



**HUNGARIAN UNIVERSITY OF AGRICULTURE
AND LIFE SCIENCES**

**EXAMINATION OF THE SPATIAL DIMENSIONS OF
POPULATION RETAINING FORCE AND EUROPEAN UNION
FUNDS IN HUNGARY**

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1. PRELUDE AND OBJECTIVES

Despite the Union's tense domestic political state, the exit negotiations with the United Kingdom and the hardships caused by the Covid-19 pandemic, on the 17th of December 2020 it managed to put an end to many years of negotiations when the European Council accepted the new framework of the upcoming community budget. Thanks to this new community budget the member states will have a never before seen amount of development funds at their disposal, that grants besides the 1074,3 billion Euro member state deposits another 750 billion Euro so called Next Generation EU recovery fund to mitigate the pandemic's negative ripple effects on the economy.

It is Hungary's vital interest to receive further fundings through regional cohesion, enhanced competitiveness, and diversified developments. Based on GDP measured through purchasing power parity, Hungary is far behind Western Europe and even among the V4 countries only managed to overtake Slovakia in 2021. Without the community funds, closing to more developed countries would almost be impossible. This is why it is important for these funds to be drawn down in the most effective way while used in the most optimal manner through established professional strategies, based on the experiences of the past two full European Union cycles.

In every cycle the CAP budget plan discussion brings about heated debates within the European Union. The CAP objectives need to be aligned with the objectives of the Green Deal's, which was only accepted in 2022, because some of the member states believe that reaching the objectives are solicitous due to the Covid-19 pandemic. The Common Agricultural Policy is such a topic, that can always be regarded as timely, but currently it has an even greater relevance. After the 2014-2020 cycle and two transitory years, in 2023 the actual application of the new CAP will start, after in June 2021 the Council of Ministers and the European Parliament managed to reach an agreement. Since agriculture is of high priority in Hungary, having generated 4,1% of GDP, 4,3% of investments, and 4,6% of employment in 2020, as well as being a major factor in preserving the rural way of life thanks primarily to its abilities, it is important how the Common Agricultural Policy will develop in the years to come. As output user of the agricultural production the food industry generated 2% of GDP, 2,7% of investments, and 3,2% of employment (KSH, 2020). Agriculture, in addition to the environmental challenges, also faces severe challenges of society like aging farmer sector or the increasing labor shortages within the manual labor intense branches of the economy. It is typical, that both the construction and the internal

social structure of the country, which is the scene of agriculture are becoming more peripheral.

The forecast of population growth trends is a very important topic not only in Europe, but in the rest of the world as well, since besides the growing world population European countries face severe aging of their societies and tackle with negative population growth and labor force shortages as a result, of low birth rates. Furthermore, in post socialist countries the migration of workforce is becoming more typical, which is primarily induced by the higher obtainable wages in the western countries. In Hungary rural population is declining as a result of the self-generating effect of ever-increasing shrinkage and peripheral tendencies due to strengthening demographic and urbanization process (KOÓS, 2020). The decline of population is not just a problem of the rural regions, but also of the mid and larger cities. A 2023 KSH study revealed the 2022 census preliminary data, which indicated the population to be around 9 million 600 thousand citizens, a significant 330 thousand people decline compared to 10 years before. I believe that the most severe issue is the decline of the work capable, young parenting age group of the rural population. This group would enable an economically, socially, and environmentally sustainable Hungary, which can hardly put up with the global economic challenges and the increasing effects of climate change without a viable country.

Into the center of my discussion, I have placed two topics, which raise significant economic and social tension. The first one is the Structural and Investment Cohesion Funds and Common Agricultural Policy, which has a major budget on the European Union's community level and the second one being the demographic processes causing increasing instability within the social, economic and spatial structures.

Research Questions, Objectives and Hypotheses

I have set the following six research questions, five hypotheses and five research objectives.

Research questions

Q1. Based on available data, does the European Union's Structural Funds (2007-2021), EAFRD (2007-2021) and EAGF (2014-2019) direct payments have any population retaining power?

Q2. Do the payments deriving from the EAFRD funds that meant to assist rural development, help the rural economy to catch-up?

Q3. Do direct payments really serve the rural population to stay in place, or they just act as a kind of income supplement that further increase the farm concentration conducting capability of well capitalized farm economies?

Q4. Based on the current tendencies how can Hungary's population be distributed on village level by the midcentury?

Q5. Is there any zone of development in Hungary, and if so, what are the trends?

Q6. What kind of rural spaces can be observed, and are there any at all, that have sustainable economic and social potential?

Objectives

O1. Getting to know the New Hungary Development Plan and the Széchenyi 2020 operative programs and exploring the effects of payments of both programs on population changes and their regional proportions on a county level.

O2. Introduction of the Common Agricultural Policy's II. pillar support funds through the New Hungary Development Plan (2007-2013) and the Rural Development Program (2014-2020), exploration of its payment mechanism, analysis of its effects on population change, exploration of the regional distribution and peculiarities on county level.

O3. Introduction of the Common Agricultural Policy's I. pillar support through direct payment as well as the effect it has on the population retaining force of rural areas when losing such payments. Furthermore, analysis of the transferred payments and their recipients time related and regional interaction on county level.

O4. An attempt to forecast the population of Hungary on village level, that can help to shed some light on the demographic processes that may come to pass by the middle of the century as well as their regional distinctiveness.

O5. Accomplishing a multi-indicator county typing not only through economic, social, environmental and cultural indicators, but also through inserting it into the model of European Union funds transfers, with special emphasis on agricultural payments.

Hypotheses

H1: In our country the beneficial effects of European Union support funds having on the retention of rural population can extensively be proven.

H2: Population retention force is mostly served by the funds spent to improve competitiveness and economic development, ones that are utilized through the operative programs in the rural areas of Hungary.

H3: Population decrease, and aging shows the realignment of rural life, the number of young people staying in the rural areas has significantly decreased. Population concentration is primarily a factor in big cities and regional capitals.

H4: Agriculture does not count as the main source of income in the rural areas nowadays. The income supplemental direct payments play a minor role in the creation of a region's sustainable demographic structure.

H5: According to my assumption a West-East directed development zone is currently developing in Hungary thanks to which economic development contributes to improving living standards.

Table 1. Summary of research methods

Number	Study area	Applied methodology	Source	Research question	Hypothesis	Objective
1.	NHDP	Linear regression, quartiles analysis, spatial autocorrelation	TeIR	Q1	H1, H2	O1
2.	Széchenyi 2020	Linear regression, analysis of quartiles, spatial autocorrelation	TeIR	Q1	H1, H2	O1
3.	NHRDP	Analysis of variance, linear regression, spatial autocorrelation	TeIR	Q1, Q2	H1	O2
4.	RDP	Analysis of variance, linear regression, spatial autocorrelation	MÁK	Q1, Q2	H1	O2
5.	Direct payments	Linear regression, analysis of quartiles, spatial autocorrelation	MÁK	Q1, Q3	H1, H4	O3
6.	Population forecast	Cohort-component method, spatial autocorrelation	TeIR	Q4, Q6	H3	O4
7.	District standardization	Factor and cluster analysis	TeIR, T-MER MÁK	Q5, Q6	H3, H5	O5

(Source: own calculation, 2023)

2. SUBJECT AND METHOD

In my research I have applied the following seven research methods while using IBM, SPSS, Arc Map, GEODA and Microsoft Office programs.

2.1. Analysis of variance

Variety analysis is an abundance explanatory sample that examines the effects of one or more than one independent variables on one non independent variable. It is a criterion of the analysis, that the non-independent variable, must be measured at least on interval scale. Another such factor is variety homogeneity, meaning that the non-independent variable must have the same spread compared to that of the different levels of the independent variable. The reason is to see whether the independent variable has traceable influence on the non-independent one or not. In our case it is important to conclude, whether the payments have any influence on the specific county categories (SAJTOS – MITEV, 2007).

2.2. Linear regression

When making linear correlation calculation we examine the connection between two variables. This regression method is also known as the Pearson coefficient. The value of r shows the strength between the variables, that can be 0 or 1, and the sign shows the direction.

The single variable linear regression is the characterization of connection between an independent and a non-independent variable along the line of regression. The determination coefficient r^2 shows how the dependency from the independent variable explains the values of the non-independent variable. If r^2 is near 0, then the independent does not explain the non-independent, if it is near 1 than the correlation is high.

2.3. Analysis of quartiles

Based on ALTMAN and BLAND (1994) grouping in abundance analysis can be important during statistical analysis, although every reducer analysis comes with data degradation. They used it primarily during the analysis of data gathered during medical research, but it is also an accepted method for abundance analysis in social studies.

So, the basis of the analysis is that it divides the abundance into four groups. Based on it there is a lower 0-25, 25-50 and an upper 50-75 and 75-100 percentage group. The distribution is made based on the number of items, but we can also consider peaking data, based on which we can determine two groups. We speak of slightly peaking value when data is reached by minimum 1.5 times that

of the quartile expanse from the median, but not more than 3 times higher. We speak of extreme peaking value when data is reached by minimum 3 times that of the quartile expanse from the median (SPSSABC, 2020). In my research I used the 1.5 method.

2.4. Analysis of spatial autocorrelation

During the analysis of the European Union funds and the population forecast I have made a regional autocorrelation analysis, which is a widely accepted method within regional analysis. „*One of the fundamental questions of regional science is, whether the presence of a phenomenon in a given area is similar or different compared to that of values of neighboring area units.*” (TÓTH, 2003, 39. o.).

According to TÓTH (2003) Local Moran I shows the relation of the explored area with its neighboring areas. So, in areas which have high intensity values next to them, the values, of the examined area is similar, or different and vice versa.

Local Moran I is a well known method in exploring neighboring relations. Based on their quadrant location it classifies villages into four groups (EGRI, 2014):

- high-high: both the examined and its neighboring unit have high values,
- high-low: the examined unit is high, but its neighbors have low values,
- low-low: the examined unit and its neighboring units also have low values,
- low-high: the examined unit has low, while the neighbors have high values.

Another exceptional measuring unit of Global Moran I is its value, based on the significance of which we can conclude the strength of the spatial autocorrelation (EGRI – PARASZT, 2022). According to KINCSES and TÓTH (2014) there is no regional autocorrelation if the significance level of Global Moran I is less than 0,0051, meaning this is an important thumb rule during the analysis.

2.5. Measurement of multidimensional phenomena

Regarding multidimensional measurements it is the conclusion of the Regional Geographic Institute of ELTE, that we can view advancement from many angles. It is hard to reach consensus because it is made up of dimensions of ever-changing importance in space and time. There are many such variables which can't be described by one indicator alone, and even those can be measured multiple ways. Such an indicator can be the level of development of a region, which for example can be measured by the number of businesses, the sizes, capital

stock or income, productivity, or any other connecting indicator. This depends mainly on the choosing of the researcher. In a broader sense during the measurement of multidimensional phenomenon the separate indicators or their groupings interact with each other, since we measure processes that often connect with each other in space, having multi sectoral effects. Therefore, it is practical to do complex analysis during the measurements of spatial movements, since we are dealing with changes that are hard to separate (REF KIADVÁNYOK, 2005b).

Factor analysis

To run the factor analysis, I used IBM SPSS 20.0 software, that allowed regional comparisons. It is a frequently used tool during spatial structure research. „*Factor analysis is not one specific method, but rather an umbrella term, referring to a specific portion of multi variable statistic methods. The method is suited for data compression and to reveal data structure, where it gathers the number of initial variables into so called factor variables, which cannot be directly observed*” (SAJTOS – MITEV, 2007, 245. o.) Factor analysis examines the relation between variables that correlate with one other. It often happens, that the variables we can measure are not the variables that best describe the phenomena we want to examine. The aim of the method is to describe the directly unobservable background variables or so-called factors, based on the correlation between the variables (KLINIKAI BIOSTATISZTIKAI TÁRSASÁG). There are no set independent or non-independent variables during the analysis, the goal is the exploration of the connection between the data. The starting point of the factor analysis is to have a data matrix necessary for the analysis. If we look at a regional analysis the coulombs will be the variables or indicators, whereas the lines will be the chosen area units. It is important that the analysis will be reliable if the number of elements within the analysis is at least double that of the number if the indicators. The correlation examination method's main feature is that it organizes the indicators into groups, whose initial point is the correlation matrix. During the establishment of the factors there can be indicators that have no connection with each other, therefore variables with a correlation coefficient of less than 0,3 should be omitted from the analysis. It is of similar importance to avoid extreme multi correlation, whose determinant is very close to 1 (FIELD, 2005).

Cluster analysis

Cluster analysis or clustering is a process to reduce the number of dimensions. The original dimensions are the variables assigned to the observation units, along which we want to group the observations in such way, so that the elements of a group are close to each other with respect to all their variables and

be further away from all other groups or clusters. As it derives from the definition, the key concept of clustering is distance. We can define distance in the Euclid sense, or we can measure it via an arbitrary associate measuring number such way, that the strong relation means proximity and the weak one means distance (SZÉKELYI – BARNA, 2004).

Clustering has two types, hierarchical and non-hierarchical or otherwise none as K center clustering. According to PÉLI (2013) there are two main differences between the methods. The hierarchical is much harder, as it compares the elements in pairs taking more time to compute. An important difference is that by the non-hierarchical method we need to give the number of the clusters ourselves. Another difference is that we do not need to give the center of the clusters, this can be calculated via software. The Euclid distance is the length of the section connecting the two groups. We can complete this distance measurement with the help of three methods which are chain, variance (ward) and centroid method (TAKÁCS et al., 2015).

In my analysis I used the ward method, that starts the combination of groups, with the two clusters where the square error growth is the smallest. To check the results, I used the non-hierarchical K center method, where I added the number of clusters created in the hierarchical analysis.

2.6. Cohort component method

The Cohort component method is a widely used process to predict total population and the distribution of the age groups within it. It provides a flexible and efficient approach that contains many theoretical models, application techniques and assumptions regarding the changing of future population whereas it can be further expanded by indicators which we hold to be (SMITH et al., 2013). As basis for the calculation the component method uses gender and age groups, both of which are regarded as population components. Forecasts are based on future fertility, willingness, and migration assumptions. The hypothesis are values relating to expected average number of children, expected lifespan, and how migration balances turn out (KAPITÁNY – SPÉDER, 2015).

The Cohort component analysis defines population trends along three important factors. The first one is birth data, which I have concluded based on fertility rate. This is where the models differ, as I have calculated with a middle 1,5, a lower 1,3 and a high 1,7 rate.

The second factor is migration, that shows the migration to and from a given city in 5year intervals. I have further developed this net migration indicator where I have also incorporated the reservoir principle. WILSON (2016) recommends a complex cohort model, where it defines negative and positive

migration areas. It uses corresponding population ratio and primarily applies age specific calculations for the total population due to their accuracy. The governing factors of the repulsive and suction forces are best defined by the GDP per capita rate. Based on a research by the Hungarian Central Statistics Office (KSH) “*the economic environment is closely related to the courses of domestic migration.*” (KSH, 2017, p.10.) By doing so I have extended the Cohort model with a complex indicator, that other researchers (EGRI – KŐSZEGI 2016, CSITE – NÉMETH, 2007) used by the de-aggregation of county GDP. With the help of the complex indicator formed by local taxes, personal income tax and registered businesses, it was possible to determine repulsive and attractive cities. By setting it into the “rural GDP” model I have determined the expected migration trends factored according to gender and age.

The third indicator is to put it into the mortality model, that best shows the mortality rate grouped according to age groups and gender. From these data, I only have cumulated values on village level, so in order, to get the proper data regarding the age and gender groups I had to ratio the national indicators. The expected lifespan increase by birth can't be disregarded, which is showing an increasing tendency in Europe and furthermore, within the ratio of genders, females are beginning to take the lead. Regarding the expected lifespan increase the Hungarian Central Statistics Office has been keeping records since 1900, based on which I have generated a trendline for the 27 EU member states.

3. RESULTS AND DISCUSSION

3.1. Comparison of the NHDP and Széchenyi 2020 results

There is no relation between population change and the NHDP, EDOP while on the other hand there is a medium and reliable connection between Széchenyi 2020 and EDIOP funds caused by the changes in the target areas of the support policy and the distribution of funds.

From the quartile analysis point of view the NHDP has hardly any exceptional values, unlike the Széchenyi 2020. Those who benefit the most from the Széchenyi 2020 are the agglomerations that have big city counties. We can state that the Széchenyi 2020 serves the improvement of center regions outside of Budapest. As we compare the maps, we can see that spatial distributions of the NHDP funds have stopped and during Széchenyi 2020 they center around the Dunántúl, the M3 and Debrecen regions. The degree of spatial concentration is obviously higher. Spatial autocorrelation shows that the Balaton and Debrecen regions became the targets of operative programs, supplemented with the Kecskemét and Győr counties, whilst during the NHDP Szeged, Debrecen, Borsod basin and Northern Zemplén were the beneficiary regions. The less supported Budapest agglomeration ring received more emphasis.

The operative programs aimed at developing the economy, concentrated along the highway lines during both development periods, although the emphasis shifted. EDOP concentrated on M1 and M5 while EDIOP focused on M5 and M3. Regions along M1 received less, while the Balaton and South of Dunántúl regions received more funding. Along the M5 highway, the group of beneficiary regions remained the same, but the zone along M3 expanded in direction of Debrecen. Based on the neighboring relations instead of the Tatabánya and Komárom regions the Balaton became the most supported regional hub. The Mórahalom region and its surrounding remained amongst the beneficiaries whilst the Győr and Berettyóújfalu regions show an exceptional value. In Békés County Gyula and neighboring villages, Karcag and surroundings and the Kisvárdá area are amongst the least beneficiary areas of the Széchenyi 2020 program.

3.2. Comparison of NHRDP and RDP

Unlike the 1336 billion budget, of the NHRDP a 1467 billion was paid for the RDP. For the sake of the comparison, I have classified the RDP's payments of competition according to those of the NHRDP's payment titles. Based on this we can see that the competitiveness ratio has decreased from 50% down to 40%. The environmental received increased emphasis as it increased from 29% to almost 40%. Rural development payments increased but their ratio remained

14,9%. The payments of LEADER have significantly decreased from the previous 5,9% down to 3,8%.

By the regional spread weighted with the population the beneficial regions have more or less remained, but several shifts can be observed. Whilst the variance analysis shows a connection between the relation of NHRDP and the regional beneficiaries, the same can't be observed with the RDP. Based on the linear regression analysis in relation of NHRDP-RDP there is also a connection between unemployment and the wages while other important indicators have an effect on them as well.

In the spread of the autocorrelation analysis of competitiveness the emphasized role of the Nyírség and Hortobágy regions remained, but the southern zone became more fractured, and the unified West-East axis has broken up. The emphasis shifted over to regions around Szeged. In case of the low-low relations amongst the mountain areas regions in Nógrád County and some of Budapest's agglomeration areas the emphasis remained the same.

From the rural development point of view, the support of regions spreading from Szikszó to Cigánd has decreased, while regarding Vásárosnamény, Nyírbátor, and Fehérgyarmat their role has increased. The support for Zalaegerszeg and Kaposvár has also decreased, while a new Mórahalom center has formed. The Budapest agglomeration continues not to be the target areas of these funds, but they are not so unified.

A shift can also be examined by the environmental axis. In the Nagykunság region the North-South zone has progressed in West-East directions. The East Borsod zone vanished, but the Nyírség zone remained. The Kiskunság zone however has become, fractured just like the low-low neighboring regions near Budapest. The exceptional values have also shifted to the Székesfehérvár, Mezőkovácsháza, Bóly, Bonyhád and Sárvár districts.

By the LEADER axis we find more important shifts. The support for the Lenti district has decreased, while Marcali, Nagykanizsa and Sellye regions came into view. A new Nyírség zone has developed while the Budapest agglomeration has become fractured.

Regarding the full NHRDP and RDP it can be said that the main beneficiaries are the surroundings of Hortobágy and Nyírség areas, but a rearrangement can be observed in the Kiskunság and Baranya districts, where fragmentation and setback can be experienced. The disgrace of the Budapest agglomeration has also decreased. The rural development, of the most-undeveloped districts, are still not optimal while Békés, Nógrád or Borsod-Abaúj-Zemplén counties do not fall into red zones. According to my opinion more

emphasis should be placed on rural development, which also gave the name of the program, while the lagging and shrinking rural areas should be handled in a more complex manner not just from an agricultural perspective.

3.3. Results of direct payments analysis

Regarding the linear regression we can conclude that 10.000 Forints income increase generates 0,046 percent population change. If we would cut the income supplement supports, the district income would decrease which could lead to an increase in population migration. With the further expansion of my linear regression analysis that showed how income effects population change, I have calculated the decrease of rural population if we would cut back on the area-based support funds that constitute the major part of the overall support funds.

We can find these quartiles in figure 1. It is very revealing which districts would lose most population. These are mostly areas where the population loss has been the highest since the regime change. There is one exceptional value, which is the Kaposvár district. This may be possible due to the many small villages attached to the district capital. It is also revealing that the loss of this support would affect, Békés County the most, but Hajdú-Bihar, Bács-Kiskun, Jász-Nagykun-Szolnok and Csongrád-Csanád as well as even Győr-Moson-Sopron County in the Kisalföld region would also be effected. The regions in orange, would suffer a decrease of 160 to 320 people, while the least effected two lower quartiles would lose a maximum of 90 people.

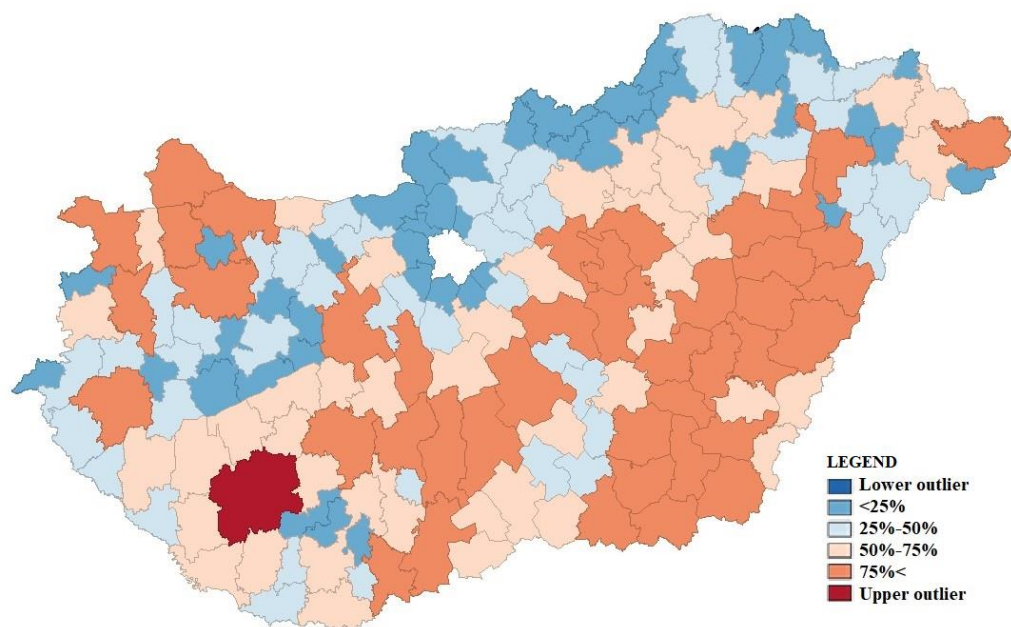


Figure 1: Probable population decrease, with the loss of direct payments

(Source: own calculation, 2023)

In figure 2 we can see how the neighboring relations of the support funds per single claimant changed in relation to the 2014 area-based support funds and SAPS+Green investments and small producers support system. The Global Moran 1 value was 0,519 in 2014 and 0,604 in 2019, which shows a reliable correlation. We can differentiate 5 exceptional areas on the map above. In the East there is a lower zone Szabolcs-Szatmár-Bereg County mainly due to the peculiarities of fruit growing, since it is an intensive culture, so the profitable plant size can be achieved even with a smaller bio greenhouse. Based on 2015 KSH data 61% of the Hungarian apple and 25% of the total cherry demand was grown here. The amount of support fund per capita was around 500 and 900 thousand Forint. An exception is the Cigánd district, where because of the many, bigger area family farms, the sum of the support fund per capita is higher. The Danube-Tisza interfluvium also contains districts with low-low neighboring relations. It reaches from the fruit producing region of Cegléd until the “foils” of Mórahalom. Due to the sandy soil, it is typically suited for farming with high needs of manual labor and where big income is achievable even on a relatively small area, thereby favoring the existence of smaller farms. In the district values of this area there are relevant differences. In the northern districts the support fund per capita is 1,5 million while in the southern ones it turns out around 600 to 800 thousand. The reasons for this are primarily the foil and greenhouse farming, since almost during the entire year several cultures with shorter vegetation can be grown. Looking at the high-high neighboring relations in 2014 we can see 3 outstanding regions. One is the region of Bóly, where the Bonafarm Group, and second is the Mezőség area where the Mezőfalvi Mezőgazdasági Termelő és Szolgáltató Zrt. is operating. The third is the area around Kaposvár, where several agricultural businesses and bigger farms can be found scattered in the small villages within the region.

By 2019 several visible changes took place, as the country average income per capita increased. This had three reasons. One is the change in Euro/Forint exchange rate. With the weakening of the Forint, the amounts of the support funds increased since the payments are in Euro. The second reason is the introduction of the green component that caused the farmers to change the structure of their economies in such way that they could maximize their support call off capabilities. Furthermore, with the increase of farm size centralization and with the reduction of the number of farmers the per capita support further increased. You can see it on the 2019 map, that compared to 2014 the concentration of the support funds has increased in the Dunántúl region and that a unified line has started to form in a North-South direction. Aside of this, another two high-high group has appeared. One is the Sárvár district, where the per capita support is

around 4 million and the other one is the Nagykunság area where there are huge grasslands. These are Tiszafüred and Karcag districts, where the per capita support payment is around 3,2-4,3 million. The blue areas indicating low-low relations increased in parts between the Danube and Tisza rivers in the northern direction, but the Szabolcs area has decreased with two districts in the southern part, where growing fruit is not so emphatic.

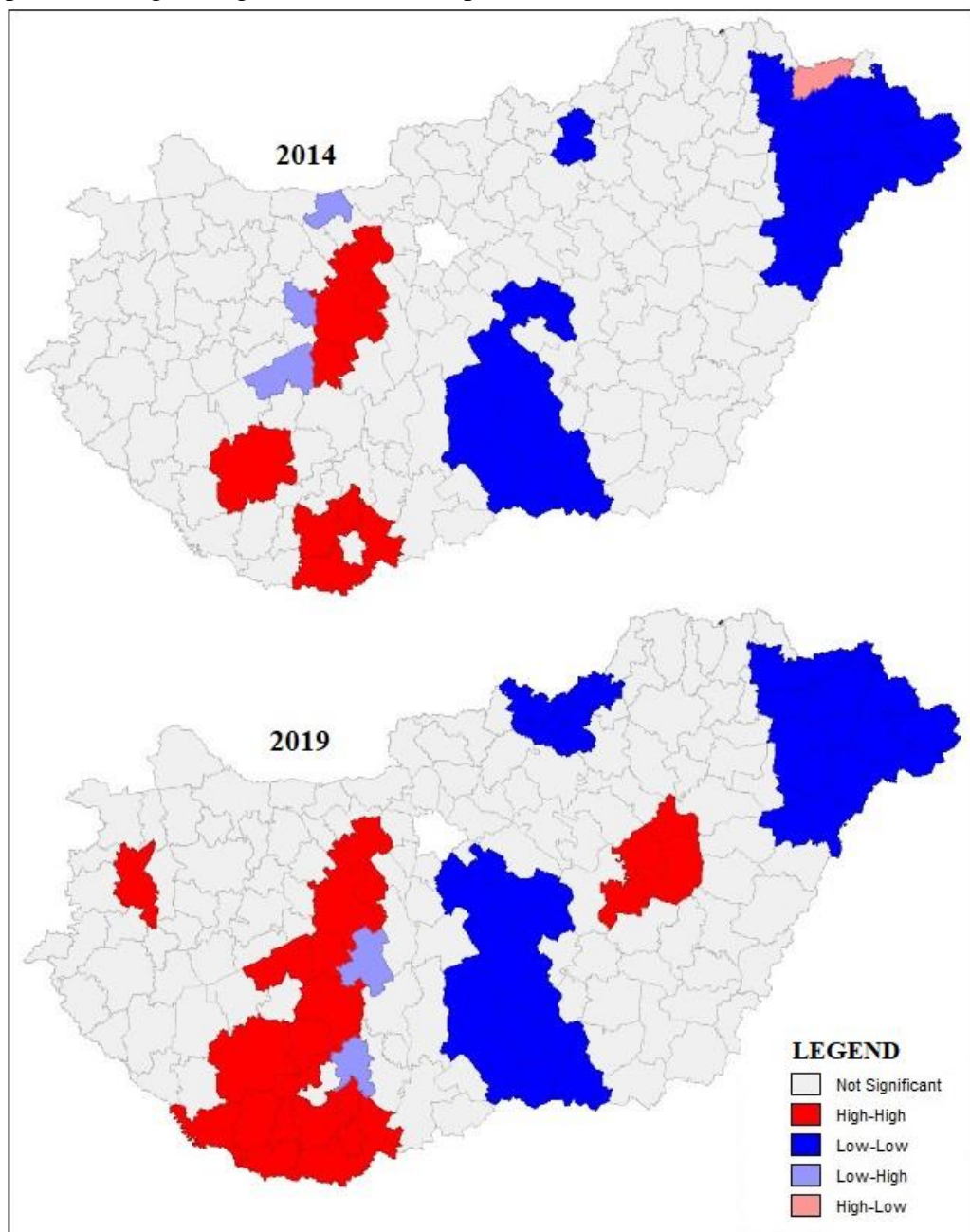


Figure 2: Average of support fund per claimant in 2014 (upper) and 2019(lower)
(Source: own calculation, 2023)

3.4. Population estimate results

Regarding population estimates it is important to handle them with reserve, since it is an estimated change, so the longer period the estimate refers to, the more inaccurate it is. It may be influenced by so many unforeseen future circumstances that may be important regarding the population drawing or repulsive capabilities of a region. Furthermore, the smaller is the area unit being examined, the higher is the uncertainty, so that is why I think of this chapter as a vision, of the population change of Hungarian villages.

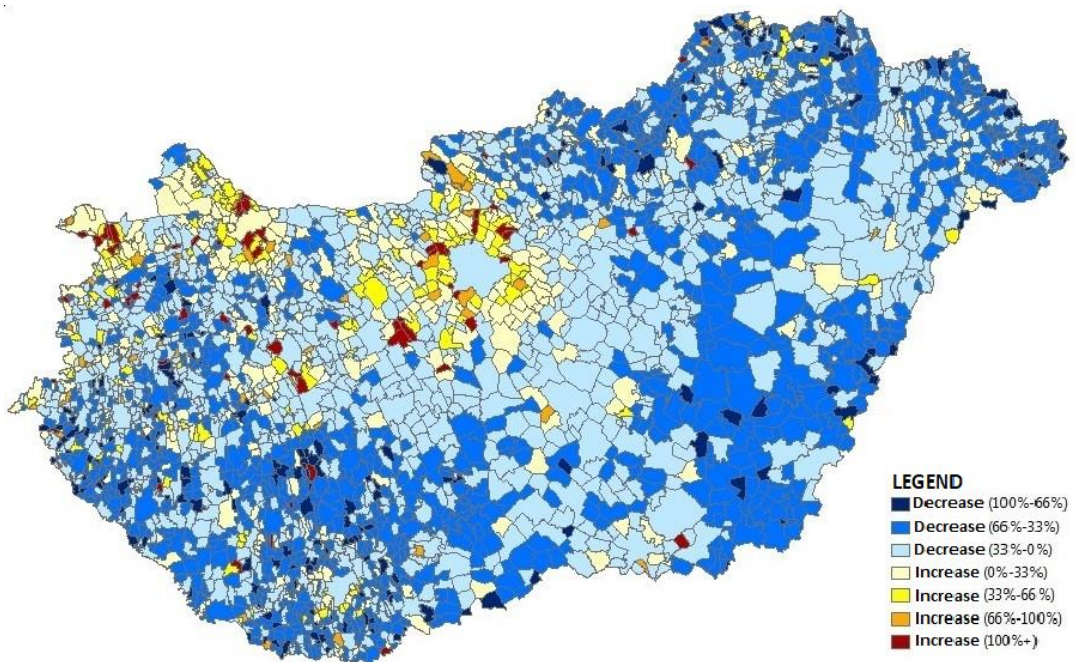


Figure 3: Ratio of population change between 2011 and 2051, calculated with a fertility rate of 1,5

(Source: own calculation, 2021)

The transformation of the Hungarian population will probably be as drastic as we can see on the map (figure 3), which was calculated with a fertility rate of 1,5. The decrease in percentage shows, how the population of a village may change compared to 2011. In 2011 the total population of Hungary was 9.93 million and by 2051 this may be just 8,72 million. This means a reduction of 1.2 million which anticipates the loss of 12% of the total population. What is even more interesting is the area distribution of the population, which shows a huge difference between central and rural areas.

In figure 4, we can see where the centers of the population change are positioned with regards to regional autocorrelation. The Global Moran I value is

0,252, meaning that the relation between villages and neighboring villages is reliable. Budapest and its narrower agglomeration, has the biggest expansion within the group of high-high neighboring relations. It is bordered by Szokolya in the North, Zsámbok in the East, Dabas in the South, and Csákerény in the West. It is obvious that the population of the neighboring villages will mostly increase in Northern and South-Western direction, along the M7 highway in direction Székesfehérvár. By the Balaton it lasts from Siófok till Veszprém, where the population change value is above average, but still going to decline. The other two clusters are Győr and its surrounding area, and the second region is stretching from Győr along the M1 highway until Sopron. Debrecen, Szeged, Kecskemét, Pécs and Szombathely also appear with such high-high neighboring relations. We can also see such outstanding values where the given village has a higher value than the one next to it. Such villages are Békéscsaba, Nagyszénás, Zsadány, and Újszalonta and Békés County, and Füzér, Dédestapolcsány or Parád in the Észak-középhegység region. Given the below average low-low zone, the Dél-alföldi cluster stands out as the biggest of such group of villages, or the ones in the northern mountain regions and smaller scattered groups in the Dél-Dunántúl region. A kind of borderline influence can also be observed, meaning that regions, which are bordering countries producing less GDP are showing population decline, while Austria with above, average EU-27 economic potential, is inducing population growth in the neighboring regions.

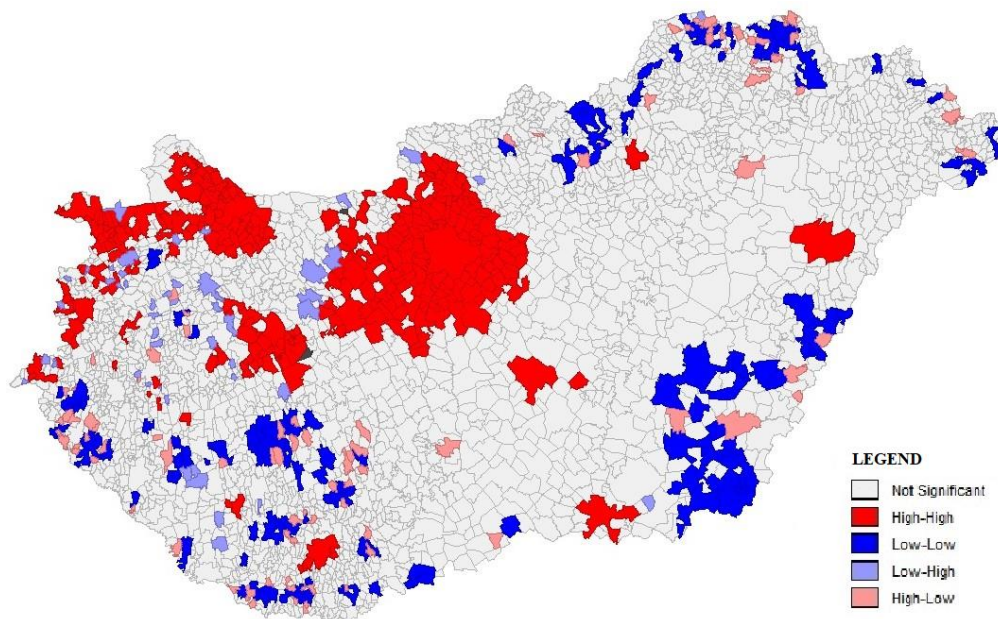


Figure 4: Spatial autocorrelation analysis of population change between 2011 to 2051 according to 1,5 fertility rate
(Source: own calculation, 2021)

3.5. Results of provincial district standardization

During the analysis of the affects which support funds have on population change I concluded that many other factors also influence population change and so with the help of a multi-indicator analysis I tried to explore the peculiarities of rural districts. The regional development of the Hungarian rural areas is governed by the 290/2014 (XI. 26.) government decree. The classification of districts within this decree uses a complex indicator that deals with subjects like social demography, housing and living conditions, local economy and labor market conditions and infrastructural environment. Altogether it contains a total of 24 indicators. I wanted to make a similar multi-sectoral analysis, into which I incorporated the European Union support funds as well as the important and available indicators of the agricultural sector. By doing so I ended up with a data set of 49 indicators. For better comprehension and to narrow it down I applied factorial and cluster analysis.

Characteristics of applied indicators

I retrieved the data from the database of the Regional Development Monitoring and Evaluation System (T-MER) within the National Regional Development and Spatial System (TeIR) and from the Hungarian Treasury (direct payments and RDP transfers). With respect to the indicators, I tried to use the most up to date database as possible. The values originate from 2019, which can be seen in figure 1. The creation of four indicators (RDP/1000 people, direct payments/1000 people, GDP/capita, population prognosis %) were the hardest, because by the previously mentioned two indicators the database was classified according to titles and claimants. Therefore, when calculating the direct support for example, the indicator suited for analysis had to be created out of 140 thousand pieces of data.

Rotated component matrix

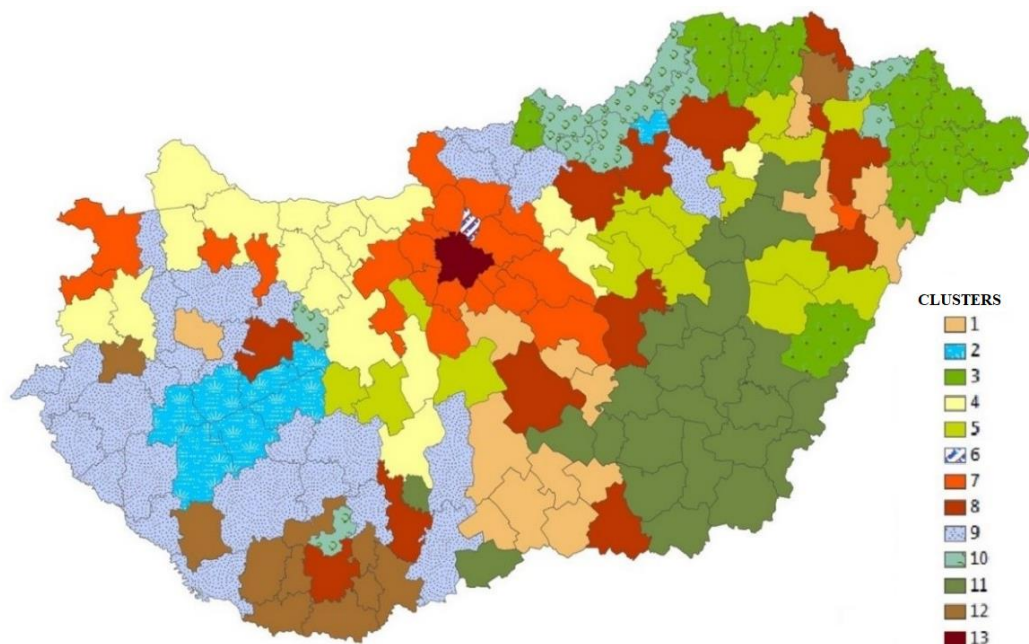
While the variance analysis makes the definition of factor quantities possible, the factor matrix shows the correlation between the original indicator and the given factor. It may occur, that it shows connections that are not true. Because of this feature, rotation is applied, that turns the axis of the factors thereby eliminating the possibility of errors resulting groups that can be interpreted. The presence of the next new factor can be observed where the correlation coefficient drops significantly. Table 2 well illustrates where I have highlighted specific factor groups.

Table 2: Rotated component matrix

Rotated Component Matrix								
Indicators	Component							
	1	2	3	4	5	6	7	8
Building industry activities/1000people	0,858							
Migration account/1000people	0,808							
New family houses /1000people	0,766							
Population forecast %	0,764							
Unemployment rate	-0,749							
Trucks/1000 people	0,727							
Underprivileged								
Kindergartners//1000people	-0,708							
New cars/1000 people	0,706							
Roma population ratio	-0,703							
Processing industry/1000people	0,701							
Medication/capita	-0,658							
German ethnic population ratio	0,620							
Professional, scientific, technical activities/1000capita	0,615		0,556					
Technical, scientific professional activities/1000people	0,597	-0,434	0,497					
Ratio of high-low waged people	0,565	-0,404	0,538					
Net income/capita	0,552		0,540					
Direct payments/1000capita		0,864						
Number of farmers/1000capita		0,838						
Number of agriculture, forestry, fishing enterprises/1000capita		0,825						
NHRDP/1000 capita		0,806						
Income through agricultural production/capita		0,806						
Ratio of employed in agriculture and forestry		0,781						
RDP/1000 capita		0,765						
Population density		-0,683	0,425					
Agricultural area %		0,659						0,466
Number of Hungarian patents/1000capita		-0,353						
Local business tax/1000capita			0,677					
Population			0,674					
Net income of export sales/1000people			0,666					
Number of people with a degree//1000people	0,461		0,632					
Number of people with a degree//1000people	0,452		0,630					
Ratio of activities requiring higher education	0,461	-0,412	0,619					
Remote access of village libraries /1000people			0,612					
Internet subscriptions/1000people	0,445	-0,411	0,542					
Vitality index				0,924				
Aging index				0,911				
Number of businesses in accommodation - service, catering/1000people	0,410			0,619				
Number of family doctor and pediatricists/1000people				0,597				

Ratio of uninhabited living units	-0,362			0,590				
Széchenyi 2020/1000people				0,386				
Time to reach own county capital					0,897			
Time to reach Budapest					0,888			
Time to reach closest highway line					0,878			
Forestry area %					0,531			-0,529
NHDP/1000capita						0,606		
Registered criminal cases/1000capita						0,465		
GDP/capita							0,772	
Ratio of employment within service industries						0,482	-0,522	
Land lease/acres							0,681	

I created 8 factors, in which the correlation value within the factor is strong, but in some cases even outside of it. We can find out how strong a factor to consider from research (HAIR et al., 1998). Categories were defined based on the number of samples. In our case this means we should focus on values higher than 0,35 out of the whole 175 values. The correlation values were added to the table above based on this principle.



I ran a Ward type hierarchic cluster analysis on the factor groups and with it I defined how many of the cluster groups are optimal. To double check this data I ran a non-hierarchic analysis that is usually used with huge data sets. This is how

I came up with 12 rural clusters and Budapest (figure 5), which are located similar distance to the cluster center. After this I labeled the clusters according to their most important features and explained their attributes in detail.

1. The “Citadel” of farmers

The main income source of the mentioned rural areas is agriculture, mainly greenhouse produce and vegetable production. These areas like the districts of the Duna-Tisza köze region or the Tokaj wine region receive outstanding amounts of external support funds, mainly through NHRDP and RDP. Population density is low, but the number of producers is high, reaching 81/1000 people. The income clusters are around the median value and the number of newly built houses is high per 1000 people. Within the economy the number of businesses related to processing industry and trucks is high, but the number of internet subscriptions, ratio of people with a degree, and jobs with higher education labor force demands is below average.

2. Aging hosts

The previously mentioned areas like Balaton and its surrounding or the B lap tfalva districts are beloved touristic destinations. The mountain region is an advantaged touristic area within the B lap tfalva district. These areas do not receive significant agricultural support funds, including the NHDP. However, in the Sz chenyi 2020 program they received the highest amounts of support funds per capita, which was the double of the country average. Although they are not agricultural districts, the number of newly built houses is outstanding their value being third among the other clusters. Number of businesses in processing industry, construction, and IKT sector as well as professional, scientific and technical activities are higher than average, almost reaching the country average. The number of new cars and trucks is also high. Despite being a population drawing region, they may experience a minor population decrease in the future. Internet subscriptions and financial businesses are above average while the number of people with a degree and remote access of libraries is high. The number of vacancies is outstanding, seven times that of the country average, but the number of uninhabited houses is also high. In the districts the indicators of the most aged population and vitality are both high.

3. „Badland” or underprivileged regions

The districts of Szabolcs-Szatm r-Bereg, like V s rosnam ny, Beretty  jfalu, G nc or Edel ny underperform based on economic and social indicators. They receive RDP funds, but the NHRDP support funds are marginal. The amounts of direct payments are on average level. The number of producers

is high, but their income is less, compared to “Citadel” incomes. The ratio of people employed in agriculture is average. The ration of people with low income is high and the number of newly built houses is low. The amount of medication traffic is high as well construction activities. The migration account is low, future population decrease can be expected. The ratio of Roma population is outstanding, the number of less privileged kinder gardeners is high. Unemployment rate is high, the number of people with a degree and local business tax is low. These regions are in the worst situation according to all indicators.

4. Successful countryside

Districts with stable economic and social vision are mostly situated in the Észak-Dunántúl region. They are mostly agricultural areas, but their success lies on other factors. They did not receive regional development funds. The wages and population density is high, the number of uninhabited houses is low. Unemployment rate is low, and the migration account is positive. Local business tax income and net income of export sales are outstanding. Aging and vitality indicators are similar to nationwide average. Vacancies take in not too many people. They were not targets of the NHDP and Széchenyi 2020 programs.

5. Stagnating districts

The districts of Füzesabony, Jászapáti, Heves, Martonvásár and Szerencs are in a stable economic and social situation. They were in favored places during the support programs, mainly with agricultural areas. The number of producers and their income rates are fourth among the agricultural clusters, similar to that of the producer’s citadel, but their processing industry and number other businesses is less. The ratio of Roma population is high, and the migration account is negative. The number of library usage as well as export sales and people with a degree is lower. The local business tax and Széchenyi 2020 support funds are above average.

6. Little Budapest

This cluster constitutes of the Dunakeszi district. It is characterized by high population density and number of patents. It has little agricultural support funds. Differences in wages are exceptional, many new houses are built, and migration is positive. From an industrial point of view, mainly IKT, construction industry and professional businesses make it stand out. The number of trucks and new cars is high. Unemployment rate, Roma and German population ratio are low. There are many available jobs that require a degree or higher education. Local business tax and export sales net income are high. It is a young cluster with

low aging and vitality indexes. It received less funding in the NHDP and Széchenyi 2020 programs.

7. Population drawing sleeping districts

These districts are also mainly not agricultural and receive little amounts of agricultural support funds. High population density and many newly build houses characterize these regions. IKT, construction industry and professional businesses are outstanding, but their numbers are smaller compared to the Dunakeszi district. Their demography indicators are good, unemployment rate is low, and they are close to Budapest and the highway routes. Economically speaking they are slightly above average, but they don't reach the best values regarding library remote access and medication traffic. They received more NHDP support funds than in the 2014-2020 program cycle.

8. Shrinking counter poles

These rural cities and county capitals have lower levels of agricultural support funds, but represent high levels of patent declarations and research and development activities. Usually they have higher income levels, detached houses, and net incomes. A decrease in population can be observed but the unemployment level is low, and the cultural indicators are high. The number of businesses in IKT and professions is outstanding, processing industry and construction industry are average. The ratio of people with a degree and jobs requiring a degree is high as well as the beneficiaries of the Széchenyi 2020 program.

9. „Grey” districts

These districts have average indicators compared to the national average. They are rural areas where the supported agriculture and sustainable welfare factor value are similar to the average. The ratio of German ethnic population and number of underprivileged kindergarteners differ significantly. Based on the time it takes to reach them and the amounts of support funds they are disadvantageous. Their aging index is high, and tourism is a popular activity in these regions.

10. Unemployed periphery

These areas belong to the ones with the second worst indicators. It consists of underprivileged mountain districts where the role of agriculture is minor. The proportion of forests is the highest throughout the country. The rural development and direct payments are low, the number of producers and their income rates are low. IKT, processing industry and professional businesses are poor. Medication traffic and the ratio of Roma population is high. The number of new cars is low,

unemployment rate is high. The NHDP and Széchenyi 2020 program support is average. The GDP per capita rate and the aging index are also average.

11. Breadbasket

The most fertile region in Hungary where the ratio of agricultural areas exceeds 80%. Districts of Békés vármegye as well as some districts of Csongrád-Csanád, Jász-Nagykun-Szolnok and Hajdú-Bihar belong here. This region is characterized by the high number of producers and high amounts of direct support fund payments. The number of entrepreneurial businesses is above average, and the ratio of employment is second best in the country. The region is mostly rural with some bigger cities. The number of newly built houses is low, income rate is average. IKT, processing and construction industries are less developed. Both the number of population and unemployment rate show a slight increase. Within the cluster, the GDP per capita is here the lowest. The NHDP and Széchenyi 2020 programs show average support.

12. "Beneficiaries" of rural funds

The districts of Baranya County, as well as some others form this region. This area is dominated by agriculture being number one in the support payments as well. Population density is low, employment rate is high, but the income rates are low. Among the businesses agriculture and processing industry are the most common. The number of cars and truck is average. The ratio of German and Roma population is high. The migration account is negative, unemployment rate is high. Business tax and export income are low. The ratio of people with a degree and jobs requiring a degree is low. These areas are far from Budapest and from the highway routes. Both the GDP per capita value and land fees are high. There are many family doctors and pediatricists in the region.

+1. Outlet deadwood

Budapest being the center of Hungary is economically and demographically outstanding. It has little significance in agriculture, but it is important due to its position in international relations. Population density and patent declarations are high. The number of high waged people is increasing, but the newly built detached houses are below average. Population may decrease, but the net income is high. It is dominated by IKT and professional businesses. There are many new cars, and the migration account is positive. The number of internet subscriptions and business tax is high. The export income rate is second highest. There are many people who have a degree as well as many jobs that require higher education. It also has a good ranking regarding forest area ratio. Crime rate and GDP per capita value are high. Land lease is high and most of the support funds

are directed in this direction. The ratio of family doctors and pediatricists is high, but in catering aging is experienced. The ratio of uninhabited houses is average.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the data no strong linear connection can be revealed between population change and the support fund payments of the New Hungary Development Plan and Economy Development Operational Program. According to the quartile analysis the NHDP funds have concentrated in the big cities and county capitals as well as in the Eastern part of the country. Regarding EDOP it is revealing that it concentrated close to highway routes, with main emphasis placed on M1 and M5. Neighboring relations analysis revealed that within the NHDP all the high-density centers were situated in the Eastern part of the country. By the EDOP the importance of the highway routes is revealing as well. In the NHDP the less supported areas were primarily in the Budapest agglomeration and scattered all around, while in case of the EDOP we see them in areas that can be characterized with bad infrastructure and peripheral location. We can draw the conclusion that the NHDP mostly targeted the less developed Eastern regions that may benefit regional cohesion and the reduction of un-equalities, but it will only have an effect in the long run and after further systematized funds, that will make it an effective tool of regional development. In my opinion within the center-periphery model, emphasis has been placed mostly on developing the periphery by supporting smaller rural centers.

The correlation analysis of the full Széchenyi 2020 and Economic Development and Innovation Operative Program shows a medium relation to population change. The regional autocorrelation analysis of the Széchenyi 2020 program, similar to the NHDP, shows that it did not significantly support the districts of Pest County, while they did not receive any support funds from the EDIOP funds at all. Compared to the NHDP program we can see more isolation in the support of the Eastern regions. There are more peak values that conclude a more concentrated call off of support funds. According to the regional autocorrelation analysis of the Széchenyi 2020 program, regarding the neighboring relations the Balaton region is clearly marked as the beneficiary of the support funds. By the EDIOP quartiles we can see that the M1 has somewhat lost its status and the funds were concentrated on the M3, M5, M7 districts. I reached the conclusion that the Széchenyi 2020 program served the concentrated support of rural centers and the peripheral districts and the ones with little regional capital received less emphasis. I recommend that during the development of operative programs more emphasis be placed on less developed regions and

districts as well as development of district centers. This way a regionally more equally shared, polycentric and more balanced hierarchy can be achieved, one that best serves investments and that can help regional cohesion to develop. It would be worth to develop a counter pole of 400-600 thousand people in the Eastern part of the country that would have the result of Budapest losing its center role. I believe this has a bigger chance of success in the Miskolc, Nyíregyháza, Debrecen triangle.

According to the variance analysis conducted on the results of the New Hungary Rural Development Program analysis it can be concluded that there is a connection between the beneficiary status of districts and the NHRDP fund transfers. The results of the linear regression analysis show an average connection between the indicators of NHRDP/1000 people and income/1000 people, although several other factors also have influence like unemployment/1000 people. According to regional autocorrelation analysis results, there are significant spatial patterns between the regional division of competitiveness, environment and the NHRDP funds transferred through LEADER rural development program. The results of the regional autocorrelation prove that the NHRDP funds concentrate on agricultural areas and regions with high environmental values. A rural development action team would serve the most the improvement of people living in the country as well as strengthen rural economy. Currently however, only a small percentage of the NHRDP funds are used this way as it is mostly believed that rural areas can be developed through the support of agriculture. It only had a marginal effect on the rural way of life and the preservation of population and furthermore it did not serve the development of rural economy efficiently.

The division of rural development funds within the group did not depend from the beneficiary classification of the districts. I found a medium correlation between income and rural development funds, however other factors may influence income. The relation between unemployment and rural development funds were weak, meaning there is no significant relation between the two indicators. Using the regional autocorrelation analysis a grouped the districts based on their neighboring relations. Generally speaking, although there were significant support payments transferred to the districts through various development programs, it did not concentrate on the most underdeveloped villages. My recommendation is that a more flexible and integrated approach need to be used while developing rural development strategies and programs, while paying attention to regional differences and taking into consideration local needs as well as putting more emphasis on the non-agricultural rural development

approach. Through the analysis of both rural development programs I came to the conclusion that with the utilization of the endogen power they could only lean toward intelligent shrinkage, and increase or intelligent increase can only be achieved by the unification of innovative outside investments and support policy, which these programs could not achieve.

It turned out during the analysis of the direct payments and population change, that the sum of area based support funds had been 336 billion forints in 2014, while it had increased up to 411 billion forints by 2019. The results show that this had little influence on population change. Afterwards I checked the connection between the tax base income per capita and population change since the area based support is an income supplemental support form. The results of the analysis show a medium and positive connection between income and population change. Both linear regression and ANOVA analysis has proved the existence of the connection. Based on the results we can conclude that districts with higher incomes are characterized by population increase or at least a lesser degree of population loss. According to the linear regression 10.000 forint income results in 0,046% population change. The loss of income supplement support funds would decrease district incomes and increase population migration. The withdrawal of area based agricultural support payments would mostly effect Békés County and several other ones as well. In districts that have high support sums population could decrease by 160-320 people. In less affected areas we can count with a maximum population decrease of 90 people which is negligible. The farm concentration of the support fund payments has increased in the 2014-2019 period. The average value of support fund payment per claimant has increased, especially in the Dunántúl and Nagyunság regions. This is mainly due to the Forint/Euro exchange rate, the introduction of the green component and the increase of the farm concentration. Geological capabilities and economical factors have also influenced the distribution of the support payments and the number of claimants. This one-sided income supplemental support policy that negatively affect competitiveness and production efficiency is being severely criticized by members of local community, economical, political and civilian organizations. The decision makers try to moderate this effect by increasing environmental and food health conditions. It is still a question how the European Union can keep up such a crucial and market disturbing support policy within the community. I recommend that for the claiming of direct support funds not only environmental protectionist but also efficiency and competitiveness in focus positioning support policies be created that assist and better serve smaller economies.

After conducting the population forecast it became obvious to me, that Hungary may face a serious demographic problem in the following decades if the current tendencies do not change. Not only will the number of the population change, but also its composition. The country's population compared to the 9,9 million in 2011 may decrease to 8,7 million calculated with a fertility rate of 1,5. In case of a two decimal decrease population is expected to be around 8,2 million while in case of a two decimal increase total population will be around 9,2 million. It can be said that rural villages are the ones that are likely to lose, most of their population. These villages are in the Southern part of the Alföld and Dunántúl and Northern part of Hungary out of which areas Békés County will lose the most of its population. There are three areas with outstanding population growth. These are the surroundings of Sopron, Győr and Budapest. The role of borders is also very well revealing as we can measure positive population change in villages that are close to the border with the neighboring well developed Austria, while in regions neighboring other countries this tendency is negative. Almost one third of the population can live in the Budapest agglomeration that will surely place the capital under a serious environmental and infrastructural pressure, while the number of villages and towns adding up to its agglomeration is increasing. The counter poles of Budapest also face population decrease out of which Debrecen, Pécs and Miskolc are affected the most. The country's deadwood tendency may further increase. The development policies face a challenge due to social and regional inequalities. My recommendation is to even the incomes of the regions, improve the rural infrastructure, reduce the Budapest centeredness and to put forward the rural centers of economic development, which would be a good solution. It would be worth bringing scientists working in the field of intelligent shrinkage into developing regional development strategies.

In the last chapter I conducted a district standardization. Since if there had been any connection between population change and support methods, the only thing that got revealed was that there are other factors playing a huge role in the rural district's population changes. This made the creation of a multi-indicator, multidisciplinary analysis necessary, that served to enlighten the spatial processes and peculiarities undergoing in rural areas. I concluded that Hungary has very diverse rural areas, but most of the rural areas show decaying tendencies, from economic, social and cultural perspectives. The most underdeveloped regions are the ones that do not even possess agricultural endogenetic resources. Cities intended to be the counter poles of Budapest, do not even fulfill the roles of regional spatial organizers yet, and suffer from shrinking. However, we can see the directions of development which are positioned along the highway routes.

One of these in the West-East direction is stretching from M1, along M3 until Debrecen. The other one is along the M6 highway in direction Pécs. The sprawl of the agglomeration zone around Budapest is also revealed. I would recommend the connection of regional capitals with highway lines and the improvement of railway lines to significantly reduce the time in which these county capitals can be reached, thereby allowing the regional participants to achieve a higher level of interaction.

Answers to research questions

Q1: Based on the data at hand does the payment transfers of the European Union's Structural and Investment funds (2007-2021), EAFRD (2007-2021) and EAGF (2014-2019) have any population retaining force with regards to direct payments?

Answer: Regarding the I. and II. pillar support funds no medium or strong connection can be presented between population retaining force and the support payments. While there is a weak connection, many other factors contribute to population changes. The transactions of the structural fund operative programs show slight connection with regards to the NHDP and medium connection with the Széchenyi 2020 program.

Q2: Do the rural development EAFRD fund payments support the catchup development of rural economy?

Answer: The NHRDP supported agricultural competitiveness and environmental actions contribute only slightly for the rural economies to catch up with the centers. The ratio of rural development actions and LEADER is negligible. This alone does not solve the problem of Hungary's rural areas to catchup.

Q3: Do direct support payments really serve the population to stay or they only serve as an income supplement, that increases the farm concentrating capability of capital strong farm economies?

Answer: Regarding direct payments a farm concentration can be experienced on a country level, mostly in regions dealing with field crops, but regionally speaking centralization is common mainly because of the support policy

Q4: Based on the current tendencies how will the population of Hungary be distributed on a village scale by the mid-century?

Answer: Population decrease is likely on country level that will mostly affect villages in the eastern part of the country. The increase of the Budapest agglomeration and isolated growth of some villages in the West and Middle of the Dunántúl regions is expected, mainly along the M1 highway route and the border with Austria.

Q5: Can a development zone in Hungary be examined, or there are only development zones around some cities and their agglomerations that have central importance?

Answer: The analysis of the operative programs and the cluster analysis, suggests that the economic development support payments concentrating along the highway routes and the exceptional economic indicators show the economic development zone stretching from Budapest, along the M3 highway till Debrecen, just like with the districts along the M1 highway. Aside of these, isolated development centers are only significant around big cities and their agglomeration.

Q6: What kinds of rural spaces can be observed, is there any with an economically and socially sustainable potential.

Answer: Most of the rural districts in Hungary show a decaying demographic status, where we can account for severe aging and population decline. From an economic and social perspective, the most prosperous one is the Budapest agglomeration, where expect further growth. Other regions are in the Northwest and big city regions, but among these are several that face challenges. Those regions not mentioned previously face economic and social shrinking of various degrees.

Answers to Hypothesis

H1: In our country the beneficial effects of European Union support funds having on the retention of rural population can extensively be proven. Among others, the CAP support funds significantly contribute to the retainment of rural population, thereby obtaining the working of agricultural and rural economy.

Answer: In case of some funds there are some hypothetical, mostly indirect connection, but rural population change is governed by several other factors as well. The NHDP and NHRDP has placed more emphasis on the poorer regions, unlike the Széchenyi 2020 and RDP programs. It's a fact, that it constitutes as a major capital injection for the agricultural and rural economy, however their utilization is not so obvious, as they just slightly contribute to population retention, and they have been built into the prices of the agricultural input material producers during the past years.

H2: Population retention force is mostly served by the funds spent to improve competitiveness and economic development, ones that are utilized through the operative programs in the rural areas of Hungary.

Answer: The operative program funds meant for economic development were requested by regions with bigger economic potential. Because of the higher

obtainable income level unemployment rates are lower and these are the target migration areas for the young working age population.

H3: Population decrease, and aging shows the realignment of rural life, the number of young people staying in the rural areas has significantly decreased. Population concentration is primarily a factor in big cities and regional capitals.

Answer: The largest population retention potential after the capital is held by the regional centers and big cities. Rural areas are expected to have severe aging and with the strengthening perforation effect the possibilities to retain the young population are less and less. These effects are also visible in big cities as well.

H4: Agriculture does not count as the main source of income in the rural areas nowadays. The income supplemental direct payments play a minor role in the creation of a region's sustainable demographic structure.

Answer: Farm concentration is visible and with the formation of big farms the population retaining force weakens. We can see that the number of people claiming direct support decreases year after year and the available support sum per claimant increases. Even with the withdrawal of these support types, the decrease of population would be expected to be minor.

H5: According to my assumption a West-East directed development zone is currently developing in Hungary thanks to which economic development contributes to improving living standards and results in a wider social welfare.

Answer: We can see that with the highway lines, mainly along the M3 route, a development zone has started out in Eastbound direction and in Southern direction along the M6 highway. One of the fundamentals of foreign capital settlement is the existence of transport infrastructure. Productive and innovative businesses induce competition in the wages which increase wages and living standards.

5. NEW SCIENTIFIC RESULTS

1. A linear connection between the New Hungary Development Plan and population change cannot be established, but based on the spatial distribution it has focused on the most underdeveloped districts of Hungary. It did not show a reliable connection by the transfers of the Economic Development Operative Program either, however being close to a highway route plays a crucial role.
2. I concluded that there is a medium connection between the Széchenyi 2020 program and population change just like in case of the Economic Development and Innovation Operative Program. Compared to the New Hungary Development Plan the Széchenyi 2020 features isolation and I could highlight a beneficiary center in the Balaton region. Just like with the EDOP, by the

EDIOP we can also see the importance of being close to a highway route, but the emphasis has shifted toward the M3, M5, M7 highway routes and their surroundings

3. The New Hungary Rural Development Program and the classification of the districts according to their beneficiary status show a connection, furthermore it is medium correlated with incomes and unemployment, but other factors have contributed as well. The main targets of its support transfers are the most competitive agricultural areas and the ones with high environmental values like Szabolcs-Szatmár-Bereg, Hajdú-Bihar and Jász-Nagykun-Szolnok counties.
4. I proved that there is no significant correlation between the rural development program and the beneficiary status of the districts. Between RDP and income rates, it shows a medium, while with unemployment it shows a weak connection. Its target areas similarly to NHDP has remained the same, but the districts of the Kiskunság and Baranya County become more finely provisioned, while the districts of Pest County also received more fundings.
5. I managed to point out that there is a weak linear connection between direct payments and population change. I concluded that with the loss of this kind of support only a minor population change is probable and would be significant in the agricultural rural regions mainly in Békés County. A farm centralization is taking place mainly in areas of field crops and wine yards.
6. I strived to create a village scale population forecast, that predicts the desolation of the South-Eastern country by 2051, while it may also cause a severe challenge to Northern regions and Southern areas of the Dunántúl region. I presented that even calculating with 1,3, 1,5 and 1,7 fertility rates a significant loss of population in Hungary is probable.
7. By conducting a multi-dimensional district standardization analysis, I concluded that the directions of regional developments in Hungary are greatly defined by the highway routes allowing me to draw up a development axis stretching in West-East direction.

I believe that my research provides a general idea of better understanding the support systems and demographic processes. I consider it to be noted, that there is very little research in Hungary dealing with the analysis of support fund transfers relating to European Union's Hungarian operative programs and the Common Agricultural Policy and the effects they have on demography and regional peculiarities.

PUBLICATIONS

Scientific journal article – in a foreign-published journal in a foreign language

Szabó, Cs. (2021): Spatial Distribution of the Rural Development Programme in Relation to Population Retention between 2015 and 2019. *Acta Universitatis Sapientiae European and Regional Studies*, 32-47 pp.

DOI: <https://doi.org/10.2478/auseur-2021-0010>

Szabó, Cs. (2020): Spatial distribution of Széchenyi 2020 resources in Hungary, with to special regard to the EDIOP and TOP Programs. *Pro Scientia Ruralis*, 2020, 7-25. pp.

Szabó, Cs. – Arany, F. (2019): The Population Retention of the Northern Great Plain Region According to the Agricultural and Rural Development. *Pro Scientia Ruralis*, 36-51 pp.

Scientific journal article – in a foreign journal published in Hungarian

Szabó, Cs. (2021): A közvetlen támogatások népességmegtartó ereje és változása 2014-2019 között a magyar vidéken. *Pro Scientia Ruralis* VI. évfolyam – 2021. 2p.

Scientific journal article – in a Hungarian-language journal published in Hungarian

Szabó, Cs. (2022): Kihalás kora? – avagy a magyar települések sorsa területi autokorrelációs vizsgálatok tükrében, *Valóság: Társadalomtudományi Közlöny*, 2022. 6-29. pp.

Szabó, Cs. (2021): Az Új Magyarország Fejlesztési Terv forrásainak területi eloszlása. *Valóság: Társadalomtudományi Közlöny*, 2021/7 p.

Egri, Z. – Arany, F. – Szabó, Cs. (2017): A közép- és kelet-európai régiók konvergenciájának területi relációi. *Jelenkori Társadalmi és Gazdasági Folyamatok, Demográfiai Osztályközi Állandó Bizottság*, 259-268 pp.

Egri, Z. – Tanczos, T. – Paraszt, M. – Arany, F. – Szabó, Cs. (2017): Az egészségtőke szerepe a társadalmi-gazdasági fejlettség területi egyenlőtlenségében. *Valóság: Társadalomtudományi Közlöny*, 87-111 pp.

Book excerpt – Hungarian

Szabó, Cs. – Egri, Z. (2015): Kelet-Közép-Európa térszerkezeti változásainak bemutatása 2000 és 2009 között. In: *A Szent István Egyetem, Gazdasági, Agrár -*

és Egészségtudományi Kar Tudományos Diákköri Műhelyeiben készült tudományos munkák, Szarvas, 69-76 pp.

Conference paper in journal or conference volume – foreign language

Szabó, Cs. (2019): Villages and Towns in Békés County. In: Digitization in Rural Spaces – Challenge and/or Opportunity? 3rd International Scientific Conference on Rural Development Conference Proceedings, 2019, 210-218 pp.

Szabó, Cs. (2018): Spatial distribution of supports to young farmers in the NHRDP. In: Magasabb (helyi) hozzáadott érték, mint a vidék kitörési lehetősége – II. Nemzetközi Vidékfejlesztési Tudományos Konferencia, 386-393 pp.

Conference paper in journal or conference volume – Hungarian

Arany, F. – Szabó, Cs. (2018): Az M6 autópálya hatása a gazdasági fejlődésre. In: Logisztika a Dél-Alföldön, Szarvas, 37-45 pp.

Arany, F. – Szabó, Cs. (2019): Magyarország infrastruktúrájának fejlettsége a vidéki terekben. In: 5. Logisztika a Dél-Alföldön, Szarvas, 23-29 pp.

Szabó, Cs. (2018): Az ÚMVP forrásainak eloszlása Magyarországon. Magasabb (helyi) hozzáadott érték, mint a vidék kitörési lehetősége – II. Nemzetközi Vidékfejlesztési Tudományos, ISBN: 9789632697987, 88-101 pp.

Szabó, Cs. – Egri, Z. (2017): A Dél-alföldi régió népességmegtartó ereje az agrár vidékfejlesztési politikák viszonylatában 2010-ben. Magyar Vidék – perspektívák, megoldások a XXI. században: I. vidékfejlesztési konferencia, Szarvas, 41-46 pp.

Szabó, Cs. (2016): Kelet-Közép Európa és a Balkán térszerkezete. A Szent István Egyetem, Gazdasági, Agrár- és Egészségtudományi Kar tudományos diákköri műhelyeiben készült tudományos munkák, Szarvas, 61-68 pp.

Abstract

Szabó, Cs. – Arany, F. – Egri, Z. (2018): Az Észak-magyarországi régió népességmegtartó ereje az agrár-vidékfejlesztési politikák tükrében. In: XVI. Nemzetközi Tudományos Napok, 272 p.

Arany, F. – Egri, Z. – Szabó, Cs. (2018): Térbeli egyenlőtlenségek vizsgálata a LEADER-jogcímek alapján. In: XVI. Nemzetközi Tudományos Napok, 47-47 pp.

Further announcements

Szabó, Cs. – Arany, F. (2022): The exercise of Hungarian agriculture on population change through the area-based aid system in 2017. „Rurality in

MTMT notice and citation summary table				
Data of Csaba Szabó (2023.08.08)				
Notice types	Number		References	
Scientific publications	All	Detailed	Independent	All
I. Scientific journal article	<u>8</u>	---	---	---
in a foreign-published journal in a foreign language	---	<u>3</u>	0	0
in a foreign journal published in Hungarian	---	<u>1</u>	0	0
in a domestic journal published in a foreign language	---	0	0	0
in a Hungarian-language journal published in Hungarian	---	<u>4</u>	<u>2</u>	<u>2</u>
II. Books	0	---	---	---
a) Book, as author	0	---	---	---
foreign language	---	0	0	0
Hungarian	---	0	0	0
b) Book, as an editor	0	---	---	---
foreign language	---	0	---	---
Hungarian	---	0	---	---
III. Book excerpt	<u>1</u>	---	---	---
foreign language	---	0	0	0
Hungarian	---	<u>1</u>	<u>1</u>	<u>1</u>
IV. Conference paper in journal or conference volume	<u>7</u>	---	---	---
foreign language	---	<u>2</u>	0	0
Hungarian	---	<u>5</u>	0	0
Total publications (I.-IV.)	<u>16</u>	---	<u>3</u>	<u>3</u>
Abstract	<u>2</u>	---	0	0
Research data	0		0	0
Other scientific works	0	---	0	0
All scientific works	<u>18</u>	---	<u>3</u>	<u>3</u>
Hirsch index	<u>1</u>	---	---	---
Educational works	0	---	---	---
Higher education works	0	---	---	---
Higher education textbook in a foreign language	---	0	0	0
Higher education textbook in Hungarian	---	0	0	0
Part of a higher education textbook in a foreign language	---	0	0	0
Part of a higher education textbook in Hungarian	---	0	0	0
Educational material	0	---	0	0
Forms of protection	0	---	0	0
Creation	0	---	0	0
Dissemination works	0	---	---	---
Journal article		0	0	0

Books	---	0	0	0
Other educational works	---	0	0	0
Works of public interest or not classified	0	---	0	0
Further announcements	<u>1</u>		0	0
Other authorship	0	---	0	0
Citation for edited works	---	---	0	0
Citation in dissertation, other types	---	---	0	0
All announcements and all their citations	<u>19</u>	---	<u>3</u>	<u>3</u>