaches, that are seemingly contradictory. The first approach is described by John Luke Gallup, Jeffrey Sachs, and Andrew Mellinger (1999). It is used to explain the differences in the economic

development between the locations /regions/ according to their basic chatacreristics. The other approach is used to give asnswer to the following question: Why is it possible that the economic faiths of areas differ, even if characteristic advantages and disadvantages are not available? Strengths that affect the regional economic development are the following: centrifugal forces, effects of market size (including the labour markets), real estates, land rent. The immovable factors, the land and the natural recources, create conditions for particular productions. People, as a nation, oppose to the production concentration on the part of supply and demand (the dispersed factors create a dispersed market). Concentrations of economic activity generate increased demand in the local area: driving up land rents and providing a disincentive for further concentration (Krugman, 1999).

Human life and all human activities depend on nature. The implication of this ecological maxim is obvious: to be sustainable humanity must live within nature's carrying capacity (Mathis Wackernage et al., 1999). Ecological economists would say that for achieving (strong) sustainability, humanity must therefore maintain the planet's natural capital stocks (Daly and Cobb, 1989; Pearce et al., 1989).

There is a growing consensus among natural and social scientists that sustainability depends on maintaining natural capital (Mathis Wackernage et al., 1999). We live in an even more hazardous world with more consumption, more waste, more people and more poverty, but with less biodiversity, less forest area, less available fresh water, less soil and less stratospheric ozone layer (UNDP, 1994; WRI, 1996; Brown et al., 1997a,b). All that has been said here is to emphasize the importance of the natural potential for the further development of mankind. This natural potential, which also includes natural factors of production, plays an extremely important role in the development of agriculture and its production.

Agriculture undergoes constant structural changes. Mostly, this is a result of the changes in the dynamics and the directions of people`s production activity. The changes are also related to the agricultural land structure, level and the agricultural production structure, its concentration and specialization. According to Niedzielski (2015), changes are derived from the civilization and the cultural changes shown in the life quality of the rural regions and the country, respectively. Along with the natural active assets and the socio-economic factors, the psychological factors have great importance, as well as their effect in the historical development (Arkadiev, 2012). Runowski (2014) refers to the following impact factors: economic, technological, international, ecological, political, law, social and cultural. The impact of these factors on the agricultural sector is constantly increasing. This impact is not equal in the different regions in EU and in Bulgaria, respectively. According to Rowve and Berriet-Solliec (2010), European regions are becoming more important in relation to the agricultural policy. From historical point of view, it has been managed on a national and European level.

It has to be emphasized that the evaluation of changes and processes in the agricultural production is contradictory to the economic and ecological aims (Zegar, 2013). Indirectly, it is due to a various degree of concentration, polarization and specialization in the particular state regions. According to Brelik and Grzelak (2011), a development created by the capital production increase, which leads to the intensification increase, results in negative external factors and does not guarantee an adequate growth of farming incomes.

The present study aims at defining the directions and strengths of impact between the selected natural factors and the organizational-production factors in the regions and the country, respectively.

Data and Methodology

The analysis covers the period 2007–2016. The information source for the investigated period is the INFOSTAT statistical information system at the National Statistical Institute (NSI). It is based on the independent and objective approach of the survey sampling and allows the analysis of employment changes and the territory use of Bulgaria in short and long terms.

To achieve the research objectives, a database was used, set up by Nikola Pushkarov Institute of Soil Science, Agro-technologies and Plant Protection in Sofia, as well as the results from our own surveys and calculations, and a specially developed software. The contours of each planning region in Bulgaria were delineated on a map presenting the agro-ecological resources of this country (Valev, V. and B. Georgiev, 2004) with the help of a Geographic Information System (GIS). An Index for the Suitability of the Agro-environmental Potential (ISAP) for each district and planning region was calculated based on the available information on the region soil and climatic characteristics of the respective municipality.

The focus of the present research work was the South Central Region (SCR) with its specific natural factors and factors of production organization. It comprises 5 administrative districts – Kardzhali, Pazardzhik, Plovdiv, Smolyan, and Haskovo. The territory of this region makes up 20 % of the total territory of Bulgaria and is home to 20 % of the population. Only 20 % of the region territory is used for agriculture, with the share of farm area in use within the country total farmland of 12 %.

According to Bates and Parkinson "Production is the organized activity of transforming resources into finished products in the form of goods and services; the objective of production is to satisfy the demand for such transformed resources". Factors of production can be divided into two groups: natural and organizational-production. The first group includes all natural resources and the second –

human skills and efforts, equipment and materials, organization and undertaking production. Factor organization and undertaking production is becoming more and more important for agriculture. It sometimes makes that productions in less favored areas in natural terms have definitely better economic results.

The following two groups of indicators were used to conduct the analysis based on our own calculations:

(1) **Natural Factors**

- Index for the Suitability of Agro-environmental Potential (ISAP)

(2) **Factors of Production Organization**

- Average farm area (ha);
- Share of cereal crops in the cropping structure (%);
- Share of vegetable crops in the cropping structure (%);
- Share of grassland and forage crops in the utilized agricultural area (UAA, %);
- Employment (AWU per 100 ha of UAA), total number;
- Stocking density of cattle and sheep (LU per 100 ha of UAA), total number;
- Stocking density of pigs (LU per 100 ha of UAA), total number;
- Stocking density (LU per 100 ha of UAA), total number;
- Standard output (EUR per ha of UAA);
- Assets (EUR per ha of UAA).

The Indices for the Suitability of the Agro-environmental Potential (ISAP) by districts and regions were calculated with the help of a specially developed methodology and software and through the implementation of the GIS in order to mark the boundaries of the regions and the agro-climatic zones.

Pearson correlation matrix was used to determine the interaction strength and direction between the examined variables, with the statistical significance of the correlation coefficients being assessed at significance level $\alpha = 0.05$.

The object of self-assessment and analysis is the ISAP index used for the development of agro-environmental potential of both the South Central Region(SCR) and Bulgaria.

RESULTS AND DISCUSSION

Indices on the suitability of the agri-environmental potential are calculated on the basis of information from the Bulgarian Survey on Agricultural and Economic Situation (BANSIK) and own calculations using the Pushkarov Institute's database. The results are presented in Table 1. The text below the table explains how the table's metrics are calculated.

legend explaining how the table's metrics are calculated.

AL(column b) is Agricultural land (according to MAFF statistics, Bulletin BANSIK, 2016).

Land weight quotient (column c) is calculated as follows: column b*10/809433

Mar Median (column d) is statistically positional mean (median) of all established hundreds “mean agronomic grades” in the respective area, processed by districts. Due to the nature of the data itself, the prevailing trends and the mean arithmetic cannot be considered sufficiently representative.

MMW (column e) is land weight values of the mean agronomic grades calculated by districts as follows: Quotients in column c* MAR MEDIAN (column d).

ISAP (column f) indices for the suitability of the agri-environmental potential by districts – obtained as follows: Values in column d divided by 60 (the difference between the suitable, semi-suitable and non-suitable land areas is 60 bonity grades.

MMW for the South Central Region (e) is mean land weight medians of the average agronomic grades within SCR. Theoretically they vary between 0 to 100 grades which include: soil and agri-climatic characteristics, as well as the requirements for the 22 crops referenced in the adopted methodology.

and **ISAP for the South Central Region** (f) is index on the suitability of the agri-environmental potential for the South Central Region, calculated as follows: MMW is divided by 60. Theoretically it varies from 0.00 to 1.67.

Figure 1. Administrative units (districts) within the South Central Region and indices on the suitability of the agri-environmental potential

The statistical analysis clearly reveals differences between the natural and the organizational-production indicators for the SCR compared to those for the country as a whole. Similarly, the individual regions within SCR also vary in terms of their environmental conditions.

There is a similarity in the results of the analysis on the correlation matrix for the SCR which includes the examined pairs of variables for the period 2007-2016 and clearly manifest a very strong correlation (r=0.98) between the variables for medium-sized agricultural property and the agricultural output values. In other words, the changes in the values indicating the agricultural output are greatly determined by the changes in medium size of the agricultural properties.

A strong correlation has been observed in the analyzed variable invested assets and the average size of the agricultural holdings (r=0.91). A very intense, negative correlation exists between the average size of the agricultural holdings and the animal density per unit area (LU per 100 ha of UAA) (r=-0.99).

The results of the analysis show that there is a strong positive dependence between the relative share of cereals and the share of vegetables in the cropping structure (%) (r=0.78). A moderate positive correlation exists between

Table 1: Indices on the suitability of the agri-environmental potential by districts within the South Central Region

SCR Districts	Agricultural land for 2016 (ha)	Land weight quotient	MAR MEDIAN (bonity grades)	MMW (bonity grades)	ISAP
a	**b**	**c**	**d**	**e**	**f**
Kardzhali	97319	1,20	26	31	0.43
Pazardzhik	129093	1,59	45	72	0.75
Plovdiv	307308	3,80	55	209	0.92
Smolyan	48840	0,60	12	7	0.20
Haskovo	226873	2,80	53	149	0.88
SCR	809433	10,00	X	47	0.78

Source: BANSIK (2016) and own calculations

Table 2: Correlation matrix characterizing relationship between natural and organizational-production indices for South Central Region

Indices	Average farrn area	Share of cereals	Share of vegetables in cropping structure	Share of permanent grassland and forage	Employment	Stocking density of catle and sheep	Stocking density of pigs	Stocking density	Standart output	Vegetable production	Assets
Average farm area	1										
Share of cereals in cropping structure	.240	1									
Share of vegetables in cropping structure	-.463	.749	1								
Share of permanent grassland and forage	.834	-.336	-.876	1							
Empoyment	-.997*	-.164	.531	-.874	1						
Stocking density of cattle and sheep	.285	-.862	-.982	.767	-.359	1					
Stocking density of pigs	-.791	.404	.908	-.997*	.836	-.812	1				
Stockig density	-.994	-.129	.561	-.891	.999*	-.392	.855	1			
Standard output	.981	.426	-.280	.709	-.962	.092	-.656	-.952	1		
Vegetable production	-.884	.242	.824	-.995	.917	-.700	.985	.931	-.775	1	
Assets	.911	.620	-.056	.531	-.876	-.136	-.468	-.858	.974	-.612	1

*Correlation: significant at the .05 level (2-talled)

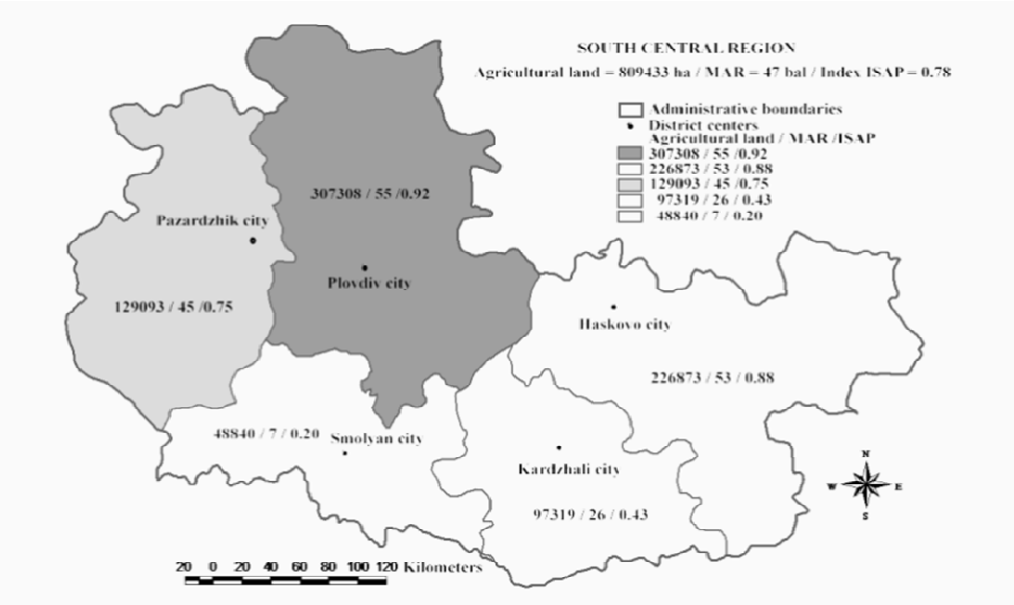

Figure 1. Administrative units (districts) within the South Central Region and indices on the suitability of the agri-environmental potential

the relative share of cereal crops and the size of the invested assets (r=0.62). There is a high negative correlation between the relative share of cereals and the density of cattle and sheep per utilized agricultural area (LU per 100 ha of UAA), (r=-0.86).

There is a strong positive correlation between the relative share of vegetables in the cropping structure and the value of the crop production which is logically determined and at the same time this is an extensive way for the development of the horticulture sector. There is a very strong positive correlation between the variables - pigs stocking density (LU per 100 ha of UAA) and the relative share of vegetable crops in the cropping structure (r = 0.91). The result explains the parallel development of the two sub-sectors – cattle breeding and horticulture focusing on better use of farm workforce.

Very high and statistically significant but negative correlation is observed between the relative share of grassland and forage crops in the utilized agricultural area in the utilized agricultural area (UAA) and the pigs stocking density (LU per 100 ha of UAA). On the other hand, the correlation between the same variable (the share of grassland and forage crops in the utilized agricultural area) and the density of cattle and sheep (LU per 100 ha of UAA) is high and positive (r = 0.77). The same is the correlation between the share of grassland and forage crops in the utilized agricultural area (%) and the production value for the region (r = 0.72).

The analysis results show a statistically significant and very strong, almost functional, correlation between the variable employment and the animal density per uutilized agricultural area (LU per 100 ha of UAA), (r = 0.99). High positive correlation is observed between the value of vegetable crop production and employment (r = 0.92). The result is logical, considering the labor-intensive nature of the vegetable crop production and the concentration of significant workforce in it. **Table 3 here**

The results of the correlation matrix analysis involving the analyzed pairs of variables for Bulgaria for the period 2007-2016 show a very high correlation between the analyzed variables of standard output (UAA) and the average size of agricultural holdings (r = 0.95).

Very strong, almost functional is the correlation dependence between the analyzed variable invested assets and the average size of agricultural holdings (r = 0.99). The result shows that the changes in the average size of agricultural holdings are mostly determined by the changes in the analyzed independent variable.

A significantly high correlation can be observed between the average size of the agricultural holdings and the density of cattle and sheep. (LU per 100 ha of UAA). A moderate positive correlation exists between the relative share of cereal crops and the share of vegetables in the cropping structure (%) (r=0.70). A similar, stronger tendency is observed in the South Central Region. This interconnection is determined by the requirements of the crop rotation in the cultivation of the above mentioned plant crops.

A moderate in strength and negative in direction correlation occurs between the relative share of cereal crops and the size of the invested assets (r=-0.72). A strong negative correlation exists between the relative share of cereal crops and the density of cattle and sheep per unit area (LU per 100 ha of UAA) (r=-0.88).

Table 3: Correlation matrix characterizing relationship between natural and organizational-production indices for Bulgaria

Indices	Average farm area	Share of cereals in the cropping structure	Share of vegetables in the cropping structure	Share of permanent grassland and forage	Employment	Stocking density of catle and sheep	Stocking density of pigs	Stocking density	Standart output	Vegetable production	Assets
Average farm area	1										
Share of cereals in the cropping structure	-.603	1									
Share of vegetables in the cropping structure	.152	.697	1								
Share of permanent grassland and forage	-.893	.898	.309	1							
Empoyment	-.334	-.550	-.982	-.126	1						
Stocking density of cattle and sheep	.913	-.877	-.266	-.999*	.081	1					
Stocking density of pigs	.321	-.949	-.888	-.712	.786	.680	1				
Stockig density	-.867	.920	.360	.999*	-.179	-.995	-.749	1			
Standard output	.948	-.825	-.170	-.990	-.017	.995	.605	-.981	1		
Vegetable production	-.971	.777	.089	.975	.099	-.984	-.538	.961	-.997	1	
Assets	.989	-.716	.002	-.950	-.189	.963	.459	-.932	.985	-.996	1

*Correlation: significant at the .05 level (2-talled)

There is no correlation between the relative share of vegetables in the cropping structure and the value of the vegetable crops output (r = 0.089). The only interpretation of the obtained result is the unsatisfactory average yields and the low prices of the vegetable production.

There is a high negative correlation between pig density per 100 ha of UAA (LU per 100 ha of UAA) and the share of vegetable crops in the cropping structure (r = -0.89). The result would have a negative impact on the more constant use of workforce on farms during the year.

A very strong and statistically significant correlation can be observed between the animal density (LU per 100 ha of UAA) and the share of grassland and forage in UAA(r = 0.999) .

The variables standard output (EUR per ha of UAA) and density of cattle and sheep (LU per 100 ha of UAA) are characterized by a high degree of correlation (r = 0.99).

Very strong and statistically significant dependence occurs between the animal population density and the relative share of grassland and forage in UAA (r= 0. 999). The statistical analysis results of the correlation matrix show that a large part of the correlations between the farm size and the other analyzed variables for the South Central Region (SCR) are different from those for the country as a whole. High employment in the region's agriculture is in a negative correlation with a large part of the indicators of those kinds of production characterized by considerable labour intensity. Consequently, core employment in SCR, as well as in the country, is the result of other, non-productive and non-agricultural activities.

The increase in commodity production in the region is a result of both: the increasee of farm size and the expansion of grain crop areas, as well as of cattle breeding. These processes are accompanied by an increase in the value of fixed assets.

The analysis confirms the thesis of significant regional differentiation of Bulgarian agricultural production, which also refers to the interaction between natural factors, on

the one hand, and factors of production organization, on the other. The relationships between factors differ (both between SCR and Bulgaria), as well as in different areas of the separate region.

CONCLUSION

Interconnections and trends observed at national level do not often occur at regional level. It can be concluded that there is a need of regionalization of the Bulgarian agricultural policy. The main reason is the fact that the effects of the changes in the examined indicators at regional level vary and differ from those at national level.

The changes affecting the factors of production organization in Bulgarian agriculture are carried out in different dimensions and are an integral part of the development process. However, the direction and the scale of changes are predetermined to a certain extent by natural conditions, although their strength has decreased over the years. The analysis has shown that the direction and strength of the relationships between the selected organizational–production factors and natural conditions differ. The observed regional and national trends and the process of interrelationships between the analyzed indicators do not properly reflect the scale and impact of the changes. Considering the multifaceted and complex conditions of agricultural production, the consequences of the impact of (natural and organizational – production factors) in the separate region and the country as a whole vary widely. This is manifested through spatial differences in the patterns of agricultural production, which are characterized by a different level of organization and intensity. The logical conclusion is a necessity for regionalizing the incentives related to agricultural production, including the Rural Development Program. This approach should contribute to more optimal and more efficient spending of funds intended for rural development.

The formulated conclusion will provide an opportunity to effectively address existing problems, focusing on the differentiation of the regions in the course of providing them with financial support.

REFERENCES

Arcadiev D (2015). Population Growth in Medieval Bulgaria. Statistics Journal. 4: 111-142.

Brown L, Flavin C, French H (1997). State of the World. World watch Institute, W.W. Norton, New York: London, 229 pp.

Brown L, Renner M, Flavin C (1997). Vital Signs. World watch Institute, W.W. Norton, New York: London, 165 pp.

Daly H, Cobb J (1989). For the Common Good. Beacon Press, Boston, pp. 482

John Luke Gallup, Jeffrey Sachs, Andrew Mellinger (1999). Geography and Economic Development. International Regional Science Review. 22 (2): 179-232.

Krugman P (1999). What's new about the new economic geography? Oxford review of economic policy. 14 (2): 7-17.

Niedzielski E (2015). Rural functions and their development. Issues of agricultural economics. 2 (343): 84-93.

Pearce D, Markandya A, Barbier E (1989). Blueprint for a Green Economy. Earthscan, London.

Runowski H (2014). Agricultural economics - transformations in agricultural holdings. In: Agriculture, food economy, rural areas - 10 years in the European Union. Warsaw. SGGW: 31-48.

Rouve A, Berriet-Solliec M (2010). Regionalization in European Agricultural Policy: Institutional Actualities, Issues and Prospects, Regional studies. 44 (8): 1005-1017.

UNDP, United Nations Development Programme, 1994, Annual Human Development Report. New York: Oxford University Press.

Valev V, Georgiev B (2004). Agri-ecological resources of Bulgaria - basis for designing in agriculture. NCAS. IP. Sofia: 110-115.

Wackernagel M, Larry Onisto, Patricia Bello, Alejandro Callejas Linares,

Ina Susana Lo´pez Falfa´n, Jesus Me´ndez Garcı´a, Ana Isabel Sua´rez Guerrero,

Ma. Guadalupe Sua´rez Guerre (1999). National natural capital accounting with the ecological footprint concept, Ecological Economics 29 (1999) 375–390

WRI, World Resources Institute (1996). World Resources 1996–1997. World Resources Institute, UNEP, UNDP, The World Bank, Washington DC.

http://www.nsi.bg/

http://www.issapp.org/