

JÓZSEF NEMES NAGY – GERGELY TAGAI

Regional inequalities and the determination of spatial structure

Introduction

Issues of spatial inequalities are not just particular and partial questions of regional policy and spatial development. Reflecting on recent or bygone events and development efforts in Hungary, we can see how the aim and idea of the progress and integration of Hungary emerges almost in every period. Essentially, it just means the need *to catch up with the western part of the continent* both in the sense of economic development and mentality or in the operation of social institutions (in a ‘European’ way – Europe means of course here Western Europe). Hungary’s lag is factual in every respect, even without idealising the characteristics of the core areas of the continent. Up to date and current knowledge of the nature of these inequalities is necessary to help regional political decisions. Moreover, for these issues, it may well be worth considering new techniques and perspectives, which could lead to new relevant findings.

The aim of this paper is to present some actual connections of the Hungarian spatial structure and the characteristics of spatial inequalities. For this, it uses the statistical information background and analytical set of tools already proven in former research – also evaluated in the preliminaries (Nemes Nagy 1987, 2005). Moreover, the study illustrates the use of some representational methods and modelling of spatial interactions in answering different questions regarding spatial inequalities.

Hungarian dimensions – the global and European outlook

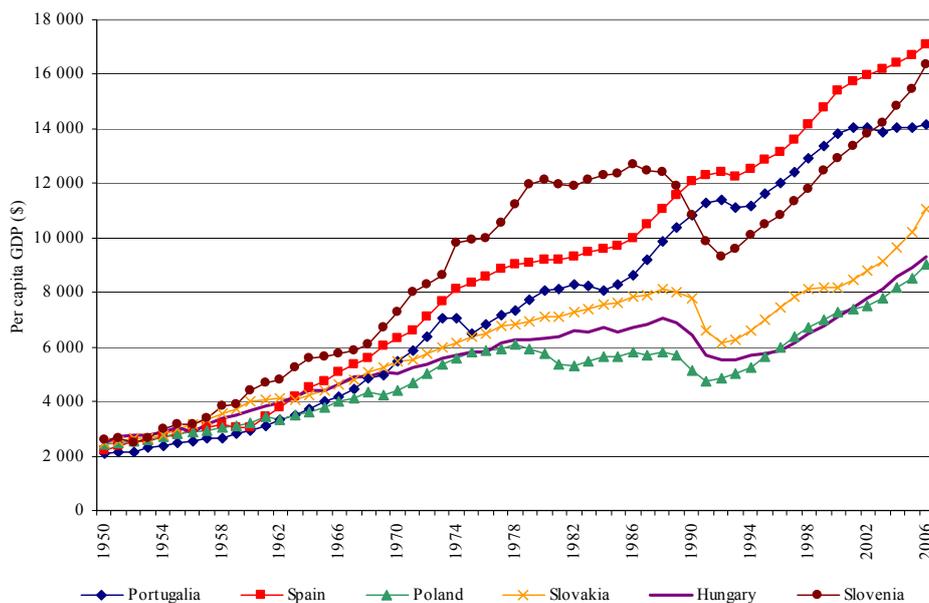
By looking at the map of global development and trying to find Hungary’s place on it, it could be suggested that *Hungary represents a very special conjunction of development factors*, some of which we would like to emphasise. Its situation is similar to that of the whole East-Central European block (of countries); one which is very expressive – like a model – as it is described and managed as a homogeneous region by global financial players. The great majority of the world’s population lives in countries or regions considerably more or less developed than Hungary. Due to the special ‘order’ of the polarised world, it *lacks a ‘middle class’* – or is that middle class actually Hungary (and its companions from East-Central Europe)? The development positions of Hungary have become fixed in the course of the 20th century, and not even Budapest has been able to reach the most developed level. According to our comparative conclusions, including two thousand regions of the world (Nemes Nagy 2006), Budapest occupies only the 200th position considering the worldwide order of rank of per capita GDP. Other parts of the

country remain generally below the national average level. The development level of Hungary is similar – or even slightly higher – to that of Latin America. Countries of Western Europe or the transatlantic areas (especially their leading regions) have nowadays hugely exceeded this comparison, while the great majority of the population of the continent-sized countries with extraordinary economic dynamics (China, India), live under poorer income and general living conditions than that of Hungary.

The study does not intend to consider the character of the multi-dimensional distances of Hungary from the developed European core areas. The aim for the country is not to catch up with these regions, only with the European ‘average’; this objective is a flexible but still distant entity. Nevertheless, this position and the desired developmental path is not clearly defined by any ‘natural law’. There are well-known examples, when several countries had the same starting conditions (position of development), but later have taken a very different path; this is illustrated using data from five other countries in Europe compared to Hungary (Figure 1).

Figure 1

Different development paths from a similar starting point in Europe between 1950 and 2008



Data source: database of Groningen Growth and Development Centre, <http://www.conference-board.org/economics/>.

Positioning Hungary in a global and continental sense, we currently find the country at the end in the order of rank of “developed countries”. This means that vital conditions suitable for the present era in Hungary are accessible to a wide degree, however, this situation also illustrates that despite intense progress, Hungary is unlikely to catch up with the most developed countries in a short time. While the global model of the most

developed countries that affects us daily is very distant, it could be considered as an example for us.

Trends of spatial inequalities

The global and continental development positions of Hungary are coupled with amplified social and spatial polarisation. The divergence of regional economic development following the transition processes is a clear and comprehensive trend. However, in line with the development level of Hungary, it cannot be called an individual, 'national' tendency, but the common spatial development path of transition (post-socialist) countries (Table 1). The former spatial equalisation tendencies (existing for decades in developed countries) have mostly stopped over the last 10–20 years. Elsewhere, opposite trends have occurred, but sharp differentiation – indicated in the table – can only be observed in the East-Central part of Europe (except for Austria!).

Table 1

Growing regional inequalities in the East-Central European New Member States of European Union (Dispersion of regional GDP at NUTS level 3)

Country	1995	2008	Change
Bulgaria	33.1	59.5	26.4
Romania	28.8	54.1	25.3
Lithuania	13.6	34.9	21.3
<i>Hungary</i>	<i>40.4</i>	<i>57.0</i>	<i>16.6</i>
Czech Republic	26.1	42.2	16.1
Poland	36.7	50.8	14.2
Latvia	37.9	49.2	11.3
Estonia	32.4	42.1	9.7
Slovakia	42.8	48.9	6.1
Slovenia	22.3	25.8	3.5
(+Austria)	30.1	26.2	–3.9

Sources: Szabó 2008, Eurostat, National Accounts.

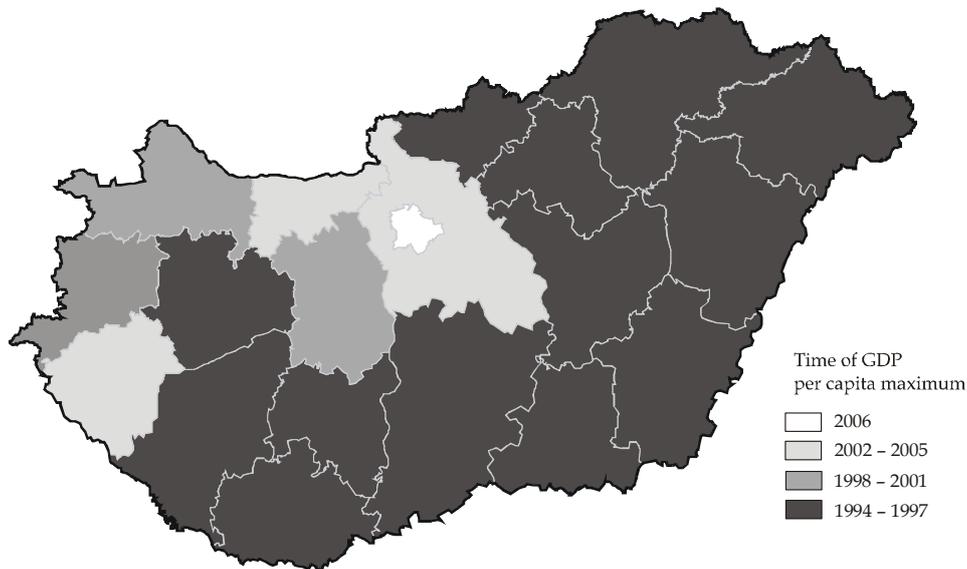
We should recognise that these countries showed strong *downward equalization* under socialism compared to their development level. Unlike in capitalist countries with the same development positions, spatial inequalities in socialist states were lower owing to a downward equalisation process, while the most developed countries showed more balanced spatial patterns due to their favourable economic positions. However, the relative spatial equalisation of socialist states had no real base according to economic processes. The socialist convergence differed from regional convergence processes of market economies, as its sectoral background was very different. While *in modern market economies, the convergence is based on the tertiarisation of economy* – in those sectors which are more strongly connected to population ratio than agriculture or industry; in socialist countries economic processes had no such content. Conversely, here, infrastructure (tertiary sector in a broad sense) was the most relegated sector. In

socialist states, the relative equalisation (financed at the cost of international indebtedness in many countries) was formed primarily by productive sectors, mass-production and equalised wage and income conditions. The change of regime resulted not only in the return to the constitutional state and market economy, but as an inevitable outcome of that it also led to *the return to the trends of market economies in the domain of regional inequalities*. This is clearly associated with *the increase of spatial differences of development and income conditions* in every socialist country owing to former relatively equalised regional characteristics.

The regional polarisation of Hungary can be illustrated in a dramatic (but not ordinary) way by mapping the maximum development levels of Hungarian counties. Figure 2 shows that except for the central parts and north-western regions of the country, every other county suffered losses in their relative development positions in the analysed period. In contrast, Budapest continuously increased its advantage (however, it has stagnated since 2006), Komárom-Esztergom is a typical example of the revived regions that although relatively recently, has closed the gap, while in the other north-eastern Transdanubian counties development positions are nowadays greatly influenced by the organic conjunctural waves of the market economy.

Figure 2

*Period of maximum development levels in Hungarian counties between 1994 and 2008
(calculation of GDP per capita in relation to national average)*



Source: HCSO, National accounts.

Spatial effects of last years' global economic-financial crisis are still incalculable. As we can see, these processes – with the shock to the financial sector – affects primarily export oriented sectors, whose operation is strongly related to credit activity. This can be observed mainly in central areas of the country, thus in a short time it can bring

downward equalisation. Nevertheless, as we know from the observations of many historical, economic crises, within the mid or longer term, the mechanisms of social and spatial shifting of the crisis will certainly begin. As a final point, the biggest losers of the crisis will presumably be lower social classes and the peripheries, resulting in the increase of spatial polarisation.

Patterns of Hungarian regional disparities – beyond the specifics at county level – include divergence between territorial levels (capital city–rural areas), a distinct regional dimension (west–east), and lesser or greater fragmentation within regions and spatial items with special social geographic content (development poles and axis). These different elements gain their essential meaning and function from different aspects. The strongly marked capital city–rural areas duality is the basic element of the structure, which ‘from a distance’ represents Hungary. It is a crude simplification but with some informative considerations, it could be suggested that this small country consists of simply Budapest and its wider agglomeration. Regional diversity underlines the dimension reflecting the level of national regional policy (as the targeted level of development and equalisation). The micro-regional mosaic and variations on a settlement level are rather the terrain of special domains of regional policy (rural and settlement development). With the rigid structure of public administration, spatial governance cannot integrate this diversity however, this is not necessary. What is required is the clear system of distinctly decentralised spatial governance with clear functions. This is still missing.

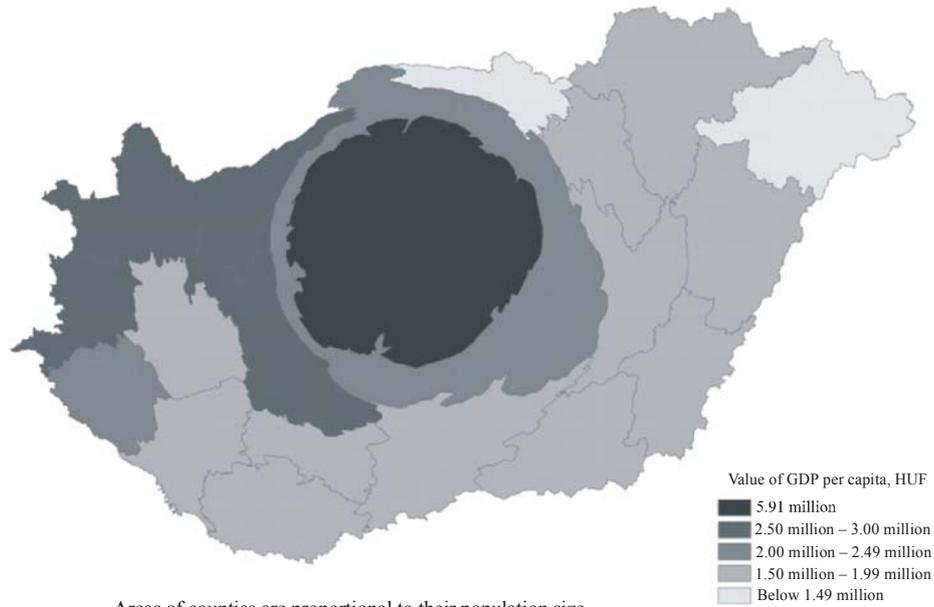
Cartograms of spatial differences in Hungary

Among the emphasised dimensions of spatial inequalities, the most fundamental is the duality of capital city and rural areas. This monocentric character is a feature of the most divided countries in East-Central Europe; beside Hungary, for example Bulgaria, Latvia and Slovakia (see Table 1).

The weight of mono-centricity in Hungary cannot be represented effectively with traditional solutions of cartography, as on these maps the unremarkable spot of the relatively small Budapest cannot express the economic and population dominance of the capital. Whereas social applications of GIS has an interesting solution used by geography for a long time. These are the cartograms. Social indicators are not represented proportional to the area of observation units (e.g. counties) on them, but proportional to the volume of population or economic power (GDP). (The topological character of these representations means that the shape of areal units changes, it becomes deformed, while their neighbourhood relations and the scheme of their spatial position remain the same). Two of these types of maps (Figures 3 and 4) are presented here to illustrate the mono-centricity of the spatial structure of Hungary. Beside this exaggeratedly emphasised aspect, other dimensions fade into the background; rural areas appear as a narrow wedge. It is especially striking viewing the cartogram based on economic power.

Figure 3

Diversity of economic development (GDP per capita) on population-based cartograms

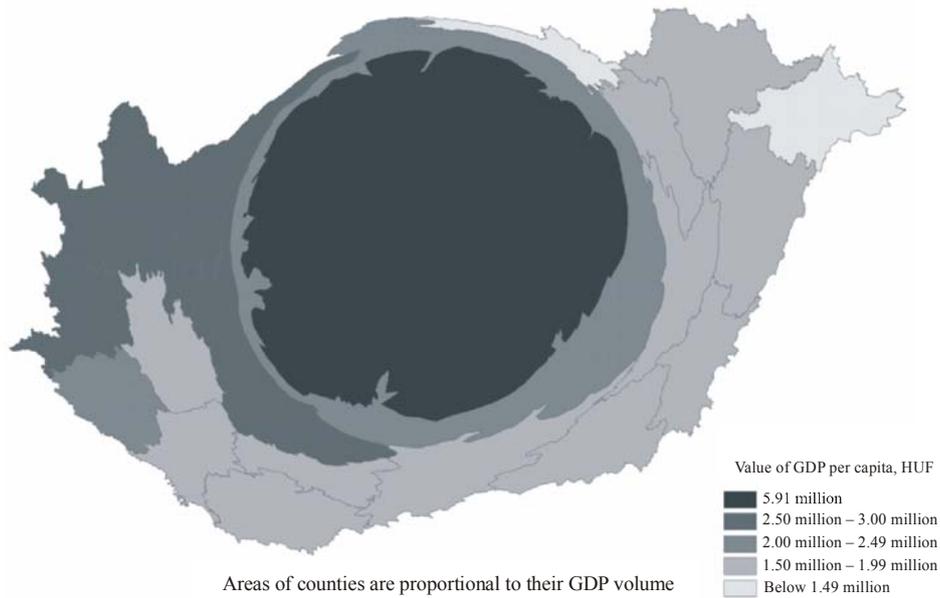


Areas of counties are proportional to their population size

Source: HCSO, National accounts.

Figure 4

Diversity of economic development (GDP per capita) on GDP volume-based cartograms



Areas of counties are proportional to their GDP volume

Source: HCSO, National accounts.

Potential models of Hungary

In social spaces, those places that have the most advantageous situation are located close to big masses, as generally, notable economic power is concentrated there and the accessibility of markets is better. These central areas – due to their positions within a given system – have the advantage over peripheries whose more isolated situation or lesser (economic) power do not allow them to be influential, active elements of the observed area.

Potential model – modelling these structures of social spaces – does not refer directly to the state of development or spatial inequalities, but explains one of their factors. Findings of international observations show that a potential model has its role in interpreting macro-structures by exploring core–periphery relations.

While the gravity model estimates the influence of a given element (e. g. a town, a country or a county) of social space on its neighbourhood, by using the potential model, we can investigate in a complex field of interactions of social space – based on the relations of mass and distance – how a single spatial item is influenced by other parts of the system. By transforming the general formula of the gravity model, it can be calculated as follows:

$v_{ij} = \frac{m_i}{d_{ij}}$, where v_{ij} is the influence of mass i in the point j , d_{ij} is the distance between

mass i and point j (distances are recorded as the shortest route – in air – among the given points). This describes the strength of the connection between the given elements of space. It can be extended in a way that the total value of potentials – of every element of the space – become interpretable, not just the interrelations between two given masses or points. For this we need to simply summarise the single potential values:

$V_j = \sum_i \frac{m_i}{d_{ij}}$, where V_j denotes the value of total potential in j . (The description of the

model and the earliest applications of it relate to John Quincy Stewart – Stewart 1942, 1948).

By interpreting *the population potentials of Hungary* – considering only this country and focusing on the interrelations within it – it can be stated that core–periphery relations in Hungary are strongly correlated to the duality of Budapest and the rural areas. In the spatial field of social interactions, every area that is far from Budapest has an unfavourable position. In fact, as values of population potentials decrease along (almost) concentric circles, it seems that in the formation of population potentials, only the distance from Budapest is the determinant factor. The population mass of the other parts of the country remarkably do not even appear; they fade into the field shaped by the capital city. Only in the peripheries where the influence of Budapest decreases – due to the greater distance – are there some more populated towns that are capable of rising above their surroundings. This is the mostly observable in the area of Debrecen and Pécs, but minor ‘vibrations’ are also detectable around Miskolc, Győr or Szeged (Figure 5).

Figure 5

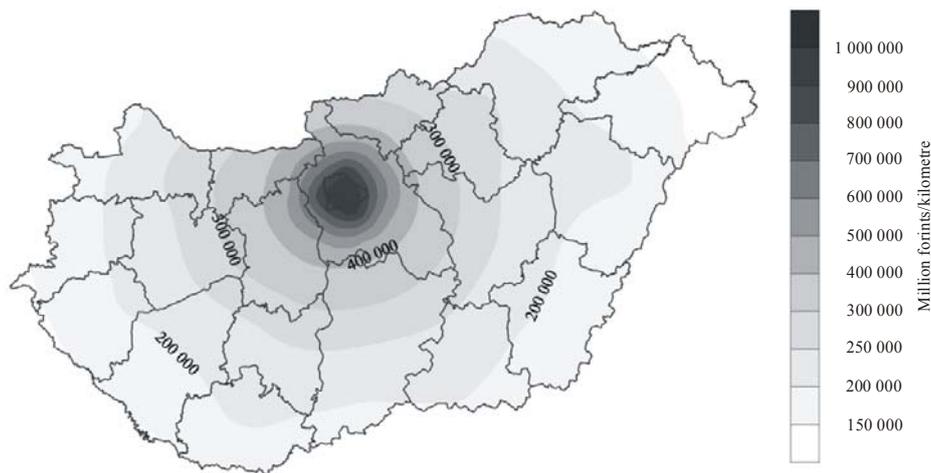
Population potentials in Hungary, 2008

Source: HCSO, Demographic statistics.

For correctly interpreting the units of measure of potential, the labels ‘person per kilometre’, ‘Hungarian forints (€) per kilometre’ refers to the model’s representation of potential intensity of economic and social interactions within a given distance. This measure gives an interpretation of the relative positions of regions within the analysed area and their favourable or unfavourable location conditions.

Economic potentials of Hungary are also mapped without external influences (from outside the country). Looking at (Figure 6), it seems obvious that contrary to the centrally positioned Budapest, the greatest part of Hungary has disadvantages according to its location conditions. In addition, the capital is closely located to the geographical centre of Hungary; its economic performance (volume of GDP) is much greater than that of the other masses. Thus, economic potential space is mainly (nearly alone) affected by Budapest, the relative spatial positions of other parts of the country depend almost only on the distance from the capital, as in the case of population potentials. The concentric decrease of potential values – increasing with distance from Budapest – illustrates this phenomenon well. This spatial pattern is not disrupted even by the county seats with notable economic weight.

Figure 6

Economic potentials in Hungary, 2008

Source: HCSO, National accounts (estimation).

While these potential maps confirm the dominance of Budapest, which is also presented on topological cartograms, something is wrong here! Every fact and analysis demonstrates the unquestionable role of the central region of Hungary, however they do not declare a concentric pattern of economic development level in the same way. Border areas have quite different positions: while the majority is typical outer periphery, there are dynamic, well-developed edges (on the western borders of Hungary) whose presence naturally cannot be explained by inner mechanisms, or by the influence of Budapest. In this case, further information can be drawn from an extension of the potential model, looking beyond the state borders, to East-Central Europe.

Potential models of East-Central Europe

European accessibility and core-periphery models (Keeble et al. 1982, Copus 1999, Schürmann & Talaat 2002, Spiekermann & Neubauer 2002) confirm that core areas of the European Union (countries and regions lying between South-Eastern England and Northern Italy) have multiple advantages in the domain of relative location – in contradiction to peripherally located Scandinavian and Mediterranean regions. This is due to the situation that accessibility conditions of the former are favourable from every part of the continent. In addition, the biggest concentration of population and regions with the most outstanding economic power are here. In this comparison, East-Central Europe (as well as Hungary) has only the role of the periphery's periphery. Local centres of the area (e.g. Prague, Warsaw or Budapest) do not possess such an economic or

population power which could be determinant in European potential fields outside their surroundings (Tagai 2004). Analyses focusing directly on Hungary also show that in a wider outlook, the pattern of Hungarian spatial inequalities is largely determined by the influence of the core areas of the European Union – e.g. location advantages of Western Hungary can be shown on the basis of this (Nemes Nagy 1998).

The area of Hungary and its neighbours cannot be seen as an independent and isolated system, the influence of regions outside the area (primarily that of the Western European countries) should also be considered. This can be realised by the calculation of outer potentials – influence coming from outside the analysed area. In this case, the formula of the potential model is changed by the replacement of the considered masses within the system to elements with a central role outside the analysed area:

$V_{jk} = \sum_k \frac{m_k}{d_{jk}}$, where V_{jk} is the outer potential of point j and m_k denotes the mass of a given

centre outside the area. The circles of the outer centres of influence cover the whole of Europe (NUTS2 units in the case of Norway and Switzerland, as well as other countries such as Albania, Republic of Macedonia, Belarus, Moldova and further parts of Ukraine). However, eventually only those elements were considered as parts of outer potentials whose measurable influence was notable in the totalised outer potentials (more than 0.5%).

An almost overall picture of spaces of social interaction can be interpreted by the calculation of totalised potential influences within and outside the analysed system. Further, the strength of a given area (self-potentials) is also considerable. This cannot be calculated by using the basic formula of the potential model – to avoid the division by zero

($V_{jj} = \frac{m_j}{d_{jj}}$). However, to every single areal unit, a fictive self-distance can be attached

which can be defined for example by the calculation of the radius for a circle, whose area is equal to the area of the given NUTS 3 unit.

With the calculation of outer potentials and the consideration of patterns of interaction within a system like the self-strength of the analysed areas – summed as total potentials ($V_{jt} = V_{jj} + V_j + V_{jk}$) – those interrelations can be explored, which help to interpret the socio-economic characteristics of a given area on the basis of its relative location within a system, together with its inner structures.

The main feature of *population potentials* characterising Hungary and its surroundings is the tendentious decrease of potential values towards the south and east. This can be interpreted as a result of the impact of outer potentials of the analysis – mainly that of the Western European core as the topmost point of the slope on the population surface. In this way, it denotes the peripheral situation of Hungary and its surroundings (primarily southern and eastern neighbours) within Europe. Naturally, in this part of Europe, there are also large towns, populated places with several million inhabitants, but these look small beside a metropolis like London or Paris. Moreover, conurbations like Randstadt in the Netherlands or the Ruhr district in Germany have not formed within the surrounds of Hungary. It is typical in countries of this part of Europe, that the capital can have (one–two) millions of inhabitants while other towns can reach only a fraction of it. In addition, larger centres are distant from each other, thus synergic

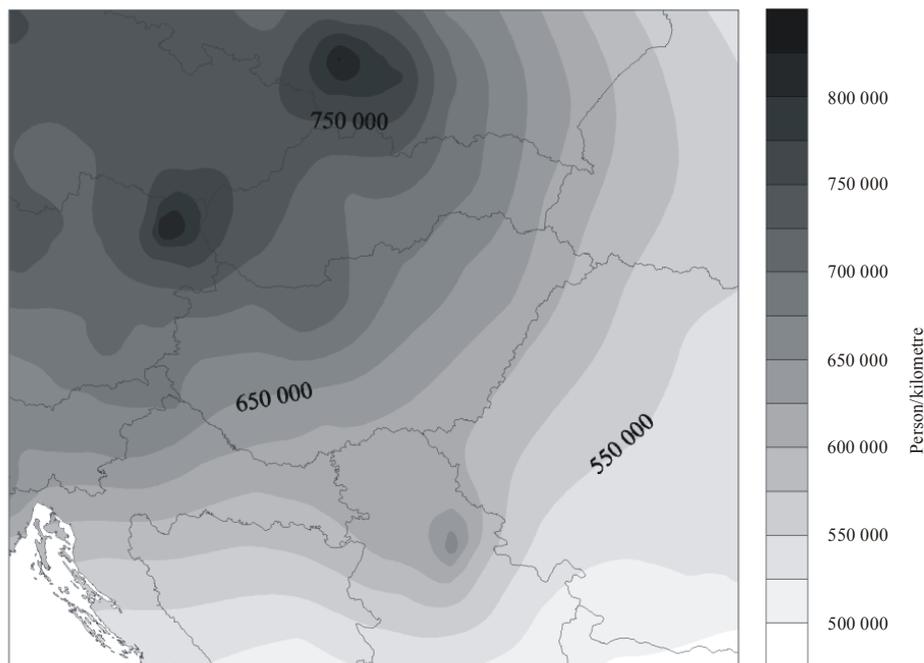
effects – raising the western part of Europe above other areas in the fields of spatial interactions – cannot be effective (Figure 7).

However, there is an exception. The conurbation of Silesia in Southern Poland is the biggest contiguous populated place in East-Central Europe (about 5 million inhabitants). As in the surroundings of Silesian NUTS 3 regions, there are other highly populated areas (Krakow or Ostrava and its neighbourhood in the Czech Republic), that generate medium synergic effects. Due to this, in the wider surroundings of Hungary, values of population potentials reach their local maximum here.

Although the effect of Western European population centres is greater in Austria due to their relative geographic nearness, here only the eastern part of the country (Vienna) can rise above its surroundings. Conversely, potential intensity is below the population potential level of Southern Poland. Starting from Vienna and the surrounding NUTS 3 units, the surface of potential space declines not just towards the south and east but also the west, which denotes that the neighbourhood of Vienna – including the near Bratislava, capital of Slovakia – forms a positive anomaly in the interaction structure of Europe.

Figure 7

Population potentials in East-Central Europe, 2008



Source: Eurostat, Demographic statistics.

In Hungary, the population concentration of Budapest and Pest county with 3 million inhabitants is actually the southern extension of this anomaly. Otherwise, the decline of the population potential surface in Hungary would fully adapt to the south-eastern

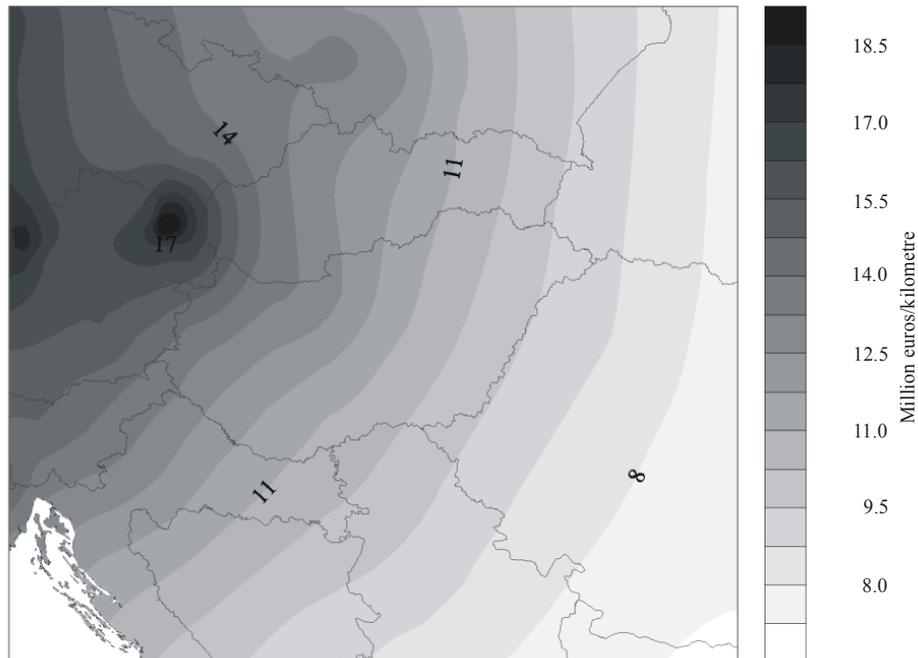
direction, but the capital is such an important local centre (the real centre of the Carpathian basin), that it does not fade into the general patterns, moreover it also raises its surroundings. Positive effects of Budapest and Pest county also reach some parts of Slovakia whose facilities are otherwise mostly formed by the neighbouring regions of Austria, Czech Republic and Poland.

The other notable towns, more populated regions of the surrounding countries hardly benefit from the synergic effects coming from the population weight of the mentioned local centres. They fade into the general European pattern; they appear at most as vibrations in the otherwise smooth-running potential curves (e. g. the neighbourhood of Graz, Zagreb or Kosice). The only exception is Belgrade, capital of Serbia with one million inhabitants, which can moderately rise above its surroundings. However, the potential level of social intensity is below the volume of population potentials measurable in the greater part of Hungary.

Patterns of potential economic interactions – modelled with economic performance (GDP) – are much clearer than population potentials. The interaction influence of economic centres outside the analysed area (almost the whole of Europe) practically dominates the structure of economic potential space. Considering population concentrations, East-Central Europe can more or less reach the level of the western part of the continent (with its metropolises and conurbations with some millions of inhabitants) – at least East-Central Europe also has local centres appearing as positive anomalies in the population potential space. Conversely, considering economic power it lags far behind the western economic core. Thus, Hungary and its wider neighbourhood are only really peripheries compared to these core areas due to their limited economic power, the poor synergic effects, and the distance from the western core. This area is not an individual and active region, forming the spaces of interactions, but it is greatly influenced and its economic potentials decrease almost uniformly – beside some anomalies – towards to the south-eastern edge of the continent (Figure 8).

As an advanced outpost of the Western European economic core, Vienna is the only real active unit of the space of economic potentials. Due to its proximity, its direct influence on the eastern part of the Czech Republic and in the western regions of Slovakia and Hungary is highly notable, but its indirect synergies are also detectable as for example it presumably strengthens the positive anomaly of Silesia. In this pattern of economic interaction space Silesia is a minor but slightly appearing local centre. It cannot exert much influence outside its close neighbourhood, which could counterbalance the level of peripherality resulting from the great distance from the western core.

Figure 8

Economic potentials in East-Central Europe, 2008

Source: Eurostat, National accounts.

Emphasising the position of Hungary, it can be said that the patterns of economic potentials hardly differ from the structures of the well-known factors of development: the basis of the (spatial) economic inequalities can be described with the elevation of the central part of the country (mainly Budapest) and a slope facing south-east. It confirms the supposition that the western counties of Hungary have advantages in their relative location in contrast with the eastern part of the country. The modelled effect, the positive impact of the relatively smaller distance of the Western European core is really working. Budapest, as the economic centre of Hungary rises only slightly above its surroundings under these circumstances, its active area is also limited, and it fades gradually into the space of economic interactions dominated by the Western European core.

Conclusions

Beyond emphasising some interesting methodological elements of this paper (that may provide inspiration for their use to the readership) and the repetition of the most important findings, as a conclusion we close the study with some ideas for regional policy and strategy – that have not been mentioned before.

The first of them can be stated in relation to the *monocentric* character of Hungary (declared in almost all the analytical works). The dominance of the capital within the

country is an unchangeable fact – naturally none of this can hide the divided nature and the inner problems of the capital and its region. Regarding the moderation of duality between the capital and the rural areas, *the size and the weight of the aimed areal units* have an essential importance (beside many other conditions). The dynamising of small, fragmented regions, the “counter-pole” programme focused on a county seat level (incommensurable with the capital) had no chance in this sense, although their content could support local development. The only considerable administrative level should be the level of NUTS2 *regions*. The loss of their importance as well as the appreciation of any other administrative units of development (spatial units with local role but without the capability of correcting the lack of balance, e.g. small districts, towns) – instead of the comprehensive and rational development of regions, is a *serious error of regional policy*.

Another emphasised finding of this study is *the existence of active mechanisms of spatial organisation irresistibly breaking through national borders*. This draws attention (also in the sense of methodological, thematic issues) to the need for abandoning provincialism experienced in many works dealing with the analysis of regional processes, and to the need to strengthen the role of international comparative investigations. This idea should have a major role in Hungarian spatial planning, which in most cases only realises international character in attaching development projects to the financial sources of the European Union.

REFERENCES

- Copus, A. K. 1999, *A New Peripherality Index for the NUTS3 Regions of the European Union*, ERDF/FEDER Study 98/00/27/130, A Report for the European Commission.
- Keeble, D. & Owens, P. L. & Thompson, C. 1982, ‘Regional Accessibility and Economic Potential in the European Community’, *Regional Studies*, 6., pp. 419–432.
- Nemes Nagy, J. 1987, *A regionális gazdasági fejlődés összehasonlító vizsgálata*, Akadémiai Kiadó, Budapest.
- Nemes Nagy J. 1998, ‘A földrajzi helyzet szerepe a regionális tagoltságban’ in Fazekas K. (ed.), *Munkaerőpiac és regionalitás*, MTA KKI, Budapest.
- Nemes Nagy, J. 2005, ‘Fordulatra várva – a regionális egyenlőtlenségek hullámai’, in *A földrajz dimenziói*, Dövényi, Z. & Schweizer, F. (eds.), MTA FKI, Budapest.
- Nemes Nagy, J. 2006, ‘A regionális fejlettségi tagoltság keresztmetszeti összehasonlítása’ in *Kárpát-medence: települések, tájak, régiók, térstruktúrák*, Györi R. & Hajdú Z. (eds.), Dialóg-Campus, Pécs-Budapest.
- Schürmann, C. & Talaat, A. 2002, ‘The European Peripherality Index’, *42nd Congress of the European Regional Science Association*, Dortmund.
- Spiekermann, K. & Neubauer, J. 2002, ‘European Accessibility and Peripherality: Concepts, Models and Indicators’, *Nordregio Working Paper*, 9.
- Stewart, J. Q. 1942, ‘A Measure of the Influence of a Population at a Distance’, *Sociometry*, 1., pp. 63–71.
- Stewart, J. Q. 1948, ‘Demographic Gravitation: Evidence and Application’, *Sociometry*, 1–2., pp. 31–58.
- Szabó, P. 2008, ‘A gazdasági fejlettség egyenlőtlensége az Európai Unió különböző területi szintjein’, *Területi Statisztika*, 6, pp. 687–699.
- Tagai, G. 2004, ‘Kelet-Közép-Európa gazdasági és népességi potenciátere’, *MTA KKI Műhelytanulmányok*, MT-DP, 2004/26.

Keywords: Regional inequalities, determinations of spatial structure, autocorrelation, space–time map, topologic cartogram, gravity modelling, potential model, potential space.