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**IDENTIFYING REGIONAL DIVERSIFICATION AND SPATIAL  
DEPENDENCE OF EMPLOYMENT IN EU REGIONS AS ONE OF  
SOCIAL COHESION INDICATORS**

**1. INTRODUCTION  
SOCIAL COHESION AS THE COMPONENT OF THE EUROPEAN  
UNION POLICY**

The concept of social cohesion emerged during the 1990s as a central policy goal at the national and regional levels (Berger-Schmitt 2002). For many years, the social sphere has been gaining importance in European Union (EU) policy and the activities it carries out. The main issues subject to regulation and public discussions in EU have evolved over time and referred to the following problems, listed in chronological order (Jorens 2005):

- unrestricted transfer of workers,
- co-ordination of social insurance systems,
- labour health and safety, equal treatment,
- fundamental social rights for workers (Community Charter),
- social dumping,
- EU social policy making and co-ordination methods,
- activities supporting employment, education improvement and larger access to the job market for people whose position on this market is the weakest.

Currently, among the European Union's Europe 2020 long-term development strategy goals, indicating the most important impact areas and development paths, social cohesion along with economic and territorial cohesion is distinguished as one of the crucial areas of interest. The European Union stimulates the conducting of social policy based on border reflection, long-term perspectives and shared priorities, as well as motivates the achievement of goals

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through the allocation of structural funds (Golinowska 2006). The methodology for investigating cohesion has been broadly discussed in the literature (*Concerted development...* 2005; Rakauskiene 2011; Karl et al. 2004), including econometric models for analysing the impact of cohesion policy programmes (Brandsma et al. 2013) and HERMIN (Bradley et al. 2003).

In one of the studies, the Council of Europe indicated that: *“with its focus on social cohesion, the Council of Europe is responding to changes in society that exacerbate the risk of inequality and instability. Social cohesion, as defined in the Council of Europe’s Revised Strategy for Social Cohesion, is an integral part of human rights”* (*Concerted development...* 2005). Social cohesion is crucial for a modern society focused on the rights of individuals and having to deal with rapid changes that are upsetting the mechanisms that have traditionally ensured the maintenance of social bonds in Europe. Social cohesion has also achieved greater importance as a complex factor in the search for equilibrium. It is considered as a condition for EU political stability and security, and more. Deficiencies in social cohesion such as weak social ties and a low level of social solidarity may have an effect of increasing public expenditures. Social cohesion is also considered a source of wealth and high economic productivity (Berger-Schmitt 2002). As stated in the book published by the OECD (2001): *“more cohesive societies are effective in realising collective goals because they are better in protecting and including individuals and groups at the risk of exclusion.”* Following Anioł (2010): *“The motto for the majority of reformatory activities, in terms of employment, social security or tax policy, is to motivate people towards professional, educational and social activity (e.g.: voluntary) activities during their entire adult life, which is identified as active or activating social policy. The strategy provides incentives to take up employment in accordance with “workfare” approach, which covers, among others, making the right to benefits dependent on obligatory participation of the unemployed in occupational trainings and integration programs. They are supposed to discipline the addressees of social benefits, prevent the addiction of becoming dependent on them, as well as counteract persisting social marginalisation and poverty trap.”*

Social policy goals include the following: employment, social protection, social order and human investments. The priorities listed in the Europe 2020 long-term development strategy indicate that the changing EU reality needs both intelligent and sustainable economic-facilitating social inclusion, placing a particular emphasis on creating new jobs and reducing poverty. The significance of these problems for EU development policy is manifested in the defined 5 quantitative goals, of which three refer to the analysed subject matter. The first place is held by employment, with the expectation that 75% of the population aged 20-64 should have a job. The fifth goal in the ranking emphasises the need for fighting poverty and social exclusion, the result of which would be the chance to reduce the number of EU citizens threatened

by poverty and social exclusion by at least 20 million. The fourth goal is also social in nature, since it refers to education-oriented issues. It covers two quantitative indicators related to the reduction of the number of students dropping out from school prematurely to a level below 10% and ensuring that at least 40% of the population aged 30-34 completed tertiary education. Obviously, these goals refer to the entire European Union. For each member state, national goals were identified in which the level of indicators was adjusted to the needs and possibilities of the domestic economies.

When discussing the problem of cohesion, attention is paid to a certain uniformity of solutions and the absence of significant disproportions on the level of the occurring phenomena. The disproportions in regional development represent one of the core EU cohesion policy problems. However, if we take into account the predictions of this approach, it cannot be expected that the objective of cohesion will be attained automatically. In spite of long-term activities carried out by the European Commission and the focus on reducing disproportions between regions, the subsequent research results have confirmed rather reverse tendencies and the emergence of divergence processes (Anioł 2010; Gorzelak 2009; Kusideł 2013a; Kusideł 2013b; Bal-Domańska 2013). In this context, there is not only a need for deep reflection on the observed divergence processes and cohesion-oriented methods, but also understanding for combining the discussed phenomena. According to Karl et al. (2004): “... *in order to understand the spatial effects of the cohesion process, it may be useful to consider the tools offered by the new economic geography theory.*”

Cohesion research following this trend and on the significance of spatial interaction for regional unemployment disparities covering a sample of European countries and regions between 1986 and 2000 using measures of spatial autocorrelation and spatial regression models have been conducted, among others, by Niebuhr (2003). Their results emphasise the importance of spatial interaction with respect to regional labour markets in Europe and point to a significant spatial dependence, i.e. both regions marked by high unemployment rates and areas characterised by rather favourable labour market conditions tend to cluster in space. These findings confirm the empirical evidence provided by several previous researchers that points to the occurrence of significant spillover among regional labour markets.

The purpose of this study is to identify the level of employment diversification as a crucial indicator of social cohesion and the nature of its spatial dependence across EU regions (NUTS-2) after the 2004 EU expansion by the new Member States, including Poland.

The increase of social cohesion – as discussed in this study – consists in the reduction of diversification in using labour force and human capital. Employment policies can have an impact on social identity and may affect the key elements of social cohesion, whereas social cohesion can also influence employment by shaping the context in which entrepreneurs make investment

decisions (*World Development Report* 2013). Thus, employment as the area of social cohesion was identified and recognised as a manifestation of participation in economic life. The analysis is focused on the measurable effects of employment policy – employment rate and labour force education quality. Data availability for all studied regions in the period under analysis was the vital criterion in the selection of indicators. The assessment of cohesion processes in a cross-section of regions was performed considering the spatial dimension of regional labour market disparities. The occurrence of cohesion processes represents the absence of groups of regions in a particular localisation characterised by low or high employment rates and human capital saturation.

The assessment of regional cluster formation was performed by analysing the existing spatial dependencies. They are expressed by situations in which the selected variable values determine and are determined by its realisation in proximity locations. The occurrence of spatial dependence (confirmed by the observed phenomenon of positive spatial autocorrelation) results in the formation of regional clusters, which represent strong development centres and which can be either an opportunity or pose a threat to long-term development. The study is focused on the European Union NUTS-2 level regions in the period 2005–2012, with particular attention paid to the situation change in 2012 in contrast to 2005.

## **2. PROCEDURE AND THEORETICAL BASIS UNDERLYING THE STUDY OF DIVERSIFICATION AND SPATIAL ANALYSIS**

For many years, localisation issues were a subject of interest for various theories in the area of geography, e.g.: J. H. von Thünen (1826), A. Weber (1909), W. Christaller's theory of Central Places of 1933 and A. Lösch (1940), or later studies by W. Tobler (1970), in which the first law of geography was presented. This line of research emphasised the importance of geographical variables as part of regional socio-economic analysis.

Currently, the new economic geography remains one of the most-cited theories in the context of regional studies taking localisation into account. The origins of this knowledge field are related to the studies by P. R. Krugman and his publication of the spatial equilibrium model for economic activity allocation in 1991. Krugman's model initiated dynamic development in the field of knowledge focused on spatial analyses in economics. It was applied in describing socio-economic phenomena, as well as in the context of cohesion policy.

The concept of the new economic geography is understood as a number of methods allowing for the conducting of analyses of spatial interactions. These methods can be divided into statistical and econometric ones (Suchecki 2010; Suchecka 2014). In this article, spatial statistics methods such as Moran's *I* statistics or the joint-count test (described below) were applied for the purposes of spatial dependence analysis.

The analysis procedure presented in the article covers the following:

- 1) Defining the socio-economic implications of the defined indicators from the perspective of the European Union policy.
- 2) Assessing the level and changes over time of spatial diversification in terms of the defined phenomena (sigma convergence analysis).
- 3) Identifying spatial dependence by means of:
  - calculating the global and local Moran's *I* statistical values for each year and each variable,
  - assessing the significance and types of regional clusters characterised by the similar level of social factors in the subsequent years covered by the analysis.

As indicated in the first point of the article, the social problems in the EU long-term development strategy are mainly perceived from the perspective of employment, unemployment and social inclusion. This study focuses on the first thematic area – employment, which is closely related to the economic situation. The problem of social cohesion, as analysed from the perspective of unemployment diversification and spatial dependence was discussed in the study by Bal-Domańska (2014).

The description of employment rate was performed by applying two measures:

- 1) Total employment rates (ages 20-64) in % (EMPL) – the indicator shows which part of society is active on the regional job market; from an economic perspective, this may result in higher gross domestic product. The employment factor is closely related to the general economic situation and displays a high sensitivity to market changes. For an individual, employment constitutes the source of income to support family members; moreover, it is related to opportunities for fulfilling professional aspirations. Having a job offers a chance to improve living standards, but it not a sufficient factor. As L. Andor (European Commission press release 2014), the commissioner for employment, social issues and social exclusion, points out, in order to achieve durable economic recovery that results in the reduction of unemployment and poverty levels, it is important not only to create jobs, but also to ensure their adequate quality as expressed, among others, by hourly working times and salary level. Unfortunately, data on the average number of the hours worked and salaries paid are available in a very limited scope at the NUTS-2 level and will not be taken into account in these analyses.

2) Employment among workers with tertiary education (ages 25–64) as a percentage of total employment (TETR) – represents the general measure of human capital in a region. In a rapidly changing world, the success of nations, communities and individuals may be linked more than ever before to how they adapt to change, learn and share knowledge (OECD 2001). This indicator illustrates the quality of human capital involved in regional economies: graduates from tertiary education should have qualifications indispensable for the development of those economic sectors that require professional expertise and creative thinking are one of the pillars responsible for the growth of developed economies, applying high and mid-level tech based on knowledge and innovations that results in the establishment of a modern, effective, innovative and competitive economy. The share of the population with a certain education level in the structure of regional human capital is a permanent quality and thus frequently identified with the type of regional capital. In the individual dimension, education offers a particular opportunity for achieving professional aspirations and higher income, and therefore is decisive in terms of living standards and social position.

In this assessment of employment diversification in a cross-section of the EU NUTS-2 level regions, the following basic descriptive statistics were applied: median as the measure of the analysed phenomenon average level (which is resistant to possible outlier values), minimum and maximum values and the classical variation coefficient ( $V$ ) based on standard deviation ( $S$ ) and the arithmetic mean ( $X_m$ ) calculated as follows:

$$V = \frac{S}{X_m}, \quad (1)$$

were defined for the assessment of phenomena variability.

For the purposes of the spatial dependence analysis, an assessment of spatial interaction type combining the analysed units and the possible effects of this dependence occurrence for the purposes of reaching valid conclusions should be determined first.

It is also worth considering the issues of regional relations at the NUTS-2 level and the type of interregional dependencies that occur. NUTS-2 level regions represent territorial units in the division of states, which constitute the focus of EU regional policy (basic regions for the application of regional policies). The current NUTS classification, valid until 31 December 2014, lists 272 regions at the NUTS-2 level. In the normative criterion, the NUTS classification favours administrative divisions for practical reasons – based on administrative divisions applied in the Member States. The NUTS regulation defines minimum and maximum population thresholds for the size of

the NUTS-2 regions as 800 000 to 3 million.<sup>1</sup> In many cases, the borders of NUTS-2 regions are those of a country (Cyprus, Malta, Lithuania, Latvia, Estonia, Luxembourg). The consequence of the NUTS-2 level regions' size is their relative high internal diversity resulting from covering large cities and peripheral areas. While analysing spatial dependences, relations between large city centres and the surrounding areas are most visible. Therefore, certain dependencies can be observed between the Prague region, which covers the area of the Czech capital, and Stredni Cechy, which surrounds the Prague region. A similar situation is true for Berlin and Brandenburg, Inner and Outer London and the surrounding areas. The situation for Mazowieckie region is, however, different since it covers both the capital city of Warsaw and the surrounding districts. In this case, regional impacts on proximity areas will be much smaller. It can be generally stated that interregional influences at the NUTS-2 level are disappearing. In this context, the identification of spatial dependences does not have to stand for socio-economic relations between regions, but can result from:

- similar socio-economic conditions; and
- common and state-specific domestic policies.

The methods applied in spatial dependence (autocorrelation) assessments can be helpful in the identification of regional clusters characterised by a similar level of development. These dependencies can be short-term in nature and influenced by socio-economic situation changes can either appear or disappear in the following periods. This situation refers to phenomena sensitive to the socio-economic situation. In the case of phenomena resistant to political turbulences and fluctuations in basic macroeconomic statistics, the clusters should be constant over time.

For the assessment of regional clusters featuring similar situations in terms of the social aspects underlying regional development, the global and local Moran's *I* and joint-count statistics are applied (Arbia 2006; Suchecki 2010; Kopczevska 2006). The occurrence of clusters of territorial units in which the values of a particular variable are similar to the values of proximity locations results in the processes of (positive) spatial autocorrelation. This is the most frequent type of autocorrelation in regional studies. Negative autocorrelation presents decidedly different values featuring objects situated in their surrounding area.

The global Moran's *I* statistic (Moran 1947; Cliff and Ord 1981) is the most popular test allowing the assessment of the intensity of spatial dependence. This statistic has two variants – the global one to determine general regional similarity and the local one which defines whether the *i*-th object (region) is surrounded by objects with similar or different values. The global Moran's *I* statistic can be presented as follows (Arbia 2006):

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<sup>1</sup> Despite the aim of ensuring that all regions of comparable size appear at the same NUTS level, each level still contains regions which differ greatly in terms of population.

$$I = \frac{L}{\sum_{i=1}^L \sum_{j=1}^L w_{ij}} \frac{\sum_{i=1}^L \sum_{j=1}^L w_{ij} (X_i - \bar{X})(X_j - \bar{X})}{\sum_{i=1}^L (X_i - \bar{X})^2}, \quad (2)$$

where:  $w_{ij}$  is the components of distance matrix and  $X$  the values of variable;  $\bar{X}$  – mean of variable  $X$ .

In case of the absence of spatial autocorrelation, the Moran's  $I$  statistic shows the tendency to present  $I \approx s \cdot (1/n-1)$  values.

The local Moran's  $I$  statistic is included in the group of Local Indicators of Spatial Association (LISA). LISA represents a group of spatial autocorrelation statistics facilitating the identification of global spatial autocorrelation shares in every location. It is used to identify clusters in large and small areas presenting high and low values. Unfortunately, the statistic value does not determine the cluster type.

A joint-count test can also be applied in the assessment of spatial dependence (Kopaczewska 2006). The idea behind this test is to verify the adjoining probability of objects featuring similar values. The zero hypothesis in this test assumes that the distribution of spatial events is random and autocorrelation is absent. Determining the test statistics requires the division of regions into classes presenting a specific variable level. For the purposes of this study, the division into four groups distinguished each time based on quartile values (first, second and third) was adopted. Thus, four classes of regions were obtained featuring low, medium, high and very high phenomenon level of comparable numbers (about 25% of the regional population).

The definitions of proximity and the describing it matrix are the key concepts for spatial autocorrelation. Its correct construction requires not only identifying networks and the direction of relations, but also the extent of its impact. It is assumed (in line with Tobler's first law) that the power of influence between units decreases with increasing distance. There are a few possible variants of the spatial dependence matrix construction resulting from physical and economic distance between objects (Arbia 2006; Suhecki 2010; Pietrzak 2010). Using different definitions of distance can result in different effects (Młodak 2012). This study applies  $n$ -th proximity matrix, where  $n$  refers to the number of borders to be crossed from one object to the next object and in this case is 1.



### 3. STATISTICAL DATA ABOUT REGIONS – THE CONCEPTS AND SCOPE

The study covers 260 NUTS-2 regions from the European Union, disregarding selected regions with missing data or located on islands far away from the mainland (Cyprus; Malta; overseas French regions: Guadeloupe, Martinique, Guyane and Réunion; three Spanish regions: Ciudad Autónoma de Ceuta, Ciudad Autónoma de Melilla and the Canary Islands; two Portuguese regions: Região Autónoma dos Açores and Região Autónoma da Madeira; and the Croatian region Kontinentalna Hrvatska).

The study covered the period 2005–2012. The main emphasis was on the assessment of changes in social factors in 2012 as contrasted to 2005.

One of the major difficulties was collecting the whole set of data for all regions in all studied years. In spatial analyses, the information cover for the entire sample of objects presents one of the basic conditions to carry out the analyses. Therefore, in the case of a small number of missing data, the gaps were supplemented using extrapolation and interpolation methods based on the available information from the period 2005–2012. In the case of the almost total information absence for a particular region, the approximate values of a superior unit (NUTS-1) were adopted.

The source for the regional labour market information (employment) down to the NUTS-2 level is the EU Labour Force Survey (EU-LFS). This is a quarterly household sample survey conducted in all EU Member States as well as in EFTA and Candidate countries. The EU-LFS survey follows the definitions and recommendations of the International Labour Organisation (ILO). One statistical unit is a person aged 15 or over, living in private households (people living in collective households such as residential homes, boarding houses, hospitals, religious institutions, workers' hostels, etc. are not included).<sup>2</sup>

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<sup>2</sup> Eurostat (data collected: <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>).

#### 4. THE SELECTED SPATIAL DEPENDENCES AND TENDENCIES IN THE FORMATION OF EMPLOYMENT

The employment rate represents the basic measure of population activity on the labour market. Sustainable development requires a stabilised employment rate. Unfortunately, the socio-economic situation of the EU regions indicates that the level of employment is spatially diversified with strong tendencies towards the occurrence of regional clusters featuring favourable or less favourable situations. Figure 1 illustrates the basic measures of employment rate diversification in the period 2005–2012.

The average employment level (measured by median) was similar in the years under analysis (2005 and 2012) and was about 70%. Until the global crisis, a slight annual growth was recorded up to the level of 71.8% in 2008, to be followed by a drop almost to the level from the beginning of the analysed period. The regional employment level shows increasing disproportions, which is manifested by the decrease of the lowest employment rate values and an increase of maximum values. As a result, the variation coefficient was gradually growing each year since 2008 (from 9.4% to 11.7% in 2012). In 2005 the weakest regions in terms of employment were the following Italian regions: Sicily at 48.1%, Campania at 48.3%, Puglia at 48.4%, Calabria at 49.1% and also Basilicata at 53.9%. Three Polish regions were also included among the weakest regions: Zachodniopomorskie at 53.9%, Dolnośląskie at 54.5% and Śląskie at 54.6%. The difficult situation of the Italian regions persisted in the subsequent analysed years. As far as the highest employment rate values are concerned, they were recorded in Sjælland, in Denmark, (81.9%) in 2005 and Åland, in Finland, (86.4%) in 2012.

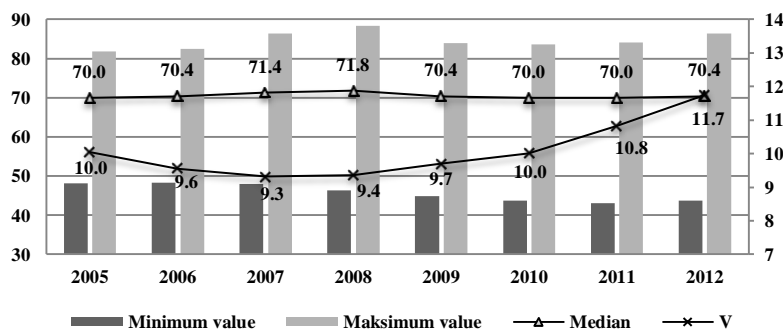
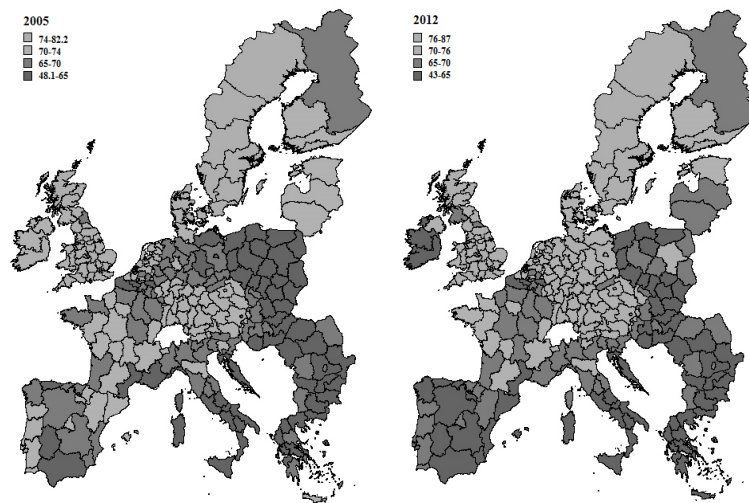


Figure 1. Employment rate in the EU NUTS-2 regions in the period 2005–2012

Source: own compilation.

Figure 1 presents the distribution of employment rate values in the EU NUTS-2 regions in 2005 and 2012. There are clearly visible tendencies towards connecting regions featuring high and low employment rate values into classes often coinciding with state borders. The global and local Moran's  $I$  statistics and joint-count were applied in the identification of the levels of spatial dependence significance.



Picture 1. Employment rate in the EU NUTS-2 regions in 2005 and 2012

Source: own compilation.

The values of the global Moran's  $I$  statistic confirm the presence of statistically significant clusters of regions featuring similar employment rate values in each analysed year (Table 1). Until 2008, the tendencies towards the occurrence of regional clusters were characterised by decreasing high and low values, which should be considered as a desirable phenomenon (especially as it was accompanied by growth and employment level stabilisation processes). Since 2009 the clustering processes in regions presenting a particular employment rate level had a tendency towards increasing.

Table 1. Global Moran's  $I$  statistic values for employment rate in the period 2005–2012

Specification	2005	2006	2007	2008	2009	2010	2011	2012
Moran's $I$	0.676	0.645	0.624	0.606	0.630	0.660	0.690	0.698
$p$ -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: own compilation.

The analysis of the local Moran's  $I$  statistic values allowed us to indicate regions in which a group of regions with similar levels of employment rates

could be identified. Statistically significant spatial dependencies were identified in almost all of the years analysed in the study for the following regions:

- Czech Republic: Severovýchod,
- Belgium: West-Vlaanderen,
- Germany: Mittelfranken an Hamburg,
- Italy: Sicily, Campania, Puglia and Calabria,
- Hungary: Közép-Dunántúl, Nyugat-Dunántúl, Dél-Dunántúl, Észak-Magyarország, Észak-Alföld and Dél-Alföld,
- Netherlands: Noord-Brabant,
- Austria: Salzburg, Tirol and Vorarlberg,
- Poland: Mazowieckie, Łódzkie and Wielkopolskie,
- Portugal: Lisboa and Alentejo,
- Romania: Bucuresti-Ilfov and Sud-Vest Oltenia,
- Slovenia: Vzhodna Slovenija and Zahodna Slovenija (both of the country's regions),
- Slovakia: Stredné Slovensko and Východné Slovensko,
- all regions in Finland: Länsi-Suomi, Helsinki-Uusimaa, Etelä-Suomi, Pohjois- ja Itä-Suomi and Åland,
- Sweden: Stockholm, Mellersta Norrland and Övre Norrland,
- distinctive clusters are also formed by the British regions, which mainly refers to: Leicestershire, Rutland and Northamptonshire; Herefordshire, Worcestershire and Warwickshire; East Anglia, Bedfordshire and Hertfordshire; Essex, Berkshire, Buckinghamshire and Oxfordshire; Surrey, East and West Sussex, Hampshire and the Isle of Wight; Kent, Gloucestershire, Wiltshire and Bristol; Dorset and Somerset; North-Eastern Scotland, the Highlands and Islands.

Only in case of the Czech region, *Moravskoslezsko*, located along the border with Poland and Slovakia, was a statistically significant negative spatial dependence for the years 2008 and 2009, which means that this region was surrounded by regions featuring radically different (in this case lower) employment rates.

Moran's *I* statistics do not consider the variable value, but just the fact of the proximity of iterations of similar variables. Joint-count statistics were applied in the identification of regional cluster types in terms of employment rate level. The analysis was conducted for the regions grouped each time into four clusters featuring: low, medium, high and very high levels of the discussed phenomenon. The division was based on quartile values (separately for each year).

The strongest spatial dependence was recognised for the regions featuring the lowest and the highest levels of employment (Table 2), which means that groups of neighbouring regions featuring very bad or very good situation were being created. For these clusters, spatial correlation identifiable at any significance level was recorded in each analysed year.

In 2005, 2006 and 2012, statistically significant dependences were observed for all types of clusters (of low, medium, high or very high levels). In the remaining years, the regions featuring medium or high employment rates were characterised by either the absence or small spatial dependence.

Table 2. Z values for the joint-count test on employment rate in the period 2005–2012

Specification	2005	2006	2007	2008	2009	2010	2011	2012	Change 2012/2005
low	9.25*	9.83*	10.36*	9.41*	9.71*	10.17*	9.61*	9.26*	9.60*
median	2.77*	2.48*	2.31	2.34*	1.13	0.43	2.61*	3.16*	4.81*
high	3.39*	3.29*	4.75*	2.06	4.53*	1.57	0.73	3.29*	6.16*
very high	12.01*	11.21*	10.95*	11.06*	10.38*	9.98*	9.06*	9.69*	13.21*

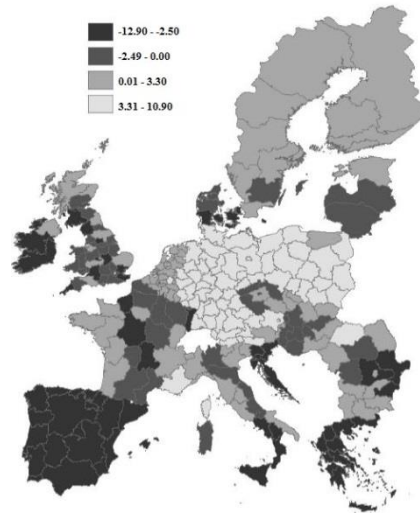
\* statistical values significant at the 0.01 level.

Source: own compilation.

The next question asked in the course of the study was on the problem related to the spatial dynamics of changes in employment level. Picture 2 illustrates the spatial dynamics of absolute changes in employment rate values in 2012 compared to 2005 (in percentage points – pp). In general terms, out of 260 analysed regions, the employment rate was higher in 2012 versus 2005 in 153 units, whereas the situation deteriorated in 107 regions.

When assessing the spatial dependence of employment rate changes, it has to be concluded that they are stronger than in cases of dependence for the value of employment rate level. In this case, the value of the global Moran's *I* statistic was 0.731. Statistically significant spatial dependence (at the level of 0.01) was recorded between regions with low, medium, as well as high and very high values (Table 2).

It is also true in this case that the measured values of absolute employment rate increase are clearly concentrated within state borders. The map illustrates the distinctive German, Polish and Austrian regions which have significantly improved their situation as expressed by employment rate increases. This group also covers individual regions, such as: the Belgian Prov. Limburg; Dutch Zeeland; British Inner London and Merseyside; French Provence-Alpes-Côte d'Azur and Corse; Romanian Nord-Vest and Finnish Åland. Slight improvement was observed in the group of Scandinavian regions, whereas a significant deterioration was recorded in all Spanish regions, Greek regions, southern Italy, Ireland and the selected regions of Great Britain, Romania, France and Denmark.



Picture 2. Changes in employment rate values in the EU NUTS-2 regions in 2012 compared to 2005

Source: own compilation.

The above observations identify two groups of regions. The first one covers regions whose situation in terms of employment rate suggests strong relations with state policy. Among them these are: Poland, Germany, Austria, Spain, Greece, Belgium, the Netherlands, Sweden and Finland. The second group includes countries whose regions were characterised by internally strong and diversified spatial tendencies (which suggest the absence of spatial interstate dependence or possible negative autocorrelation). Examples of such countries in terms of employment rate are France, Great Britain, Romania and Italy (even though a very strong division is present between the northern and southern regions, within which very similar tendencies are observed). It has to be emphasised that such regional division can refer only to those constituting a part of large countries composed of several to a dozen or so regions. In the case of small regions, whose territory consists of one or a small number of regions, such dependence is not possible to determine.

Human capital represents an important development factor for contemporary economic, the growth opportunities for which are combined with knowledge and innovation. The selected spatial dependences in the regional system in terms of workforce education rate have been characterised below. As already mentioned in point 2 of the article, this represents a permanent component of regional human resources structure and therefore lower fluctuations than in case of employment rate are expected in time regarding spatial dependence.

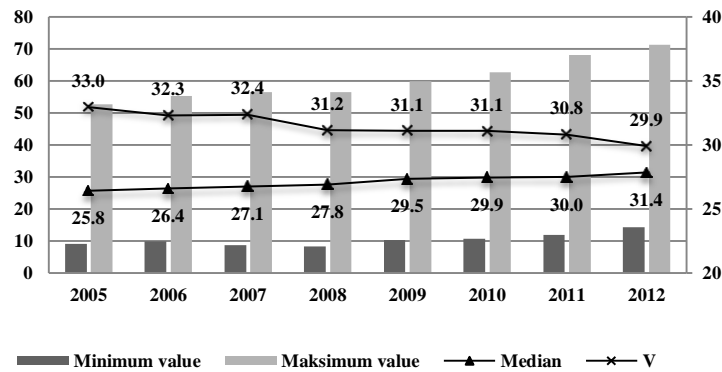


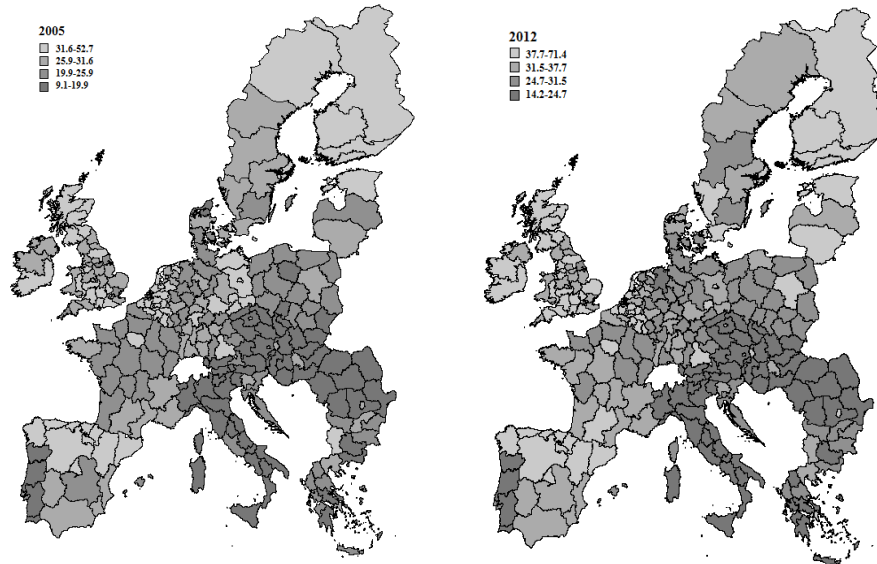
Figure 2. Employment among workers with tertiary education as the percentage of total employment in the EU NUTS-2 regions in the period 2005–2012

Source: own compilation.

Figure 2 presents the selected statistics characterizing the regional level and diversification of human capital (human capital involvement rate). They indicate on-going positive tendencies in the development of regional human capital, as expressed by the following factors:

- the increase of average level expressed by the median value (from 25.8% in 2005 to 31.4% in 2012).
- the increase of outlier values, i.e. minimum (from 9.2% in 2005 to 14.2% in 2012 – along with a slight drop in 2007 and 2008 – whereby in both years these values referred to the Czech region of Severozápad) and maximum (from the level of 52.6% in 2005 in the Belgian region of Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest, up to 71.4% in Inner London in 2012 – it has to be emphasised that, except for 2005, the region of Inner London had the highest rate of workforce with tertiary education out of all the analysed regions).
- the increase of the population with tertiary education in the regional workforce structure was accompanied by a drop in regional disproportions in human capital levels. Even through the interregional differences are still visible (variation coefficient of about 30%), they were decreasing year by year ( $V=33\%$  in 2005;  $V=29.9\%$  in 2012).

In accordance with the data presented in Picture 3, the distribution of human capital involvement rate shows some stability over time in the regional space. It is manifested, among others, by low values in south-eastern regions and in Portugal, as well as a more favourable situation of the remaining EU parts in each analysed year.



Picture 3. Employment among workers with tertiary education as the percentage of total employment in the EU NUTS-2 regions in 2005 and 2012

Source: own compilation.

As expected and observed, the map distribution of TETR variable value has identifiable, distinctive clusters of regions. Following the application of Moran's  $I$  statistic, the significant spatial dependence was statistically confirmed (Table 3) by an  $I$  statistic at a level of about 0.5.

Table 3. The values of the global Moran's  $I$  statistic regarding the share of the population with tertiary education in the total workforce structure in the period 2005–2012

Specification	2005	2006	2007	2008	2009	2010	2011	2012
Moran's $I$	0.548	0.551	0.566	0.558	0.581	0.583	0.554	0.56
$p$ -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: own compilation.

Similarly to the employment rate, the regional clusters frequently overlap national borders.

In case of workforce education level, the local Moran's  $I$  spatial autocorrelation indicated a much larger number of regions around which units featuring similar workforce education structure were clustered. In fact, this particular phenomenon covered all countries characterised by an expanded spatial structure. Nevertheless, several "outsiders" were identified, i.e. regions presenting a definitely different structure of workforce education than it was true for neighbouring regions. These included the following: Mittelfranken



in Germany, País Vasco in Spain, Bretagne in France, Lazio in Italy, Bratislavský kraj in Slovakia and Västsverige in Sweden.

Table 4 presents the values of the joint-count statistic regarding the values and changes in the rate of tertiary education population share in the total workforce structure in the period 2005–2012. The strongest clustering tendencies were observed in the regions with the lowest and the highest level of the TETR rate. For medium and high TETR rate values, it was also possible to confirm the occurrence of clusters in the majority of periods.

Table 4. Z values for the joint count test regarding the rate of tertiary education population share in the total workforce structure in the period 2005–2012

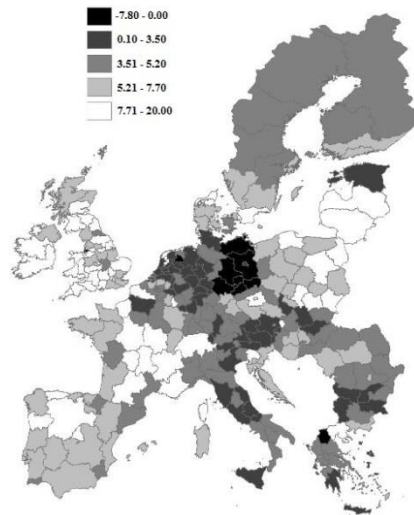
Specification	2005	2006	2007	2008	2009	2010	2011	2012	Change 2012/2005
low	10.58*	10.33*	10.43*	10.35*	9.01*	10.72*	11.38*	11.64*	5.86*
median	3.81*	5.00*	5.26*	4.39*	4.75*	5.50*	4.80*	4.83*	1.82
high	2.47*	2.19	2.92*	1.30	2.78*	3.18*	3.34*	3.10*	0.83
very high	9.31*	8.57*	8.63*	8.09*	8.47*	8.55*	6.58*	7.53*	7.05*

\* statistical values significant at the 0.01 level.

Source: own compilation.

The lowest level of human capital was recorded in the south-eastern regions (in Italy, Greece, Romania, Austria, Czech Republic, Hungary) and those in Portugal. The highest education level was characteristic for the workforce in the regions of Spain, Finland, Sweden, Great Britain and Ireland. As already mentioned above, the level of workforce education in the regional space is undergoing evolutionary changes, without any major turbulences or fluctuations.

Picture 4 presents the values of TETR variable absolute change in 2012 contrasted to the situation in 2005. Only in 10 of 26 regions was a detrition in the employment structure recorded in terms of tertiary education workforce share decrease. This refers to 8 German regions (located in the territory of the former German Democratic Republic), one Dutch region (Drenthe) and one Greek region (Dytiki Makedonia). In the remaining regions, the employment of the population with tertiary education grew. In 56 regions (including 6 Polish, and many British and French ones) the increase exceeded 7.7 pp.



Picture 4. Values of absolute change in the TETR variable in 2012 contrasted to the situation in 2005.

Source: own compilation.

The value of the global Moran's  $I$  statistic confirms the occurrence of statistically significant clusters of regions with similar values of absolute change in the TETR variable ( $I = 0.48$ ). Statistically significant spatial dependence was only recorded in the regions featuring the lowest (less than 3.7 pp.) and the highest (more than 7.3 pp.) values of absolute change in the human capital rates (Table 2).

## 5. FINAL REMARKS

Considering the European integration experience, one of the tasks of the European Community is to encourage social and economic cohesion. The employment rate, as a key factor of regional communities' wealth, constitutes one of the priority European Union activity areas, which is manifested in both economic growth and quality of life (social aspects). Therefore, regional cohesion is of great importance in this area, and is observed as the absence of any significant disproportions.

Due to data availability and limited possibilities for presenting the results in a single article, the analysis was limited to two basic employment measures:

employment rate and the share of the population with tertiary education, indicating the quality of human capital in a region.

The analysis of the diversification pointed to a strong dependence between the employment rate and economic prosperity, also including sensitivity to the financial crisis from 2008. The return of employment rate values to the pre-slump trend in the period 2008-2009 represents a positive aspect that has been observed in the course of recent years. However, along with median values of about 70.4% in 2012 and the values for the entire EU amounting to 68.4%, the European Union is still far behind the goal adopted for 2020 of having the employment rate at a level of 75%. It is, however, optimistic that the employment rate value exceeded the EU average in 60% of the regions (158 regions).

The quality of human capital, as measured by the level of workforce education, presents an on-going increasing trend with a tendency towards equalisation between regions. In this case, clusters of regions can be differently identified, i.e. featuring higher or significantly lower qualifications of human capital. The lowest education level is characteristic for workers from the following regions: the south-eastern part of the European Union, as well as the Czech Republic, Portugal, Austria and Italy.

The spatial dependence analysis confirms the occurrence of distinctive regional clusters featuring either good or bad situations in terms of employment. This dependence has become more significant in the case of regions with the highest and the lowest indicator values. It is worth observing that regional clustering is most visible along country borders. This mainly refers to large countries such as Poland, Germany and Spain. The factors associated with state policy and the general socio-economic and legal situation in a given country seem to have a particular influence on employment rate changes.

Spatial statistics tools represent a useful tool for regional analyses in terms of identifying regional clusters featuring similar levels of various phenomena. This mainly refers to the global Moran's *I* statistic regarding the assessment of both the presence and the intensity of regional clusters, the local Moran's *I* statistic in identifying regional centres that attract regions with either similar or extremely different situations. The joint-count statistic is also a very useful tool, since it allows for an in-depth analysis of regional spatial dependencies. The statistical values allowed for capturing regions featuring similar values (spatial autocorrelation), as well as the identification of outsider regions. The occurrence of negative spatial autocorrelation was observed only in individual regions (the Czech region of Moravskoslezsko, located on the border of Poland and Slovakia, in the years 2008 and 2009).

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#### ABSTRACT

The objective of this article is to identify spatial dependence in terms of employment as one of the basic indicators of social and economic cohesion in the European Union. The implementation of the social cohesion principle refers to reducing disproportions between countries and regions in areas such as employment. For the European Community, this aspect is of particular importance since one of its objectives consists precisely in the promotion of the development of balanced economic activities across the territory.

The presented analysis is to provide an answer to the question about the occurrence of regional clusters characterised by similar labour market development levels. This approach can be helpful in taking decisions about financial support and allow for the identification of spatial clusters characterised by an unfavourable situation. The analysis covers the period 2005-2012, which allowed for the assessment of changes in spatial interaction vis-à-vis employment as one of the most important indicators of social cohesion after EU enlargement in 2004 – the largest single expansion of the European Union (EU) in terms of territory, number of states and population, including labour market.

**IDENTYFIKACJA ZRÓŻNICOWANIA REGIONALNEGO I PRZESTRZENNEJ  
ZALEŻNOŚCI ZATRUDNIENIA W REGIONACH UE JAKO JEDEN  
ZE WSKAŹNIKÓW SPÓJNOŚCI SPOŁECZNEJ**

**ABSTRAKT**

Celem niniejszego artykułu jest identyfikacja zależności przestrzennych dla zatrudnienia jako jednego z podstawowych wskaźników spójności społecznej i gospodarczej w Unii Europejskiej. Wprowadzenie w życie zasady spójności społecznej odnosi się do zmniejszenia dysproporcji między krajami i regionami w obszarach m.in. tj. zatrudnienie. Dla Wspólnoty Europejskiej, ten aspekt jest szczególnie ważny, ponieważ jeden z jej celów dotyczy właśnie wspierania rozwoju zrównoważonych działań gospodarczych na całym terytorium.

Przedstawiona analiza jest próbą udzielenia odpowiedzi na pytanie o występowaniu regionalnych klastrów charakteryzujących się podobnym poziomem rozwoju rynku pracy. Takie podejście może być pomocne w podejmowaniu decyzji dotyczących wsparcia finansowego i pozwolić na identyfikację klastrów przestrzennych charakteryzujących się niekorzystną sytuacją. Analiza obejmuje lata 2005–2012, co pozwala na ocenę zmian interakcji przestrzennej *vis-a-vis* zatrudnienia, jako jednego z najważniejszych wskaźników spójności społecznej po rozszerzeniu Unii Europejskiej w 2004 roku – największym pojedynczym rozszerzeniu Unii Europejskiej w aspektach: terytorialnych, liczby państw i ludności, w tym rynku pracy.