THESES OF DOCTORAL (PhD) DISSERTATION

TÍMEA GYŐRI

GÖDÖLLŐ

2024

MAGYAR AGRÁR- ÉS ÉLETTUDOMÁNYI EGYETEM

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

Study of the spatial correlation between employment policy and unemployment in Europe, with a special focus on Hungary

THESES OF DOCTORAL (PHD) DISSERTATION

DOI: 10.54598/002790

Tímea Győri

Gödöllő

2024

The doctoral school

Name: Doctoral School of Economics and Regional Sciences

Field of science:: Regional sciences

Leader: **Prof. Dr. Zoltán Bujdosó**
university professor
Hungarian University of Agricultural and Life Sciences
Institute for Rural Development and Sustainable Economy

Supervisor:: **Dr. Zoltán Egri**
associate professor
Hungarian University of Agriculture and Life Sciences
Institute for Rural Development and Sustainable Economy

…… ……

Approval of the Head of the School

Approval of Supervisor

1. BACKGROUND AND OBJECTIVES OF THE WORK

Employment and unemployment, which are the most important determinants of labour market processes, can be considered as a frequently changing and at the same time "evergreen" research topic of regional science (KÓTI 2020). Labour market analyses are of crucial importance for many Hungarian and EU policies, especially cohesion and employment policies. Employment policy, which is increasingly adapted to social and economic development, spatially differentiated employment and real processes, prioritises different active instruments for each region (ARANDARENKO – JOVIČIĆ 2007). In Hungary, there is no practice of employment policy differentiated by regions (LIPTÁK 2014). According to G. FEKETE – LIPTÁK (2014), different combinations of elements of the mixed employment model are recommended for areas with different endowments.

In our country, the 1990s saw a more profound transformation of the economy and society. Among these changes, the most marked impact was caused by the transformation of the economy, the decline in production of varying nature, rate and direction, the main causes of which were privatisation and thus changes in ownership, unemployment and the reorganisation of foreign trade relations. The change of regime coincided with the emergence of open unemployment, with a dramatic increase in the number of registered jobseekers in the early 1990s. According to KSH data, by the end of 1992 the number of registered unemployed had reached 663,000 at national level, while the unemployment rate was 12.7%.

Following the economic downturn caused by the regime change, the financial and economic crisis that started in 2008 with the collapse of the US housing market (BARTA – LŐCSEI 2011) also spilled over into the labour market. The crisis has had a significant impact on employment trends in the European Union, with the number of unemployed rising by five million in 2009 (KÁDÁR 2018). Unemployment has hit the Baltic countries, Spain and Ireland hardest. Countries have developed differentiated instruments to address the general labour market crisis. The specificity of the situation in Hungary is that within a relatively short period of time, the domestic labour market has experienced its second shock since the turn of the 1990s. Within the set of instruments designed to address labour market anomalies, priority has been given in Hungary to widening the scope for public employment.

The relatively brief period of recovery was brought to an end by the economic recession caused by the emergence of the coronavirus epidemic at the end of 2019. The economic downturn caused by the epidemic has made it even more challenging for Member States to reach a number of Europe 2020 targets.

According to the National Employment Service (NFSZ) in Hungary, the number of jobseekers increased by 25.95% in 2020 compared to 2019 due to the restrictions imposed by the epidemic, similar to the surge caused by the 2008 economic crisis.

Crises have affected regions to different degrees, thus reinforcing further territorial differentiation in development gaps. The key questions about crises affecting the labour market are where, which segments and to what extent they affect, and what opportunities exist to address the crisis. What alternatives are available to recover from global employment crises? The central question for crisis management is whether global responses exist or whether local solutions are needed.

In the short term, increasing spending on employment policy is the obvious way to tackle employment crises, but in the longer term, more complex, territorially differentiated economic development and employment policy measures are needed. My paper seeks to answer a number of questions related to crisis management and economic development. What has been the composition of spending on employment policy instruments in the European Union, and which labour market interventions have been favoured by Member States? How has the methodology of resource allocation in EU cohesion policy changed? What possibilities are available for rethinking and refining the methodology?

I have personal experience, especially of the local employment and social situation in rural areas. In my opinion, an effective response to employment crises requires a territorially differentiated employment policy and resource allocation, in which analysis and forecasting based on consistent information and in-depth territorial analysis of unemployment play a key role.

From a policy perspective, the categorisation of regions according to their level of development is of particular importance in the design of spatially differentiated interventions. In the European Union, the eligibility of regions is determined on the basis of the Community average GDP per capita. Composite indicators provide a more complex assessment of the differences in development between regions. In Hungary, the classification of districts and settlements is based on a complex index of social, economic and environmental indicators. Nowadays, the grouping criteria used to design differentiated support schemes (e.g. unemployment rate, GDP, etc.) are typically used to categorise regions not in isolation but in the form of complex indicators. Composite indicators provide policy makers with a more comprehensive understanding of employment conditions, challenges and opportunities.

1.1 Objectives

The objectives set out in this thesis are very broad. On the one hand, they require a theoretical overview of unemployment as a general social phenomenon and of the closely related issue of public employment as an active employment policy instrument. On the other hand, they are of a methodological nature (analysis of the spatial structure and concentration of unemployment and public employment, complex indicators) and summarise the experience of analyses, both theoretical and methodological. The main objectives of the dissertation can be summarised as follows:

C/0. Review of the national and international literature on the subject

In the context of the conceptualisation, the literature on unemployment, public employment, employment and cohesion policy is reviewed, both at home and abroad. The chapter concludes with a discussion of some simple and composite indicators of economic growth, development and underdevelopment that can help in the design of territorially differentiated employment policies.

C/1. Analysis of employment policy expenditure in the EU Member States

In this chapter, I aim to provide an objective picture of the composition of spending on specific employment policy instruments in the EU Member States. My aim is to explore how EU Member States responded to the crises of 2008 and 2019, what labour market interventions were favoured and how the structure of labour market expenditure in the Member States changed. In this research, I examine how unemployment has evolved across Member States as a function of labour market expenditure.

C/2. Change and correlation analysis of the Europe 2020 indicators

In this research unit, I examine the changes in and correlations between the indicators of smart and inclusive growth of the Europe 2020 strategy designed to address the 2008 crisis.

C/3. Categorization of regions of the European Union

The focus area of the research is the methodology of eligibility of NUTS2 regions in the European Union. The EU resource allocation is based on the Community average GDP per capita. The research calls for a methodological rethink of the traditional GDP-based allocation of cohesion policy resources. My aim is to create a more complex regional categorisation model based on the Europe 2020 indicators for smart and inclusive growth and to explore whether the model results in a significant shift from traditional GDP-based categories.

C/4. Comparative analysis of labor market databases, territorial inequalities

Examining the differences between the basic unemployment databases of the Hungarian Statistical Office (KSH) and the National Unemployment Office (NFSZ), I seek to answer the question of the extent of the differences between the information on unemployment in Hungary, exploring also the differences in the concentration of the databases by age group with different methodologies. Finally, I examine the tightness of the labour market and the spatial polarisation of the number and relative rates of jobseekers.

C/5. Analysis of the spatial structure of unemployment and public employment in Hunrary

An in-depth territorial analysis of unemployment is a key element in the development of employment strategies best suited to each area. In this research, I will examine changes in national unemployment and closely related public employment at the settlement level between 1993 and 2022. Furthermore, I will map the evolution of the concentration and spatial structure of jobseekers and public employees according to their main human resource characteristics (age, education) and their interrelationships, examining whether regular spatial patterns and overlaps can be detected in their distribution. In order to identify groups with critical concentration, I will process the compiled basic database using several statistical methods (location coefficient, spatial autocorrelation, spatial intersection) and compare the differences in the results.

C/6. Labour market typology of settlements in Hungary

As part of the research, I set the goal of building on the results of previous studies and using a combination of other labour market indicators, to typify Hungarian settlements using a multivariate cluster analysis algorithm operationalized with contiguity restrictions. I compare the obtained results with the size of the settlements and the spatial distribution of settlements with significant unemployment, as defined in Government Decree 105/2015 (IV. 23.), in the spatial delimitation of the labour market districts created in 2017.

1.2 Hypothesis

In line with the objectives, I have formulated the following hypotheses related to the research topic:

H/1. Different groups of employment policy instruments are prioritised in the EU Member States to address the labour market effects of different economic crises.

H/2. There is a fault line along the smart and inclusive dimensions of the Europe 2020 strategy in Europe, linked to structural inequalities in the labour market and to national and regional institutional specificities.

H/3/a. I assume that a new composite model based on the indicators of the Europe 2020 strategy will provide a more complex expression of the differences in development between regions and will allow a more nuanced delimitation, in particular with regard to the labour market.

H/3/b. I assume that the regional composite model constructed identifies a larger number of regions as catching-up and lagging regions than the traditional GDP-based categorisation of entitlements.

H/4. I assume that institutional labour force surveys provide information on unemployment trends that is more representative than labour force surveys and with different relative frequencies across age groups.

H/5. The spatial structure of the unemployed and the publicly employed differs with respect to the main human resource characteristics.

H/6/a. The spatial structure model at the settlement level, using the main indicators and concentration values of unemployment and public employment, parameterised by a clustering procedure with contiguity constraints, differs from the traditional spatial structure characteristics (centre–periphery, urban–rural, East–West).

H/6/b. It is assumed that the proportion of small villages (settlements with a population of less than 500) is highest in the worst-off category of settlements.

2. MATHERIAL AND METHODS

The focus of the paper was mainly on the analysis of statistical data collected from secondary sources. The following national and international databases were used in the research Central Statistical Office (KSH), National Employment Service (NFSZ), National Spatial Development and Planning Information System (TeIR), Ministry of Interior (BM) Public Employment Database and EUROSTAT. The data on the settlement level of public employees by age and education level were provided by the Ministry of Interior. The summary of the methodological plan of the research (*Table 1*) provides a breakdown of the data sources used to test the hypotheses and the methods used, according to the objectives.

Table 1. Summary of the research methodology plan

Objectives	Hypothesis	Database	Period	Methods used
C/1.	H/1.	EUROSTAT	2008–2021	Search-matching model
C/2.	H/2.	EUROSTAT	2009–2022	Correlation analysis Coefficient of determination
C/3.	H/3/a. H/3/b.	EUROSTAT	2019	Descriptive statistics Correlation analysis Multiple imputation Spatial autocorrelation Factor analysis Cluster analysis Analysis of variance
C/4.	H/4.	KSH, NFSZ	2013–2022	Lorenz curve Dual indicator Hoover index Beveridge curve
C/5.	H/5.	TeIR, NFSZ, BM	1993–2022	Correlation analysis Location quotient Spatial autocorrelation Spatial intersection
C/6.	H/6/a. H/6/b.	TeIR, NFSZ, BM	2022	Descriptive statistics Correlation analysis Factor analysis Cluster analysis with restrictions Analysis of variance Discriminant analysis

Forrás: Saját szerkesztés

The methodology used in the survey is very broad, ranging from simple inequality indicators to multivariate data analysis methods. MS Excel and World and IBM SPSS Statistics 26 were used to process the data. Spatial statistical analyses and visualisation of results on cartograms were carried out using ArcGIS 10.8 and GeoDa 1.22.0.2 software.

2.1 Analysis of employment policy expenditure in the EU Member States

The data used for the analysis of the structure of employment policy expenditure at Member State level was provided by the EUROSTAT LMP database datasets. The labour market can be analysed with a number of models, the most well-known of which are search-pairing models (MORVAY 2012). In the framework of this research, I have used a so-called **search-pairing model** to illustrate the evolution of labour market expenditure and unemployment in the individual Member States in order to facilitate the visualisation of the relationships.

2.2 Change and correlation analysis of the Europe 2020 indicators

The territorial base of the analysis was the Member States and regions of the European Union. The data used were provided by the EUROSTAT databases. Pearson correlation analysis was used to examine the correlation between the indicators of the Europe 2020 strategy. The coefficients indicate a strong correlation in absolute value at intervals 0.7–1; a medium correlation at intervals 0.3–0.7; and a weak correlation at intervals 0–0.3 (NEMES NAGY 2005). The **Pearson correlation coefficients** were used to calculate the **coefficients of determination**.

2.3 Categorization of regions of the European Union

The territorial base for the research on the categorisation of regions in the European Union was the regions of the 28 EU Member States. The study is based on the NUTS2 (regional) territorial levels defined according to the NUTS 2016 statistical classification system. The data used were provided by the NUTS2 level datasets of the EUROSTAT database. As a first step in the compilation of the research base database, the annual base data were subjected to a data gap analysis, and the results were taken into account and further research was based on the indicator datasets for 2019.

The initial baseline of the research included the 5 main indicators of smart and inclusive growth of the Europe 2020 strategy and 18 other indicators (background variables). Potential background variables were screened based on missing data, with data gaps considered to be significant (more than 20%) being excluded. From a base database of 14 variables compiled according to

the criteria, a total of 8.1% of the variables were missing. **Multiple imputation** (MI) was defined as the method for dealing with data gaps.
In order to compress the variables of the imputed base database with minimal loss of information, I performed a **factor analysis** after Z-standardising the data. The extraction method was principal component analysis, which was run with multiple parameters and components. The number of significant principal components was both directly shaped and operationalized by assigning eigenvalues based on the Kaiser criterion.
The clustering of the latent variables generated by principal component analysis was also investigated using spatial autocorrelation and hierarchical cluster analysis. The spatial autoregressive modelling procedures used in this research were **Global and Local Moran I statistics**. Spatial autocorrelation was parameterized with several spatial weights. The number of permutations in the calculations was 999. Finally, I operated with the control neighbourhood weight matrix with the highest Global Moran I value.
Finally, I grouped the regions along the dimensions of the generated principal components using **hierarchical cluster analysis**. The squared Euclidean distance was used to measure the distances between clusters. The discriminatory power of the variables was also tested by **analysis of variance**, ANOVA variance decomposition table was constructed to check them. The rank-based **Kruskal–Wallis test** was run as a control test.

2.4 Comparative analysis of labor market databases, territorial inequalities

In the analysis of the labour market databases I also used secondary data sources, the public databases of the KSH and the NFSZ. By exploring the differences between the databases, I sought to find out to what extent they differ. The research has produced a consolidated table illustrating the differences between the two databases, which contains data for 3 age groups (15–74, 15–64 and 20–64) for the period 2013–2022.
I focused on the labour market data for the age group 20-64, which is the age group covered by the Europe 2020 strategy. The concentration of jobseekers in the priority age group by predefined age groups (20–24, 25–34, 35–44, 45–54 and 55–64) is plotted on **Lorenz curves**, illustrating the differences in the distribution of age groups.
The existing spatial disparities and their extent were assessed using the **Dual Indicator** and the **Hoover Index**. The labour market tightness between 2009 and 2022 is illustrated by a **Beveridge curve**.

2.5 Analysis of the spatial structure of unemployment and public employment in Hungary (1993–2022)

The data used in the analysis of the spatial structure were provided by the TeIR datasets and the Ministry of Interior. The research interval is 1993–2022. The spatial base of the analysis was 3155 settlements in Hungary.
Among the methodological procedures that can be used to investigate the spatial structure, the **location quotient** (LQ) was chosen, which is well suited for the study of domestic regions (VAS et al. 2015). I map the groups with a decisive weight within the registered job seekers and the public employed. I split the registered jobseekers into three age groups: under 25, 25–54 and 55+. I also distinguish three groups according to educational attainment: primary, secondary and tertiary. I interpreted the index according to the following scale: no concentration below 1, weakly concentrated between 1,000 and 1,250, moderately concentrated between 1,251 and 1,500, moderately concentrated between 1,501 and 2,000 and highly concentrated above 2,001.
For a more complex analysis of the concentration of unemployed and publicly employed (LQ), I used the method of **spatial autocorrelation** (**Global and Local Moran I statistics**). In the framework of this research, I sought to answer the question whether regular spatial arrangements can be detected in the spatial distribution. In order to select the most appropriate weight matrix, I also modelled the spatial autocorrelation of the concentration of jobseekers with tertiary education in 2022 using different weight matrices. I calculated 999 permutations in the statistics. When choosing the spatial weight matrix to be applied, it is important to keep in mind that the settlements closer to each other always have a greater impact on each other, so for the spatial autocorrelation in the rest of the research I used the fixed (Euclidean) distance weighting with threshold distances of 15 km and 30 km.

2.6 Labour market typology of settlements in Hungary

The basic data used for labour market typification of settlements were provided by the TeIR databases and the Ministry of Interior. Using the results of the previous chapter, I have examined the unemployment and public employment situation of settlements by building on multivariate data analysis techniques. The territorial base of the research was 3155 settlements in Hungary.
To the 2022 population, permanent population, registered jobseekers and unemployed registered beyond 180 days, I have added the ratio of the total number of jobseekers and the public employed to the working age population (MN+KF rate) and the LQ values for the groups with primary education and under 25 years of age, identified as a critical group in the previous chapter.

After Z-standardising the selected indicators, I performed a **factor analysis** to compress the information carried by the 7 indicators selected. The extraction method was principal component analysis. All of the selected variables were considered suitable for factor analysis, with the communality (coefficient of multiple determination) for none of the indicators being less than 0.25. Only factors with a Cronbach's alpha greater than 0.70 were used to construct the principal components in the study. The number of significant principal components was operationalized by giving the Eigenvalues according to the Kaiser criterion.

In the empirical research, I investigated the clustering of settlements along the dimensions of the generated principal components using, in addition to the **traditional K-means cluster analysis**, additional **contiguity constrained procedures** and several parameterizations to identify the appropriate method. To determine the number of clusters, I used the results of previous tests (hierarchical cluster analysis) and took into account policy considerations. Finally, I created 5 categories, with the proviso that Budapest should be a separate category in the model deemed appropriate. The number of specific categories varies depending on the aims and objectives of the policy, but it is not considered desirable to have too many categories as this may make it difficult to develop specific programmes. The discriminatory power of the variables was also assessed by **analysis of variance** (ANOVA).
During the research, I isolated and tested (ANSELIN 2017) 4 methods with different parameters: the **traditional K-means cluster analysis**, the extension of K-means cluster analysis with **geometric centroids**, the method based on the **Skater procedure** and the **Max-p cluster method**.
Prior to the selection of the final spatial weight parameters (fixed 15 and 30 km), a complementary study was carried out based on the results of the simulation tests. **Discriminant analysis** was performed to determine the differences between the clusters obtained by cluster analysis.
For the model with 30 km weighting, each cluster shows a much more heterogeneous spatial distribution, with an accuracy of 66.8% for categorisation. In contrast, the parameters of the 15 km model resulted in much more homogeneous clusters, while the accuracy of categorisation deteriorated to 51.2%. In my view, if a more homogeneous delineation of area clusters is justified for policy reasons, the model accuracy criterion can be interpreted more broadly. Following the simulation tests, I selected a model based on the **Skater algorithm** to categorise domestic settlements based on unemployment indicators, using a 15 km distance-based model weighted by a 10% permanent population.

3. RESULTS AND DISCUSSION

3.1 Analysis of employment policy expenditure in the EU Member States

Related to the research objective on employment policy spending, I assumed that different employment policy instruments are prioritised differently across EU Member States to address the labour market effects of different economic crises.

3.1.1 Impact of the 2008 economic crisis

In order to analyse the short-term labour market effects of the 2008 economic crisis, I first examined the increase in unemployment among the active population aged 20–64 in the first year of the crisis and the related changes in the level of labour market interventions (MEPI) between 2008 and 2010 at Member State level.

Within the set of instruments to address labour market anomalies, the weight of each measure varied considerably. Most Member States' expenditure as a share of GDP was highest in the category of maintaining and supporting incomes outside work, at around 56% at EU level. Within the instruments, on average, almost 10–10% is allocated to labour market services and training, and 5–5% to supported employment and rehabilitation and employment incentives. The share of other instruments is below 5%.

The composition of LMP expenditure in Bulgaria, Poland, Belgium and Slovakia in 2008 was different from the average (*Figure 1*). Looking at the composition of labour market instruments, direct job creation stands out in Bulgaria (37%), early retirement in Slovakia (47%) and Belgium (27%), while in Poland early retirement and supported employment and rehabilitation interventions were prioritised by 23–23%. Belgium also spent more than the average on early retirement, with 27% of its resources devoted to this. There are also disparities in the Czech Republic and Malta, where more than a quarter of expenditure is spent on labour market services.

The composition of labour market expenditure as a share of GDP changed little between 2008 and 2010. Overall, the share of maintaining and supporting incomes outside work increased, while the share of other employment policy instruments decreased. In Member States with a different preference for employment policy instruments than the average, with some exceptions, differences in the distribution of interventions persisted. In Slovakia and Poland the share of early retirement decreased, in the Czech Republic the share of labour market services decreased, in Bulgaria the share of direct job creation decreased, while in Hungary the share increased from 12% to 29%.

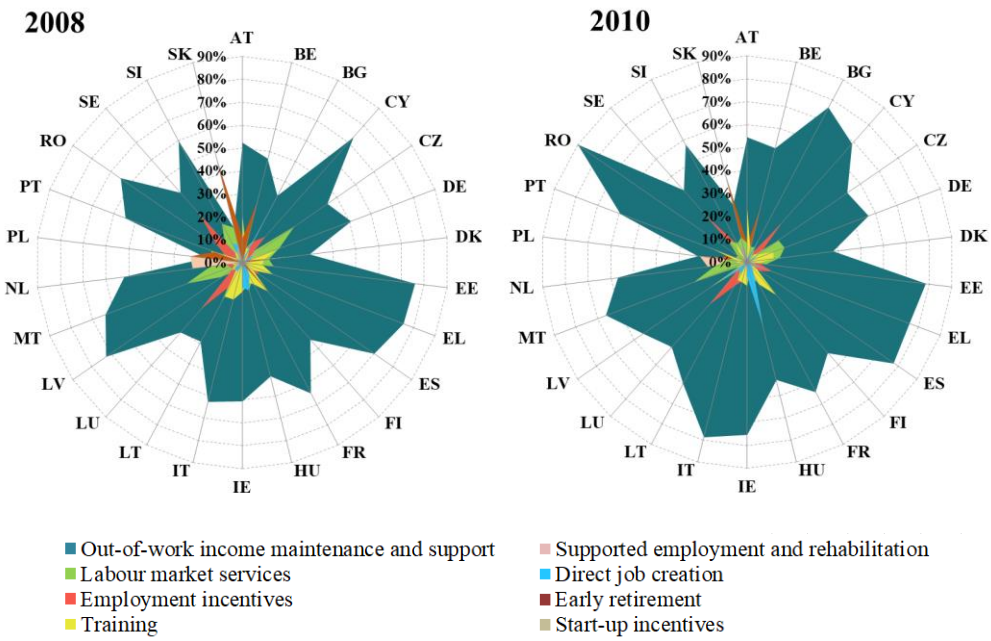

Figure 1. Composition of labour market expenditure (2008, 2010)

Source: Own calculation and editing based on EUROSTAT data

I also examined the evolution of unemployment per expenditure for the Visegrad 4 between 2008 and 2018 (*Figure 2*). Hungary and Slovakia started from almost identical labour market situations in 2008. In Hungary, the volume of labour market expenditure increases with rising unemployment and the curve shifts outwards. After 2013, there was a change, with the curve shifting towards the origin, i.e. less was spent on labour market interventions in parallel with improving unemployment figures. Unemployment in the 20–64 age group fell below pre-crisis levels by 2018. Unemployment in Slovakia increased at a higher rate in the first years of the crisis, peaking at 13.8% in 2013, but at the same time the increase in expenditure as a share of GDP has lagged behind.

In Poland, unemployment and interventions as a share of GDP followed almost the same trends as in Slovakia. The pace of expenditure growth has also lagged behind the rate of unemployment growth, and after a turnaround in 2013, unemployment fell as expenditure declined, approaching pre-crisis levels in 2018.

Unemployment in the Czech Republic has risen at the slowest rate, peaking at 7.1% in 2010, before gradually declining to just 2.2% in 2018. Interventions as a share of GDP were also lowest in the Czech Republic, with the exception of 2014 and 2015.

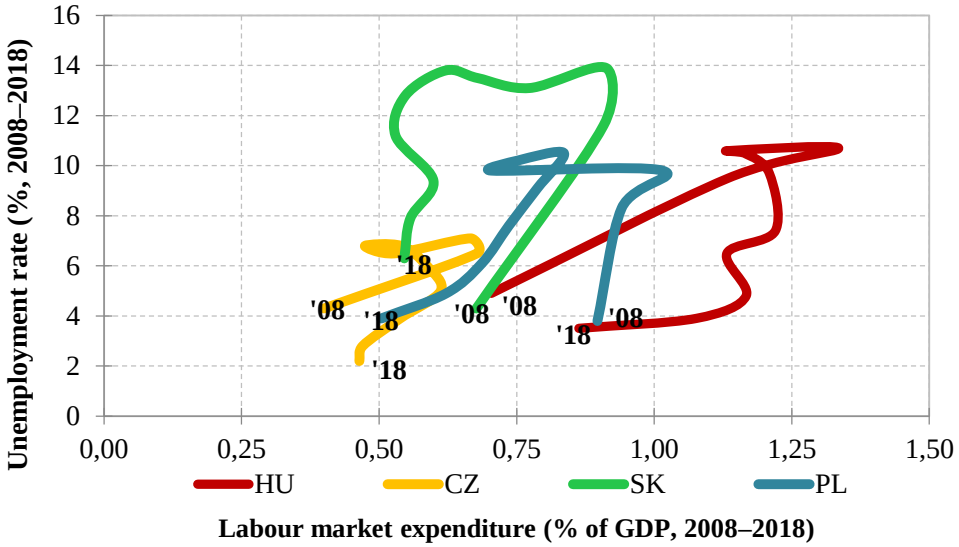

Figure 2. Trends in unemployment and labour market expenditure in the Visegrad 4 (2008–2018)

Source: Own editing based on EUROSTAT data

3.1.2 Impact of the COVID-19 epidemic

After 2018, the year of recovery from the 2008 crisis, Member States faced new labour market difficulties. New employment policy interventions were needed to address the economic recession in the context of the crown virus epidemic in 2019. Labour market expenditure as a share of GDP rose above the 2008 crisis, with 2.91% of GDP on average in the EU spent on labour market measures in 2020, while the unemployment rate for the 20–64 age group was 7.1% of the working-age population. The share of instruments changed little on average in the EU between 2018 and 2020, with expenditure on maintaining and supporting incomes outside work (72%) and employment incentives (9%) continuing to increase, while the share of other categories decreased. As a result, the short-term effects of the recession caused by the coronavirus epidemic have typically been addressed by employment incentives and the maintenance and support of in-work income. The share of employment incentives within the instruments has increased significantly in Ireland, Bulgaria, the Netherlands, Lithuania and Poland (*Figure 3*). In Denmark, the importance of subsidised employment decreased and the amount used to maintain and support in-work income increased. In Hungary, the share of direct job creation has decreased from 48% to 27% in 2020, while spending on employment incentives and on maintaining and supporting incomes outside work has increased. In addition, tax and contribution relief

for workers and employers has been provided in some sectors to mitigate the economic impact of the emergency declared due to the coronavirus epidemic.

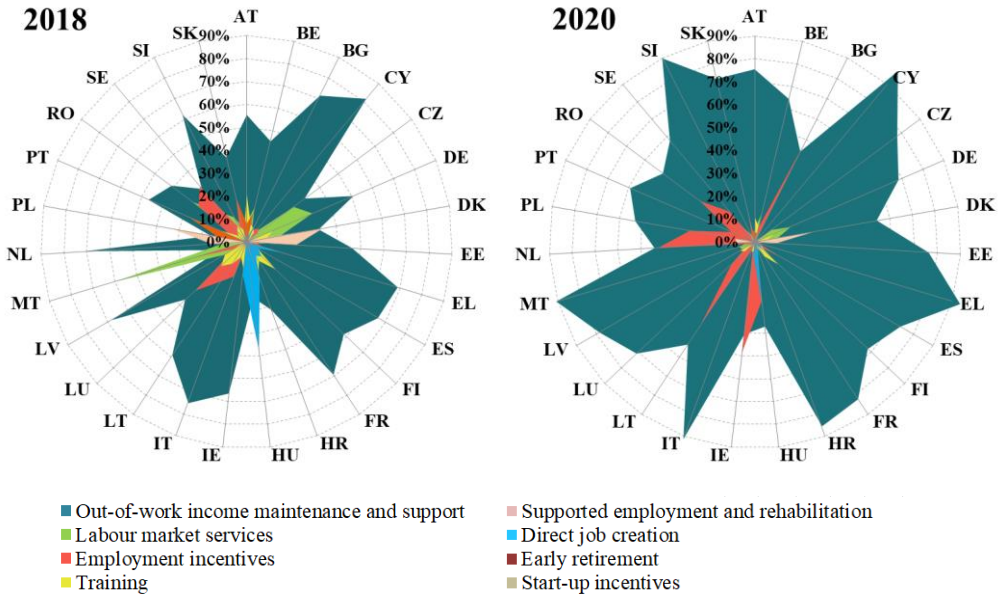

Figure 3. Composition of labour market expenditure (2018, 2020)

Source: Own calculation and editing based on EUROSTAT data

In 2021, labour market expenditure as a share of GDP fell in all but Bulgaria, Slovakia and Portugal, but typically remained above 2018 levels. Looking at the composition at Member State level, the share of employment incentives continued to increase in Bulgaria (63%), while direct job creation was again more prominent in Hungary (39%).

3.2 Change and correlation analysis of the Europe 2020 indicators

In relation to the indicators of the Europe 2020 strategy for smart and inclusive growth, I hypothesised that there is a fault line along the smart and inclusive dimensions of the strategy in Europe, which is related to structural inequalities in the labour market and to national and regional institutional specificities.

3.2.1 Indicators at EU and national level

Progress towards the targets set in the Europe 2020 strategy is very mixed. EU-level headline indicators have improved significantly between 2009 and 2021. R&D expenditure as a share of GDP increased by 2.3%, while the employment rate reached 72.2% in 2020. The share of people living in poverty and social exclusion is 21.5%, with the headcount down by 8 853 thousand compared to 2008. Among the indicators relevant to the research, only the

education target was met at EU level in 2020, with the recession caused by the coronavirus epidemic in 2019 playing a role. In the first year of the crisis, which also affected the labour market, employment rates in most Member States ranged between 65% and 80%, while the share of tertiary education was between 20% and 45% and the share of early school leavers was typically below 20%. Indicators show a significant improvement over the period. In 2020, the dispersion across Member States is much smaller in all three dimensions, reflecting the narrowing of regional disparities.

3.2.2 Variables at regional level

The analysis of indicators at the regional level showed a much higher degree of differentiation than the aggregated national data. At the regional level, the regions of Sweden, the United Kingdom, Germany, the Czech Republic and the Baltic States have employment rates close to or above the EU target (Figure 5). Employment rates are well below the EU average in Romania, Greece, Southern Italy and Southern Spain. The 75% employment rate target was met at national level in Hungary, but there are significant regional differences. Budapest (79.3%), West Transdanubia (78.5%), Pest county (77.9%) and Central Transdanubia (77.0%) had the highest employment rates, while South Transdanubia had a lower employment rate than the national average, at around 70%. Employment figures improved after the COVID19 epidemic, with 141 regions above 75% in 2022.

Early school leaving rates have been reduced to below 20% by 2020 in all but 10 regions, mostly in Spain, Bulgaria and Romania. The indicator remains high in the regions of Northern Hungary (20.8%), Southern Transdanubia (17.5%) and Northern Great Plain (15.2%). The indicator continued to improve after 2020, with all regions in Spain having a drop-out rate below 20% in 2022.

The share of people with tertiary education is high at regional level, typically above 60% in the capital cities and their agglomerations (e.g. Stockholm, Warsaw, Prague, etc.). The share of the population with tertiary education is much lower than average in many regions of Romania, Bulgaria, Poland and Italy. The indicator is below 30% in all regions except Budapest (58.9%) and Pest county (37.3%).

3.3 Categorization of regions of the European Union

In relation to the research question, I hypothesised that a composite model based on the Europe 2020 indicators could be created that would capture the differences in development between regions in a more complex way and allow for a more nuanced delineation, in particular with regard to the labour market. Furthermore, I assumed that the composite model constructed identifies a

larger number of regions as catching-up and lagging regions than the traditional GDP-based categorisation of eligibility.

3.3.1 Correlation analysis of variables

Taking into account the results of the data gap analysis of the indicators defined in the strategy, I selected the data set on which my research is based, which contains data for 2019 for 9 additional regional-level potential background variables in addition to the 5 indicators selected in the strategy. Pearson correlation analysis was used to identify the correlations between the indicators and the selected background variables (*Table 2*).

Table 2. Correlation analysis of indicators and variables (2019)

Indicators	Intramural R&D expenditures	Early leavers from education and training	Tertiary educational attainment	Employment rate	People at risk of poverty or social exclusion
Intramural R&D expenditures	1	-.275**	.291**	.373**	-.306**
Early leavers from education	-.275**	1	-.453**	-.417**	.493**
Tertiary educational attainment	.291**	-.453**	1	.300**	-.353**
Employment rate	.373**	-.417**	.300**	1	-.646**
People at risk of poverty	-.306**	.493**	-.353**	-.646**	1
GDP at current market prices	.562**	-.231**	.457**	.475**	-.409**
Income quintile share ratio (S80/S20)	-.175**	..487**	-.221**	-.282**	.607**
Life expectancy (years)	.321**		.259**		-.196**
Activity rate (20–64 age group)	.393**	-.330**	.366**	.896**	-.528**
Employed in high-tech sector	.468**	-.364**	.601**	.396**	-.399**
Unemployment rate (20–64 age group)	-.255**	.452**	-.150 *	-.861**	.611**
Long-term unemployment	-.275**	.309**	-.416**	-.709**	.540**
Levels 0–2 education % of unemployed	-.159**	.380**	-.147 *	-.675**	.474**
Lifelong learning (25–64 age group)	.362**	-.190**	.419**	.345**	-.334**

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Source: Own calculation and editing based on EUROSTAT data

It was found that there is no explicit strong correlation between the indicators. A positive correlation of medium strength (r= 0.373) was found between R&D

expenditure as a share of GDP and employment. Of the Europe 2020 indicators, the indicator on the risk of poverty and social exclusion has the highest correlation and the employment rate the strongest.

3.3.2 Principal component analysis of indicators and variables

In the regional model, using a narrow set of background variables with little or no data gap, the strategy indicators were complemented by indicators for high-tech employment, unemployment rate and unemployment rate with low educational attainment (MCI 0–2). The variables included were found to be appropriate for factor analysis. Two principal components were generated in the composite model. The combined coefficient of variance of the principal components is 68.1%. The first factor has an eigenvalue of 3.106 and the second factor 2.339. The first principal component includes variables related to unemployment, employment and poverty risk, while the second includes indicators related to skills, R&D expenditure and the share of high-tech sector employment. Hereafter, I will refer to the new latent variables as Relative Deprivation and Innovation Environment based on the information they summarise.

3.3.3 Cluster analysis of principal components

In order to facilitate the interpretation of the results, a hierarchical cluster analysis was used to classify and type the regions into homogeneous groups (*Figure 4*). The clusters were interpreted by comparing the averages. The four clusters created were named Outstanding, Catching-up (Innovation), Catching-up (Employment) and Declining, based on their characteristics according to Relative Deprivation and Innovation Environment. When interpreting the data for the two latent variables, it should be noted that while the above-average values of the Innovation Environment variable are considered as indicators of development, the above-average values of the Relative Deprivation variable are considered as indicators of lagging behind (*Table 3*).

Table 3. Summary statistical table of the cluster analysis

Analysis of variance	Relative deprivation	Innovation environment
F-test	224,626	247,689
Significance	0,000	0,000
Kruskal-Wallis test	126,960	204,539
Asymptotic significance	0,000	0,000
ETA	0,841	0,852

Descriptive statistics for clusters		Relative deprivation	Innovation environment
Mean (Final Cluster Centers)	1	2,135	- 0,419
	2	- 0,978	1,773
	3	- 0,123	0,262
	4	- 0,558	- 0,764
Standard deviation	1	0,859	0,811
	2	0,538	0,583
	3	0,505	0,324
	4	0,440	0,533

Source: Own calculation and editing based on EUROSTAT data

3.3.4 Characterisation of clusters

40 regions have been identified as Outstanding in the dimensions of the principal components. Outstanding regions are typically the capitals of the Member States and their agglomerations (e.g. London, Brussels, Madrid, Berlin, Vienna, Prague, Warsaw, Budapest, Bucharest, Helsinki, Stockholm, etc.).

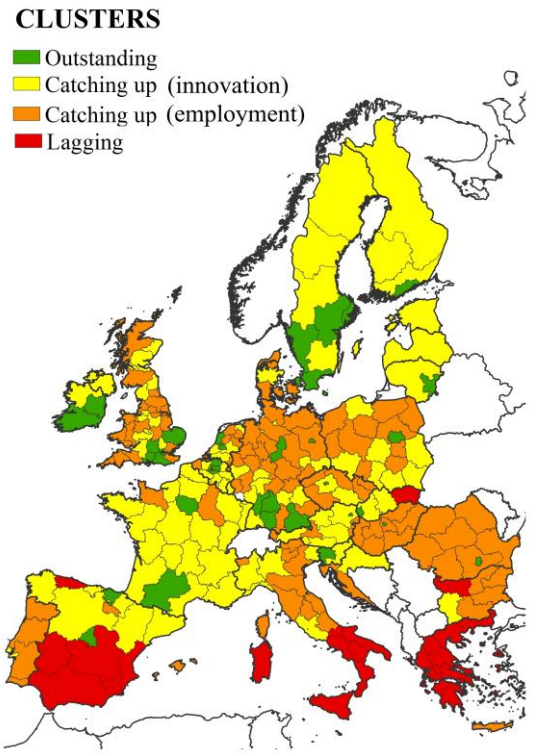

Figure 4. Clusters of Relative Deprivation and Innovation Environment

Source: Own calculation and editing based on EUROSTAT data

Catching up (innovation) regions are typically Belgium, Luxembourg, Germany, Denmark, the Netherlands, Ireland, the United Kingdom, Spain, France, Poland, the Nordic and Baltic regions (*Figure 4*). The Catching up (employment) category is dominated by regions in Germany, Poland, Hungary, Bulgaria, Romania, Northern Italy and Portugal. 11 regions of the Visegrad 4 were in the Catching up (innovation) group and 21 in the Catching up (employment) group. A total of 36 regions were placed in the Lagging group, typically regions belonging to Greece, Southern Italy and Southern Spain. The Catching up and Lagging groups are typically made up of regions from Member States that joined after 2004. The regions of Hungary, with the exception of Budapest, are part of a Catching up (employment) cluster.
I compared the regional categories developed in the research with the GDP-based categorisation for the 2014–2020 and 2021–2027 periods. The region categories overlap in several respects, but differences can be identified. The region categorisation based on 2019 data created in the research identified a narrow range of regions as Outstanding and Lagging, so these categories can be interpreted as extreme values. Almost all regions in the Outstanding category are classified as developed, while regions in the Lagging category are classified as underdeveloped. A significant number of regions in the Catching up (Innovation) category are considered more developed in the period 2014–2020, while in the period 2021–2027 they are considered transitional, and this category is the most affected by the change in the regulation. Regions in the Catching up (employment) category were typically classified as underdeveloped in both funding periods.

3.4 Comparative analysis of labor market databases, territorial inequalities

In a comparative analysis of domestic labour market databases, I examined which database provides a more representative picture of the evolution of the number of unemployed. I explored how much (how many percentage points) the aggregate unemployment and relative rates differ, also examining the differences in the concentration of different methodologies by age group. I hypothesised that institutional labour force data collections provide information on unemployment trends that is more representative than labour force surveys and that is characterised by different relative frequencies by age group.

3.4.1 KSH versus NFSZ database

In the framework of the research, I compiled a consolidated dataset for the period 2013–2022 to illustrate the differences between the aggregated data of the two databases. In general, the relative rate is 2% points higher than the unemployment rate of the KSH until 2020; from 2021 onwards, there is a

slight levelling off between the databases, which is presumably related to the methodological change of the KSH in 2021. The difference between the unemployment rate and the relative rate has narrowed to 1.5 percentage points following the methodological changes to the KSH Labour Force Survey as set out in the EU Framework Regulation.
The research demonstrated the existence of significant differences in the distributions of the different age groups. According to the KSH database, 14.5% of the unemployed are aged between 20 and 24, while only 8.46% are aged between 20 and 24 according to the NFSZ. The difference in the distribution of the unemployed is most marked in the 55–64 age group, which accounted for 14.36% of the unemployed according to the LFS and 32.04% according to the NFSZ.

3.4.2 Relationship between registered jobseekers and vacancies

I have plotted the evolution of labour market tightness on a Beveridge curve. The relationship between the relative rate of the economically active population aged 20–64 and the job vacancy rate (the ratio of job vacancies to the number of employed) was examined over the interval 2009–2022 (*Figure 5*). Subsequently, from 2010 onwards, the vacancy rate increased as the unemployment rate fell, so that the two factors moved in opposite directions. The job vacancy rate decreased significantly between 2016 and 2021, while the unemployment rate hovered between 5–7%.

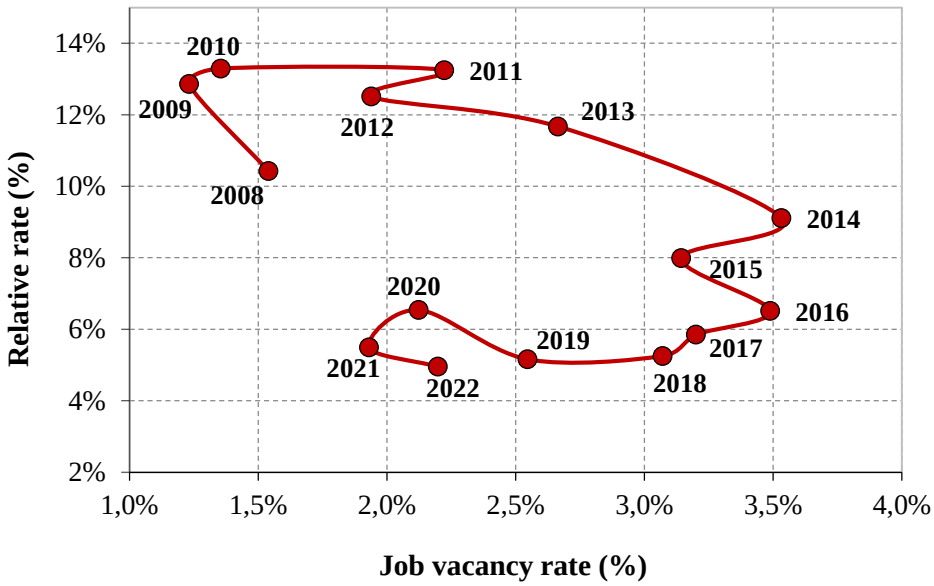

Figure 5. Beveridge curve (2009–2022)
Source: Own calculation and editing based on NFSZ and KSH data

3.4.3 Spatial polarisation of the relative rate

The spatial inequalities of the December 2022 data on the relative unemployment rate at the settlement level for the working-age population aged 15–64 calculated by the NFSZ were analysed using the Dual Indicator. The results show that there are significant differences in the spatial distribution of the relative rate. The degree of inequality varies with changes in the spatial level of the area under examination, the smaller the spatial level, the greater the differentiation.

3.5 Analysis of the spatial structure of unemployment and public employment in Hungary (1993–2022)

The analysis using simpler inequality indicators and methods confirmed the spatial inequalities in the distribution of registered jobseekers. With regard to the spatial distribution of unemployment and public employment, I assumed that the spatial structure varies significantly with respect to the main human resource characteristics.

3.5.1 Milestone marking

In my opinion, by analysing data from several major milestone years in the period 1993–2022, a more complex picture of the changing concentration of registered jobseekers and public employees at the settlement level can be obtained. I considered the following years as milestones:

- **1993**: post-change unemployment peak, labour market shock
- **2001**: changes following the Bokros package, falling unemployment
- **2011**: peak of unemployment caused by the 2008 economic crisis
- **2016**: peak in public employment
- **2020**: short-term impact of the COVID epidemic, rising unemployment
- **2022**: return to pre-epidemic situation, loss of public employment

3.5.2 Spatial polarisation of the relative and the public employment rate

A more realistic picture of the spatial structure than the headcount data can be obtained by examining the relative rate of unemployment and the public employment rate. The polarisation of the rates has undergone major changes in the period under review as a result of the crises (*Figure 6*).

The relative rate was above 10% in 1993 in most parts of the country as a result of the shock to the labour market following the change of regime, but it was also above 5% in the Budapest–Győr–Zalaegerszeg development zone, which was already emerging at that time. The only exceptions were Budapest and a few settlements near the Austrian border.

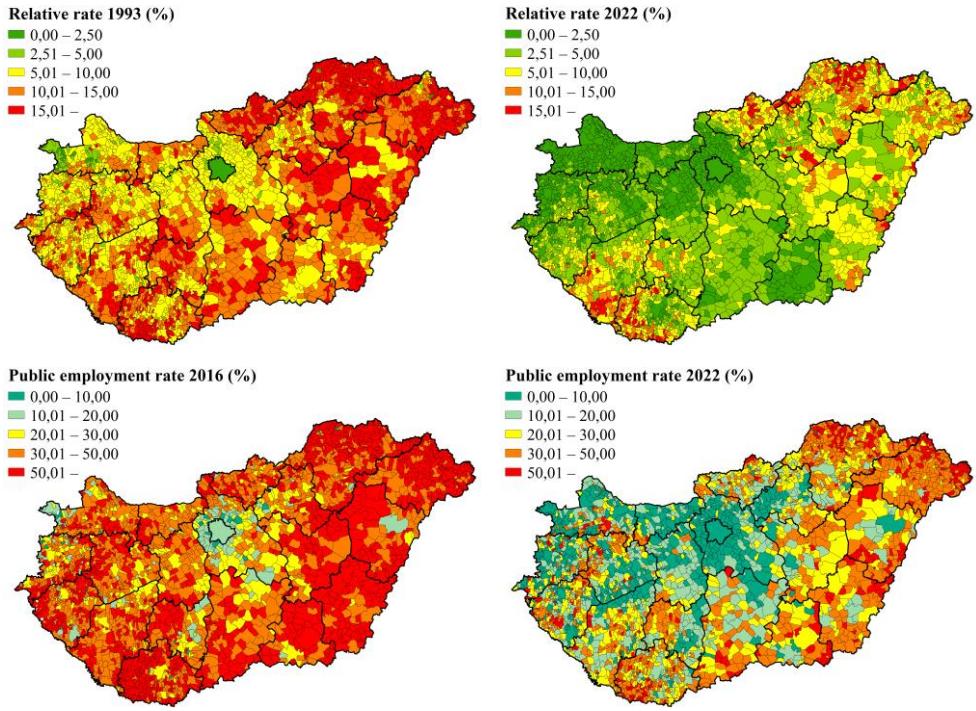

Figure 6. Changes of relative and public employment rate (2016, 2022)

Source: Own calculation and editing based on TeIR data

The economic crisis of 2008 has also generated striking changes. Higher unemployment escalated again to a more significant extent by 2011. As a result of the crisis response, the coverage of areas with higher unemployment had declined significantly by 2016. The public employment used to address the crisis has taken a statistically significant number of unemployed people out of the register, significantly improving unemployment and employment data *(Figure 6*). Unemployment figures improved until the appearance of the coronavirus epidemic, but public employment, which had previously been a priority, has been reduced year on year, mainly in the Budapest–Győr–Zalaegerszeg development zone. In general, it can be concluded that crises of different causes tend to affect the same areas, the differences being only noticeable in their extent.

3.5.3 Analysis of the spatial structure of groups using the location quotient

During the period under review, not only the number of unemployed people has changed hectically, but also the concentration and spatial distribution of groups categorised by human resource characteristics. The most significant changes, compared with 1993, were in the age groups of those aged under 25 and in the education groups of those with primary and tertiary education (*Figure 7*).

Even with the decline in the share of the younger age group and the improvement in unemployment figures, the concentration of the age group in 2022 is significant. Concentration has increased in some areas of the country, especially in the settlements of Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and the western part of the country. At least medium concentration (LQ> 1.5) of young jobseekers was found in 635 municipalities, 44.1% of which are small villages with less than 500 inhabitants and only 2.4% with a population of more than 5 000.

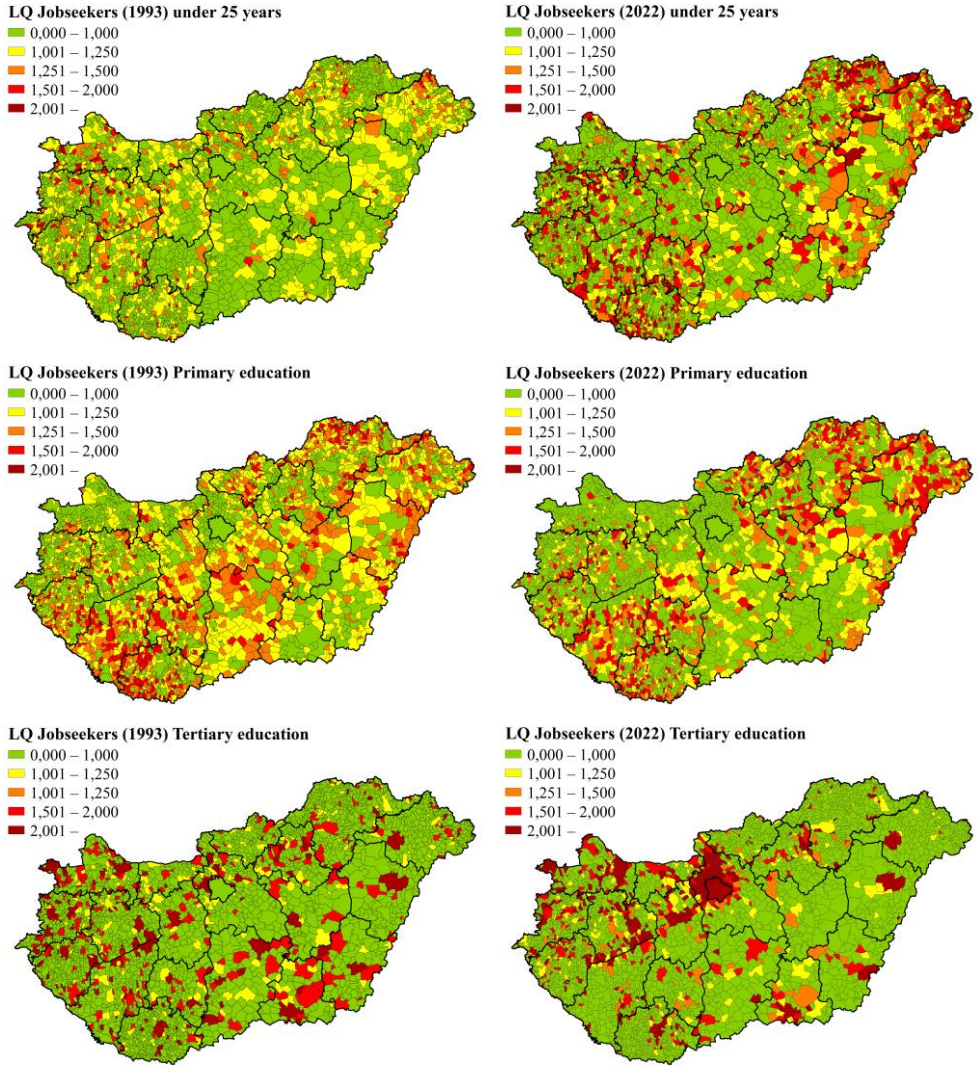

Figure 7. Concentration of priority jobseeker groups (1993, 2022)

Source: Own calculation and editing based on TeIR data

The distribution by educational attainment has changed less. The proportion of unemployed with primary and secondary education decreased proportionally over the interval, while the proportion with tertiary education increased. A comparison with the census data confirms that the reallocation of the unemployed by educational attainment is linked to a general increase in the level of qualifications in society. The higher than average concentration of jobseekers with a primary education in 2022 is mainly concentrated in the small villages of the North–East and South–West. 50.1% of the settlements with a concentration of less than 500 inhabitants are small villages with a concentration of less than one and a half times the national average.
The share of graduate jobseekers increased from 2% in 1993 to 7% in 2022. As the share of unemployed with tertiary education increased, the spatial distribution also became more concentrated between 1993 and 2022. The most spectacular spatial rearrangement also took place in this group: while in 1993 the concentration was clearly concentrated in settlements with higher education institutions and their surrounding areas, by 2022 the centres of gravity had gradually shifted to Pest county and the areas around Győr and Lake Balaton.

3.5.4 Spatial autocorrelation analysis of the spatial structure of groups

The location of the hotspots identified by spatial autocorrelation for some groups of unemployed and publicly employed people shows a high degree of similarity with the high concentration indicated by the location coefficients, but their extent is significantly escalated by the inclusion of neighbourhood ties (*Figure 8*).

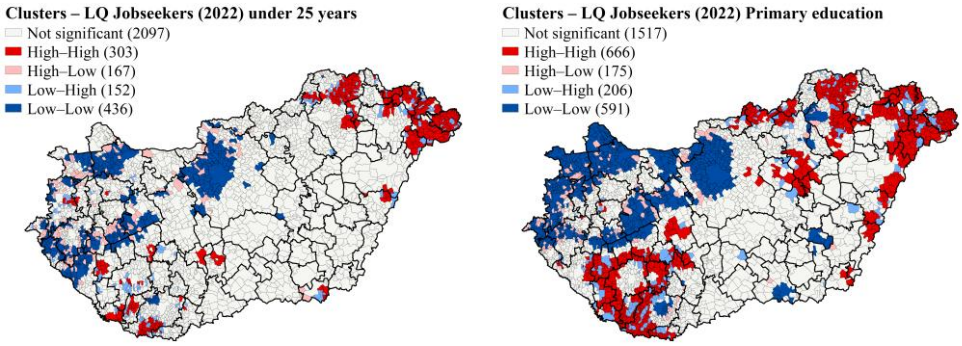

Figure 8. LISA (15 km) – Spatial autocorrelation of the concentration of critical jobseeker groups (2022)

Source: Own calculation and editing based on TeIR data

Settlements with higher than average concentrations of unemployed youths form larger, contiguous clusters in the eastern part of the country in the employment districts of Miskolc, Kisvárda, Vásárosnaményi, Fehérgyarmat

and Nyírbátor, and in the western part of the country in the employment districts of Pécs, Szigetvár and Barcs. Low concentration areas were predominantly identified in the employment districts of Budapest, Győr, Sopron, Lenti, Nagykanizsa, Zalaegerszeg, Keszthely, Tapolca and Veszprém.
The highest degree of clustering is found in the concentration of unemployed people with primary education. Unemployed persons with 8 years of primary education or less are over-represented in the eastern part of the country in the employment districts of the counties of Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and Hajdú-Bihar; in the western part of the country in the districts of the counties of Baranya and Somogy (in settlements outside the agglomeration of Kaposvár and Pécs). A significant coldspot has developed in the counties of Győr-Moson-Sopron, Komárom-Esztergom, Vas, Zala, Veszprém and Pest, and in some rural cities (Miskolc, Szeged, Pécs) and their agglomerations.

3.5.5 Spatial cross-section of unemployed and public employment groups

The spatial interdependence of the settlement level Local Moran I values calculated from the 2022 concentration of each group of unemployed and publicly employed persons was examined on maps depicting the joint intersection. The maps by group clearly identify the employment districts with above/below national average concentrations of unemployed and publicly employed. By increasing the distance threshold of 30 km chosen for the parameterisation of spatial autocorrelation, the clusters became more extensive, thus significantly escalating the overlapping areas. In general, it is found that mainly clusters younger than 25 years and those with primary education show a higher degree of overlap.

3.6 Labour market typology of settlements in Hungary

With regard to the categorisation of settlements, I assumed that the spatial structure model of settlements typified by a clustering procedure parameterised by contiguity restrictions using the main indicators and concentration values of unemployment and public employment differs from the traditional spatial structure characteristics (centre–periphery, urban–rural, East–West). The correlation between the established settlement categories and settlement size was assumed to be the highest for the most deprived group of small villages.

3.6.1 Principal component analysis of selected population and unemployment indicators

The 7 variables included were found to be suitable for factor analysis. The KMO of the analysis is 0.721, i.e. the variables are suitable for factor analysis.

Two principal components were generated in the composite model with a combined coefficient of variance of 79.3%. The first factor has an eigenvalue of 3.880 and an explained variance of 55.4%. The data of the rotated component matrix show that the first principal component includes the indicators related to the available labour force (permanent population, working age population, registered job seekers and number of job seekers beyond 180 days). The second factor has an eigenvalue of 1.673 and explains a variance of 23.9%. The second factor combines the combined rate of unemployed and publicly employed persons and the concentration values of persons with primary education and young jobseekers. I will refer to the principal components as "Labour Force" and "Critical Mass" hereafter, based on the information they condense.

3.6.2 Weighted cluster analysis of principal components

After methodological considerations, the assignment of the settlements into homogeneous groups was carried out with the Skater algorithm, parameterized with a distance weighting of 15 km and a population threshold of 10%. The clusters created were considered homogeneous based on the within-group variance. In none of the cases did the within-cluster variance of the principal components exceed the total variance. The number of clusters was set at 5 when parameterising the analysis. In the model created, Budapest (5) is a separate category. The other four clusters were named Firsts, Emerging, Hendikepes and Lasts based on their characteristics in terms of Labour Force and Critical Mass (*Table 4*).

Table 4. Descriptive statistics of cluster analysis

Descriptive statistics of clusters		Labor force	Critical mass
Mean (Final Cluster Centers)	1	-0,078	0,185
	2	0,061	-0,359
	3	0,064	0,923
	4	-0,093	-1,076
	5	51,574	-0,692
Staandard deviation	1	0,270	0,810
	2	0,493	0,648
	3	0,510	0,933
	4	0,239	0,479
	5	-	-

Source: Own calculation and editing based on TeIR data

3.6.3 Characterisation of clusters

Among the categories, Budapest performs exceptionally well on almost all specific variables. Overall, the high population density naturally leads to a

high potential labour force, while the concentration of jobseekers with critical human resource characteristics is lower than the national average.
The riders belonging to 540 settlements in the Firsts have the lowest total population among the categories. This group includes settlements with below average relative potential labour supply and, in turn, lower than national average concentrations of the two groups of unemployed considered most critical (those with a primary education and jobseekers under 25). The settlements identified are typically concentrated in employment districts near the north-western border and around Lake Balaton (*Figure 9*).
The category of Emerging includes 755 municipalities, with the highest total population. The settlements in the cluster are characterised by higher than average relative potential labour supply, with a below average concentration of the critical groups. The majority of the settlements are located in the employment districts of Budapest and the surrounding and nearby areas, as well as in Békés county.

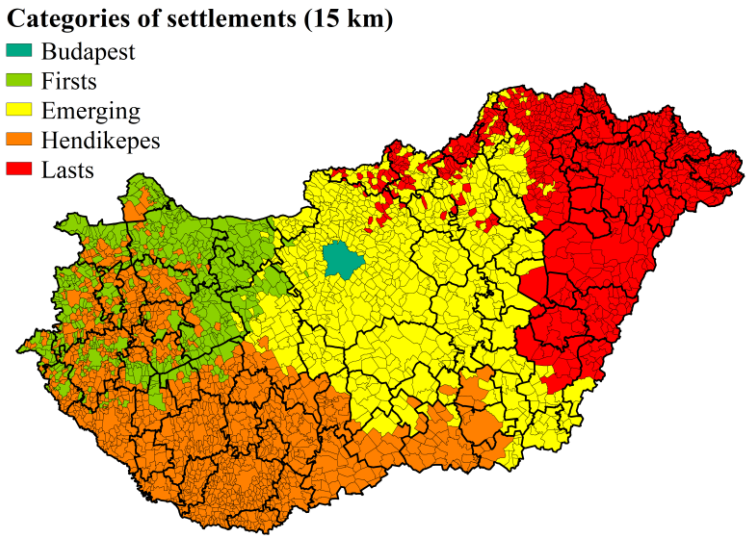

Figure 9. Categories of settlements (2022)

Source: Own calculation and editing based on TeIR data

The Hendikepes group has 1172 settlements, the most prominent. The settlements have a lower potential labour force compared to the Firsts, while the concentration of those with critical characteristics is higher than average. The share of small villages (53.1%) is the highest in this group. The coverage of the group is not completely uniform. The largest coherent, homogeneous area is found in the employment districts of Somogy, Tolna and Baranya counties, as well as in the southern border districts. The group is also represented in the counties of Zala, Veszprém and Vas, with a heterogeneous territorial distribution.

The cluster of the Lasts is made up of 687 settlements, representing 17.26% of the permanent population. Public employment still plays an important role in the employment policy instruments in the settlements of the cluster. Overall, the Lasts cluster includes the most severely affected municipalities, with a higher than average proportion of the critical unemployment stratum. The share of small villages in the group is 26.1%. The settlements in this category form a homogeneous territorial unit throughout the counties of Hajdú-Bihar and Szabolcs-Szatmár-Bereg, and also cover some employment districts in the counties of Borsod-Abaúj-Zemplén and Békés.

I examined the distribution of settlements with significant unemployment within the categories defined in Government Decree 105/2015 (IV. 23.). 45.1% of the settlements recorded in the Decree belong to the Serious unemployment group and 43.5% to the Hendikepes group, while the number of elements in the better-off groups is almost negligible. The spatial distribution of the settlements is highly polarised. In conclusion, the settlements defined in the Regulation are still disadvantaged, but the model, which was built using an algorithm that takes account of spatial constraints, identified problem areas with a much larger area *(Figure 10*).

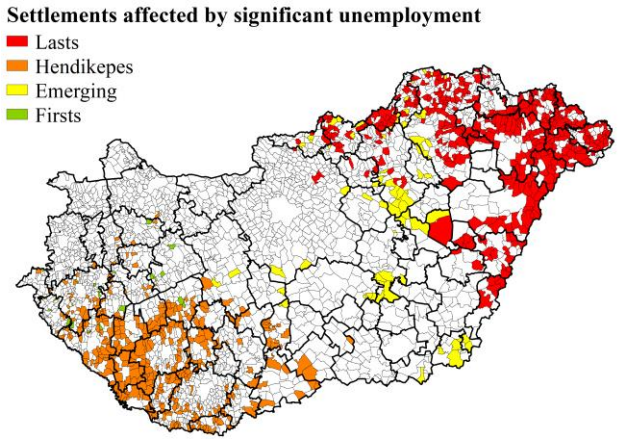

Figure 10. Clusters and settlements with high unemployment (2022)

Source: Own calculation and editing based on TeIR data and pursuant to Government Decree 105/2015 (IV. 23.)

The total number of eligible settlements under the programmes established to support beneficiary settlements (GÉP, FETE) is 747. The spatial distribution of eligible settlements can be mostly (78%) matched with the areas delimited by the research groups of the Lasts and Hendikepes (*Figure 11*). The spatial distribution of settlements included in the grants between 2019 and 2021 is polarised, which implies the possibility and the risk of implementing several isolated projects.

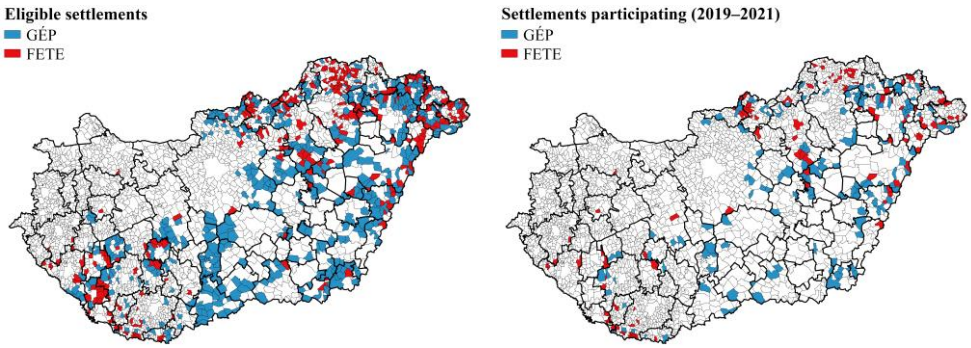

Figure 11. Range of settlements that can be supported by the GÉP and FETE programs

Source: Own editing based on the relevant government regulations

The research has confirmed that Hungary still has significant spatial disparities in unemployment, but the former East-West divide has shifted noticeably (*Figure 12*). Budapest, the Leading and the Emerging groups appear as the more developed areas on the map, as these groups share the common characteristic of having a below average concentration of unemployment groups defined as critical. The axis fitted to the area delimited by the categories shown is clearly North–West and South–East, i.e. the previously East–West axis has clearly shifted. The new inequality axis is increasingly tilted North-South, with the disadvantaged situation affecting settlements in the Northern Hungary, Northern Great Plain and Southern Transdanubia regions.

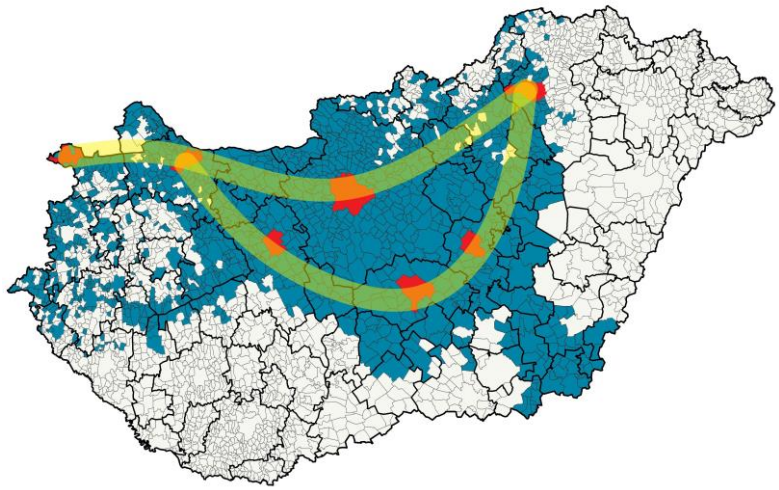

Figure 12. Displacement of the axis of division (2022)

Source: Own calculation and editing based on TeIR data

4. CONCLUSIONS AND SUGGESTIONS

C/1. Analysis of employment policy expenditure in the EU Member States

The volume of expenditure on employment policy interventions has generally increased significantly after the 2008 crisis in those Member States with high unemployment rates (Lithuania, Estonia, Latvia, Spain, Ireland), with the exception of Greece, which was the Member State most severely affected by the crisis, but which has not seen a rise in intervention expenditure despite a sharp rise in unemployment. The impact of the 2008 crisis on the labour market has been addressed in most Member States mainly by increasing the share of the instrument to maintain and support in-work income. The short-term effects of the recession resulting from the coronavirus epidemic have typically been addressed by stimulating employment and maintaining and supporting in-work income.

Unemployment remained below 10% in most Member States in 2020, with the exception of Spain and Greece, where the unemployment rate remained above 15% despite interventions. The share of employment incentives within the instruments increased significantly in Ireland, Bulgaria, the Netherlands, Lithuania and Poland. In Denmark, the importance of subsidised employment decreased and the amount used to maintain and support in-work income increased. In Hungary, expenditure on employment incentives and on maintaining and supporting incomes outside work increased to address the short-term effects of the COVID-19 epidemic, while the share of public employment decreased.

Different instruments are needed to deal with economic crises of different types and at different intervals, but crisis management must always take into account the economic objectives and the social, economic and institutional specificities of the Member State or region concerned. There are many reasons for the diversity of instruments used: economic structure, primary economic objectives, labour market and social situation, technological change, etc.

Of course, different employment policy instruments can have complex and multifaceted socio-economic effects. Effective policy design requires careful consideration of these impacts.
Maintaining and supporting in-work income provides a financial safety net for individuals who lose their jobs and maintains aggregate demand in times of economic downturns. However, generous unemployment benefits may inadvertently discourage jobseekers from actively seeking work, leading to prolonged periods of unemployment and reduced labour market efficiency. Furthermore, the cost of financing unemployment benefits may put a strain on public finances.

Wage subsidies can encourage employers to hire disadvantaged or marginalised groups, thus reducing unemployment among the target groups and promoting social inclusion. It should be considered that wage subsidies may distort labour market incentives if they encourage employers to hire people who would have been hired anyway without the subsidy.
Investing in on-the-job training and education can improve the skills and productivity of the workforce, leading to higher wages, lower unemployment rates and greater economic competitiveness. However, the effectiveness of training programmes can vary and the mismatch between skills acquired and labour market needs can limit their impact.

I **accept** my hypothesis **H/1** on interventions, that different sets of employment policy instruments are prioritised in different EU Member States to address the labour market effects of different economic crises.

C/2. Change and correlation analysis of the Europe 2020 indicators

During the period under review, there was a slight levelling off between indicators at national level, with a trend towards greater cohesion as regional disparities narrowed. There has been a marked positive change in employment, with employment rates for the 20–64 age group predominantly shifting to between 70% and 80% by 2020. The share of people with tertiary education has also risen, and is concentrated around 30-60%, forming a more homogeneous picture. The share of early school leavers has also improved overall, reaching around 10% in most Member States. The analysis of indicators at regional level shows a much higher degree of differentiation than the aggregated national data. The regions of Sweden, the United Kingdom, Germany, the Czech Republic and the Baltic States have employment rates close to or above the EU target. Employment levels are well below the EU average in Romania, Greece, Southern Italy and Southern Spain.

The impact of the 2008 economic crisis has varied across Member States. Most of the regions of the Member States severely affected by the crisis (Greece, Spain, Italy) were still facing significant unemployment in 2022. The research has shown that there is a sharp divide in Europe along the employment and education dimensions, which is linked to the differential impact of the economic recession in some regions as a result of the 2008 economic crisis and the COVID-19 epidemic. While the cohesion policy of the last decade has reduced the gap between peripheral regions somewhat, they will still perform well below the EU average in 2022.

In my view, further monitoring of key economic and social indicators is of utmost importance and it would be advisable to improve the availability of

indicators at regional level to ensure adaptability and evidence-based policy making.

The objectives of the Europe 2020 strategy have been defined on the basis of the economic growth drivers. The correlation between economic development (R&D expenditure) and human capital (share of tertiary education) was confirmed by the analysis, albeit only to a moderate degree. A skilled workforce is a key factor in attracting investment and promoting economic growth.

I **accept** my hypothesis **H/2**, which is related to the spatial structure of the European Union, that along the smart and inclusive dimensions of the Europe 2020 strategy, a fault line can be identified in Europe, which is related to structural inequalities in the labour market and to national and regional institutional specificities.

C/3. Categorization of regions of the European Union

In the research, I categorised the regions of the European Union using multivariate data analysis methods. The cluster analysis of the new latent variables, called Relative Deprivation and Innovation Environment, created, has well distinguished the regions according to their differences in development. Overall, the regions in the Outstanding cluster are characterised by development, while the regions in the Lagging cluster are characterised by lagging behind. The Catching-up cluster is considered to be divided. The map produced is a striking example of a polycentric pattern, where capital regions tend to perform strongly.
The Outstanding group typically includes the regions of the capital cities and their agglomerations. The results are consistent with the correlation found in previous research that the presence of a capital city in a region has a positive impact on economic growth.
The Lagging is considered underdeveloped along both dimensions, with a below average innovation environment and a lagging labour market. They are typically regions belonging to Greece, Southern Italy and Southern Spain, with a significant share of them being external border regions. The results also show a strong correlation with the findings of the literature on peripheral border regions, i.e. that being located on the borders can have a negative impact on economic growth.

Based on the community average GDP per capita, the more advanced and transition regions identified for the 2014–2020 period overlap significantly with the Outstanding and Catching-up (innovation) groups established in the research framework. The European Commission has proposed to modify the previous thresholds for the transition and more advanced regions for the

budget period 2021–2027. The regions most affected by the downgrading are those in Finland, Germany, France and Spain, which have been classified by research as Catching-up (innovation). Regions in the Catching-up (employment) and Declining categories will continue to be classified as underdeveloped according to the GDP-based categorisation for the period 2021–2027.
In addition to the changes in the legislation, the rearrangements between the categories were also determined by changes in the NUTS system and changes in the economic situation of the regions. The deterioration in economic performance between 2009 and 2020 has affected the classification of some regions in Spain and Greece, while the improvement in economic performance has affected the classification of several regions in the Czech Republic and Poland. Most of the changes in the NUTS system have been aimed at separating the more developed regions from their wider agglomeration (e.g. the division of the Central Hungary region).

Ultimately, this research has also demonstrated the need for reclassification. On the basis of the research results, I propose to rethink the traditional GDP-based resource allocation and to delimit the regional categories by a more complex composite indicator including several dimensions (economic, social, etc.).

I **accept** my hypothesis **H/3/a** on the categorisation of regions in the European Union, which is related to the creation of a new composite model based on the indicators of the Europe 2020 strategy, which expresses the differences in development between regions in a more complex way and allows for a more nuanced delimitation, in particular with regard to the labour market.

I also **accept** my hypothesis **H/3/b** in the context of the allocation methodology for the eligibility of EU regions for aid, that the regional composite model constructed will identify a greater number of regions as catching-up and lagging regions than the traditional GDP-based categorisation of eligibility.

C/4. Comparative analysis of labor market databases, territorial inequalities

The research looked at differences between national unemployment databases. The analysis confirmed that, in addition to being fundamentally different, the databases of the KSH and the NFSZ also differ. In general, until 2020 the relative rate is 2% points higher than the unemployment rate of the KSH; from 2021 onwards there is a slight levelling off between the rates, which is presumably related to the methodological change of the KSH in 2021. However, I would like to underline that the number of registered jobseekers

may in reality be higher even than the figures reported by the NFSZ, as some of those entitled to jobseeker's allowance do not register.

The research demonstrated the existence of significant differences in the concentration of predefined age groups in the 20–64 age group for databases based on different methodologies. The discrepancy is most significant in the 55–64 age group in 2022, with 14.36% of the unemployed in the LFS and 32.04% in the NFSZ.

The analysis using simpler inequality indicators and methods confirmed the spatial inequality of the labour market. Labour market tightness is characterised by significant fluctuations between 2008 and 2022. Over the interval studied, the unemployment rate has fallen along with the vacancy rate, but in my opinion it is not the degree of matching that is more optimal, it is merely the fact that the situation in the labour market has forced firms to lower their expectations of workers.

I **accept** my hypothesis **H/4** that institutional labour force surveys provide information on unemployment trends that is more representative than labour force surveys and with different relative frequencies across age groups.

C/5. Analysis of the spatial structure of unemployment and public employment in Hungary (1993–2022)

As a result of the post-recessions, the negative demographic and migration trends were more pronounced between 1993 and 2022, with the country's population falling by 6.89% over the period. The changes were also accompanied by hectic changes in the number and structure of the unemployed. The number of registered jobseekers fell by 60.81% between 1993 and 2022, with a significant fluctuation. The analysis shows that the crises, which have different causes, tend to affect the same areas, with differences only in their scale.

During the period under review, not only the number of unemployed people has changed hectically, but also the concentration and spatial distribution of groups categorised by human resource characteristics. The most significant changes, compared with 1993, were in the age groups of those aged under 25 and in the education groups of those with primary and tertiary education. In my view, the shift by age group has been influenced both by the outward migration of the younger age group and by the increase in the number of people pursuing higher education. In addition to the improvement in unemployment figures and the decrease in the share of the younger age group, the concentration of the age group is significant. Concentration has increased in some areas of the country, particularly in the settlements of Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and the western part of the country.

A comparison with census data confirms that the reallocation of the unemployed by educational attainment is linked to a general increase in the level of qualifications in society. The distribution of graduate jobseekers increased from 2% in 1993 to 7% in 2022. The most spectacular spatial reallocation took place in this group: while in 1993 the concentration was clearly concentrated in settlements with higher education institutions and their surrounding areas, by 2022 the focus had gradually shifted to Pest county and the areas around Győr and Lake Balaton.

Public employment, which is closely linked to unemployment, has declined significantly from its peak in 2016. The distribution of groups categorised by human resource characteristics changed little between 2016 and 2022. The share of young people varied between 5–10%, middle-aged people between 55–60% and vulnerable age groups between 30–40%.

The spatial autocorrelation analysis clearly shows that there is a significant inverse spatial correlation between the concentration of people with primary and tertiary education. The spatial structure of the unemployed by educational attainment is strongly influenced by the 'brain drain' phenomenon. The more qualified potential labour force tends to be concentrated in the north and mid-west and in the settlements of Pest county. This process is leading to increasingly sharp spatial disparities, with a significant loss of population in disadvantaged areas and relative growth in more favourable areas.
In my view, the main factors contributing to the brain drain include better job opportunities (higher salaries, more favourable conditions) and training opportunities in a more favourable economic environment, access to an environment conducive to scientific and technological progress, and the possibility of achieving a better work-life balance.

The analysis of overlaps between clusters revealed that there is a higher degree of overlap between areas with higher relative rates and settlements with a high concentration of unemployed and public employment groups younger than 25 years and with a high concentration of unemployed and public employment groups with primary education. Consequently, these groups can be considered as critical groups for access to the primary labour market.

In my view, in areas with high concentrations of unemployed people under 25 and with primary education, there is a case for implementing specific training and education programmes and skills development initiatives that will create the skills needed for the job opportunities offered by local industries. It is also proposed to promote entrepreneurship in these areas and, in turn, to mentor would-be entrepreneurs.
In the longer term, policies focusing on skills development and training programmes will help workers to adapt to technological developments, contributing to the overall competitiveness of the workforce. Above all, of

course, synergies need to be exploited to stimulate economic activity in the region by developing infrastructure, providing financial incentives (tax breaks), mentoring local SMEs and stimulating cooperation between local actors, thus increasing job creation.

My hypothesis **H/5** on the spatial structure of unemployment and public employment, that the spatial structure of the unemployed and the public employed is different with respect to the main human resource characteristics, is **accepted**.

C/6. Labour market typology of settlements in Hungary

The categorisation of domestic settlements was based on unemployment and public employment data, using the results of previous research. As a first step in the research, I compressed the selected population and unemployment indicators by factor analysis, creating the Labour Force and Critical Mass factors that form the basis of the clustering. The next phase of the research was the selection of the appropriate clustering procedure, for which I conducted simulation tests with additional contiguity constrained procedures besides the traditional K-means cluster analysis. Based on the results of the simulation tests, I came to the following conclusions:

- The application of the traditional K-means cluster analysis has been discarded due to its inadequacy to take into account neighbourhood relations and spatial weights.
- Only the different degree of consideration of the geographical coordinates overly influences the results obtained.
- The Max-p clustering method is still under development and proved to be rather slow when using more than 1 000 elements and was therefore not considered.
- I consider the method based on the Skater procedure to be suitable for categorising municipalities, with the limitation that it is worth maximising the population weighting at 10%.

Finally, to categorize the national settlements based on unemployment indicators, I chose a Skater algorithm based model with a distance of 15 km and a permanent population weighted by 10%. The aim of this research is to provide a policy-based delimitation based on unemployment indicators that can help to inform spatially differentiated employment policy decisions. In my view, if a more homogeneous delimitation of territorial units is justified from a policy perspective, the criterion of model accuracy can be interpreted more broadly.

The five clusters resulting from the cluster analysis were named the Firsts, Emerging, Hendikepes and Lasts based on their characteristics according to the Labour Force and Critical Mass factors; Budapest was a separate category. Budapest, due to its high population density, naturally has a high potential labour force, while the concentration of jobseekers with critical human resource characteristics is lower than the national average. In the top group, the relative potential labour stock is below average and the concentration of critical unemployed is also lower than the national average. They are typically concentrated in the employment districts in the North-West, near the border and around Győr and Lake Balaton.
The Emerging cluster has a higher than average relative potential labour stock, while the concentration of critical groups is below average. The cluster forms a contiguous cluster in the employment districts of Budapest and the surrounding areas, as well as in some districts of Békés county. The settlements belonging to the Hendikepes cluster have a lower potential labour supply, while the concentration of those with critical characteristics is higher than average. The area of the group is not completely homogeneous, with a larger contiguous area covering the employment districts of Somogy, Tolna and Baranya counties and the southern border districts. The Lasts group includes the most severely affected municipalities, with a much higher than average concentration of the critical unemployment stratum. The group is homogeneous throughout the counties of Hajdú-Bihar and Szabolcs-Szatmár-Bereg, and also includes some employment districts of Borsod-Abaúj-Zemplén and Békés counties.

As regards the relationship between clusters and settlement size, it can be noted that, in general, the crisis area (Sereghajtok) does not have the highest proportion of small villages. In the crisis area, the higher than average potential labour force, associated with a higher concentration of critical mass, is concentrated in settlements with a population of 1 000–2 500.

The settlements with significant unemployment, as defined in Government Decree 105/2015 (23. IV.), can be said to fall into the two categories of underdeveloped (Lasts and Hendikepes). The settlements defined by the Regulation are still disadvantaged, but the model, using an algorithm that takes account of spatial constraints, has identified problem areas with a much larger extent.
In the context of the research, I have also looked at the territorial distribution of the programmes designed to support the beneficiary municipalities, which I consider to be somewhat polarised. Excessive polarisation can also be detrimental from a policy point of view, just think of the dangers of isolated projects. Independently implemented development and support projects lack an overall context, a holistic approach, tend to have a short-term focus, fail to exploit synergies and can lead to fragmented economic and infrastructure

development. Territorial coordination of projects is recommended, with sensible centralised planning, joint project coordination and sharing of resources, ensuring that projects complement each other. In determining geographical proximity, it is suggested that consideration be given to employment district boundaries.

The research has shown that there are still significant spatial disparities in unemployment in Hungary, but the former East–West divide has shifted noticeably. The new axis of inequality is increasingly tilted North–South, with the disadvantaged situation affecting settlements in the Northern Hungary, Northern Great Plain and Southern Transdanubia regions. As development zones, I have identified the employment areas around Budapest and its agglomeration, the line of Győr and Sopron, and the areas around Lake Balaton.

I **accept** my hypothesis **H/6/a** related to the typification of settlements, that the settlement level spatial structure model typified by a clustering procedure parameterised by contiguity restrictions using the main indicators and concentration values of unemployment and public employment differs from the traditional spatial structure characteristics (centre–periphery, urban–rural, East–West).

My hypothesis **H/6/b** on the relationship between the established settlement categories and settlement size, i.e. that the proportion of small villages (settlements with a population of less than 500) is highest in the worst-off settlement category, is **rejected**.

5. NEW SCIENTIFIC RESULTS

C/1. Analysis of employment policy expenditure in the EU Member States

A structural inventory analysis of employment policy instruments by Member State, based on the LMP database, shows that different groups of employment policy instruments are prioritised in different EU Member States to address the labour market effects of different economic crises.
By examining the statistical data, I have shown that while the labour market effects of the 2008 crisis were addressed in most Member States primarily by increasing the share of the instrument of maintenance and support of in-work income, the short-term effects of the recession following the coronavirus epidemic were typically addressed by stimulating employment and maintaining and supporting in-work income.

C/2. Change and correlation analysis of the Europe 2020 indicators

Statistical analysis of indicators, which play a key role in monitoring and evaluating the achievement of the Europe 2020 targets and in guiding and adjusting policies, has shown that there is a sharp divide in Europe along the employment and education dimensions, which is linked to the differential impact on regions of the economic recession caused by the 2008 economic crisis and the COVID-19 epidemic.
Correlation analysis has shown that there is a positive correlation of medium strength between economic development (R&D expenditure) and human capital (share of tertiary education).

C/3. Categorization of regions of the European Union

By building multivariate data analysis methods on top of each other, I have demonstrated that using the indicators of the Europe 2020 strategy, a composite regional categorisation model can be created that expresses differences in development between regions in a more complex way than the traditional GDP-based resource allocation and allows for a more nuanced delineation, especially with regard to the labour market.
By comparing the established categories of regions (Outstanding, Catching-up, Lagging) with the traditional GDP-based categories, I have demonstrated the need to rethink the allocation of resources and to delimit the categories of regions with a more complex composite indicator, including several dimensions (economic, social, etc.).
The Outstanding group typically includes the regions of Member States' capitals and their agglomerations, demonstrating that the presence of a capital in a region has a positive impact on economic growth. The composition of the Lagging group, which was considered lagging behind on both dimensions,

highlighted the negative impact of the location of borders on economic growth, as it typically included regions belonging to Greece, Southern Italy and Southern Spain, a significant part of which are external border regions.

C/4. Comparative analysis of labor market databases, territorial inequalities

By comparative analysis of the domestic labour market databases (KSH, NFSZ), I have shown that the extent of the differences between the KSH unemployment rate and the relative rate of the NFSZ due to different methodologies varies in general between 1.5–2 percentage points.
The research has shown that there are significant differences in the relative prevalence of pre-defined age groups in the 20–64 age group for databases based on different methodologies. It has been shown that the difference is most significant for the 55–64 age group in 2022.

C/5. Analysis of the spatial structure of unemployment and public employment in Hungary (1993–2022)

By examining spatial concentration and its clustering using location coefficients and spatial autocorrelation, I show that the spatial structure of the unemployed and the publicly employed differs with respect to the main human resource characteristics. I have shown that between 1993 and 2022, not only the number and share of unemployed people changed hectically, but also the concentration and spatial distribution of groups categorised by human resource characteristics (age, educational attainment).
Concerning the relationship between the spatial concentration of each unemployment group and the size of the municipality, I have shown that the concentration of the unemployed is generally high in settlements with less than 500 inhabitants. I have shown that villages with a lack of functions are typically the epicentres of higher concentrations of unemployed groups.
Compared with census data, I have shown that the rearrangement of the unemployed by educational attainment is associated with a general increase in the level of qualifications in society.
I show that the spatial differences indicated by the concentration weights are most significant for unemployed graduates. The most spectacular spatial rearrangement also took place in this group: while in 1993 the concentration was clearly concentrated in settlements with higher education institutions and their surrounding areas, by 2022 the centroids had gradually shifted to Pest county and the areas around Győr and Lake Balaton, pointing to the very strong "brain drain" phenomenon.

The spatial autocorrelation analysis clearly demonstrated that there is a strong inverse spatial correlation between the concentration of people with primary and tertiary education.
The analysis of overlaps between clusters revealed that areas with higher relative rates overlap more with areas with high concentrations of unemployed and publicly employed groups under 25 and with a high concentration of unemployed and publicly employed groups with a primary education. Consequently, these groups have been identified as critical groups for access to the primary labour market.

C/6. Labour market typology of settlements in Hungary

By superimposing multivariate data analysis techniques on the unemployment and public employment situation of municipalities, I show that a clustering model of the settlement level spatial structure parameterized by contiguity constraints differs from traditional spatial structure features.
Preliminary simulation testing of clustering procedures parameterized with contiguity constraints has led to several methodological findings:

- Traditional K-means cluster analysis is not suitable to account for neighborhood ties and spatial weights.
- Only considering different degrees of geographic coordinates overly influences the results obtained.
- Models still under development face technological difficulties.
- When using a method based on the Skater procedure, it is worth maximising the weighting by population at 10%.

I have shown that the settlements defined in Decree 105/2015 (23. IV.) are still disadvantaged, but the model with the algorithm that takes into account the territorial constraints has identified problem areas with a much larger extent.
The research has shown that there are still significant spatial disparities in unemployment in Hungary, but that the former East–West divide has shifted significantly. The new axis of inequality is increasingly tilted North-South.
I have shown that, in general, the crisis area (Lasts) does not have the highest share of small villages. In the crisis area, the higher than average potential labour force, associated with a higher concentration of critical mass, is concentrated in settlements with a population of 1 000–2 500.

6. SCIENTIFIC PUBLICATIONS RELATED TO THE TOPIC OF THE DISSERTATION

6.1 Journal articles

Scientific articles published in foreign languages

1. GYŐRI T. (2021): Labour market crisis management after crisis of 2008 - Intervention expenditure and "Europe 2020" indicators. In: *Deturope,* 13 (3) 4–31. p. DOI: 10.32725/det.2021.017
2. GYŐRI T. (2021): Changes in the territorial distribution of population and job seekers with higher education in Hungary. In: *Studia Mundi – Economica*, 8 (3) 117–130. p. DOI: https://doi.org/10.18531/Studia.Mundi.2021.08.03.117-130
3. GYŐRI T. (2023): Categorisation of regions in the European Union based on smart and inclusive growth indicators for the Europe 2020 strategy. In: *Regional Statistics*, 13 (2) 299–323. p. DOI: 10.15196/RS130205
4. GYŐRI T. – JUHÁSZ B. (2020): Beveridge curves of three Hungarian counties with the highest public employment rates. In: *Deturope,* 12 (2) 122–139. p. DOI: 10.32725/det.2020.016
5. JÁRDÁNY K. – GYŐRI T. (2021): Spatial research of the labour reserve in the winery center of the Danube Wine region between 2014–2019. In: *Regional Economy South Of Russia,* 9 (4) 109–120. p. DOI: https://doi.org/10.15688/re.volsu.2021.4.11

Scientific articles published in Hungarian

6. GYŐRI T. (2021): Az álláskeresők iskolai végzettség szerinti koncentrációjának vizsgálata a XXI. század gazdasági recesszióinak kezdetén. In: *Észak-magyarországi Stratégiai Füzetek,* 18 (1) 38–48. p. DOI: https://doi.org/10.32976/stratfuz.2021.18
7. GYŐRI T. – EGRI Z. (2020): A munkanélküliek – mint potenciális munkaerő-tartalék – térszerkezetének vizsgálata Békés megyében. In: *Studia Mundi – Economica,* 7 (2) 2–17. p. DOI: https://doi.org/10.18531/Studia.Mundi.2020.07.02.2-17

6.2 Conference proceedings

Conference proceedings in foreign languages

8. EGRI Z. – GYŐRI T. (2019): Roles of country effect and country group effect in regional health inequality process of Europe and CEE. 264–272. p. In: JAKAB G. – CSENGERI E. (Szerk.): *XXI. Századi vízgazdálkodás a tudományok metszéspontjában: II. Víztudományi Nemzetközi Konferencia.* Szarvas, Magyarország: SZIE-AGK (2019) 380. p. ISBN: 978-963-269-809-0
9. GYŐRI T. (2020): EUROPE 2020 Strategy at national and regional level – human capital and employment targets. 35–49. p. In: GYŐRI T. – ARANY F. – EGRI Z. (Szerk.): *Chances and challenges for the European rural development (2021-2027): 4th International Scientific Conference on Rural Development, Peer-reviewed Scientific Conference Proceedings.* Szarvas, Magyarország: SZIE (2020) 205. p. ISBN: 978-963-269-947-9

10. GYŐRI T. (2020): Labour market analysis – Refilled Beveridge curve. 418–425. p. In: BUJDOSÓ Z. – DINYA L. – CSERNÁK J. (Szerk.): *Environmental, Economic and Social Challenges after 2020: 17th International Scientific Days, Publications.* Gyöngyös, Magyarország: Károly Róbert Nonprofit Kft (2020) 1241. p. ISBN: 978-615-5969-02-7
11. GYŐRI T. (2022): Spatial structure in 2020 of Hungarian unemployment and public employment. 58–70. p. In: ARANY F. (Szerk.) Rurality in Europe 5th International Scientific Conference on Rural Development Conference Proceedings. Gödöllő, Magyarország: Hungarian University of Agriculture and Life Sciences (2022) 206 p. ISBN: 978-963-2699-95-0
12. GYŐRI T. – JÁRDÁNY K. (2019): Comparison of Hungarian labour market databases. 77–85. p. In: EGRI Z. – MOLNÁRNÉ KRAJCSOVICZ M. – PARASZT M. (Szerk.): *Digitization in Rural Spaces – Challenge and/or Opportunity?: 3th International Scientific Conference on Rural Development*. Szarvas, Magyarország: SZIE-AGK (2019) 230. p. ISBN: 978-963-269-884-7
13. GYŐRI T. – JÁRDÁNY K. (2020): Changes in the territorial distribution of the unemployed in the Kunság wineland between 2009–2019. 50–59. p. In: GYŐRI T. – ARANY F. – EGRI Z. (Szerk.): *Chances and challenges for the European rural development (2021-2027): 4th International Scientific Conference on Rural Development, Peer-reviewed Scientific Conference Proceedings.* Szarvas, Magyarország: SZIE (2020) 205. p. ISBN: 978-963-269-947-9

Conference proceedings in Hungarian

14. EGRI Z. – GYŐRI T. (2019): Az elérhetőség szerepe a Kelet-Magyarországi gazdasági fejlettségben és fejlődésben. 10–22. p. In: BODNÁR K. (Szerk.): *5. Logisztika a Dél-Alföldön: Lektorált tudományos konferenciakiadmány.* Csongrád, Magyarország, Agro-Assistance Kft. (2019) 72. p. ISBN: 978-615-00-5186-4
15. JÁRDÁNY K. – GYŐRI T. (2020): Egy kiaknázatlan lehetőség – Borturizmus Soltvadkerten. 536–543. p. In: BUJDOSÓ Z. – DINYA L. – CSERNÁK J. (Szerk.): *Environmental, Economic and Social Challenges after 2020: 17th International Scientific Days, Publications.* Gyöngyös, Magyarország: Károly Róbert Nonprofit Kft. (2020) 1241. p. ISBN: 978-615-5969-02-7

6.3 Book, book excerpt, note

16. GYŐRI T. (2019): A Békés megyei álláskeresők térségi koncentrációjának vizsgálata a főbb humánerőforrás-jellemzők alapján. 62–82. p. In: EGRI Z. – RÁKÓCZI A. (Szerk.): *Társadalmi-gazdasági folyamatok a periférián – Békés megyei tapasztalatok* (Lektorált tudományos tanulmánykötet) Szarvas: SZIE-AGK (2019) 135. p. ISBN: 978-963-269-885-4
17. GYŐRI T. – ARANY F. – EGRI Z. (2020): Chances and challenges for the European Rural Development 2021-2027 (4th International Scientific Conference on Rural Development) Chances and challenges for the European rural development (2021-2027): 4th International Scientific Conference on Rural Development, Peer-reviewed Scientific Conference Proceedings. Szarvas, Magyarország: SZIE (2020) 205. p. ISBN: 978-963-269-947-9