

SPATIAL DISTRIBUTION OF SZÉCHENYI 2020 RESOURCES IN HUNGARY, WITH TO SPECIAL REGARD TO THE GINOP AND TOP PROGRAMS

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Summary

In my article, I use linear regression to explore whether there is a correlation between the entire Széchenyi 2020, Economic Development and Innovation Operational Program and the Territorial Operational Program, as well as income, unemployment and emigration. Furthermore, the territorial specificity of the payments of these operational indicators is presented by quartile analysis and spatial autocorrelation study.

Keywords: countryside, support, district, difference

Signal Classification: P25

Introduction

After Hungary's accession to the European Union in 2004, a short 2-year transition period began, followed by the 7-year development period of the New Hungary Development Plan. Here we arrived at the 2014-2020 development cycle, which was named the New Széchenyi Plan, but its payments only started in 2015, as there was a one-year transition period. The allocation of resources was carried out according to the previous methodology, but an important element was the preservation of the population of rural areas in addition to increasing competitiveness and population retention. The increasing migration of labor within the borders of the European Union has become a crucial point for Eastern European countries. At the peak of the Member States' planning period, there is a Partnership Agreement document, which is binding on all countries.

There was no such basic document in the previous cycle. This provides a kind of higher level of cooperation, as it provides a fully comprehensive development policy through the Cohesion and Structural Funds, the European Agricultural Fund for Rural Development and the Fisheries Fund, in line with the Member States' program. Member States' partnership documents are coordinated by the European Commission, which must be in line with the Europe 2020 strategy. Compared to the development of the previous cycle, there are no regional territorial level operational programs in Hungary, there are a total of 10 sectoral operational programs, which finance the development and sustainability goals. I would like to present the territorial distribution of payments of these programs between 2015 and 2021 (except for the Rural Development Program) with my article and get an answer to my hypothesis that operational programs contribute to population retention, especially the Economic Development and Innovation Operational Program (GINOP) and Territorial Operational Program.

Literature review

The design period of the 2014-2020 cycle was marked by a much greater degree of integrity. The Structural and Cohesion, European Agricultural and Rural Development and Fisheries Funds had to establish a comprehensive network of contacts in line with Member States' policies.

According to Faragó, in formulating the framework for the 2007-2013 programming period, in the eyes of the Western Member States, the former socialist area is like that which needs to be Europeanized, communicated to them, developed values and democratic institutions. The development of common targets agreed by all Member States is mainly influenced by large net contributor countries and is less reflective of the specific needs of less developed countries. These demands make the poor eastern region vulnerable (Faragó, 2016).

According to Éva Perger, at the end of 2007 the GDP per capita compared to the average of the EU member states was lower in Hungary than in 2004 at the national level, only in 2004, while the employment and unemployment indicators improved practically unchanged elsewhere. And after the crisis erupted, almost all of our indicators deteriorated significantly. Territorial inequalities within the country have increased, further widening the gap with the EU average in some regions. Of course, many factors influence the development of macroeconomic indicators, yet it

is thought-provoking that these indicators do not reflect the fact that Hungary has been able to use the EU subsidies provided by cohesion policy (Perger, 2010).

Széchenyi 2020

As early as October 2012, preparations for the new cycle began, both for the Partnership Agreement and the operational programs. The Partnership Agreement is drawn up by the Ministry of National Economy with the involvement of each ministry, but is approved by the Commission of the European Union. Three highlight sections can be distinguished. In the first phase, the Partnership Agreement continued to be based on top-down comments, and then in the second phase, the design of the Partnership Agreement continued with the involvement of operational programs, as well as a wide-ranging consultation in the framework of higher cooperation. The third phase was on finalization through consultations with the European Commission (Miniszterelnökség, 2014). The Széchenyi 2020 program plan for the cohesion and development goals of Hungary for the 2014-2020 cycle was born with the completion of the third phase. The regional operational programs have been terminated compared to the previous cycle. The operational programs adopted by the Commission are as follows:

- Human Resources Development OP (EFOP)
- Economic Development and Innovation OP (GINOP)
- Integrated Transport OP (IKOP)
- Environment and Energy Efficiency OP (KEHOP)
- Support of Persons in Need OP (RSZTOP)
- Territorial OP (TOP)
- Competitive Central Hungary OP (VEKOP)
- Rural Development Program (VP)
- Public Administration and Services OP (KÖFOP)
- Fisheries OP (MAHOP)

Territorial Operational Program (TOP)

The TOP is funded by the Cohesion Fund, the European Regional Development Fund (ERDF) and the European Social Fund (ESF). Of the NUTS2

regions of Hungary, only the Central Hungary region is not eligible for TOP resources.

It has two main goals, which are to promote economic development and increase employment by developing local conditions, and to create a settlement image that is business-friendly and enhances the population retention force. It has a total of 7 priority axes, which mostly target urban spaces (Nemzetgazdasági Minisztérium, 2015):

- Development of a regional economic environment to promote employment
- Business-friendly, population-retaining settlement development
- Transition to a low-carbon economy, especially in urban areas
- Improving local community services and strengthening social cooperation
- County and local human resource development, employment promotion, social cooperation
- Sustainable urban development in cities with county status
- Community-led urban local development

Economic Development and Innovation Operational Program (GINOP)

It is also funded by the ERDF and the ESF, but it was created specifically for economic development. In addition to the development and growth of small and medium-sized enterprises, its main objectives are to expand employment and create competitive jobs. It focuses on 5 main economic development goals (Nemzetgazdasági Minisztérium, 2014):

- Creation of advanced enterprises that will not require state aid in the future
- Avoid market failures and untapped endogenous resources
- Development of enterprises with added value and export growth potential
- Bringing R&D and technological innovation to the forefront
- Increasing embedding in global systems in addition to local and national economic integration

Development policy of other EU countries

Of the V4 countries, Poland has stuck to its development policy. According to them, the structure of the programs adopted for the 2007-2013 programming period was based on the experience gained from the implementation of the first edition of

the operational programs under the 2004-2006 perspective. At that time, bold decisions were taken on the design of national and regional programs, including the implementation of the Infrastructure and Environment Operational Program, the EU's largest multisectoral program, the decentralization of responsibility for managing about a quarter of regional allocations or the commitment of region-specific interventions. Eastern Poland, for example, could have developed under a separate program. The results of the analysis of the implementation of the operational programs for the period 2014-2020 in terms of expenditure and achievement of indicators show that the assumptions made have proved to be correct in most cases and should be continued in 2014-2020. That is why sectoral and regional operational programs have also remained. In addition to the 16 regional programs, not 4 but five sectoral programs have now been demarcated (Poland Ministry of Infrastructure and Development, 2014). Romania has continued the path it has started and has continued to mobilize cohesion funds along 8 operational programs to achieve 11 thematic objectives (Ministry of European Funds, 2014). However, in the case of Slovakia, for example, there are no longer regional programs, only an integrated approach to the regional allocation of resources, so 9 operational programs have been established. Neither did Austria vote by hand, as in the 2007-2013 period, so 2014-2020 is left with only one comprehensive operational program, aiming at research and development, enhancing the competitiveness of SMEs and building a low-carbon economy. The five sectoral operational programs of the previous cycle remained in Romania (European Commission, 2014).

Overcoming major territorial disparities is almost impossible. According to Rehnitz, several types of urban or urban spaces can be demarcated, which suggests that some areas will never be the driving force for catching up, but not even on a growth trajectory. Unfortunately, there are zones of deep poverty and permanent periphery that will be even more backward in the future, and the attractiveness of capitals will further exacerbate territorial disparities. In his view, only certain core areas can form development hubs and common EU development principles will never lead to a uniformly developed pan-European catch-up towards territorial cohesion due to the different territorial and economic policies of countries (Rehnitz, 2016).

Methodology

I retrieved the data from the Teir system for 2015-2021 in terms of actual payments. No payments were made in 2014, and funding from most operational programs only started in 2015. I am conducting the analysis at the district level, as many smaller settlements did not benefit from these sources at all, so it is not worth conducting a settlement-level study. I performed the analysis on a total of 174 districts, performing linear regression, quartile analysis, and spatial autocorrelation analysis. I worked with 6 indicators in the linear regression calculation, these were the payments of GINOP/1000 capita, TOP/1000 capita and Széchenyi 2020/1000 capita to the Unemployed/1000 capita, Net migration/1000 capita and Income/1000 capita. I omitted the Territorial Operational Program from the analyzes of Széchenyi 2020 because I conducted a separate study on it. I used several IT programs in the study, so I basically clarified the data tables in Excel, and then I used the IBM SPSS statistical data analyzer and GEODA GIS software to illustrate the results.

Linear regression

Csallner explains univariate linear regression by presenting the relationship between an independent and a dependent variable along a regression line. The coefficient of determination, r^2 , shows the extent to which the independent variable explains the changes in the dependent variable. If r^2 approaches 0, then there is no more significant relationship between the dependent and independent variables, if it approaches 1, the relationship is already much more significant. If there is a significant correlation between the two variables, but r^2 is small, it means that other factors also play a role in determining the independent variable. (Csallner, 2015)

According to Sajtos and Mitev, in the correlation and regression models it is not possible to state immediately that there is a causal relationship between the two variables, but in the regression analysis, we can separate dependent and independent variables. In fact, this is what makes the difference between the correlation and regression models, and we are looking for estimated values here compared to the correlation analysis. In the model, we assume that there is a linear relationship between the dependent and the independent variable. (Sajtos-Mitev, 2007)

Quartile analysis

According to Altman and Bland, group analysis can be useful in statistical analyzes as a rather useful method of characterizing the population, although any analysis that reduces the population is associated with loss of information. They were used primarily to illustrate data collected from medical research, but are also an accepted method in the social sciences for characterizing the population (Altman and Bland, 1994).

According to Luc Anselin and Bao, if we are curious about the spatial distribution of only one indicator, the map of quartiles is perfect. He mainly illustrated the possibilities provided by the Arc View program, which will later be used by the Geoda software. There are four groups that are supplemented by a salient value that is separated from quartiles by so-called “fences” (Anselin - Bao, 1997).

So the basis of the analysis is to divide the population into 4 parts. Based on these, there is a lower 0-25, 25-50 and upper 50-75 and 75-100 percent groups. The distribution is based on the number of elements, but we can also take into account the outliers, on the basis of which we can define two types of groups. We speak of a slight outlier if the deviation of the data from the median is at least 1.5 times the quartile range but not more than 3 times. We speak of an extreme outlier if the deviation of the data from the median is at least 3 times the quartile range (Spssabc, 2020).

Spatial autocorrelation analysis

According to Géza Tóth, one of the basic questions of regional science is how similar or different the appearance of a phenomenon on a given territorial unit is compared to the values of neighboring territorial units. Based on the quantification of the similarities, conclusions can be drawn about the spatial correlation system of the examined phenomenon and its nature (Tóth, 2003).

The first spatial autocorrelation studies are named after Moran and Geary, who first began exploring the relationships between territorial units as early as the early 1950s. The next milestone can be seen in the work of Cliff and Ord in the early 70s, who have already explicitly written about spatial correlation. Subsequent

discussions described possible errors in the model as well as the nature of the spatial weight matrix, based on both the Moran and Geary methods. While the former takes into account the covariance between areas, the latter takes into account the numerical difference between places. Then more and more researchers started using it because it is capable of system-level analysis, so it can work with larger data sets. With the development of informatics, researchers such as Getis or Anselin (Getis, 1999) have used it more and more widely.

Based on Dusek's work, the neighborhood matrix is an important factor in establishing neighborhood relationships. If the value of those two adjacent elements is 0, then we cannot talk about neighborhood, if it is greater than 0, then yes. Territorial units are not neighbors to themselves. Two types of shapes can be distinguished in autocorrelation analysis, point shapes and area shapes, and these also have additional types and combinations. An irregular point shape examines the nearest points, and relationships with other factors can also be weighted. Territories can correspond to countries, counties or other smaller territorial units. The fact of neighborhood can also prove the existence of a common border, but it is also possible to turn spatial shapes into point shapes by designating central axes at the spheres. Here, too, it is even possible to weight according to several methods (Dusek, 2005).

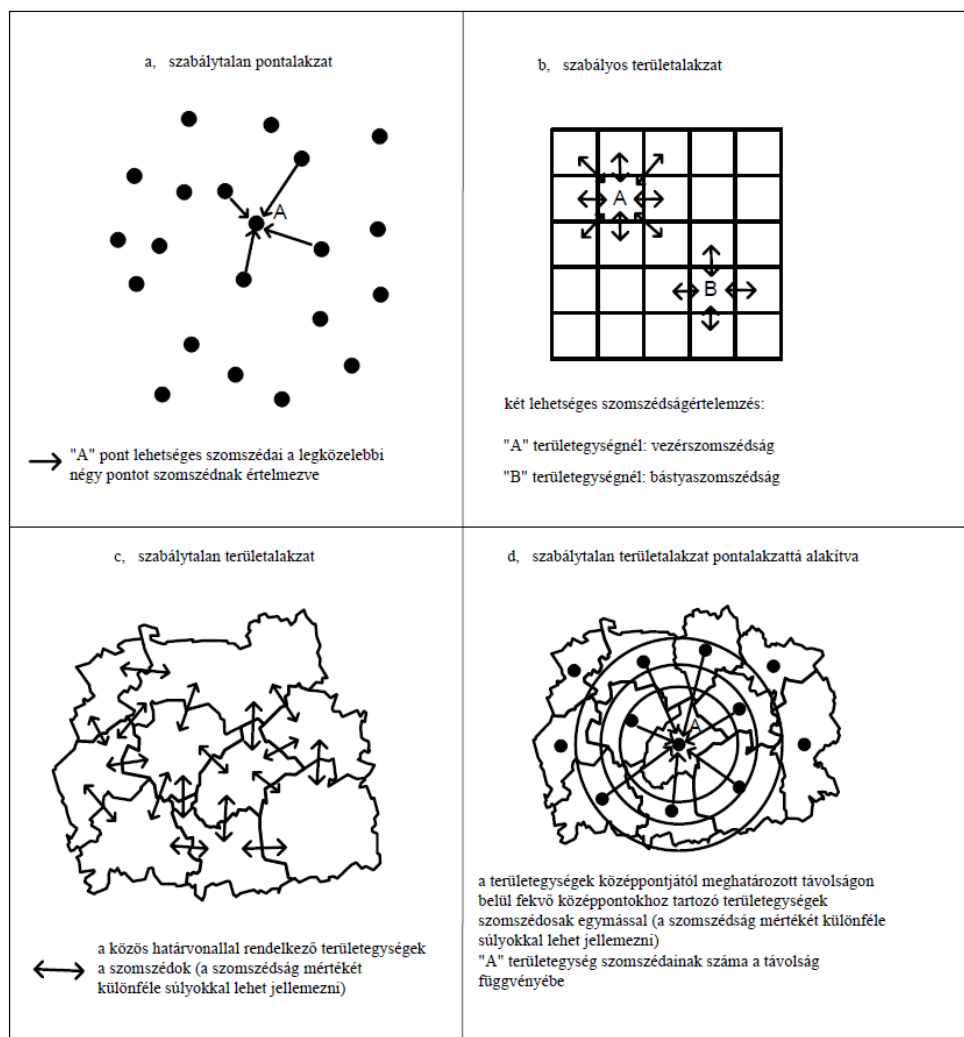


Figure 1. Shapes of spatial autocorrelation analysis

(Source: Dusek, 2005)

The regular shapes have a queen and a rook (Figure 1.) i.e. a matrix of queen and bastion neighborhoods. Within this, the k-nearest Neighbors method means the application of the k-nearest neighbor. In this case, we can set how many nearest neighborhood weight matrices we will apply to the indicator we have chosen, and I also used this method in my research. (Egri, 2014)

Results

Results of Linear regression

I subjected the two most population-retaining operational programs, which I assume, to a linear regression analysis. One is the Territorial Operational Program for the Development of Rural Settlements and the other is the Economic Development and Innovation Operational Program for Economic Competitiveness and Growth. Furthermore, I also checked the sum of the total Széchenyi 2020 resources, whether there is a linear relationship between the Income/1000 capita, Unemployed/1000 capita and Net migration/1000 capita and the aforementioned programs (Table 1.).

Table 1.: Values of Model Summary and Anova

(Source: Author's calculation, 2021)

		R	Adjusted R Square	Std. Error of the Estimate	ANOVA sig.
Income/1000 fő	R	R Square	Adjusted R Square	Std. Error of the Estimate	ANOVA sig.
Széchenyi 2020/1000 capita	0,086	0,007	0,002	0,004	0,262
TOP/1000 capita	0,087	0,080	0,001	0,004	0,281
GINOP/1000 capita	0,165	0,027	0,021	0,004	0,039
Unemployed/1000 capita					
Széchenyi 2020/1000 capita	0,25	0,063	0,057	0,106	0,001
TOP/1000 capita	0,383	0,147	0,141	0,102	0,000
GINOP/1000 capita	0,004	0,000	-0,006	0,111	0,965
Net migration/1000 capita					
Széchenyi 2020/1000 capita	0,05	0,002	-0,003	72,203	0,513
TOP/1000 capita	0,064	0,004	-0,002	73,521	0,424
GINOP/1000 capita	0,027	0,001	-0,006	73,648	0,742

For the most part, we can state that there is no linear relationship between any of the variables and sources, i.e., the districts are not scattered along a regression plane, as shown by the values of the standard deviation and the significance levels above 0.05 in the Anova column. In a few cases there is a very weak correlation, these are between the Unemployed / 1000 capita and the Széchenyi 2020/1000 capita, TOP / 1000 capita, which is shown by the significance values below 0.05 in the Anova column, but since the value of r^2 is below 0.3, it is negligible in both cases.

Result of quartiles and spatial autocorrelation

Quartiles of GINOP

The task of the GINOP (Figure 2.) is primarily to develop enterprises, make them more competitive and promote the spread of new technologies, mostly in order to increase employment and living standards. Figure 2 shows the quartile distribution of GINOP payments at the district level. If we look at the map well, it is clear that most of the support was called along the highways. There are two outstanding districts, one in Szeged marked in red and the other in Balatonfüred. In the case of the former, the priority funding of the ELI laser research center and in the case of the latter, in addition to the proximity of the motorway, its tourist attractiveness and outstanding level of development from its surroundings also play a role. This makes it easy for new businesses to set up, which is also helped by the GINOP's tender objective, which helps to start small businesses. In the upper two quartiles, there are districts that are located along the highway route. The M1, M3 or M5 and M7 stand out nicely. The most backward areas received the least GINOP support, such as the border districts of Hortobágy, the Danube tributary or even Zala County. There are also two lower outliers, such as Téli or Cigándi district.

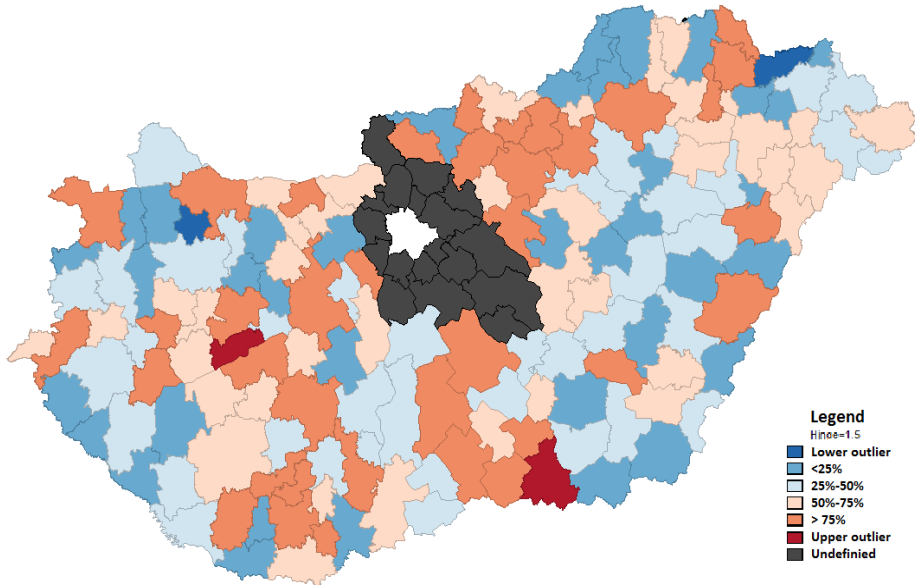


Figure 2. Quartiles of the Economic Development and Innovation Operational Program

(Source: Author's calculation, 2021)

Spatial Autocorrelation of GINOP

Based on the Moran I autocorrelation study, in some cases a significant neighborhood correlation emerges, which shows which sets can be the beneficiaries of the subsidies or which ones are avoided the most. We can see two positive areas (Figure 3.), one of which is the previously mentioned area of Lake Balaton, where it may have developed due to the pass-through of processes similar to the Balaton-füred district. Central districts are Tapolca, Ajka and Siófok on the southern shore. The other beneficiary area is Mórahalom and its surroundings, which can also be identified on the basis of the quartile map. A total of 129 supported districts were implemented here, of which network diagnostic and biotechnology research was also funded. Out of the neighbors, an exceptionally high amount was drawn in the districts of Győr and Berettyóújfalu, which can be found in pink on the map. The reason for going to Győr is mainly due to Audi and its supplier network, and it is located in the “Pentagon” area of Eastern Europe, which is why the entrepreneurial spirit is high. The situation is different in the Berettyóújfalu district, where a larger investment can increase the GINOP resource per 1,000 people, as it is a low-population area, but mostly larger capacity expansions are stories.

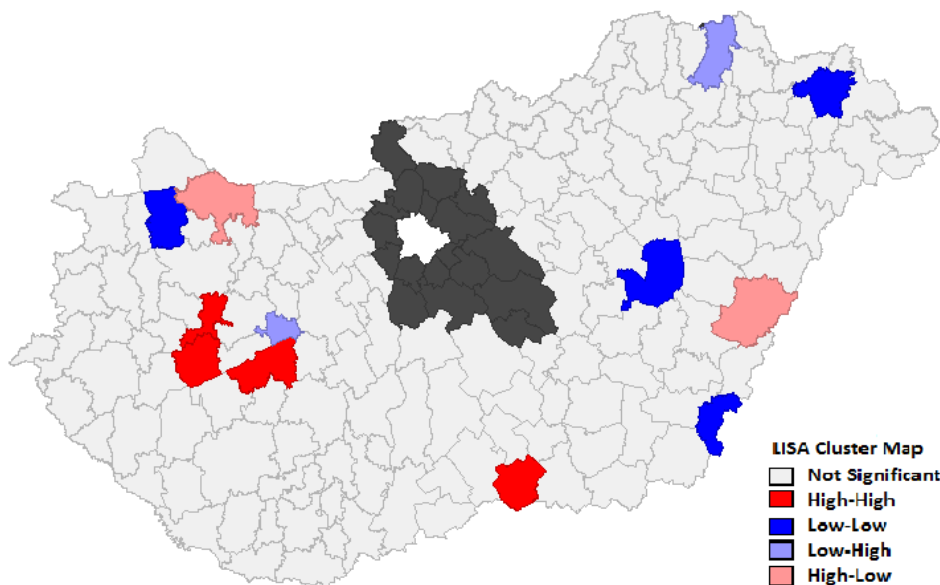


Figure 3. Autocorrelation analysis of the Economic Development and Innovation Operational Program

(Source: Author's calculation, 2021)

Quartiles of TOP

The aim of the Territorial Operational Program is primarily to catch up with rural areas and implement a decentralized development policy, while at the same time expanding employment and sustainable urban development. In the map (Figure 4.) below we can see the payments of these efforts, which we can say that the Pest county area has been left out, there are no more outstanding values. It mostly favors areas with the greatest economic and social problems. In Békés County, for example, Sarkadi falls into the upper quartile due to a nearly 4 billion-road development project or Mezőkovácsházi due to the many settlements belonging to it. Also in Békéscsaba, where significant sums of money were allocated for the development of local employment cooperation as its central role. The largest focal point is in the Northern Hungary and Northern Great Plain regions. Often a district stands out due to a project, such as the development of a bicycle path in Tokaj or

the establishment of a children's museum in Salgótarján. These are mostly multi-billion dollar projects, although they may not be the most significant opportunities for areas facing such severe aging and emigration. Fortunately, the least developed districts, i.e. those in the northern part of Transdanubia, benefited from TOP payments.

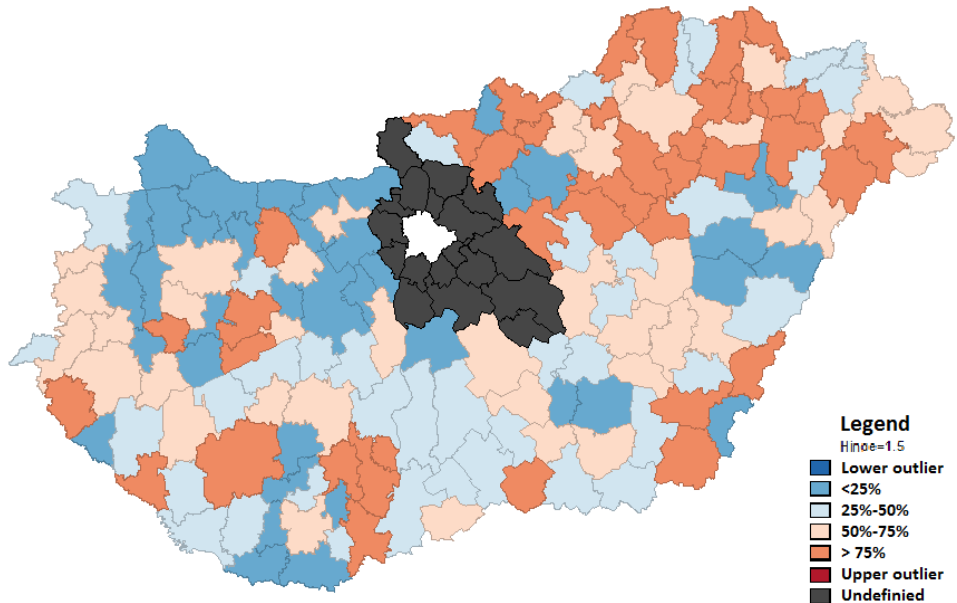


Figure 4.: Quartiles of the Territorial Operational Program

(Source: Author's calculation, 2021)

Spatial Autocorrelation of TOP

In terms of neighborhood, the differences between the territorial distributions of TOP payments are even more relevant. The largest connected beneficiary area (Figure 5.), Miskolc, Gönci, Sárospatak, Szerencs, Tiszavasvár, Tiszaújváros, Mezőkövesd, Mezőcsát, as well as the districts of Kunhegye and their immediate neighbors, constitute the districts receiving a high amount. It is island-high in the districts of Debrecen, Dunaújváros, Tatabánya, Pápa and Sümeg. These were mostly given a higher amount compared to those near them due to their territorial priorities. The least beneficiary are the neighbors of Mosonmagyaróvár, Győr, Csornai and Bicskei, Gárdonyi districts. There are also areas where they received a lower amount than their neighbor, such as the Békés and Gyula districts in Rétsági, Szécsényi, Ózdi, Gyöngyösi and Békés counties.

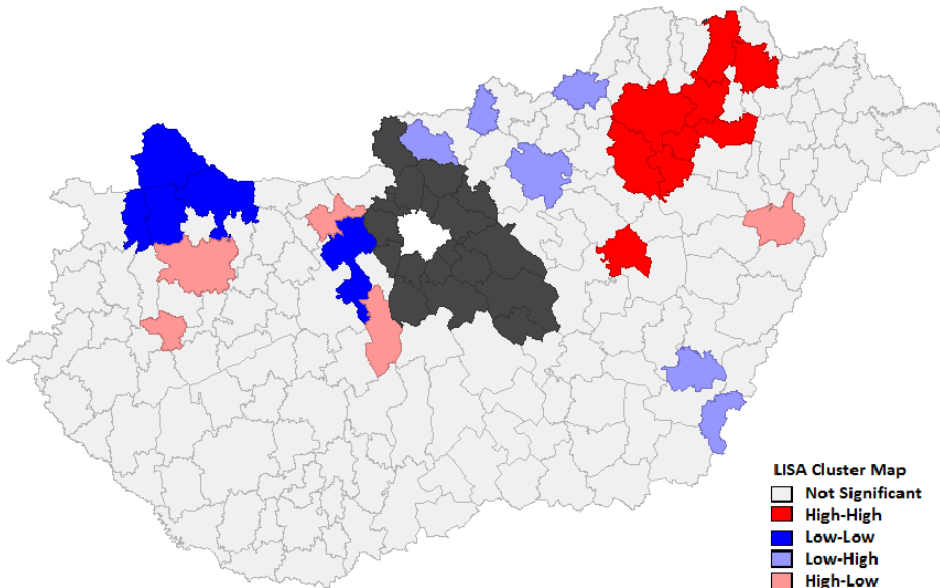


Figure 5.: Autocorrelation analysis of the Territorial Operational Program

(Source: Author's calculation, 2021)

Quartiles of Széchenyi 2020

The distribution of the total payments of 9 of the 10 operational programs mentioned in the literature review can be seen. Except for VP, as I illustrated it in a separate analysis. The top outstanding data (Figure 6.) include tourist districts such as Fonyód, Balatonfüred or Tokaj, as well as metropolitan areas such as Miskolc, Eger and Debrecen. These are mainly beneficiary districts, which despite their development or large population have received an exceptionally large amount of resources. Suffice it to mention the example of Debrecen, where the BMW factory was in a very favorable position during the funding process. There are also areas where, due to their low population, it has been included in this set due to a larger project. These are the districts of Bácsalmási, Fehérgyarmat, Körmendi or Berettyóújfalu. Almost all districts with big cities fell into the upper quartiles, even the more developed ones in Győr or Sopron. The districts of Pest County received a small part of the resources of Széchenyi 2020, and this is characteristic of the Danube-Tisza area and the agglomeration of Győr. There were some very backward areas where they could have received even a larger per capita amount. I would also

mention the Orosháza or Makó districts, which are located in one of the poorest parts of the country or in Püspökladány and Nagykanizsa.

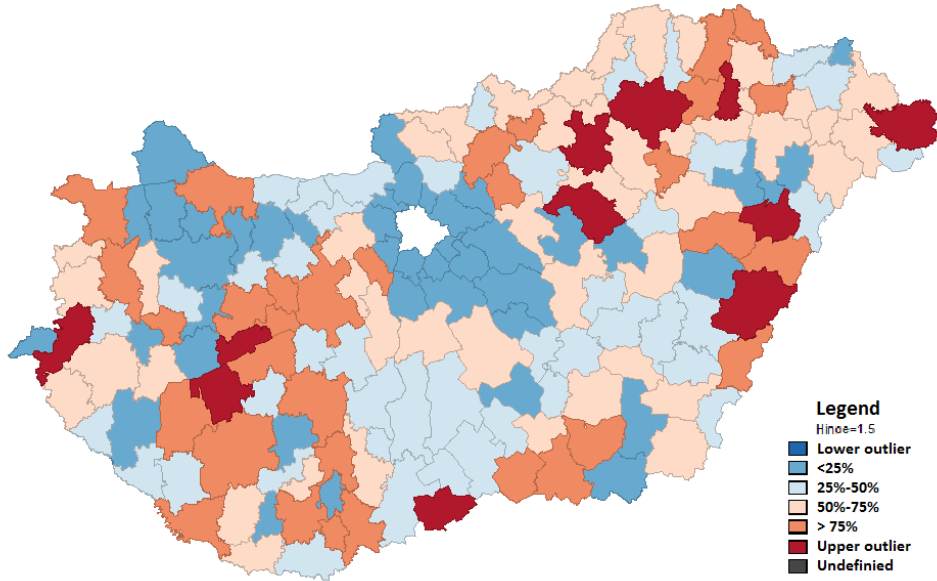


Figure 6.: Quartiles of Széchenyi 2020 Program
(Source: Author's calculation, 2021)

Spatial Autocorrealtion of Széchenyi 2020

In the neighborhood, we can see the Pest County area (Figure 7), which is not a beneficiary of the subsidies. It has a higher island value than its neighbors Győr and Kecskemét, which are two strongholds of the automotive industry in the country due to Audi and Mercedes. In addition to the Lake Balaton agglomeration, the target area of cross-border development resources is the Derecskei district and its neighbors. The development of these two focus areas serves the creation of the Hungarian Government's top tourist attraction and Budapest as a kind of counter-pole (Debrecen). We can even see districts where their own value is lower compared to the districts adjacent to them, these are Püspökladányi, Tatabánya, Tapolca, Gyöngyösi or Szentgotthárd and Szombathelyi.

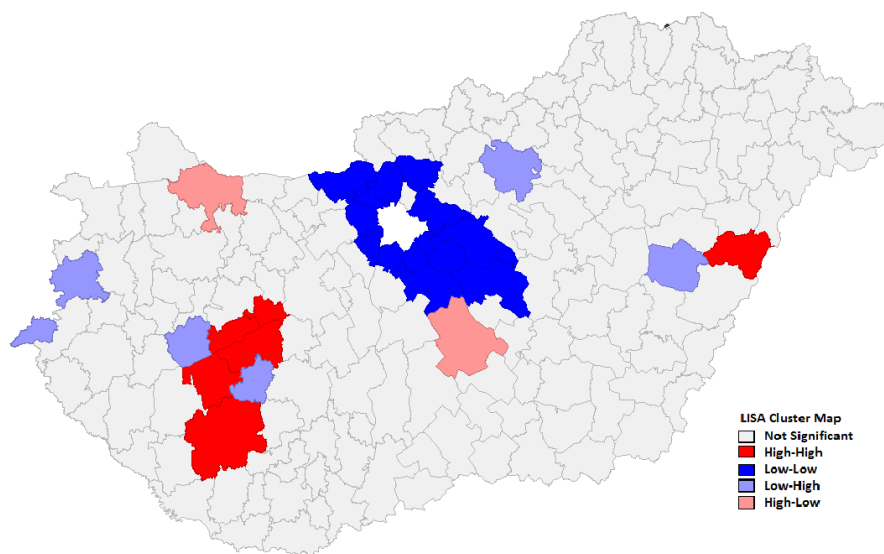


Figure 7. Autocorrelation analysis of the Széchenyi 2020 Program

(Source: Author's calculation, 2021)

Conclusions

The linear regression analysis showed that there is no correlation between the Széchenyi 2020, GINOP and TOP operational programs and the welfare indicators I analyzed, such as income, number of unemployed or migration balance. They are not scattered along a linear line at all, but in some cases there is a slight relationship so I reject my hypothesis. Quartiles and spatial autocorrelation analysis illustrate interesting spatial distributions. Based on the GINOP payments, Szeged and the Lake Balaton area emerge as a beneficiary zone, as well as a kind of motorway access, as the appropriate infrastructure is an important installation factor for investments. In the case of Lake Balaton, it is a popular holiday destination for investors and enterprising people in Budapest, and thus the question arises that - Why not work and relax in the same place all year round? - thus, more and more companies are being started in the vicinity of Lake Balaton, for which they are also using tender funds. Moreover, Szeged was included in the crossroads of resources with the investment of the ELI research center. In the TOP tenders, the districts of Northern Hungary and the Northern Great Plain region came to the fore, although some districts with real social problems, such as Ózd or Szécsényi, received a

smaller slice of the cake. If we analyze the territorial distribution of the payments of the Széchenyi 2020 operational programs for the development of Hungary 2014-2020 (except for VP), I would highlight two specifically beneficiary sets of districts. These are the agglomeration of Lake Balaton and the development zone around Debrecen. Unfortunately, there are districts that have received undeservedly few resources, even though they are very much in need of development in economic, social and infrastructural terms.

Bibliography

- Altman, D. G. – Bland, J. B. (1994): Statistics Notes: Quartiles, quintiles, centiles, and other quantiles, doi: <https://doi.org/10.1136/bmj.309.6960.996>
- Anselin, L. – Bao, S. (1997): Exploratory Spatial Data Analysis Linking SpaceStat and ArcView, DOI: 10.1007/978-3-662-03499-6_3
- Csallner, A. (2015): Bevezetés az SPSS statisztikai programcsomag használatába
Jegyzet
- Dusek, T. (2005): Térparaméteres elemzési eszközök, ELTE Regionális Földrajzi Tanszék <http://www.sze.hu/~dusekt/10reszdusekteruletielemzesek.pdf>
- Egri, Z. (2014): Bevezetés az egészségi állapot általános és területi vizsgálataiba; Oktatási segédlet; Szent István Egyetem Gazdasági, Agrár- és Egészségtudományi Kar, Tessedik Campus Szarvas, 2014
- European Commission (2014): https://ec.europa.eu/regional_policy/en/atlas/programmes/
- Faragó, L. (2016): Az EU területi politikájának a változásai közép-kelet-európai nézőpontból. Tér és Társadalom 30. évf., 2. szám, 2016 doi:10.17649/TET.30.2.2765
- Getis, A. (1999): Spatial statistics, Geographical information systems, Citeseer
- Ministry of European Funds (2014): Summary of the Partnership Agreement for Romania, 2014-2020, European Commission, August 2014
- Miniszterelnökség (2014): Magyarország Partnerségi Megállapodása a 2014–2020-as fejlesztési időszakra: https://ec.europa.eu/info/publications/partnership-agreement-hungary-2014-20_hu

- Nemzetgazdasági Minisztérium (2015): Terület- és Településfejlesztési Operatív Program, Elfogadott változat, 2015.02.12.
- Nemzetgazdasági Minisztérium (2014): Gazdaságfejlesztési és Innovációs Operatív Program, 2014.11.07.
- Perger, É. (2010) Az EU kohéziós politika kormányzati irányításának magyar sajátosságai. Tér és Társadalom 24. évf. 2010/1. 119-136. p.
- Poland Ministry of Infrastructure and Development (2014): Programming of the 2014-2020 financial perspective. Partnership Agreement 2014.05.23. https://www.popt.gov.pl/media/9498/Partnership_Agreement.pdf
- Rechnitzer, J. (2016): Elmozdulások és törésvonalak Kelet-Közép-Európa térszerkezetében, Tér és Társadalom 30. évf., 4. szám, 2016 doi:10.17649/ TET.30.4.2811
- Sajtos, L. – Mitev, A. (2007): SPSS kutatási és adatelemzési kézikönyv; Alina Kiadó; ISBN: 978-963-9659-08-7
- Spssabc (2020): <https://spssabc.hu/leiro-statisztika/>
- Tóth, G. (2003): Területi autókorrelációs vizsgálat a Local Moran I módszerével. Tér és társadalom 17 évf. 2003/4. 39-49. p.