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Selected Intangible Factors Of Regional Development: An Analysis Of Spatial Relationships

Abstract

As spatial diversity of economic development is one of the main problems of modern economies, researchers have attempted to define the conditions and factors influencing this phenomenon. Among others, two intangible factors are suggested: human capital and social capital (Herbst ed. 2007).

The primary objective of this work is a spatial and spatio-temporal analysis of the diversification of human and social capital within the Polish NUTS 3 subregions. The two detailed targets are constructing composite indicator of both of the mentioned types of capital as well as examining spatial interactions between human capital, social capital and the GNP level per capita.

The large diversification of human and social capital in the Polish subregions has been confirmed. Clusters of regions with low levels of human capital have been indicated, whereas in the case of social capital a grouping of its high values was observed. The research also confirmed the positive correlation between GNP per capita and human capital, with high values of both variables in the larget cities. Additionally, there are some subregions with high levels of economic development surrounded by low levels of human and social capital (Łódź, Szczecin, Wrocław). It is possible that high level of GNPpc in these regions was the incentive causing the relocation of human capital from the neighbouring regions. The correlation between GNPpc and social capital, where significant, is of the low-high type. These subregions are located in the east and south of Poland.

***Keywords**: human capital, social capital, regional development, exploratory spatial data analysis*

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1. Introduction

In classical economics, labour, land and capital were considered the main factors of production. Capital was understood as financial and material goods which may be disposed of if one has conducted profit-generating activities. However, effectively exploiting the available physical or financial capital is influenced by qualifications, competences and health condition. This conviction led in the 1960s to the formulation of the term human capital (Becker 1964). In the literature, a view was formed concerning the role of human capital as one of the most important factors in deciding on work productivity (both on the aggregate and individual levels), which then translates to increased economic innovation and a higher rate of economic growth (Benhabib, Spiegel 1994; Bassanini, Scarpetta, 2001). Human capital also positively impacts the development of regions – empirical studies show that those regions that decided to invest in human capital developed at a faster rate than others, regardless of the initial level of wealth (de la Fuente 2002).

The notion of social capital has been introduced in sociology (P.Bourdieu, J.Coleman) and economics to enrich the existing theories, especially the theory of economic growth (eg. Trigilia 2001, Blume, Sack 2008).

The success of contemporary economies and societies depends on their ability to create and absorb knowledge and innovation. Many researchers and experts believe that the effective use of production assets, infrastructure and financial resources is possible only with the appropriate level of human and social capital. Endogenous growth models highlight the fact that it is human capital that stimulates the diffusion of knowledge and technological development. Social capital, as opposed to human capital, is not an individual resource but occurs in relationships between individuals. It refers to the institutions, relationships and norms that shape the quality and quantity of a society's social interactions. Human and social capital, together with the institutional environment, are the three pillars of the human capacity to create wealth (Cote 2001).

The regional (spatial) disparity of human capital in Poland is the object of the numerous regional and local studies. The diversification of social capital in Poland according to the different levels of administrative division was analysed, among others, in papers by: Działek (2009, 2011) and Janc (2009). This study is the first in which the spatial and spatio-temporal relationships of those capitals levels are analysed. Presenting the results of this analysis is is the primary objective of this work. We can also indicate two detailed targets: constructing a composite indicator for both of the mentioned types of capital, as well as

examining spatial interactions between human capital, social capital and GNP level per capita; this objective was achieved by means of the methods of the exploratory analysis of spatial data.

2. Human capital and social capital – basic terms and measures

Regional development, including its spatial disproportions, is the object of numerous regional and local studies. This is due to, among others, the policy of the European Union, which is aimed at the strengthening of regional economy.

Contemporary concepts of regional development refer to the new economic geography and the neoclassical models of growth. In the neoclassical models of growth, great importance is attached to the accumulation of knowledge in science and technology, and human capital. Following Becker, we may assume that this is the "whole of the activities, which impact the future monetary and physical income by increasing the resources within people".

An important feature of human capital is its uniqueness and multidimensional nature. The complex nature of this category is the reason why a uniform definition of the term human capital has not been worked out. However, there are recognised cognitive orientations which include the following approaches: income-related, cost-related and those relating to the human capital quality (Florczak 2006).

For the purpose of the presented studies, the OECD proposal was adopted, according to which "human capital is the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being," (OECD 2001).

This definition was also applied by the Central Statistical Office (GUS) of Poland (GUS 2010) for collecting data characterising human capital on the provincial (voivodeship) level in 2010. In the research carried out by GUS, the indicators were subjected to analysis describing human capital or having influence on its development. This concept was also applied in the presented analysis on the subregional level. The set of indicators available for the subregions is much narrower when compared to that proposed for the provinces. Given the limited availability of statistical data concerning the variables (indicators) which directly or indirectly characterise the resources of the human capital on the NUTS 3 level, the following concept was adopted to build the quality measure of human capital.

The following diagnostic variables were selected to account for various human capital aspects (in relation to the population):

education

- share of persons with tertiary educational level in the population in %,
- gross enrolment rate - post-secondary schools (aged 19-21),
- the number of university-level students,
- the number of graduates[1],
- computerisation rate in primary and lower secondary schools – number of computers with Internet access,

health (access to health care, health and prevention)

- life expectancy – males,
- life expectancy – females,
- expenditures of local government units on health care,
- number of medical consultations (out-patient health care),

demography

- demographic dependency ratio - the non-working age population per 100 persons of working age.

The above features served to build the composite indicator providing a comprehensive picture of human capital in the individual subregions.

Several significant variables being used in the studies on human capital such as concerning the B+R sphere are not available on the NUTS3 level.

We should also note that a condition for the high quality and value of human capital is the ability to use it effectively. It is emphasised that the quality of human capital is reduced by the inability of individuals to apply practically their knowledge and skills as well as by passive attuitudes and a lack of commitment to social issues.

Social capital is understood differently by different researchers. It is a multidimensional and multifaceted term, and a single recognised definition does not exist (Bartkowski 2007). In classical perspectives on social capital, two levels are analysed – those relating to individuals andthose to the community. This study presents a spatial analysis: administrative units on the NUTS4 level are compared within the whole country (Poland), and, therefore, the collective dimension of social capital was taken into consideration and it was treated as a feature of the territorial communities. Therefore, capital is understood as a resource for the whole community, from which benefits can be drawn by both the community as a whole and individual members. The closest to this understanding

[1] Statistical data concerning the number of graduate students are presented according to the actual location of the colleges/units – not residence. It does not reflect the actual situation well (it is only an approximation).

seems to be the definition by Coleman (1988), according to which social capital manifests in the co-operation of people within groups and organisations with the purpose to realise common interests. This co-operation is possible thanks to trust, observance of social norms, and the existence of networks and social organisations.

Many researchers consider crime and economic development as indicators of social capital, arguing that regions in which a high level of social capital resources occur should be safer and their economies better developed.

To construct the social capital measures, composite indicators are used based on the average standardised variables, ranking, graphs of standardised deviations from the average, main components' method. Alternative features utilised to construct composite indicators describe different dimensions of social capital (eg. the existence of social and organisational networks, security levels, voter turnout). Using that last feature is opposed by Portes (1998), who states that it does not participate in creation of social capital, but instead is its effect.

The analysis presented in this study was carried out on the subregional level (NUTS-3). The availability of statistical data on this level of aggregation is unsatisfactory. Among the indicators of social capital proposed in the literature, those listed below had statistical date available and were used. All features are expressed per 10,000 people. These indicators were used to construct the composite measures of:

- number of cultural centres, clubs and day rooms,
- number of events organised by a.m. entities,
- number of sports clubs,
- number of persons exercising in sports clubs,
- number of divorces,
- number of crimes committed, discovered in the completed preparatory proceedings,
- expenditures from the communities and districts budgets on security, culture and protection of national heritage and on physical culture.

The first two features testify to the effectiveness of the local self-government and cultural institutions it runs. Organised events provide the opportunity for meetings and contacts with other people living in a given area. Membership and activities in sports organisations contribute to increased confidence and involvement in social and political life. The number of crimes and number of divorces are known as destimulants, which means that an increase in their number negatively impacts the feeling of security on the family and public levels. Increased expenses from the budgets in the mentioned groups can

contribute to the limitation of negative social phenomena (crime) and strengthened intensity of the activities of clubs, social-cultural and sports organisations.

The variable depicting the number of non-governmental organisations, although frequently mentioned and used in scholarship (eg., Janc 2009, Działek 2009) has not been used in this research because the data is missing on the NUTS-3 level. The same refers to voter turnout.

Composite indicators describing the level of human capital and social capital have been built as unweighted sums of the above-mentioned diagnostic variables after unitarisation:

$$Q_i = \sum_{j=1}^{K} z_{ij}, \tag{1}$$

where:

$$z_{ij} = \begin{cases} \dfrac{x_{ij} - x_{j\min}}{x_{j\max} - x_{j\min}} & \text{gdy } x_{ij} - \text{stimulant} \\ \dfrac{x_{j\max} - x_{ij}}{x_{j\max} - x_{j\min}} & \text{gdy } x_{ij} - \text{destimulant} \end{cases}$$

The higher value of the composite indicator means a higher level of human or social capital. The values for both measures are calculated for 2004 and 2012. The choice of 2004 was justified first of all by the fact that this was the year of Poland's accession to the European Union, and therefore possible changes in the spatial patterns of both variables or changes to their levels could reflect the influence of membership in this organisation. 2012 is the last period for which statistical data is available.

3. Spatial diversification of human and social capital

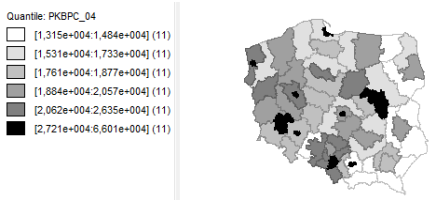
Graph 1 shows the spatial diversification of the GDP per capita, human capital and social capital. A concentration of high GDP values is noticeable in the subregions to which the largest Polish cities belong, and low values of the indicator occur predominantly in regions in the so-called Polish Eastern Wall.

Moreover, we can see that in 2012 some subregions improved their condition, which is marked by darker colour on the map. The values of social capital show in the opposite way. We can see a concentration of high values of the composite indicators in the eastern subregions and, first of all, the south-

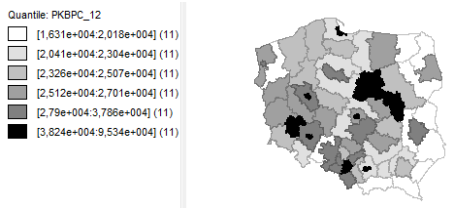
eastern ones. In 2012, the number of subregions with the highest value of this feature (the darkest colour on the map) decreased. On the contrary, big cities are characterised by very low levels of social capital in both of the studied years. This result is certainly the effect of the selection of diagnostic variables in order to construct the capital measure. Because of the missing data, the number of non-governmental organisations, most dense in large cities, was passed over. On the other hand, when we take into account the number of activities, the number of cultural centres and day rooms favour rural areas with lively regional traditions or numerous ethnic minorities. The activities of the sports clubs is most intense in places where percentage of young people is highest.

Graph 1. Spatial diversification of the GNP per capita, human and social capital in the sub-regions

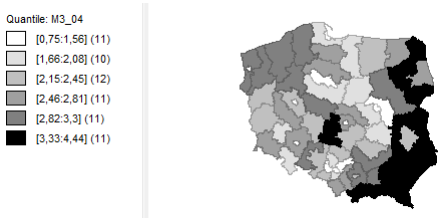
GDP per capita, (PLN, c.p), 2004



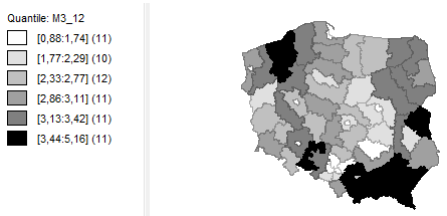
GDP per capita (PLN, c.p), 2012



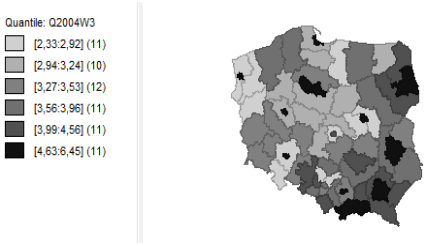
Social capital, 2004



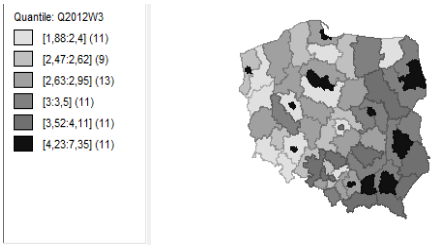
Social capital, 2012



Human capital, 2004



Human capital, 2012



Source: own elaboration based on GUS data.

Subregions containing big cities (Warsaw, Gdańsk, Szczecin, Wrocław, Kraków and Łódź) are the subregions with both high human capital as well as high GNP per capita. In 2012, we can observe an increase of the human capital level in subregions neighbouring the city of Warsaw subregion and the subregion bordering on the subregion of the city of Szczecin (subregions becoming alike).

The other subregions with high human capital include the subregions of Bydgoszcz-Toruń, Rzeszów, Białystok and Lublin.

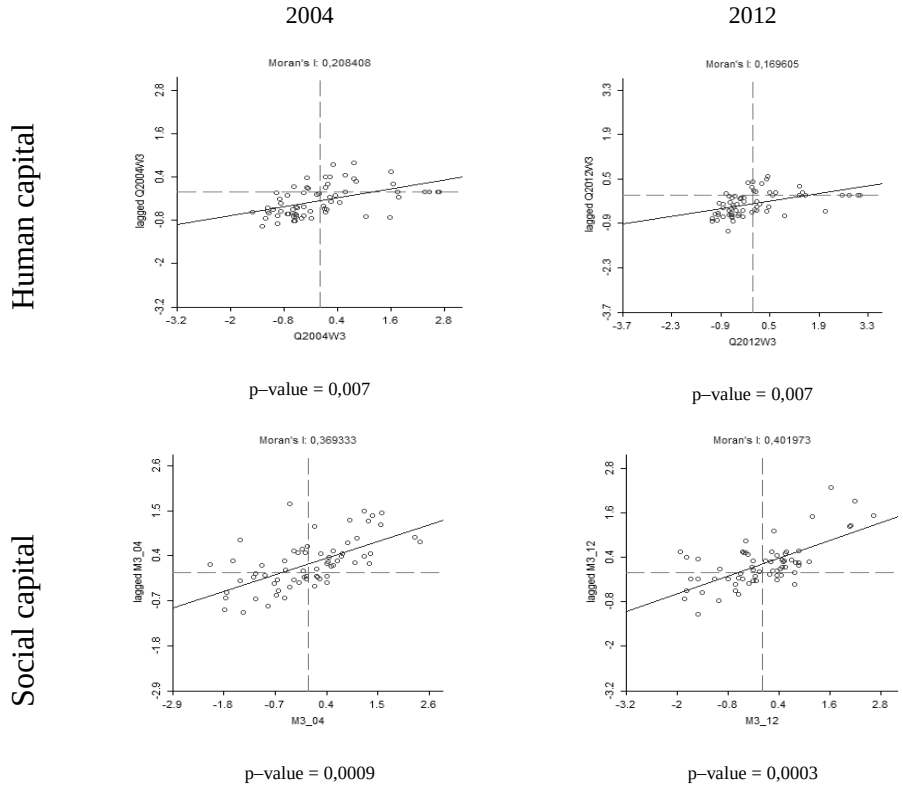
In the subregions with low levels of GNP located on the Eastern Wall, we can observe a relatively high level of human capital in both of the studied periods.

4. Relations in the shaping of human and social capital – one- and two-dimensional analysis

The first stage of the analysis was to examine whether spatial relationships occur in the shaping of human and social capital. Global spatial autocorrelation was tested using the Global Moran's I statistic, and local autocorrelation by calculating the LISA statistics. All of the statistics were calculated for the years 2004 and 2012.

Graph 2 shows the global Moran's I test results for human and social capital in the two years under analysis. In each case, the null hypothesis of the absence of spatial dependence in the human and social capital variables was strongly rejected. The Moran's I statistics show that the spatial clustering of high values (and/or low values) of both variables in the two analysed years is significant. The clustering is stronger for social capital, as the I-values are higher than for human capital. Furthermore, in the case of human capital we can see a concentration of values in the third quadrant (therefore negative), and in the case of social capital, the distribution between the first and third quadrants is more equinumerous.

Graph 2. Global Moran's I statistics for human and social capital



p–value = 0,007

p–value = 0,007

p–value = 0,0009

p–value = 0,0003

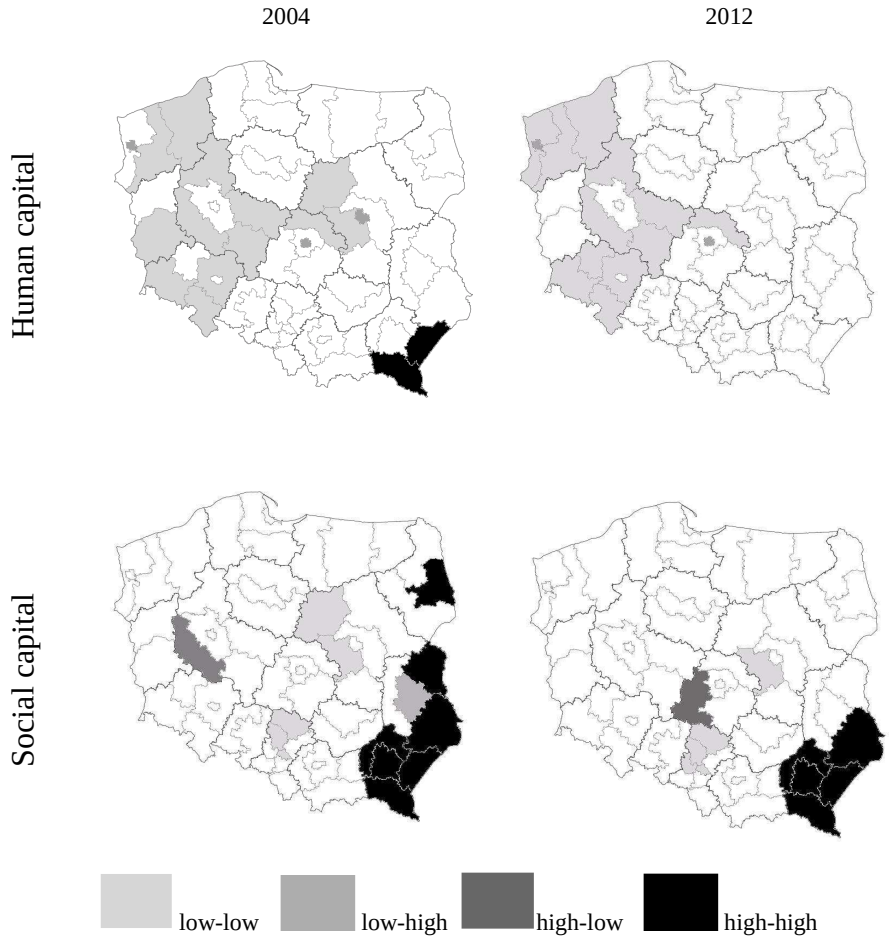
Source: own elaboration.

More detailed analysis can be done on the basis of local measures of spatial autocorrelations. This consists of studying the correlations of the variable value in the chosen location with its neighbours, and the results provide answer to the question of where precisely (in which part of the studied area) the spatial autocorrelation occurs. The values of Moran's Local Indicators of Spatial Association have been calculated and their graphic presentation is shown in Graph 3.

In the shaping of human capital values in 2004, the low – low types of relationships dominate, and therefore the subregions with low levels of human capital are concentrated in the areas of western Poland. Three cities, Warsaw, Łódź and Szczecin, are the so-called hot-spots or regions with high levels of human capital surrounded by regions with low levels. On the other hand, in 2012, the subregion of the city of Warsaw was no longer a hot-spot, which was due to the fact that the level of capital increased in the neighbouring subregions (see the map on Graph 1), yet not so much as to make the high – high type

dependence statistically important. However, social capital shows the tendency for the clustering of positive values. Important relationships of the high – high type are noticeable in 2004 in the Podkarpacie region and near the eastern border, and in 2012 – only in Podkarpacie. Additionally, the range of the low values concentration decreases – for example, in 2012 it does not cover the Ciechanowsko–Płocki subregion, which could result from an increase of the capital value in the neighbouring Włocławek subregion. The hot-spot has moved from the Leszno subregion to the Sieradz subregion.

Graph 3. Local Moran's statistics for human and social capital

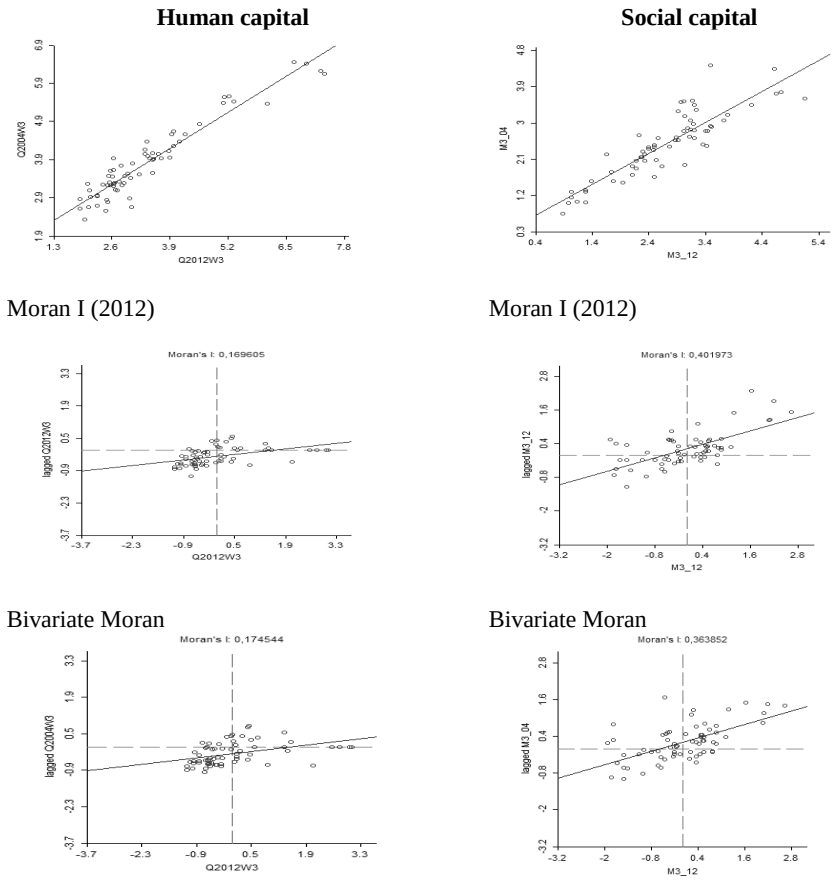


Note: only those subregions for which the statistical values are important on the level of least 0.05 are marked in colour.

Source: own elaboration.

Based on a visual analysis of the Graphs 1 and 3, it seems that the spatial patterns shaping both types of capital are rather stable over time, which is additionally indicated by the correlation coefficients: r = 0.952 for human capital in 2004 and 2012 and r = 0.881 for social capital. To confirm this, an additional analysis was performed using the bivariate Moran's I statistics. Using the bivariate Moran scatter plot in combination with the usual Moran scatter plot and the correlation plot enables an analysis of the space-time correlation patterns for human and social capital in Poland's NUTS3 regions.

Graph 4. Space-time correlation patterns for human and social capital



Source: own elaboration.

The current measurement values in a given location are compared with the past values in neighbouring locations. In the case of both measures, the correlation is positive and is of high – high or low – low type. This means that between the years 2004 and 2012 no significant changes in the spatial patterns occurred in

relation to human and social capital. In the case of social capital, the value of the bivariate Moran's I was 0.36, and for human capital it was 0.17, which means that stability of the distribution in time and space is stronger in case of social capital.

5. Human capital and social capital vs. GNPpc – an analysis of spatial relationships

The next stage of study was an analysis of the relations between human and social capital and the GNPpc level. Both local and spatial relations have been considered.

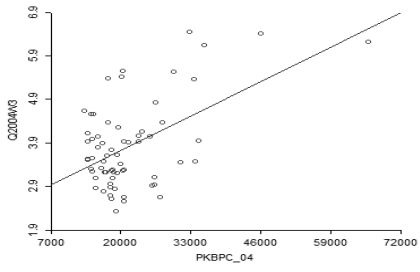
The correlation coefficients r = 0.57 for 2004 and r = 0.61 for 2012 show a positive relationship between the GDPpc and human capital in a given subregion. In 2012, the force of the relationship was slightly higher. This confirms the positive role of human capital in regional development.

However, the correlation coefficients of GNPpc with social capital in the studied years have negative values: r = -0.685 for 2004 and r = -0.631 for 2012. This result may be considered surprising because the literature hightlights the positive influence of social capital on economic development (economic growth, regional development). However, it is consistent with the conclusions resulting from the analysis of Graph 1, and it results from the choice of the diagnostic variables for the construction of the social capital measurement, in general, favoring the rural areas.

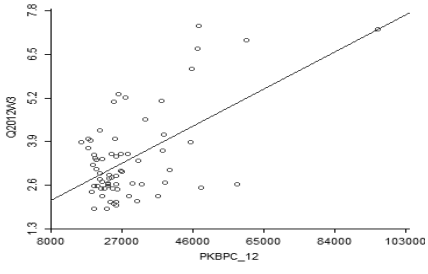
In the analysis of the spatial relationships between the GNPpc level and both types of capitals, bivariate Moran's I statistics were used, allowing an investigation of the relations between the GNPpc in a given region and the human capital or social capital in the neighbouring regions.

Graph 5. GDP per capita vs. human capital

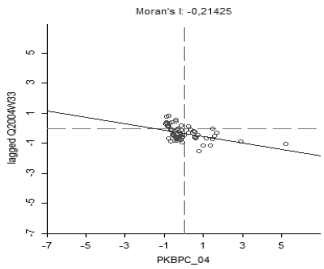
Scatter plot, 2004



Scatter plot, 2012

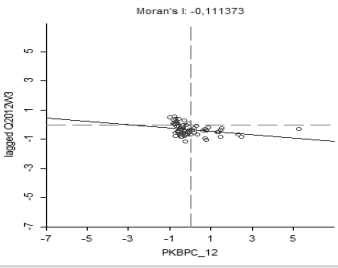


Bivariate Moran's I (2004)



p–value = 0,001

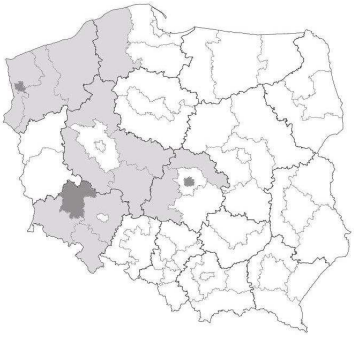
Bivariate Moran's I (2012)



p–value = 0,049

BiLISA cluster map (2004)

BiLISA cluster map (2012)



low-low low-high high-low high-high

Source: own calculations.

The values of the bivariate Moran's I statistics for 2004 and 2012 indicate the existence of a negative spatial correlation between the GNP in a given region and the level of human capital in the neighbouring regions.

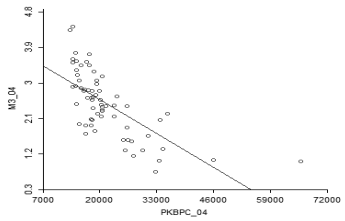
Relations of the low-low type are a definiate majority among the significant statistical spatial relations; these are subregions with low GNPpc are surrounded by subregions with low levels of human capital. There are a number of regions with high level of GNPpc which are surrounded by regions with low levels of human capital. In 2004, these were the Ciechanów-Płock subregion, the city of Warsaw, the city of Łódź and the city of Szczecin. In 2012, these subregions

included the following: the city of Łódź, the city of Szczecin and the Wrocław subregion. Based on the obtained results, we can conclude that high levels of GNPpc characterising most of the mentioned subregions constituted the incentive causing the relocation of the human capital from the neighbouring subregions. It is worth adding that the results from 2012 should be treated with great caution (the pseudo p-value is close to 0.05).

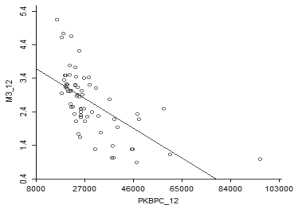
The value of the bivariate Moran's I statistics connecting GNPpc in the subregion with the social capital in neighbouring subregions, amounting in the studied years is, respectively, -0.2 for 2004 and -0.3 for 2012, indicating the existence of negative correlations. This is confirmed by the BiLISA results. Where significant, the correlation is of the low-high type: the low values of GDP is surrounded by high values of social capital. These subregions are situated in the east and south of Poland.

Graph 6. GDP per capita vs. social capital

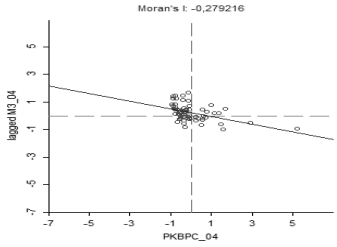
Scatter plot (2004)



Scatter plot (2012)

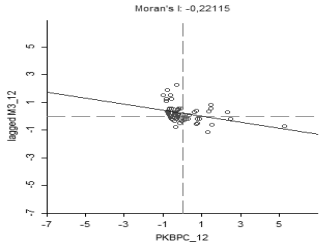


Bivariate Moran's I (2004)

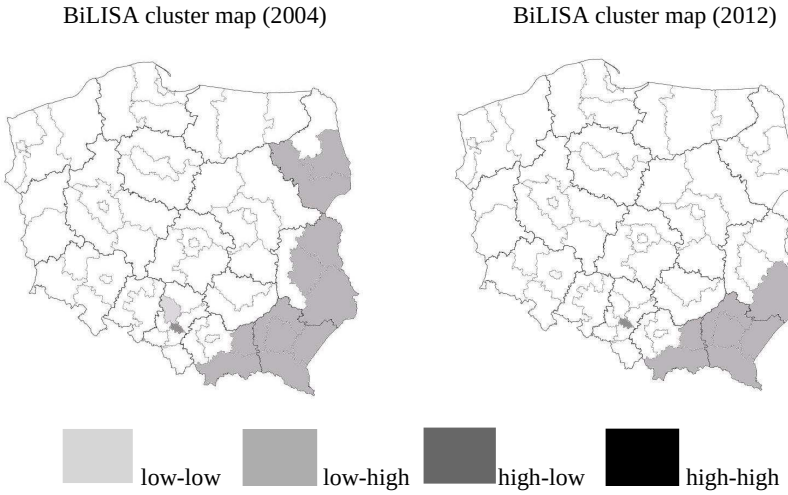


p-value= 0,002

Bivariate Moran's I (2012)



p-value=0,035



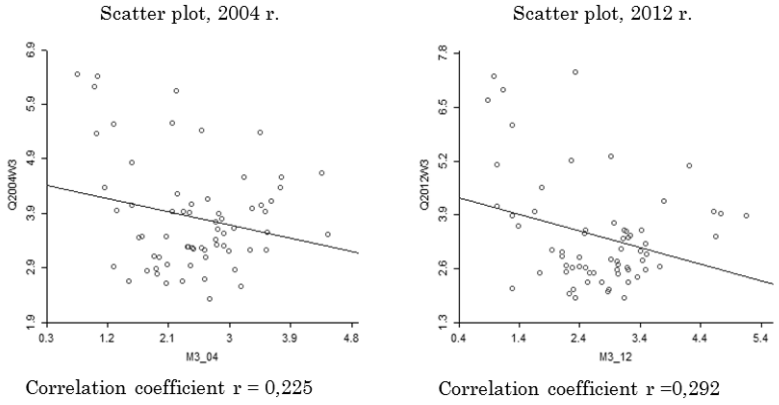
Source: own calculations.

6. Relationships between human capital and social capital in the subregions

The literature on this subject emphasises the mutual relatinships that connect social capital and human capital. On one hand, attention is drawn to the fact that in societies with higher levels of trust (social capital), individuals have greater propensity to invest in human capital (Knack Keefer 1997; OECD 2001). On the other hand, participation in education through the expansion of social networks and the intensification of social interactions and promotion of common standards supports the formation of social capital in a given society (Field 2005).

The relationship between social capital (horizontal axis) and human capital (vertical axis) in the Polish subregions in the analysed period is presented in Graph 7. The plots show a weak dependence between human and social capital. Great variation observed can be observed, as the values are highly scattered.

Graph 7. Human capital vs. social capital



Source: based on the authors' calculations.

A condition for the effective use of human capital is involvement in the social issues. In the analysed period, the correlation of both capitals in the subregions was not high, indicating that a high level of human capital is not associated with an equally high level of social capital. According to some authors (e.g., Kotarski, 2013), institutions and local leaders who are able to activate residents of a given local society to act have a great role to play.

7. Conclusions

In the studies on the competitiveness of regions, which can be defined as the ability to achieve success in economic competition, the importance of intangible factors is emphasised: human capital and social capital. The relationships between these factors and economic development on the regional level may differ from their interdependence in the national economy. Because the region differs from the national economy in that it cannot be characterised by significantly higher levels of openness enabling the easy migration of production factors, but mainly the migration of labor between the regions. This induces the conducting analyses of not only the local connections but also spatial relationships.

The presented studies confirm the large diversification of human and social capital measures in the subregions of Poland. Subregions containing big cities (Warsaw, Gdańsk, Szczecin, Wrocław, Kraków, Łódź) are the subregions with both high human capital measures and high GNP per capita. The analysis of data confirmed the positive correlation between the GNP level per capita and the human capital measure. The values of the correlation measures confirm the

relationship between the discussed categories within a given subregion. However, the results of the spatial analysis show that some subregions with high level of development are surrounded by regions with low human capital and social capital.

The analysis confirmed the presence of spatial dependence in the formation of these variables. The one-dimensional analysis showed that measures of both types of capital exhibit spatial dependency. In the case of human capital, clusters of subregions with low levels of that measure are clearly observed. The spatial distribution of social capital is different. Subregions with the highest levels of the composite indicator are situated in the east and south of Poland, and measures of the local spatial correlation indicate groupings of subregions with high levels of social capital measures.

It is worth mentioning that the measurement of both phenomena – broadly understood human capital and social capital – is extremely difficult. Limitations in the scope of the data are caused in that many essential indicators are not available on the NUTS3 level, which may impact the obtained results. Despite these methodological weaknesses, it is worth using the idea of the human and social capital in regional analyses. Passing over such important factors may result in the insufficient explanation of some phenomena and processes.

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Streszczenie

WYBRANE NIEMATERIALNE CZYNNIKI ROZWOJU REGIONALNEGO. ANALIZA ZALEŻNOŚCI PRZESTRZENNYCH

Ponieważ przestrzenne zróżnicowanie rozwoju uznawane jest za jeden z podstawowych problemów współczesnych gospodarek, podejmowane są liczne próby określenia warunków i czynników kształtujących ten proces. Wskazywane są między innymi czynniki niematerialne: kapitał ludzki i kapitał społeczny (Herbst (red.), 2007).

Zasadniczym celem niniejszej pracy jest przestrzenna oraz przestrzenno – czasowa analiza zróżnicowanae poziomów kapitału ludzkiego i społecznego. Dwa cele szczegółowe to: skonstruowanie syntetycznych mierników obu wymienionych rodzajów kapitału, oraz zbadanie interakcji przestrzennych między kapitałem ludzkim i kapitałem społecznym a poziomem PKB per capita.

Stwierdzono znaczne zróżnicowanie poziomu kapitału ludzkiego i społecznego. Zauważono koncentrację podregionów o niskim poziomie kapitału ludzkiego, natomiast kapitał społeczny wykazuje tendencję do klastrowania się wartości dodatnich. Wykazano również występowanie dodatniej zależności między PKB per capita a poziomem kapitału ludzkiego, przy czym najwyższymi wartościami obu cech charakteryzują się największe miasta. Ponadto, występują podregiony dobrze rozwinięte gospodarczo (Łódź, Szczecin, Wrocław) otoczone niskimi wartościami kapitału ludzkiego i społecznego. Może to świadczyć o zjawisku wysysania przez te regiony kapitału z obszarów sąsiednich. Korelacja między PKB per capita i kapitałem społecznym jest w większości wypodków typu low-high. Podregiony, dla których to zjawisko występuje koncentrują się w Polsce wschodniej i południowej.

Słowa kluczowe: *kapitał ludzki, kapitał społeczny, rozwój regionalny, eksploracyjna analiza danych przestrzennych*