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TERRITORIAL DIFFERENCES OF THE LIFE QUALITY, AS A COMPLEX INDICATOR IN GERMANY AND HUNGARY

AZ ÉLETMINŐSÉG, MINT KOMPLEX INDIKÁTOR TERÜLETI DIFFERENCIÁI A NÉMET ÉS MAGYAR GAZDASÁG ESETÉBEN

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Abstract

In the last three decades the analyses of convergence are in the foreground of the empirical analysis. Most of the empirical works examine the realization of convergence according the GDP indicator. In the author's opinion in some cases the GDP-based analyses do not indicate the changes of the social processes. That is why the author suggests in this recent research the use of a complex indicator to measure the inequalities of the life quality. The aim of the analysis is twofold. First to examine the spatial characteristics of the life quality compared to the GDP, and second to analyse the neighbourhood relations with the use of spatial autocorrelation methods.

Keywords: territorial inequalities, life quality, spatial autocorrelation, German-Hungarian

Kivonat

Az elmúlt három évtizedben a konvergencia vizsgálatai a szakirodalomi elemzések homlokterébe kerültek. Az empirikus vizsgálatok többsége a GDP alapján vizsgálja a konvergencia megvalósulását. A szerző megítélése szerint a GDP alapú vizsgálatok sok szempontból nem tükrözik a társadalmi folyamatokban bekövetkező változásokat, ezért a tanulmányában a szerző egy komplex indikátor alkalmazására tesz javaslatot. A vizsgálat célja kettős, egyrészt az életminőség területi jellegzetességeinek bemutatása a GDP-hez viszonyítva, másrészt a szomszédsági hatások elemzése területi autokorrelációs vizsgálattal.

Kulcsszavak: területi egyenlőtlenségek, életminőség, területi autokorreláció, német-magyar

INTRODUCTION

The territorial social and economic inequality is one of the most fundamental characteristics of space economics (Nemes Nagy, 1990; Nagyné Molnár, 2007). In the space there are not two points which have the same characteristics, because their economic, social and cultural parameters are different (Nagyné Molnár, 2007; Benedek-Kurkó, 2011). There are several methods and indices to measure inequalities depending on the aim of the analysis (Nemes Nagy, 1990).

My main research field is the analysis of the convergence process of peripheral regions, with special regards on the inner convergence of Germany and Hungary, focusing on the territories of Saxony-Anhalt (Germany) and Northern Hungary (mainly Borsod-Abaúj-Zemplén County).

In this recent research I examine the territorial differences of the life quality index (which measures the social inequalities) in Germany and Hungary. My main research question is first what kind of differences can be observed in the distribution of the life quality compared to the GDP, and second whether the spatial connection (neighbourhood effects) plays a significant role in the distribution of the values.

Life Quality as a Complex Indicator

The analysis of the spatial inequalities is not new. Several researchers have examined the field of the countries' and regions' economic development, and of the territorial inequalities. In the topic of territorial inequalities most of the studies are focusing on the disparities of the GDP per capita. But the economic viewpoint is only one aspect of inequalities. In the countries' or regions' economic development there can be huge disparities also in the case of the social and infrastructural factors and the decrease of economic differences not always goes together with social convergence. So beside the mainstream GDP based analyses it is reasonable to examine other factors which can outline also the regions' social situation. The life quality indicator can be an adequate index for this.

Giannias et. al. (1999) has examined the convergence of the life quality in the European Union for the time period 1970-90. In their research beside the GDP they used also some life quality indicators, like: consumption of the households, consumer prices, passenger car ownership, phone and television ownership, health care and population density. According their statements the convergence was realized between 1970 and 1975 in every country, but after that the countries' paths differ from each other. For example Spain and Portugal could improve their life quality but Greece has lost positions.

Hyun Song Lee (2003) has focused on the following factors by creating Korea's life quality index: income, health care, education, work, culture and information, social equality. As a result of the analysis Korea has big disadvantages in this indicator compared to the OECD average. The income of Korea had a 30 years handicap in 1995 related to the OECD average.

Marchante and Ortega (2006) have analysed the economic and life quality convergence of the Spanish regions between 1980 and 2001 based on the GDP per capita and the HDI indicator. Their statement was that regions with similar gross value added can reach higher HDI growth rates.

Einig and Jonas (2009) have examined the living conditions across the NUTS3 districts of Germany, with special focus on demographic indicators, economic conditions, labour market, welfare, real estate market, and infrastructural situation. Their results show that there are huge welfare disparities across Germany, mainly between the eastern and western part of the country.

Pose and Tselios (2013) have made a statement that there are huge welfare disparities between the different parts of the EU according the values of Sen's welfare index. As the results have showed the differences are the largest in the northern-southern relation. The welfare level of the countries of the southern periphery (Spain, Portugal, Greece and Southern Italy) reaches only the half of the EU average.

The OECD (2014) examines the regional welfare level along 9 main dimensions (income, workplaces, housing situation, health care, education, environment, security, elections and the availability of services), and calculates a ranking based on these.

In my recent research I have examined the welfare level and life quality of the German and Hungarian territories. So beside the analysis of the economic situation my main goal was to examine also the social processes. To measure this beside the GDP there was a need for using a complex indicator. Based on the above mentioned researches I have created a life quality indicator to measure the welfare of the German and Hungarian territories. Basic goal of this index was to construct such a measurement indicator which does not contain the GDP. I have used the following six dimensions:

1. life expectancy by birth,
2. education (people with secondary school qualification in the age group 18-x with 1/3 share; people with high school degree in the age group 25-x with 2/3 share),
3. health situation (infant mortality per 100000 inhabitants),
4. travelling (passenger cars per 1000 inhabitants),
5. living conditions/housing (new house building per 1000 inhabitants),
6. unemployment rate.

By weighting the six index components I used the UNDP's (2013) method which was applied in the measurement of the micro regional level HDI in Poland. In this methodology the calculation of one sub index can be made by the following equation:

$$Index = 1 + 99 * \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (1)$$

The complex life quality indicator is the geometrical mean of the six sub-indices.

$$I_{life\ quality} = \sqrt[6]{I_{lifeexp} * I_{educ} * I_{health} * I_{trav} * I_{house} * I_{unempl}} \quad (2)$$

In my research I have also analysed the role of neighbourhood effects in the distribution of the life quality indicator. The main question is whether the spatial distribution of the data is stochastic or there are kinds of patterns in the space (Varga, 2009). To achieve the results I used the spatial autocorrelation analysis. Autocorrelation means that the neighbouring territories have an influence on each other. If there is no autocorrelation, than the values are independent from each other, the distance of the regions does not matter. In the spatial autocorrelation analysis the Moran's I index is the most common used measure developed by Patrick Alfred Pierce Moran in 1950. The index calculation method is the following:

$$I = \frac{N}{\sum D_{ij}} * \frac{\sum\sum (x_i - x) * (x_j - x) * D_{ij}}{\sum (x_i - x)^2} \quad (3)$$

where $(x_i - x) * (x_j - x)$ is the product of the regions values and the difference of the means. D_{ij} is the contiguity matrix and N is the number of territories. The index's maximum is 1 and the minimum equals zero, but it has not got an exact value, for example it depends on the neighbourhood matrix. If $I > -1/N - 1$, then there is a positive and if $I < -1/N - 1$, then there is a negative spatial autocorrelation (Dusek, 2004).

By choosing the adequate neighbourhood matrix there can be used different techniques. Most simple is the use of queen and rook contiguity matrices (these are used mostly by grids – natural science and ecological analyses). Another method can be the application of distance based matrices or the nearest neighbours method. In the empirical analyses the most frequently used techniques are distance based and nearest neighbours matrices.

Other form of the calculation is the Local Moran I, developed by Luc Anselin in 1995, which creates clusters from regions. The index shows where the homogeny high developed (high-high cluster) and relatively underdeveloped territories (low-low cluster) are in the

space, and shows the regions which differ mostly from their neighbours (Anselin, 1995; Tóth-Nagy, 2013). The cluster characteristics can be seen on the following Tab. 1.

Table 1 The characteristics of the Local Moran clusters

Cluster	Characteristics
High-high	The examined territory and their neighbours also have significantly higher values than the average.
High-low	The examined territory has significantly higher value than the average, but their neighbours values are below the average.
Low-high	The examined territory has significantly lower value than the average, but their neighbours values are above the average.
Low-low	The examined territory and their neighbours also have significantly lower values than the average.

Source: Tóth, 2013.

APPLIED METHODOLOGY AND DATABASE

In my research I analysed the distribution and spatial connections of the above introduced life quality index in the two countries. Because of the availability of the data I made the analysis for 2011. In Germany I made the calculation for the 434 NUTS3 districts, while in the case of Hungary I used the 168 LAU1 micro regions. To calculate the index I applied different databases by the sub-indices, which is summarized in Tab. 2.

Table 2 Data sources of the quality of life index indicators

Indicator	Data source	
	Germany NUTS3	Hungary LAU1
life expectancy by birth	German Statistics Office	TEIR
people with secondary school qualification in the age group 18-x	Census	Census
people with high school degree in the age group 25-x	Census	Census
infant mortality per 100000 inhabitants	German Statistics Office	Hungarian Statistics Office
passenger cars per 1000 inhabitants	German Statistics Office	TEIR
new house building per 1000 inhabitants	German Statistics Office	TEIR
unemployment rate	German Statistics Office	Hungarian Statistics Office

Source: author's own compilation

Different Spatial Patterns in the Distribution of the Life Quality and GDP

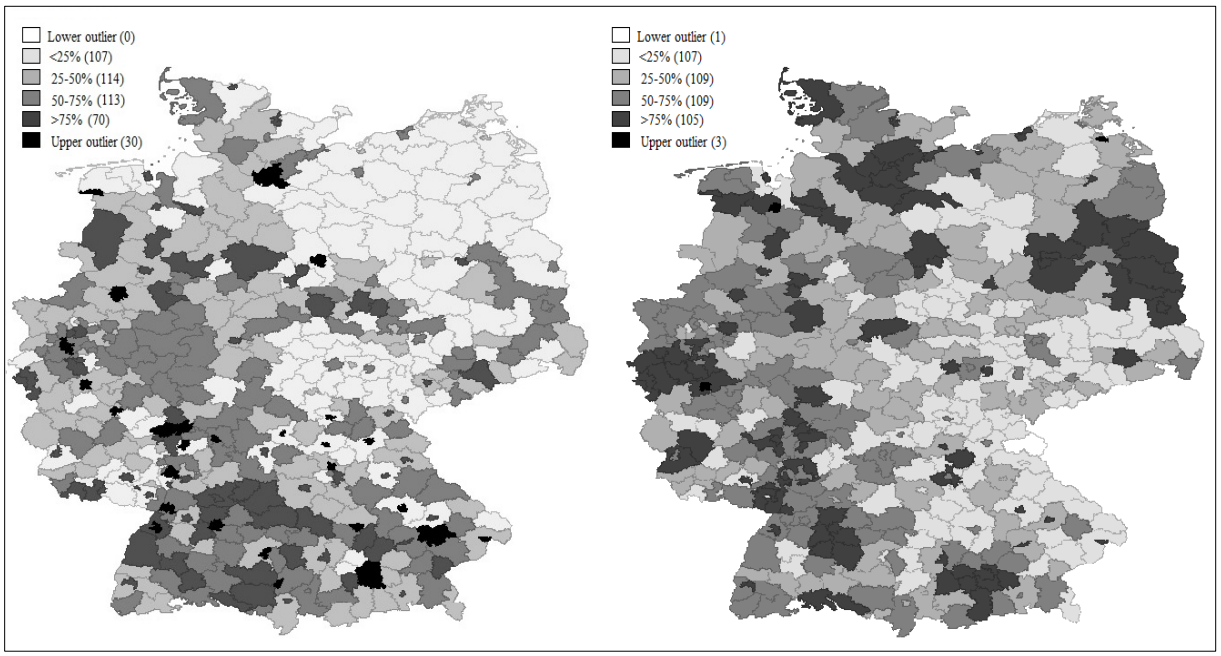
In my research I have analysed the distribution of the life quality indicator compared to the GDP in the case of the 434 NUTS3 districts in Germany, and the 168 LAU1 micro regions of Hungary. The main question was whether there is an observable difference in the distribution of the examined socio-economic indicators. In Germany the western-eastern development

differences appear sharper by the GDP per capita than in the case of the life quality indicator. By the life quality indicator the lag of the eastern territories is not so significant; for example the development level of Brandenburg and Saxony is similar to the western part of the country. Moreover there are several hot spots also in the territory of the East German provinces which are clustering in the areas of the big cities (for example higher education centres of Magdeburg, Halle, or Dessau in Saxony-Anhalt, Leipzig, Chemnitz and Dresden in Saxony, Berlin). The cause for this can be found in the complex character of the life quality. In the index the life expectancy, health and unemployment indicator does not show big standard deviation among the territories (the values of the city regions are only a little higher than in the rural areas) but the educational component, the passenger cars ownership and the house building shows big differences among the areas. Beside this in the eastern part of the country the city regions with high education institute appear also as hot spots, for example Magdeburg, Halle or Dessau in Saxony-Anhalt, Leipzig, Chemnitz and Dresden in Saxony or Berlin belong to this group (Fig. 1).

There are also some common hot spots (spatial concentration) of the two indicators, like part of the Ruhr-area, South-Bavaria (Munich, Ingolstadt), Northeast-Baden-Württemberg, Hamburg, Bremen and Braunschweig. The most developed territories in the term of the GDP can be found in the city regions of Munich, Ingolstadt and the cities of Ruhr-area (for example Düsseldorf, Duisburg, Dortmund, Essen, Leverkusen), as the least developed ones are there in Mecklenburg-Vorpommern and Saxony-Anhalt province.

The cause for the extremely high GDP can be found in a significant part of the districts by the persistence of the capital intensive big enterprises (like BMW, MAN, Siemens, Linde in Munich, Audi in Ingolstadt, Volkswagen AG in Wolfsburg, or in the Ruhr-area: E.on, Metro, Henkel in Düsseldorf, RWE and Thyssen Krupp in Essen, or Bayer in Leverkusen). Mecklenburg-Vorpommern province is mainly a rural region, which big cities also do not play great role in Germany, so its peripheral situation is observable.

Figure 1 Dispersion of the GDP per capita (left) and quality of life in Germany, NUTS3, 2011.

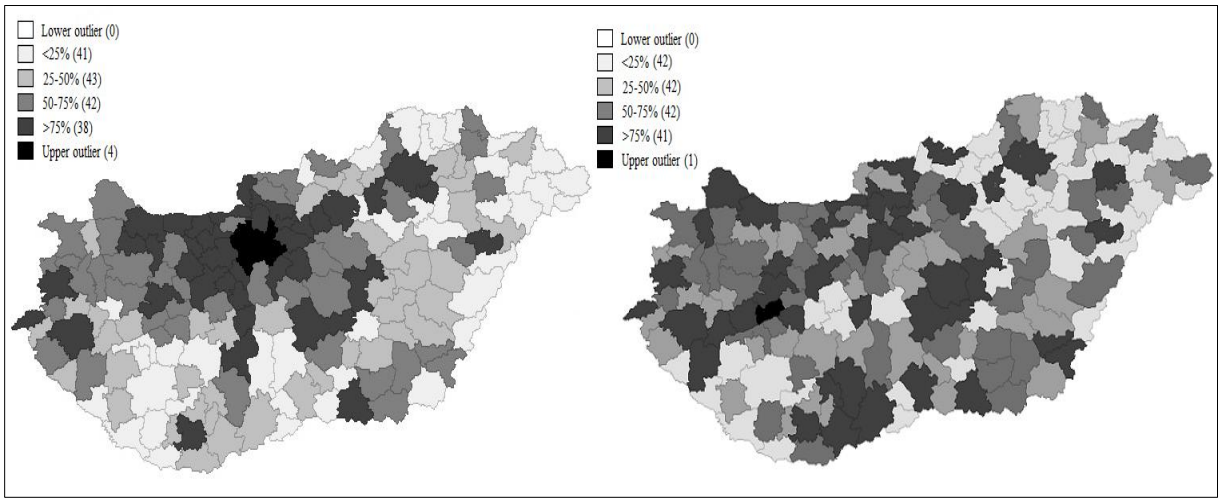


Source: author's own compilation

In the case of life quality beside Munich and Frankfurt also Münster, Regensburg, Heidelberg, Darmstadt and Bonn have good positions. In Munich and Frankfurt the educational component, passenger cars ownership and the house building is more above the average. In the case of Münster, Heidelberg, Darmstadt and Bonn the value of educational component is extremely high, which is because of the historical high schools. The life quality is the lowest in Thüringen (Sömmerda) and Saxony-Anhalt (for example Harz, Saale, Mansfeld-Südharz, Salzland districts), which is caused by several factors. The educational attainment is relatively low, there are not big university centres, and the health care also shows a disadvantage. So in the case of the GDP per capita the western and eastern territories show some different clusters, while in the case of the life quality there are some spatial concentrations in the country.

In the case of Hungary I made the analysis at micro regional level (by the GDP I have used the calculated value of the micro regional income per tax payer). In both of the indicators the centralized, radial structure of the country can be observed (highly developed Budapest-Miskolc, Budapest-Győr, Budapest-Szeged, Budapest-Keszthely and Budapest-Pécs axis). Along these axes is the highest both the GDP and life quality (Fig. 2). The cause for this can be found in the case of the GDP that many big enterprises are clustering along these axes (resulting higher income in the area), which also follow the highway structure. Moreover in the territories there is a dominant automobile industry activity at the side of producers and suppliers (Pannon Automotive Cluster and Central Hungarian Automotive Cluster).

Figure 2 Dispersion of the income per capita (left) and the quality of life in Hungary, LAU1, 2011.



Source: author's own compilation

In the case of the GDP the least developed territories can be found in the north-eastern – northern part of Hungary (Borsod-Abaúj-Zemplén, Nógrád, Szabolcs-Szatmár-Bereg counties), and in Békés county. The least developed one from these is Nógrád County. These territories are in terms of the accessibility and of the western capital intensive enterprises peripheral ones, in several cases only the county centre has significant economic potential. The most developed territories in the life quality are beside the capital in Veszprém, Pest, Fejér and Csongrád counties. In Hungary the life quality shows a more polycentric pattern than the GDP. Cause for it can be the different distribution of the passenger cars ownership, number of infant mortality, and house building volume. In the case of the life expectancy, the unemployment and the educational situation there are not so big differences among the territories.

Table 3 Linear correlation of the GDP per capita and the quality of life

Territory	Linear correlation coefficient
Germany – NUTS3	.471*
Hungary – LAU1	.567*

Source: author's own compilation
*significant correlation

The correlation analysis of the GDP and life quality indicator shows that there is a significant, positive and medium strong correlation between the two indicators in both countries, so as the GDP is increasing it has positive effects on the life quality (Tab. 3).

Weak Spatial Autocorrelation of the Life Quality

In the case of the countries I have also analysed the spatial autocorrelation of the life quality index, examining whether the neighbourhood connections have an influence on the distribution of the values. To prove the validity of the results I used three different contiguity methods: queen contiguity, threshold distance and nearest neighbours method. By the threshold distance I have used in both cases the 56 kilometres distance, because this fits for both territorial levels the best. The spatial autocorrelation results of the life quality compared to the GDP are summarized in Tab. 4.

Table 4 Differences in the spatial autocorrelation of the GDP/capita and the quality of life

		GDP			life quality		
		queen contiguity	**nearest neighbours (5)**	**threshold distance (mean centres; 56 km)**	**queen contiguity**	**nearest neighbours (5)**	**threshold distance (mean centres; 56 km)**
Germany	Moran I	**.0707**	**.1175**	**.0918**	**.3016**	**.2967**	**.2327**
	number of permutations	999			999		
	pseudo-p value	.021	.001	.001	.001	.001	.001
	z score	2.23	4.15	4.46	9.52	8.82	6.37
	Local Moran clusters	HH: 11 LL: 68 LH: 8 HL: 18	HH: 19 LL: 37 LH: 15 HL: 14	HH: 29 LL: 71 LH: 40 HL: 17	HH: 37 LL: 55 LH: 0 HL: 12	HH: 53 LL: 49 LH: 8 HL: 10	HH: 77 LL: 65 LH: 17 HL: 27
	significance level	min. 95%			min. 95%		
Hungary	Moran I	**.5561**	**.5824**	**.4812**	**.0854**	**.0726**	**.0855**
	number of permutations	999			999		
	pseudo-p value	.001	.001	.001	.001	.001	.001
	z score	11.58	12.79	16.86	5.18	7.39	7.58
	Local Moran clusters	HH: 28 LL: 26 LH: 1 HL: 4	HH: 27 LL: 22 LH: 0 HL: 2	HH: 38 LL: 46 LH: 5 HL: 7	HH: 9 LL: 12 LH: 6 HL: 7	HH: 5 LL: 14 LH: 6 HL: 6	HH: 15 LL: 23 LH: 15 HL: 8
	significance level	min. 95%			min. 95%		

Source: author's own compilation

HH=high-high; LL=low-low; LH=low-high; HL=high-low.

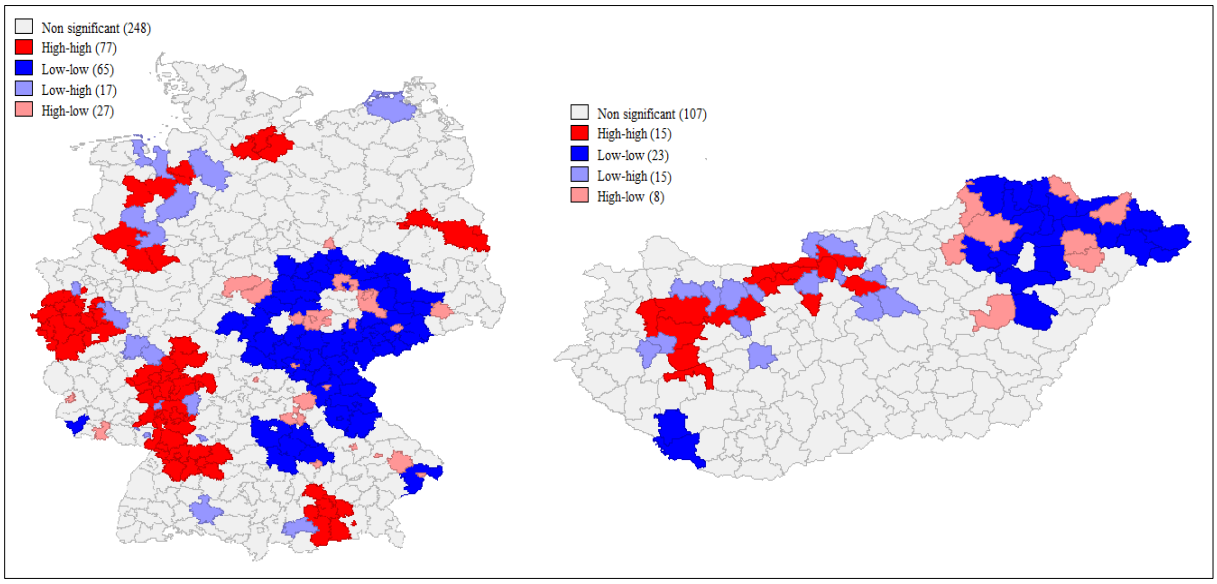
According the results can be made a statement that in Germany similar to the GDP there is a weak, positive and significant spatial autocorrelation also by the life quality. In the case of

the Hungarian micro regions the GDP per capita had medium strong positive autocorrelation, but this cannot be verified by the life quality. In that case there is only a weak connection among the neighbouring territories. But the neighbourhood effects are significant in both countries.

In Germany the members of high-high cluster can be found by every model in the territory of North Rhine-Westphalia, northeast of Rhine-area-Pfalz, west Baden-Württemberg, and in the area of Munich, Hamburg, and the capital, Berlin.

These territories are emerging because of their educational component, and infrastructural situation. They are homogenous highly developed areas according the life quality. Instead of this the low-low cluster can be defined in northeast Bavaria, and Thüringen, Saxony and Saxony-Anhalt. The appearance of the low-high cluster is rare, can be seen only in some regions of Baden-Württemberg, Rhine-area-Pfalz and North Rhine-Westphalia (Fig. 3). The high-low cluster can be found in the eastern part of the country, with city hot spots (Leipzig, Plauen).

Figure 3 Neighbourhood effects of the quality of life in Germany and Hungary, 2011.
(threshold distance based analysis results)



Source: author's own compilation

In Hungary the pattern of life quality underlines the medium strong connection between the GDP and life quality, because the higher GDP shows higher life quality patterns. The high-high cluster can be seen in the area of some micro regions of Pest, Komárom-Esztergom, Fejér and Veszprém counties, similarly to the GDP, while the low-low cluster is dominant in Szabolcs-Szatmár-Bereg, Hajdú-Bihar, Borsod-Abaúj-Zemplén and Baranya counties. The

members of low-high cluster are grouping on the peripheries of high-high cluster, and the members of high-low cluster on the peripheries of the low-low cluster.

According to the results of the spatial autocorrelation can be made a statement that the different neighbourhood matrix methods showed different results, which difference was higher in the case of the German territories. The cause for it can be found in the spatial structure of Germany, hence from the 434 NUTS3 districts there are 107 city regions. This can have an influence also on the autocorrelation. Another result of the spatial structure can be the more hot spots in the LISA clusters of Germany.

SUMMARY

In my recent research I have examined the distribution and spatial autocorrelation of the life quality indicator in Germany and Hungary. In both countries there are differences between the distribution of the life quality and the GDP per capita. The centre-periphery relations are not as sharp in the case of the life quality as by the GDP. By the life quality there is a more polycentric space pattern. In Germany the lag of the eastern provinces is smaller compared to the GDP, because the city regions and for example whole Brandenburg province appears as hot spot according the life quality. In some cases there are common hot spots of the indicators, like part of the Ruhr-area, South-Bavaria (Munich, Ingolstadt), Northeast-Baden-Württemberg, Hamburg, Bremen and Braunschweig; while Mecklenburg-Vorpommern province shows signs of a periphery. In Hungary similar to the income also the life quality underlies the persistence of highly developed Budapest-Miskolc, Budapest-Győr, Budapest-Szeged, Budapest-Keszthely and Budapest-Pécs axes. So the radial structure of the country can be observed in both indicators. In both countries there is a significant positive, but weak spatial autocorrelation of the life quality. It means that the neighbourhood effects are influential factors in the distribution of the index, but the volume of the influence is not strong.

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