

## THE COMPETITIVENESS OF THE VISEGRAD GROUP REGIONS IN THE CONTEXT OF HUMAN CAPITAL

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**Abstract:** Competitiveness is an essential condition for regional development. Regional competitiveness a result of many factors. To succeed in a competitive environment, regions must attract the necessary resources, which currently include human resources and human capital. The objective of this paper is to assess the competitiveness and the level of human capital in the regions of the Visegrad Group countries based on selected indicators in the two observed years 2017 and 2022 and to assess their interrelation. From the results of the competitiveness assessment, we conclude that the best performing regions are Prague, Budapest and Bratislava. When assessing the level of human capital, the Prague region, the Polish Warszawski stołeczny region, the Hungarian Budapest region and the Slovak Bratislava region are again among the best performers. Consequently, we confirmed a positive relationship between the level of human capital and the competitiveness of the regions.

**Keywords:** competitiveness, competitiveness indicators, human capital, human capital indicators, Visegrad Group.

### 1 Introduction

The success and economic level of individual national economies is dependent on the socio-economic level of their individual regions, which implies that regions play an increasingly important role in the economic development of states (Staničková, 2019). According to Bąk et al. (2022), the development of regions is a complex process that depends on many conditions. On one hand, emphasis is placed on the need to increase the competitiveness of regions and, on the other hand, on their sustainable development. Therefore, the development of regions and their competitiveness are closely interlinked. To succeed in a competitive environment, regions must attract the desired resources, such as capital, human resources and human capital, new technologies, firms. Crucial factors in the process of increasing the competitiveness of a region are also a well-developed innovation system and knowledge base, quality of public decision-making processes, quality of life, and functional networks that eliminate the risks of losing competitive advantage by diffusion of knowledge or technology to other regions. (Kačírková, 2009) The European Union also strives for the development of individual regions, and according to Fantechi and Fratesi (2024), competitiveness is a key feature of the EU's current regional policies aimed at reducing disparities between its territories. The European Commission has adopted regional competitiveness policy objectives as the main instrument to induce economic growth, export capacity and performance in the global market (Iacob, Iordache, 2023).

Differences among regions are typical not only for the European Union as a whole, but also for the countries of Central Europe, namely the Visegrad Group (Czech Republic, Slovakia, Poland and Hungary). These countries share a common history and similar features. Apart from Poland, these are smaller economies that are very vulnerable to various crises and recessions within the global economy. Their lower economic strength is compensated by higher specialization in production processes (Calgánková, 2020).

This study is aimed at assessing the competitiveness and the level of human capital in the regions of the Visegrad Group countries and assessing their interrelationship.

### 2 Theoretical backgrounds

Competitiveness is one of the main alternative indicators of economic performance, complementing the key indicator of economic performance, gross domestic product. It combines economic aspects with social aspects and thus more comprehensively monitors all important factors that reflect not only economic efficiency but also the social maturity of a country (Habánik et al., 2016), as competitiveness has a positive impact on long-term economic growth (Charles, Zegarra, 2014). As stated by Staničková (2019), competitiveness is one of the most observed characteristics of national economies today and is increasingly emerging in the assessment of their prosperity, well-being and living standards. The author further states that fostering regional competitiveness requires the creation of framework conditions for the development of necessary infrastructure, human capital, technology and efficient markets that can help attract talent and investment to raise the standard of living of the population (Staničková, 2019).

Competitiveness is an analysed and compared characteristic of different entities, such as companies, institutions, organizations, as well as different regions. In addition to the assessment of national and corporate competitiveness, regional competitiveness is more and more coming to the fore. At national level, competitiveness depends on regional competitiveness. Because, as Ežmale (2019) states, the concept of regional competitiveness is located between two levels of competitiveness (microeconomic and macroeconomic), and this concept has recently gained even more significance, which was mainly because more attention is paid to the regions and also that regional competitiveness is a source of national competitiveness (Ramik, Hančlová, 2012).

Regional competitiveness is the result of many factors. In this context, it should be kept in mind that regions have different geographical conditions, sources of raw materials, historical and economic development, as well as populations that share certain moral and ethical values, which are reflected in the social environment and overall culture of the region. (Pelantová & Kouřilová, 2016) It is difficult to clearly define, both because of the complexity of the functioning of a region as an economic and social unit (Žitkus, 2015), but also because it remains an area of contentious theoretical debate, with some arguing that it is about firms and not territories that compete for resources and markets (Huggins et al, 2014). On the other hand, it can be argued that sustained improvements in competitiveness are a prerequisite for growth and the very viability of production units, which has sparked interest in better assessing the regional and national levels of competitiveness (de la Vega et al., 2019). Different views on the notion of regional competitiveness also stem from which competitiveness factors are given more importance.

The ability to compete with other regions is thus understood as the ability to be economically active. According to Wokoun (2016), the competitiveness of a region depends on its attractiveness to investors and know-how, with the presence of entrepreneurship and immigration being its hallmark. Vukovic et al (2016) characterize the regional competitiveness as the ability to be productive and maintain a high standard of living. Accordingly, Jašková (2022) defines regional competitiveness as the ability of a region to support and attract economic activity to the region to raise the standard of living of its inhabitants.

The regional competitiveness in relation to the overall socio-economic level of regions is considered as the ability of regions to compete successfully with others and many aspects of socio-economic performance are considered in its assessment (Wokoun, Krejčová, 2013). As stated by Chrobocińska (2021), stimulating regional competitiveness is a challenging and complex process that leads to achieving a better competitive position in relation to other compared regions. In the view of

Svoboda et al. (2024), it is essential to understand how fiercely regions compete, where this rivalry comes from and what factors influence territorial economic attractiveness. It is necessary to understand that regional strategic management of competitiveness is a process of strategic decision-making on the choice of alternatives, formed by comparing the existing potential of a particular region with the opportunities and threats of its external environment, as well as with global changes in the external environment. (Borovitskaya et al., 2019). With this, the competitiveness of a region is defined both by the indicators that determine the ability of the region to compete with other regions and by the results that regional competitiveness has created. It is difficult to characterize the main factors of regional competitiveness, as many factors are both indicators and outcomes of competitiveness, thus they intertwine and influence each other.

As stated by Kouskoura et al. (2024), an analysis of key factors and their correlations, aimed at measuring regional competitiveness, provides valuable insights into what influences the growth and development of disadvantaged regions. According to Borovitskaya et al. (2019), the competitiveness of each region is based on certain competitive advantages in its different areas of activity. Among the factors of regional competitiveness can be included both indicators of economic performance, the labor market, the standard of living, the region's infrastructure endowment, factors characterizing the level of health care, educational infrastructure, environmental indicators, and, finally, the level of science and research or innovation. As Penatová and Kouřilová (2016) state, the definition of regional competitiveness is the basis for its measurement, which usually emphasizes those factors that can influence regional competitiveness. According to Bednářiková (2022), regional competitiveness is determined either by indicators that determine a region's ability to compete with other regions, or by the results that the competitiveness of the region has produced. In view of the above, it is possible to note a wide dispersion of indicators and of the methods used in scientific research to assess regional competitiveness.

Ramík and Hančlová (2012) used two methods of multicriteria decision making in assessing the competitiveness of NUTS2 regions in the Visegrad Group countries for the years 2000-2006: the Ivanovic deviation and DEA models. DEA models were also used by Charles and Zegarra (2014) in assessing the regional competitiveness. Pelantová, Kouřilová (2016) evaluated the regional competitiveness in the Czech Republic using the regional competitiveness index created by prof. Huggins for regions in the UK, which they adapted to the conditions of the Czech Republic regarding the availability of indicators. Their index consists of three sub-indices: inputs, outputs and outcomes. De la Vega et al. (2019) developed a multidimensional view of the competitiveness of Spanish Autonomous Communities, where they assessed 53 indicators covering 5 key areas (productive capital, human capital, social and institutional capital, infrastructure and knowledge). Navarro et al. (2017) assessed the level of Spanish regions using an index that contains 15 pillars. In each pillar there is a set of variables that allow measuring the annual value of the pillar index. These indices take values between 0 and 1, with a higher value representing a higher level of competitiveness.

Other competitiveness indices have been created by authors to assess regions in different countries, e.g. Latvia (Judrupa, 2021), India (Moirangthem, Nag, 2021), Italy (Scaccabarozzi et al., 2022), Peru (Charles, Zegarra (2014)), or to compare regions in a

specific territory (Lakócai, Capoani, 2023 - for 11 countries in Central and Eastern Europe; Richterová et al., 2021 for the EU27 countries). Several authors also use the RCI values developed and reported by the European Commission to assess the regional competitiveness (e.g. Lithuania, 2017; Alexa et al., 2021), or suggest its modification with the addition of other indicators (Bilbao-Terol et al., 2019; Maza, Hierro, 2024).

Research on regional competitiveness varies not only because of the number and structure of indicators used, but also because of the methods used. The use of multi-criteria evaluation methods is also quite common. These evaluation methods belong to the group of multivariate statistical methods. They are used when examining multivariate statistical sets. Their characteristics include the fact that they can synthesize several different features (indicators) into one integral indicator (the resulting characteristic) expressed by a specific number. The group of multicriteria methods includes, for example: the weighted sum of ranks method, the scoring method, the normalized variable method and the method of distance from a fictitious object (Šebo, Šebová 2010). A frequently used method for assessing regional competitiveness is the composite indicator (Jašková, 2022) or cluster analysis (Chrobocińska 2021, Jašková and Haviernikova, 2020).

### 3 Goal and methodology

The goal of the paper is to identify and assess the competitiveness of the Visegrad Group regions and the level of human capital and to establish their interrelationship. We examine the above in two years: 2017 (the year with the highest economic growth before the recession) and 2022 (the last year for which data are available for all the examined indicators).

To achieve the above objective, it is necessary to find out the answers to the research questions:

1. What is the competitiveness level of the individual NUTS2 regions of the Visegrad Group in 2017 and how have its values changed in 2022?
2. What is the human capital level in each Visegrad Group region in 2017 and 2022?
3. Is there any relationship between the competitiveness and human capital in the V4 regions?

The basis of effective regional policy is the analysis of factors relevant to regional development, i.e. the identification of key determinants that stimulate regional development (Wokoun, 2016). Regarding the above objective, we will work with selected determinants (Table 1) that represent competitiveness and human capital at the regional level. The selection of the indicators is determined by the available data that can be obtained for all regions of the Visegrad Group countries from relevant databases and the available time series.

The input data are drawn from the Eurostat database as the annual values in the interval from 2017 to 2022.

Tab.1: Investigated indicators

Indicator name	Unit of measure	Data source
<b>Indicators of human capital</b>		
population with tertiary education (levels 5-8) - (from 25 to 64 years)	percentage	[edat_lfse_04_custom_11880893]
life expectancy at birth	years	[demo_r_mlifexp_custom_11868656]
infant mortality	rate	[demo_r_minfind_custom_11880423]
persons with tertiary education and employed in science and technology (HRST)	percentage of population in the labour force)	[hrst_st_rcat_custom_11609865]
<b>Indicators of competitiveness</b>		
gross domestic product	Euro per inhabitant	[nama_10r_2gdp_custom_11596014]
employment rate	percentage	[lfst_r_lfe2emprtn_custom_11226781]
R&D expenditure	percentage of GDP	[rd_e_gerdreg_custom_11879534]
nominal labour productivity	Euro per person	[nama_10r_2nlp_custom_11597192]
total railway lines	kilometres per thousand square kilometres	[tran_r_net_custom_11882820]
motorways	kilometres per thousand square kilometres	[tran_r_net_custom_11882902]

To assess the level of competitiveness and human capital, we will use one of the multi-criteria methods - the scoring method.

For each parameter we assign the region, which reached the best value, 100 points, and other regions are assigned indicator points as follows:

- if the maximum value is the best value:

$$b_{ij} = x_{ij}/x_{jmax} \times 100 \tag{1}$$

- if the minimum value is the best value (infant mortality rate):

$$b_{ij} = x_{jmin}/x_{ij} \times 100 \tag{2}$$

where:

- $x_{ij}$  - the value of  $j$ -th variable in the  $i$ -th region
- $x_{jmax}$  - highest value of the  $j$ -th variable
- $x_{jmin}$  - lowest value of the  $j$ -th variable
- $b_{ij}$  - the scores of the  $i$ -th region for the  $j$ -th variable.

Next the overall scores for both competitiveness and human capital levels for each NUTS2 region are calculated. To assess the relationship between the competitiveness level and human capital level, we use the arithmetic mean of the scores of the above areas, due to the different number of determinants examined within competitiveness and human capital.

The relationship between the level of human capital and the level of competitiveness in the Visegrad Group regions is assessed using the Pearson correlation coefficient ( $r_{xy}$ ):

$$r_{xy} = \frac{n \sum_{i=1}^n x_i y_i - \sum_{i=1}^n x_i \sum_{i=1}^n y_i}{\sqrt{[n \sum_{i=1}^n x_i^2 - (\sum_{i=1}^n x_i)^2][n \sum_{i=1}^n y_i^2 - (\sum_{i=1}^n y_i)^2]}} \tag{3}$$

where:  
 $x$  is the independent variable  
 $y$  is the dependent variable.

This coefficient allowed to identify the magnitude and direction of the dependence between the explored indicators. The competitiveness was considered as the dependent variable, and the human capital level as the independent variable.

**4 Results and Discussion**

Firstly, the competitiveness of the individual V4 regions will be estimated by assigning points for selected competitiveness determinants and aggregating them. The structure of the scores obtained is presented in Figure 1.

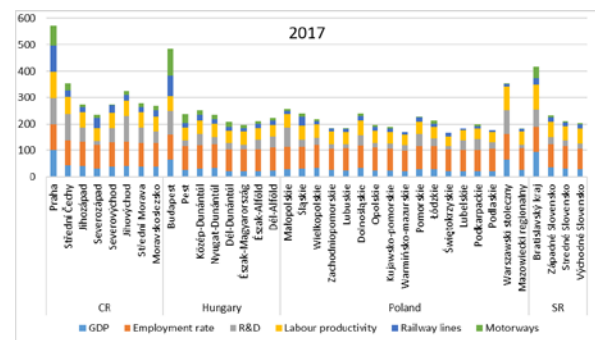


Figure 1: Competitiveness of the V4 regions in 2017  
 Source: own calculations according to Eurostat data (2024).

In 2017, the Prague region scored the highest for competitiveness (572.54 points), as it scored the best in four out of the six indicators. This was followed by Budapest and the Bratislava region. In addition to the capital city regions, the Czech region of Střední Čechy was among the regions with the best scores. On the other hand, the regions with the lowest scores (less than 200 points) are the regions of Poland and the Hungarian region of Észak-Magyarország. In 2017, the smallest differences between the V4 regions were in employment rates, while the largest differences were in motorway and railway density.

The next observed period is 2022, an assessment of the competitiveness of the V4 regions is presented in Figure 2.

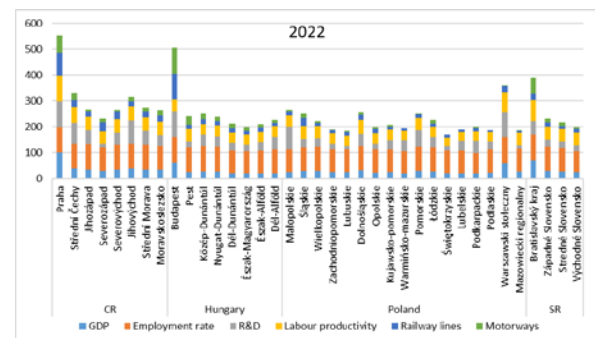


Figure 2: Competitiveness of the V4 regions in 2022  
 Source: own calculations according to Eurostat data (2024).

In 2022, the ranking of the top three regions remained unchanged, but the top region, Prague, scored fewer points than in 2017 (553.67 points). The number of regions with less than 200 points decreased to 10, with the Eastern Slovakia region tumbling down within this category.

When comparing the scores obtained in 2017 and 2022, we can state that the biggest decrease in scores was recorded in the Bratislava region, in addition, there was a decrease in two other regions of the Slovak Republic, there was also a decrease in all regions of the Czech Republic, followed by two regions of Hungary and Poland. These facts point out to a narrowing gap between the V4 regions.

Next there is an assessment of the human capital level in the V4 regions in 2017 (Figure 3) and in 2022 (Figure 4).

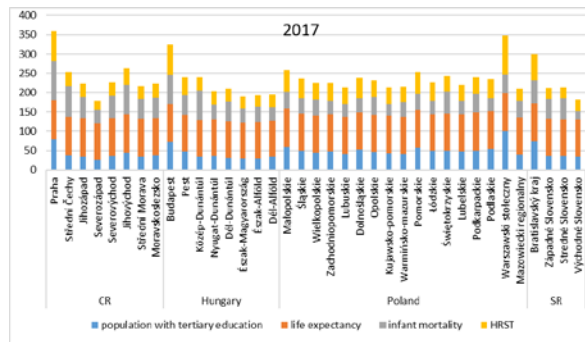


Figure 3: Assessment of human capital level in the V4 regions in 2017  
Source: own calculations according to Eurostat data (2024).

Also in the human capital assessment, the highest number of points was gained by the Prague region (358.90), followed by the Warszawski stołeczny region (348.14 points), Budapest (324.06 points) and the Bratislava region (299.90 points). Three Hungarian regions, one Slovak and one Czech region scored less than 200 points. The smallest differences between the V4 regions are in life expectancy at birth.

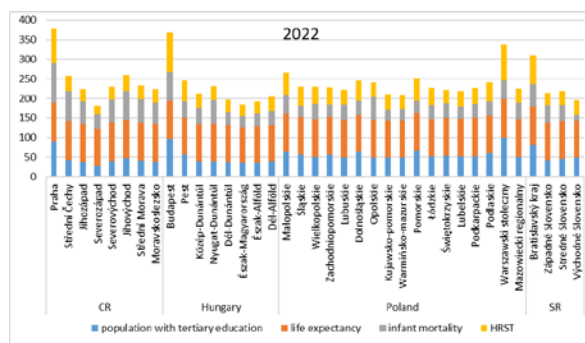


Figure 4: Assessment of the level of human capital in the V4 regions in 2022  
Source: own calculations according to Eurostat data (2024).

In 2022, the ranking of the top four regions was the same, apart from the Warszawski stołeczny region seeing an increase in their scores. The worst-ranked region this year remained the Czech region of North-West.

In 2022, compared to 2017, the human capital assessment increased the most in the Budapest region (by 43.28 points), mainly due to an increase in the share of the population with tertiary education and the number of university graduates working in science and research. In contrast, the greatest deterioration occurred in the Közép-Dunántúl region (by 28.23 points), which was mainly due to a worsening of infant mortality.

An assessment of the relationship between competitiveness and human capital in the regions of the Visegrad Group countries in

2017 and 2022 is presented in Figure 5 and Figure 6, respectively.

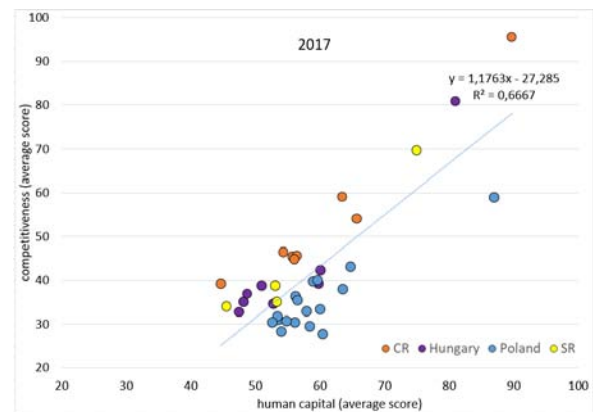


Figure 5: Relationship between competitiveness and human capital in the V4 regions in 2017  
Source: own processing.

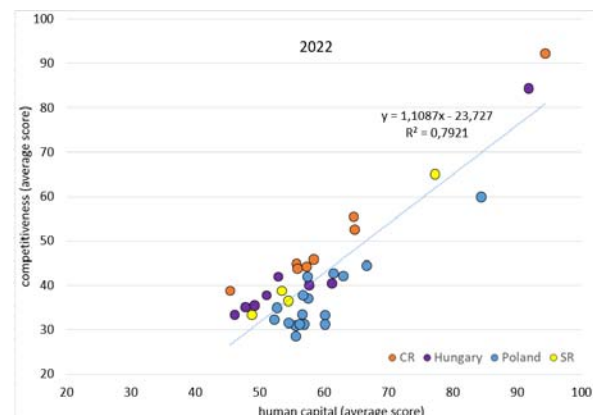


Figure 6: Relationship between competitiveness and human capital in V4 regions in 2022  
Source: own processing.

The graphical representation shows a positive relationship between the level of human resources and the competitiveness of regions, which is confirmed by the Pearson correlation coefficient, which reached 0.8165 in 2017 and 0.8900 in 2022. Based on this, the coefficient of determination reflects that in 2017 66.67% of the variability was explained by the model, and even 79.21% in 2022.

The highest competitiveness and the highest level of human resources is in the Prague region and other regions with the capital city. When comparing the average scores of competitiveness and human capital, we note that only the Prague region in 2017 achieved values of competitiveness higher than the level of human capital (Figure 7). All other regions achieved higher values of human capital than competitiveness in both years under study, suggesting that there are reserves in exploiting the advantage of quality human resources, therefore they did not translate into an increase in their competitiveness. The regions of Poland score significantly higher on human capital than on competitiveness, while in the Czech Republic there are smaller differences between competitiveness and human capital levels, indicating better use of existing human capital to increase competitiveness or the influence of other factors on competitiveness enhancement.

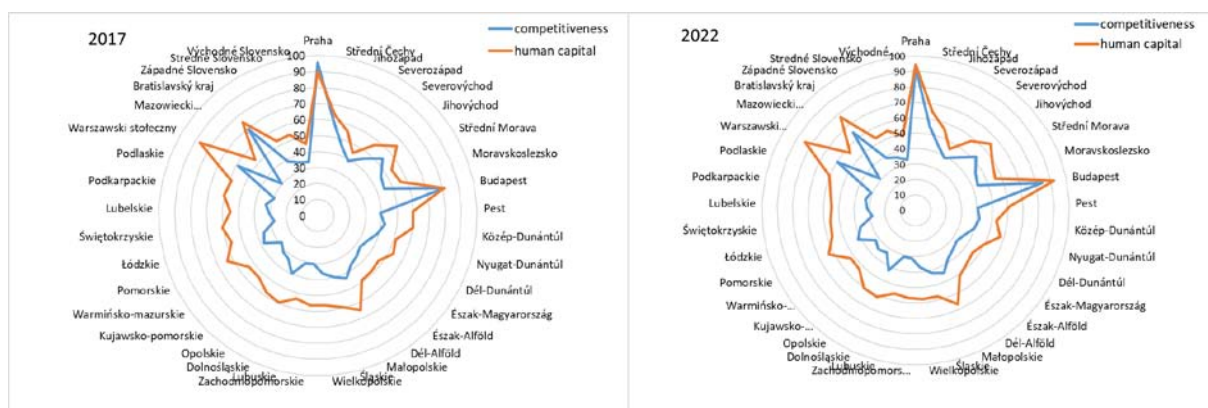


Figure 7: Assessment of the level of competitiveness and human capital in the V4 regions  
Source: own processing.

#### 4 Conclusion

From the results regarding the competitiveness assessment, we note that the best results in both the years 2017 and 2022 are achieved by the Prague region, followed by the Budapest and Bratislava regions. When assessing the level of human capital, the Prague region is again among the best, followed by the Polish Warszawski stołeczny region, the Hungarian Budapest region and the Slovak Bratislava region. Consequently, we confirmed a positive relationship between the level of human capital and the competitiveness of the regions. When comparing the average scores of competitiveness and human capital, we concluded that only the Prague region achieved competitiveness values higher than the level of human capital in 2017. In the other observed regions, the values of the human capital quality level were higher than competitiveness. It could be suggested that there are reserves in taking advantage of quality human resources.

In conclusion, we can agree with the suggestions recommended by Kouskoura et al. (2024) that investments in education and innovation are needed to improve prosperity and competitiveness, as well as more informed policies and collective actions for a greener, healthier and more sustainable future and finally, well-planned investments in transport, which is the foundation of the link between R&D, innovation and economic progress, as well as further development of high-tech industries and innovative measures should be taken for sustainable and economic growth of regions.

We are aware that our research has some limitations and constraints, but we encounter this fact in almost all research. In this thesis, we worked with a limited number of literature sources and scholarly works, which may have influenced our perspective on the issue. In the analytical part, we worked with data provided by the Eurostat database, where it was difficult to obtain relevant data for some of the observed factors within the timeframe.

#### Literature

- Alexa, D., Cismas, L.M., Rus, A.V. & Silaghi, M.I.P. (2019). Economic growth, competitiveness and convergence in the European regions. A spatial model estimation. *Economic Computation and Economic Cybernetics Studies and Research*, 53(1): 107-124. <https://doi.org/10.24818/18423264/53.1.19.07>.
- Bąk, I., Wawrzyniak, K. & Oesterreich M. (2022). Competitiveness of the Regions of the European Union in a Sustainable Knowledge-Based Economy. *Sustainability*, 14(7):3788. <https://doi.org/10.3390/su14073788>
- Bednáriková, N. (2022). Competitiveness and regional disparities in Slovakia: selected economic indicators. *Slovak Journal of Public Policy and Public Administration*, 9(1). <https://sjpppa.fsvucm.sk/index.php/journal/article/view/135>

- Bilbao-Terol, A., Arenas-Parra, M. & Onopko-Onopko, V. (2019). Measuring regional sustainable competitiveness: a multi-criteria approach. *Operational Research* 19(3), 637-660. <https://doi.org/10.1007/s12351-017-0367-9>
- Borovitskaya, M., Strelnikov, E., Khayrullina, R., Kolesnikov, M. & Mukhniuk, M. (2019). A basis for regional competitiveness: socio-economic potential. *Revista de la Universidad del Zulia*, 10(28), 345-356. <https://dialnet.unirioja.es/servlet/articulo?codigo=8809784#>
- Calgánková, V. (2020). Competitiveness of V4 countries using the global competitiveness index. In *SHS Web of Conferences, Globalization and its Socio-Economic Consequences 2019*, 74, 06007. <https://doi.org/10.1051/shsconf/20207406007>
- de la Vega, J. C. S., Azorín, J. D. B., Segura, A. C. F., & Yago, M. E. (2019). A new measure of regional competitiveness. *Applied Economic Analysis*, 27(80), 108-126. <https://doi.org/10.1108/AEA-07-2019-0010>
- Eurostat. (2024). Database. Available at: <https://ec.europa.eu/eurostat/data/database>
- Ežmale, S. (2019). Regional competitiveness analysis and its implications for the spatial planning of Latgale region. *Society. Integration. Education. Proceedings of the International Scientific Conference*, 6, 142-155. <https://doi.org/10.17770/sie2019vol6.3710>
- Fantechi, F. & Fratesi, U. (2024). Spatial patterns of territorial competitiveness: The role of peripherality, urbanization and physical geography. *Socio-Economic Planning Sciences*, 91(2024), 101754. <https://doi.org/10.1016/j.seps.2023.101754>
- Habánik J., Kordoš M. & Hošťák P. (2016). Competitiveness of Slovak economy and regional development policies, *Journal of International Studies*, 9(1), 144-155. <https://doi.org/10.14254/2071-8330.2016/9-1/10>
- Huggins, R., Izushi, H., Prokop, D. & Thompson, P. (2014). Regional competitiveness, economic growth and stages of development. *Zbornik Radova Ekonomskog Fakulteta u Rijeci- Proceedings of Rijeka Faculty of Economics*, 32(2), 255-283. <https://hrcak.srce.hr/file/194343>
- Charles, V. & Zegarra, L.F. (2014). Measuring regional competitiveness through Data Envelopment Analysis: A Peruvian case. *Expert Systems with Applications*, 41(11), 5371-5381. <http://dx.doi.org/10.1016/j.eswa.2014.03.003>
- Chrobocińska K. (2021). Comparative Analysis of Regional Competitiveness in Poland from 2010–2019 in the context of the concept of sustainable development. *Sustainability*. 13(6):3202. <https://doi.org/10.3390/su13063202>
- Iacob, C. G., & Iordache, E. (2023). Measuring Regional Competitiveness at the Level of the European Union. *The Journal Contemporary Economy. Revista Economica Contemporană*, 8(1), 39-47. [http://www.revec.ro/images/images\\_site/articole/article\\_d2961b02571515476efe4635162497aa.pdf](http://www.revec.ro/images/images_site/articole/article_d2961b02571515476efe4635162497aa.pdf)
- Jašková, D. (2022). Evaluation of human capital in relation to regional competitiveness. *RELIK 2022: reprodukce lidského*

kapitálu - vzájemné vazby a souvislosti, 15, 269-279. <https://telic.vse.cz/2022/download/pdf/634-Jaskova-Dana-paper.pdf>

17. 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.

18. Judrupa, I. (2021). Regional Competitiveness as an Aspect Promoting Sustainability of Latvia. *European Journal of Sustainable Development*, 10(1), 650. <https://doi.org/10.14207/ejsd.2021.v10n1p650>

19. Kačírková, M. (2009). Formovanie spolupracujúceho regionálneho inovačného prostredia. *Working Papers 18*. Bratislava: Ekonomický ústav SAV. 31 p. [https://www.magnanimitas.cz/ADALTA/1202/papers/A\\_glova.pdf](https://www.magnanimitas.cz/ADALTA/1202/papers/A_glova.pdf)

20. Kouskoura, A., Kalliontzí, E., Skalkos, D. & Bakouros, I. (2024). Assessing the Key Factors Measuring Regional Competitiveness. *Sustainability*. 16(6): 2574. <https://doi.org/10.3390/su16062574>

21. Lakócai, C., & Capoani, L. (2023). Spatial Dynamics of Regional Competitiveness in Central and Eastern Europe. *Global Economic Observer*, 11(2), 13-21. [https://real.mtak.hu/183661/1/geo\\_2023\\_vol11\\_no2\\_art\\_002.pdf](https://real.mtak.hu/183661/1/geo_2023_vol11_no2_art_002.pdf)

22. Litva, D. (2017). Impact of European integration on competitiveness of Czech Regions. *Business, Management and Economics Engineering*, 15(2), 227-241. <https://doi.org/10.3846/bme.2017.371>

23. Maza, A. & Hierro, M. (2024). Measuring Regional Competitiveness: New Insights Based on the RCI. *Review of Regional Studies*. 54. <https://doi.org/10.52324/001c.117218>

24. Moirangthem, N.S. & Nag, B. (2023). Developing a competitiveness index at sub-national level for India: An economic growth measure. *International Journal of Emerging Markets*, 18(10), 4481-4503. <https://doi.org/10.1108/IJOEM-02-2021-0209>

25. Navarro, T.M., Durán, F.M. & Santos, J.L. (2017). Un índice de competitividad regional para España. *Revista de Estudios Regionales*, Universidades Públicas de Andalucía, 2, 67-94. <https://www.redalyc.org/pdf/755/75552738003.pdf>

26. Pelantová, K. & Kouřilová, J. (2016). Konkurenceschopnost krajů České republiky (Competitiveness of regions in the Czech Republic). In Klímová, V., Žitek, V. (eds.) *19 th International Colloquium on Regional Sciences. Conference Proceedings*, 74-81. <https://doi.org/10.5817/CZ.MUNI.P210-8273-2016-8>

27. Ramík, J. & Hančlová, J. (2012). Multicriteria methods for evaluating competitiveness of regions in V4 countries. *Multiple Criteria Decision Making* 7, 169-178. [https://mcdm.ue.katowice.pl/files/papers/mcdm12\(7\)\\_12.pdf](https://mcdm.ue.katowice.pl/files/papers/mcdm12(7)_12.pdf)

28. Richterová, E., Richter, M. & Sojková, Z. (2021). EU regions competitive efficiency and the key competitiveness. *Agrarian perspectives XXX: Sources of competitiveness under pandemic and environmental shocks, Proceedings of the 30th International Scientific Conference*, 229-239. <https://ap.pef.cz/u.cz/dl/99565?lang=en>

29. Scaccabarozzi, A., Mazziotta, M. & Bianchi, A. (2022). Measuring Competitiveness: A Composite Indicator for Italian Municipalities. *Social Indicators Research* (2022). <https://doi.org/10.1007/s11205-022-02990-x>

30. Staničková, M. (2019). Regional competitiveness index as a suitable tool for evaluating socio-economic situation of the EU NUTS 2 regions (Index regionální konkurenceschopnosti jako vhodný nástroj pro hodnocení socio-ekonomické situace NUTS 2 regionů EU). In Klímová, V., Žitek, V. (eds.) *22 nd International Colloquium on Regional Sciences. Conference Proceedings*. 28-36. <https://is.muni.cz/do/econ/soubory/katedry/kres/4884317/proceedings2019-articles/2019-003.pdf>

31. Svoboda, O., Melecký, L., & Stanickova, M. (2024). The nexus of a regional competitiveness and economic resilience: The evidence-based on V4+4 NUTS 2 regions. *E&M Economics and Management*, 27(1), 6-23. <https://doi.org/10.15240/tul/001/2024-1-001>

32. Šebo, J. & Šebová, M. (2010). Meranie konkurencieschopnosti viackriteriálnym hodnotením. *Journal of Competitiveness*, 1(2010), 33-40. <https://www.cjournal.cz/files/23.pdf>

33. Vukovic, D., Markovic, D. & Hanic, A. (2016). Snowflake model of regional competitiveness - evidence from Serbia. *International Review*. 1, 59-73.

34. Wokoun, R. & Krejčová, N. (2013). Socioekonomická úroveň a faktory konkurenceschopnosti regionů v ČR (Socio-economic level and regional competitiveness factors of regions in the Czech Republic). *XVI. mezinárodní kolokvium o regionálních vědách Sborník příspěvků*. 30-41. [https://is.mun.i.cz/do/econ/soubory/katedry/kres/4884317/41725568/04\\_2013.pdf](https://is.mun.i.cz/do/econ/soubory/katedry/kres/4884317/41725568/04_2013.pdf)

35. Wokoun, R. (2016). Fundamentals problems of regional competitiveness and regional development factors in the Czech Republic (Základní problémy regionální konkurenceschopnosti a faktorů regionálního rozvoje v České republice). *XIX. mezinárodní kolokvium o regionálních vědách Sborník příspěvků*. 59-64. <https://doi.org/10.5817/CZ.MUNI.P210-8273-2016-6>

36. Žitkus, L. (2015). New approach to regional competitiveness as instrument of regional development. *European integration studies*. 9, 114-126. <https://doi.org/10.5755/j01.eis.0.9.12800>

#### Primary Paper Section: A

#### Secondary Paper Section: AH