

DIFFERENTIATION OF THE REGIONAL DEVELOPMENT IN THE CZECH REPUBLIC, SLOVAKIA AND POLAND

Marcin SPYCHAŁA

Poznań University of Economics and Business, Poznań; marcin.spychala@ue.poznan.pl,
ORCID: 0000-0002-3860-303X

Purpose: The purpose of the article is to present the variation in the level of the development of 95 subregions of the NUTS-3 level in Poland, the Czech Republic and Slovakia. The level of the development shall be established in a multi-criterion manner, separating three factors of the regional development: the society, the natural environment as well as the economy.

Design/methodology/approach: The article presents the level of the regional development of the NUTS-3 regions based on 31 indicators based on public statistical data of the Eurostat database. The level of the development has been presented based on the synthetic gauge exhibiting the taxonomic distance of each region from the established pattern of development. The research procedure was composed of four stages and comprised: a selection of variables, a reduction of multi-attribute space, specifying the level of the regional development of the researched units as well as a classification of regions against the scale of the level of the regional development based on the ranking created according to a decreasing value of the synthetic gauge.

Findings: As a result of the research procedure conducted, spatial differentiation of 95 subregions of the NUTS-3 level in Poland, the Czech Republic and Slovakia with respect to the level of the regional development as well as three components constituting the factors of the said growth is presented. The highest value of the synthetic gauge has been registered in regions comprising the capitals of the respective countries. Moreover, large developmental discrepancies within the respective countries have been identified.

Originality/value: The results obtained as a result of having conducted the research may constitute a source of inspiration for the EU institutions within the scope of specifying the richest and the poorest EU regions with the purpose of an efficient management of the cohesion policy in the subsequent programming periods.

Keywords: regional development, distance from the role model, Hellwig's reduction method, NUTS-3 units.

Category of the paper: Research paper.

1. Introduction

Specifying the level of the regional development as well as its changes is an incredibly important research problem both in the economic theory and in the economic practice. For example, the allocation of the EU funds to specific subregions, as well as the intensity of state aid for communities depends on the level of the development (Albulescu, Goyeau, 2014; Nistor, Glodeanu, 2014; Azis, 2020; Matsuura, 2015). Researching the significance of the process of the regional development, its core, its causes and consequences is the subject of a lot of scientific reports (Jašková, Havierníková, 2020; Dreyer et al., 2006; Mukhametzhan et al., 2020; Shikverdiev et al., 2019; Orlova et al., 2018; Vučković et al., 2018). A characteristic feature of the regional development is its spatial differentiation. The growing discrepancies in regional development in turn constitute one of the main problems of the contemporary economy, and the fundamental goal of the European cohesion policy is convergence, i.e. activities directed towards decreasing the differences in the level of the development of the EU regions (Beugelsdijk et al., 2018; Charron et al., 2014; Martin, Sunley, 1998).

In the study, the level of the regional development based on 31 indicators categorized within the three subcomponents (factors) of the development has been presented: the society, the natural environment and the economy. The basis applied to calculate the indicators was statistical data from the Eurostat database, enriched by the data from Statistical Offices of Poland, Slovakia and the Czech Republic. The main assumption of the article is to present the variation of the level of the regional development of the Czech Republic, Slovakia and Poland within the arrangement of specific subregions, i.e. the third level of classifying territorial units for statistical purposes applied by Eurostat (the so-called NUTS-3). The level of the regional development shall be presented based on a synthetic gauge representing a taxonomic distance of a given subregion from the established pattern of development.

In the article, a hypothesis is verified according to which the regional development of the subregions in Poland, the Czech Republic and Slovakia is highly varied, and its highest level is registered in the subregions located around the capitals of the countries researched as well as the biggest provincial cities: Warsaw, Prague, Bratislava, Wrocław, Cracow or Poznań, and the lowest – in the subregions located the farthest from the large cities indicated constituting the centres of growth. The research encompasses all NUTS-3 subregions in Poland, the Czech Republic and Slovakia – 95 units in total.

2. Stages of the research procedure

In order to research the level of the regional development of the NUTS-3 level subregions in Poland, the Czech Republic and Slovakia, a synthetic gauge of the distance from the recommended pattern has been used. The research procedure has been conducted parallelly – in the static dimension (based on the values of the indicators in 2019) as well as in the dynamic dimension (based on the change of the value of the indicators in the years of 2010-2019). The research procedure was composed of four respective stages:

1. the selection of variables – the creation of a matrix of geographical information,
2. the reduction of the multifeature space,
3. indicating the level of the regional development of the units subject to research,
4. the classification of the subregions against the scale of the regional development.

Table 1.

Indicators taken into account in the analysis specifying the subcomponents of regional development

The subcomponent of development	Indicators
The society (11 variables)	the natural growth per 1,000 inhabitants; the migration balance per 1,000 inhabitants; the feminization coefficient in total; the share of people at the production age in the total number of people; the share of people at the post-production age in the total number of people; the share of people at the pre-production age in the total number of people; the number of people at the post-production age per 100 people at the pre-production age; the number of people at the non-production age per 100 people at the production age; the total birthrate; the median age of the population; the average age of women at birth
The natural environment (10 variables)	the share of farms below 5 hectares in the total number of farms; the share of farmland as well as natural green areas in the total area; the share of farmers-farm owners under the age of 35 in the total number of farm owners; road transport of goods measured in tonnes per 1,000 inhabitants; registering misdemeanour and a crime concerning the natural environment per 1000 inhabitants; the use of the electrical energy for heating the living quarters (as the EU average), the use of electrical energy for freezing the living quarters (as the EU average), the quantity of accommodation per 1,000 inhabitants; the municipal waste per 1 inhabitant; disposed of municipal waste per 1 inhabitant
The economy (10 variables)	the creation of enterprise coefficient; the share of microenterprises in the total number of economic entities; the share of the employed in farming in the total number of the employed; the share of the employed in the financial sector in the total number of the employed; the share of the employed in the sector of information and communication in the total number of the employed; the share of the employed in the sector of professional services in the total number of the employed; the number of trademarks per 1 mln inhabitants; the share of the employed in services in the total number of the employed; the number of consumables per 1 mln inhabitants; GDP per 1 inhabitant (as the EU average)

Source: authors' own elaboration.

At the first stage of the research procedure conducted, a matrix of geographical information was built based on 31 indicators (table 1), which specified the level of the development of the NUTS-3 units in 2019 as well as the changes thereof in the years between 2010-2019 in relation to three subcomponents of growth: the society, the natural environment and the economy. Subsequently, Pearson's linear correlation coefficients were calculated between all the researched departure indicators separately for 2019, as well as separately for its change in the years of 2010-2019. It is extremely important, however, for the indicators selected for a synthetic gauge of distance from the recommended pattern to be loosely correlated between each other. As a result, the information capacity of those indicators differs.

The matrices of Pearson's correlation coefficients were the basis of conducting a reduction of the departure variables by using Z. Hellwig's reduction method – i.e. to separate the diagnostic features, i.e. those indicators which shall be taken into account in further research procedure (Balcerzak, 2016). Z. Hellwig's reduction method uses for calculation the correlation coefficients between the variables. In Z. Hellwig's reduction method, the diagnostic feature is the indicator whose sum total of the absolute correlation coefficients with other features is the highest. Next those variables are eliminated for which the value of the correlation coefficient with the diagnostic feature is higher than the critical value specified based on the hereinbelow mentioned pattern (Nowak, 2018):

$$r^* = \sqrt{\frac{(t^*)^2}{n-2+(t^*)^2}} \quad (1)$$

where:

r^* – critical value of Pearson's linear correlation coefficient,

t^* – the t-Student statistics value (at the significance level $p = 0.05$),

n – the number of departure indicators (variables).

As a result of the method applied, those variables are eliminated which are significantly statistically correlated with the diagnostic feature (called satellite features). At every next step, there is a reduction of the correlation matrix by the central feature and the satellite features. Z. Hellwig's method is repeated, obtaining new reduced correlation matrices, up to the point of exhausting a collection of features or the separation of isolated features (Hauke, Kossowski, 2011). The procedure of the reduction of variables has been eightfold: separately for the level of the regional development in total as well as separately for the level of the development for each subcomponent both in the static dimension (for the data for 2019), as well as the dynamic one (for the data for 2010-2019).

At the next step of the research procedure, a pattern and an anti-pattern of the level of the regional development have been devised. A pattern has been defined as the maximum standardized values of the respective diagnostic features, and the anti-pattern – their minimum values (Spychała, 2020). At the next stage, the taxonomic value of each researched subregion of the NUTS-3 level from the pattern of development was devised based on the hereinbelow mentioned pattern (Reiff et al., 2016):

$$d_{i0} = \sqrt{\sum_{j=1}^m (z_{ij} - z_{0j})^2} \quad (2)$$

where:

d_{i0} – the taxonomic distance of the i subregion from the assumed pattern of development,

z_{ij} – the standardised value of the j indicator (feature) for the i subregion,

z_{0j} – the standardised value of the j indicator (feature) for the pattern of development.

At the last stage of the research procedure, a synthetic gauge for each NUTS-3 subregion was devised, being an indicator of the level of development in a particular subregion. The value of the synthetic gauge was calculated for the general level of the regional level of development as well as separately for each of the three subcomponents of the development. The synthetic gauge was calculated based on the following pattern:

$$v_i = 1 - \frac{d_{i0}}{d_0} \quad (3)$$

where:

v_i – a synthetic gauge of the level of development of the i subregion,

d_{i0} – the taxonomic distance of the i subregion from the assumed pattern of development,

d_0 – the taxonomic distance of the pattern from the antipattern of development.

A synthetic gauge of the level of the development assumes values from 0 to 1, with a proviso that the higher the value, the higher the level of the development of a particular phenomenon. Based on the calculated synthetic gauges, a ranking of 95 subregions of the NUTS-3 level in Poland, the Czech Republic and Slovakia was established, and its subcomponents were subsequently subdivided into five groups: at a very high (20% of the subregions at the highest value of the synthetic gauge – the 1. group – places 1-19 in the ranking), high (the following 20% of the subregions – the 2. group – places 20-38 in the ranking), average (subregions located on positions 39-57, taking account of their decreasing placement based on a given synthetic gauge – the 3. group), low (subregions on positions 58-76 – the 4. group) and very low (20% of the subregions at the lowest value of the synthetic gauge – the 5. group – positions 77-95) level of development. Taking account of the research conducted in the dynamic dimension, subregions for which the indicator took the highest values (20% of the researched units), were classified into the group comprising units of a very high variability of the intensity of the phenomenon, and the units for which the indicator assumed the lowest values (20% of the researched subregions), classified into the group exhibiting the relatively low variability of the level of development of a particular phenomenon.

Table 2.

Extreme values of the synthetic gauge within the respective subcomponents of the regional development in 2019

The highest values of the synthetic gauge (2019)			The lowest values of the synthetic gauge (2019)		
Item	The NUTS-3 subregion	Value	Item	The NUTS-3 subregion	Value
The society					
1	Poznanski (PL)	0.652	95	Miasto Łódź (PL)	0.148
2	Gdanski (PL)	0.646	94	Sosnowiecki (PL)	0.254
3	Kosický kraj (SK)	0.611	93	Walbrzyski (PL)	0.270
4	Presovský kraj (SK)	0.604	92	Královéhradecký kraj (CZ)	0.273
5	Warszawski wschodni (PL)	0.596	91	Sandomiersko-jedrzejowski (PL)	0.295
The natural environment					
1	Koszalinski (PL)	0.566	95	Miasto Wrocław (PL)	0.270
2	Liberecký kraj (CZ)	0.533	94	Bratislavský kraj (SK)	0.284
3	Slupski (PL)	0.522	93	Gliwicki (PL)	0.298
4	Jihočeský kraj (CZ)	0.490	92	Katowicki (PL)	0.300
5	Gdanski (PL)	0.478	91	Miasto Warszawa (PL)	0.301
The economy					
1	Miasto Warszawa (PL)	0.856	95	Sandomiersko-jedrzejowski (PL)	0.094
2	Miasto Kraków (PL)	0.610	94	Pulawski (PL)	0.127
3	Miasto Wrocław (PL)	0.594	93	Lomzynski (PL)	0.127
4	Miasto Poznań (PL)	0.590	92	Chelmsko-zamojski (PL)	0.135
5	Hlavní mesto Praha (CZ)	0.573	91	Bialski (PL)	0.143
The level of the regional development in general					
1	Miasto Kraków (PL)	0.471	95	Sandomiersko-jedrzejowski (PL)	0.245
2	Miasto Warszawa (PL)	0.456	94	Sosnowiecki (PL)	0.272
3	Bratislavský kraj (SK)	0.450	93	Chelmsko-zamojski (PL)	0.273
4	Poznanski (PL)	0.439	92	Lomzynski (PL)	0.277
5	Warszawski zachodni (PL)	0.438	91	Pulawski (PL)	0.285
6	Gdanski (PL)	0.437	90	Miasto Łódź (PL)	0.287
7	Kosický kraj (SK)	0.423	89	Walbrzyski (PL)	0.290
8	Hlavní mesto Praha (CZ)	0.422	88	Kielecki (PL)	0.290
9	Slupski (PL)	0.414	87	Kraj Vysocina (CZ)	0.292
10	Miasto Poznań (PL)	0.409	86	Czestochowski (PL)	0.294

Source: authors' own elaboration.

Table 3.

The highest and the lowest values of the synthetic gauge within the respective subcomponents of the regional development in the years of 2010-2019

The highest values of the synthetic gauge (the period of 2010-2019)			The lowest values of the synthetic gauge (the period of 2010-2019)		
Item	The NUTS-3 subregion	Value	Item	The NUTS-3 subregion	Value
The society					
1	Miasto Warszawa (PL)	0.571	95	Szczecinecko-pyrzycki (PL)	0.226
2	Warszawski wschodni (PL)	0.542	94	Legnicko-Glogowski (PL)	0.243
3	Miasto Kraków (PL)	0.540	93	Jeleniogórski (PL)	0.261
4	Warszawski zachodni (PL)	0.530	92	Wloclawski (PL)	0.261
5	Bialostocki (PL)	0.526	91	Koszalinski (PL)	0.279
The natural environment					
1	Bytomski (PL)	0.672	95	Nowosadecki (PL)	0.346
2	Miasto Warszawa (PL)	0.666	94	Slupski (PL)	0.383
3	Trojmiejski (PL)	0.638	93	Leszczynski (PL)	0.416
4	Katowicki (PL)	0.631	92	Jeleniogórski (PL)	0.430
5	Gliwicki (PL)	0.627	91	Nowotarski (PL)	0.464
The economy					
1	Miasto Warszawa (PL)	0.552	95	Gorzowski (PL)	0.274
2	Trojmiejski (PL)	0.537	94	Koszalinski (PL)	0.279
3	Miasto Kraków (PL)	0.490	93	Ústecký kraj (CZ)	0.286
4	Jihomoravský kraj (CZ)	0.489	92	Walbrzyski (PL)	0.289
5	Plocki (PL)	0.488	91	Legnicko-Glogowski (PL)	0.293
The level of the regional development in general					
1	Miasto Warszawa (PL)	0.590	95	Jeleniogórski (PL)	0.329
2	Trojmiejski (PL)	0.550	94	Legnicko-Glogowski (PL)	0.329
3	Warszawski zachodni (PL)	0.534	93	Koszalinski (PL)	0.340
4	Bialostocki (PL)	0.513	92	Szczecinecko-pyrzycki (PL)	0.347
5	Miasto Kraków (PL)	0.497	91	Slupski (PL)	0.354
6	Warszawski wschodni (PL)	0.493	90	Walbrzyski (PL)	0.359
7	Rzeszowski (PL)	0.492	89	Gorzowski (PL)	0.367
8	Jihomoravský kraj (CZ)	0.483	88	Szczecinski (PL)	0.368
9	Lódzki (PL)	0.483	87	Karlovarský kraj (CZ)	0.374
10	Miasto Łódz (PL)	0.482	86	Nowosadecki (PL)	0.376

Source: authors' own elaboration.

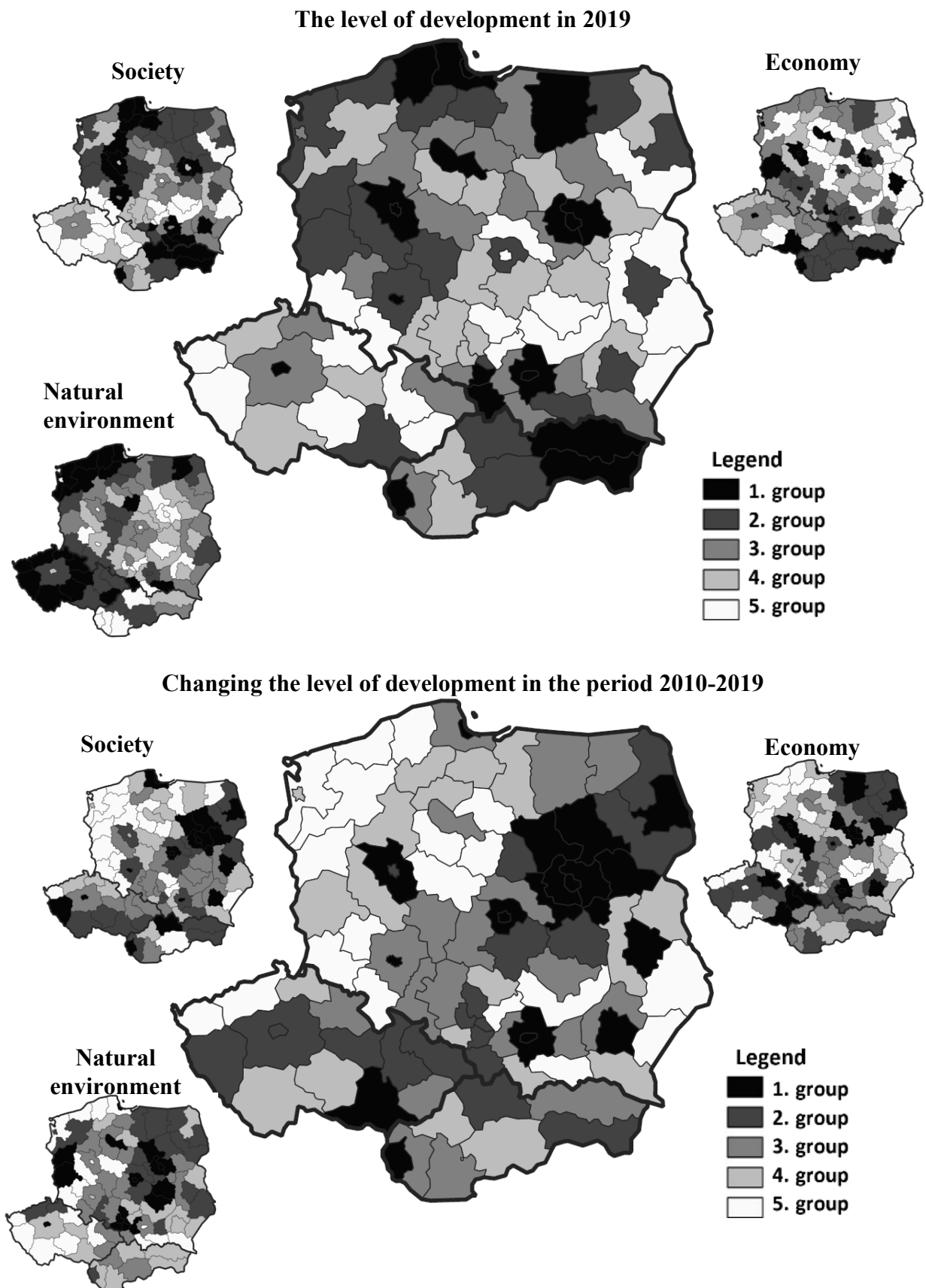


Figure 1. The differentiation of the regional level of the subregions in Poland, the Czech Republic and Slovakia. Source: authors' own elaboration.

In figure 1 as well as in table 2 and 3, the results of the research conducted have been presented. Table 2 presents the NUTS-3 units exhibiting the highest and the lowest values of the synthetic gauge within the respective subcomponents of the regional development calculated separately for 2019. In tab. 3, the NUTS-3 subregions of the extreme values of the synthetic gauge were compiled calculated for the changes in the years of 2010-2019. Figure 1 contains choropleth maps representing the spatial variation of the regional level of the NUTS-3 subregions in Poland, the Czech Republic and Slovakia in 2019 as well as the changes in the development in the years 2010-2019.

3. Conclusions based on the research conducted concerning the respective subcomponents of development

As a result of the research procedure conducted, spatial differentiation of 95 NUTS-3 level subregions in Poland, the Czech Republic and Slovakia was presented with respect to the level of the regional development as well as three subcomponents being factors of that growth (figure 1). In the researched group of units, the value of the synthetic gauge representing the level of the regional development in 2019 ranged from 0.24 to 0.47 (table 2). The value of the gauge representing the change in the level of the regional development of the subregions in the years of 2010-2019 ranged from 0.33 to 0.59 (tab. 3). A similar differentiation was observed in the case of the society (0.15-0.65 for 2019 as well as 0.23-0.57 for the change in the years of 2010-2019), the natural environment (0.27-0.57 as well as 0.35-0.67 respectively) as well as the economy (0.09-0.86 respectively as well as 0.27-0.55). One should thus note that the biggest differentiation of the subregions was registered in terms of the economy, and the biggest similarity of the researched units was observed in the case of the natural environment.

Taking account of the level of the development of the „society” subcomponent, the highest value of the synthetic gauge in 2019 was registered in the poznański, gdański and kosický kraj subregions, and the lowest in Łódź and the subregions: sosnowiecki and wałbrzyski. The high position of the districts indicated was decided on by: a high migration balance, the beneficial age structure of the population as well as a high indicator of fertility. A low position of the respective units was decided on by: a very high share of people at the post-production age in the total number of people as well as the negative birthrate. Taking account of the analysis conducted in the dynamic dimension, the biggest change in the level of the development of the „society” subcomponent in the years of 2010-2019 was observed in Warsaw, Kraków and the Eastern warszawski subregion, and the lowest – in the following units: the szczecinecko-pyrzycki, legnicko-głogowski and jeleniogórski subregions. The weaker position of the NUTS-3 units indicated in the research on the change in the level of the development of the society was decided on by: the decrease in the birthrate indicator as well as an increase in the

indicator of the demographic burden. A high position of the respective subregions in the ranking was decided on by: a very high increase in the migration balance, an increase in the share of the people at the production age in the total number of people, as well as a relatively high decrease of the average age of women at the moment of giving birth.

Based on the state of the natural environment, the highest value of the synthetic gauge in 2019 was registered in the following subregions: koszaliński, liberecky kraj as well as in the śląski subregion, and the lowest – in Wrocław, bratislavsky kraj as well as in the gliwicki subregion. The high position of the NUTS-3 units in the research was impacted mainly by: the lowest use of electrical energy for the purpose of cooling the living quarters as well as the number of accommodation units per 1,000 inhabitants. The low position in the ranking of the subregions mentioned hereinabove was decided on by: the problematic road transport of goods measured in tonnes per 1,000 inhabitants as well as a significant amount of municipal waste per 1 inhabitant. Taking account of the analysis conducted in the dynamic dimension, the biggest improvement of the state of the natural environment in the years of 2010-2019 was observed in the bytomski subregion, Warsaw and the trójmiejski subregion, and the lowest – in the following subregions: nowosądecki, śląski and leszczyński. The lower position of the units in the research was decided on by: the increase in demand for cooling the living quarters per capita as well as an increase in the quantity of municipal waste per 1 inhabitant. A high position in the ranking of the respective units was decided on by: a relatively high share of natural green areas in the area in total as well as the highest in the period researched increase in the percentage of waste disposed of.

Taking account of the level of the development of the economy, the highest value of the synthetic gauge in 2019 was registered in Warsaw, Cracow and Wrocław (in those cities the most microenterprises per 1,000 inhabitants were registered, as well as the biggest share of the employed in the finance sector in the total number of the employed was observed), and the lowest – in the subregions: sandomiersko-jędrzejowski, puławski and łomżyński (of the lowest number of microenterprises per 1,000 inhabitants as well as the lowest coefficient of the creation of enterprises). From another standpoint, taking account of the analysis conducted in the dynamic dimension, the biggest progress in the level of the development of the „economy” subcomponent in the years of 2010-2019 was observed in Warsaw, Cracow and Trójmiasto, and the lowest – in the following subregions: gorzowski, koszaliński and ustecky kraj. The NUTS-3 units position in the research conducted in the dynamic dimension was influenced mainly by: the percentage of the employed in the financial sector, the share of the employed in the sector of professional services as well as GDP per capita (in all three indicators, the highest growth was registered in Warsaw), as well as the number of trademarks per 1 mln inhabitants (the highest growth in Cracow) as well as the changes in the structure of the size of the enterprises.

4. Summary – the general level of the regional development of the NUTS-3 subregions in Poland, the Czech Republic and Slovakia

Summarizing the results of the research conducted concerning the level of the regional development of 95 NUTS-3 subregions in Poland, the Czech Republic and Slovakia, one may indicate the following conclusions. The level of the general development of the subregions in 2019 was specified based on 31 indicators separated within three subcomponents of the development: the society, the natural environment as well as the economy. The highest value of the synthetic gauge was registered in big cities being supraregional centres of growth: Cracow, Warsaw and Bratislava as well as the subregions forming agglomerations – the poznański, the Western-Warsaw and gdański subregions. The hypothesis stated at the beginning of the article has been positively verified. Moreover, among 3 national capitals (Warsaw, Prague and Bratislava) as well as 5 remaining subregions being single cities (Cracow, Wrocław, Poznań, Szczecin and Łódź), 6 units have been qualified into the group of units at a very high level of the regional development. However, Szczecin and Łódź have not been classified in the group of the best developed subregions: Szczecin was found in the middle of the compilation (51. position), and Łódź has been classified on the 90th position in the ranking of the best developed NUTS-3 units in Poland, the Czech Republic and Slovakia (the 5th position from the bottom). Taking account of the analysis conducted in the dynamic dimension, the biggest change in the level of the regional development in the years of 2010-2019 was observed in Warsaw, Trójmiasto (comprising Gdańsk, Gdynia and Sopot), Cracow and the Western warszawski as well as białostocki subregion. Łódź, Bratysława and Wrocław (the 9th, 12th and 17th position respectively) were also high in the ranking. Prague was on the 30th position and Poznań – on the 34th position among the 95 subregions at the biggest change in the level of the regional development in the years of 2010-2019, and Szczecin – as far as on the 62nd position. It is well worth noting that the subregions at a very high level of the regional development are usually those units in which the biggest change in the development was registered in the years of 2010-2019 (and the reverse). Apart from the big cities indicated, the group also includes the subregions surrounding the provincial capitals such as those including: the gdański, poznański, wrocławski, warszawski wschodni, warszawski zachodni, krakowski, rzeszowski or bydgosko-toruński provinces. On the other hand, the subregions at the weakest level of the regional development include the NUTS-3 units located at the periphery as well as far from the strongest regions, e.g. the sandomiersko-jędrzejowski, sosnowiecki, chełmsko-zamojski, jeleniogórski or koszaliński regions. One may thus conclude that – on one hand – the current level of the development of the respective subregions in Poland, the Czech Republic and Slovakia is to a large extent shaped by the activities taken in the last decade, i.e. in the period of complete participation in the policy of cohesion of the European Union, and on the other hand – bigger and bigger disproportions are observed at the level of NUTS-3

units, as to the largest extent, the level of the regional development has increased in the economically strongest subregions (in Warsaw as well as in the capitals of the provinces being at the same time supraregional centres), and to the least extent – in the relatively weakest developed subregions (e.g. in those ones that are located at the northern, north-eastern and south-western border of Poland as well as the south-western border of the Czech Republic). Large developmental disproportions may also be observed at the NUTS-2 level units. Within the area of almost each of them, the subregions both at a very high level of the regional development, as well as units classified as the 20% of the least developed NUTS-3 units in the countries researched, are located. The abovementioned considerations, the research conducted as well as the results obtained may thus constitute an inspiration to go into more in-depth analyses in that direction.

Acknowledgments

Supported by the grant No. 51109-19-57“Absorption of European Union funds and changes in the level of regional development of regions in Poland, the Czech Republic and Slovakia” of the Poznań University of Economics and Business.

References

1. Albulescu, C., Goyeau, D. (2014). EU Funds Absorption Rate and the Economic Growth. *Timisoara Journal of Economics and Business*, 6(20), 25-26.
2. Azis, I.J. (2020). *Regional Development and Noneconomic Factors*. International Encyclopedia of Human Geography. <https://doi.org/10.1016/b978-0-08-102295-5.10117-9>.
3. Balcerzak, A.P. (2016). Multiple-criteria evaluation of quality of human capital in the European union countries. *Economics and Sociology*, 9(2), 11-26. <https://doi.org/10.14254/2071-789X.2016/9-2/1>.
4. Beugelsdijk, S., Klasing, M.J., Milionis, P. (2018). Regional economic development in Europe: the role of total factor productivity. *Regional Studies*, 52(4), 461-476. <https://doi.org/10.1080/00343404.2017.1334118>.
5. Charron, N., Dijkstra, L., Lapuente, V. (2014). Regional Governance Matters: Quality of Government within European Union Member States. *Regional Studies*, 48(1), 68-90. <https://doi.org/10.1080/00343404.2013.770141>.
6. CZSO (2021). *Regional statistics*. https://www.czso.cz/csu/czso/regions_towns_, 14.04.2021.

7. Dreyer, L.C., Hauschild, M.Z., Schierbeck, J. (2006). A framework for social life cycle impact assessment. *International Journal of Life Cycle Assessment*, 11(2), 88-97. <https://doi.org/10.1065/lca2005.08.223>.
8. Eurostat (2021). *Regional statistics by NUTS classifications*. <https://ec.europa.eu/eurostat/web/main/data/database>, 13.04.2021.
9. Hauke, J., Kossowski, T. (2011). Comparison of values of pearson's and spearman's correlation coefficients on the same sets of data. *Quaestiones Geographicae*, 30(2), 87-93. <https://doi.org/10.2478/v10117-011-0021-1>.
10. Jašková, D., Havierníková, K. (2020). The human resources as an important factor of regional development. *International Journal of Business and Society*, 21(3), 1464-1478.
11. Main Statistical Office (2021). Local Data Bank. <https://bdl.stat.gov.pl/BDL/start>, 1.04.2021.
12. Martin, R., Sunley, P. (1998). Slow convergence? The new endogenous growth theory and regional development. *Economic Geography*, 74(3), 201-227. <https://doi.org/10.1111/j.1944-8287.1998.tb00113.x>.
13. Matsuura, M. (2015). Contribution of EU Funds to Economic Growth in Poland. *Russian and East European Studies*, 44, 87-98. <https://doi.org/10.5823/jarees.2015.87>.
14. Mukhametzhan, S.O., Junusbekova, G.A., & Daueshov, M.Y. (2020). An econometric model for assessing the asymmetry of urban development as a factor of regional economic growth: The case of Kazakhstan. *Industrial Engineering and Management Systems*, 19(2), 460-475. <https://doi.org/10.7232/iems.2020.19.2.460>.
15. Nistor, R.L., & Glodeanu, A.-C. (2014). Regional economic development influenced by the EU funds absorption rate. *Managerial Challenges of the Contemporary Society. Proceedings*, 7(1), 115-118.
16. Nowak, P. (2018). Regional variety in quality of life in Poland. *Oeconomia Copernicana*, 9(3), 381-401. <https://doi.org/10.24136/oc.2018.019>.
17. Orlova, L., Gagarinskaya, G., Gorbunova, Y., Kalmykova, O. (2018). Start-ups in the field of social and economic development of the region: A cognitive model. *Entrepreneurship and Sustainability Issues*, 5(4), 795-811. [https://doi.org/10.9770/jesi.2018.5.4\(7\)](https://doi.org/10.9770/jesi.2018.5.4(7)).
18. Reiff, M., Surmanová, K., Balcerzak, A.P., & Pietrzak, M.B. (2016). Multiple criteria analysis of European union agriculture. *Journal of International Studies*, 9(3), 62-74. <https://doi.org/10.14254/2071-8330.2016/9-3/5>.
19. Shikverdiev, A.P., Oganezova, N.A., Mazur, V.V., Obrezkov, N.I., Ichetkina, M.A. (2019). Development of regional competitiveness as a factor in creating a favorable business environment. *Espacios*, 40(28).
20. Spychała, M. (2020). The absorption of EU funds and the socio-economic development in the subregional dimension in Poland. *Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu*, 64(3), 78-91. <https://doi.org/10.15611/pn.2020.3.07>.

21. Statistical Office of the SR (2021). *Regional statistics*. <https://slovak.statistics.sk/wps/portal/ext/themes/regional/>, 15.04.2021.
22. Vučković, S.Đ., Đorđević, J., Jovanov, J.M., Bibić, L.I., Đorđević, T. (2018). Socio-economic characteristics as limiting factors of regional development. The case of Kolubara District, Republic of Serbia. *Romanian Journal of Geography*, 62(2), 217-232.