RISKS ASSOCIATED WITH EVALUATION OF REGIONAL DISPARITY: THE INFLUENCE OF METROPOLITAN AREAS ON RESULTS IN VISEGRAD GROUP COUNTRIES

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Abstract: *The aim of this paper is to evaluate the influence of metropolitan areas on the development of regional disparity results in Visegrad Group countries. The methodological framework is based on the neoclassical growth model. In particular, the approaches of beta- and sigma convergence have been used to examine the development of regional disparity between 2000 and 2016. The analysis results suggest that the influence of metropolitan areas on the results of regional disparity is large in many fields of development like: GDP, income, unemployment, education and expenditures on research and development. In fact, inclusion, or exclusion, of metropolitan area is very often the decisive reason for considering the convergence, or divergence, process to be statistically significant. However, the metropolitan areas do not bias only the results about tendency. The analysis suggests they are much more important in terms of intensity of particular processes. The results of intensity differ by hundreds of percent between the samples with and without the metropolitan areas. On the other hand, the results have been usually biased only in terms of intensity and significance. In general, the effect of metropolitan areas in Visegrad Group countries is not strong enough to change the results from convergence to divergence, and vice-versa.*

Keywords: *disparity measurement, metropolitan areas, Visegrad Group, regional development, regional policy.*

JEL Classification: *R11, O47.*

Introduction

The interest in the field of detailed assessment of regional disparity does not belong among the long-standing and well explored topics of regional development; however, more and more attention is currently being focused on this area. It can be argued that in the last decades it has inherently gained its place in extensive discussions about the potential and limits of economic growth and regional development. Nowadays, the issue of measuring and evaluating of regional development became very important, especially at the level of the European Union. The reason is that there is a need to defend and improve the mechanism of annual redistribution of tens of billions of EUR from the European structural and investments funds (European Commission, 2015; Dyba et al., 2018). In fact, the challenge of directing of existing disparity belong among pivotal and outstanding objectives of the European regional policy or the European Cohesion Policy respectively, which has long been pursuing the so-called "growth oriented convergence" for a very long time (Kraftová, Matěja, 2015).

One can consider the area of growth is dominant for the assessment of disparity across the European regions, due to the assumption of a correlation between economic performance and the welfare of the population (Barca et al., 2009). However, considering the "Beyond GDP indicators" discussion, it is appropriate to focus more attention on indicators that have a more evident link to the quality of life of population in regions (Constanza et al., 2009). In this framework, it is therefore appropriate to evaluate development aspects and disparity

in other relevant areas such as income, investment, (un)employment, etc. (Capello, Nijkamp, 2009).

As it is not appropriate to focus on a single indicator in the detailed assessment of regional disparity to understand the wider context and the shaping process of the regional policy, it is literally necessary to consider the socio-economic space as a heterogeneous entity, which has a decisive influence on regional development (Greenhut, Smith, 2006). The entity in which the distribution of population and economic activity is very uneven due to the several reasons like natural assumptions, as well as random deviations, the effect of agglomeration economies and the underlying reality of imperfectly competitive markets, at least. In other words, where a significant share of economic life is concentrated and performed mainly in a few cities and regions (Krugman, 1996; Fujita et al., 1999).

The metropolitan areas are very often the extreme cases of such regions. In fact, these areas usually concentrate tens of percent of the national economic potential and performance, making them a major element that is responsible for the level of regional disparity in a particular country (Fujita, Thisse, 2002). Moreover, metropolitan areas often have significant benefits exceeding the other regions on both the demand side (Morris et al., 2018) and the supply side (Henderson, 1987; Rosenthal, Strange, 2004). Hence, they are usually "tuned" on completely different development trajectories than the other regions. Moreover, the relative weight of metropolitan areas can also make a significant impact on the results of the assessment of the development of regional disparity, especially in smaller countries. For instance, the results of examination in samples involving metropolitan areas and samples without these areas are different by tens of percent, in terms of regional variability of selected indicators of social and economic development in the Visegrad Group countries (Reifová, 2018). Moreover, some partial conclusions on the issue of influence of metropolitan areas on the development of regional disparity in Visegrad Group countries are also revealed by other studies (Zdražil, Applová, 2016).

With all the above in mind, the aim of this paper is to evaluate the influence of metropolitan areas on the development of regional disparity results in Visegrad Group countries. In particular, the paper will focus on the assessment of disparities in terms of selected indicators that represent traditional themes of economic and social development, and that are usually considered and influenced by the regional policy. One can suggest the knowledge on potential biases caused by the effect of metropolitan areas is very important for evaluation of the development of regional disparity and shaping of further development interventions and strategies. In fact, it allows to avoid the risks of inappropriate development policy interventions.

1 Methods

To fulfil its aim, this paper has been based on the following methods and assumptions. The analysis at the NUTS 2 level of regions has been conducted to capture the effect of metropolitan areas on the development of regional disparity in Visegrad Group countries. In particular, it focused on 35 regions, of which 8 were Czech (CZ), 7 Hungarian (HU), 16 Polish (PL) and 4 Slovak (SK). In addition, the development of disparities across all regions of the Visegrad Group (V4) has been examined as well. In order to assess the effect of metropolitan areas, the results of measurements were compared between the samples with the metropolitan areas – full samples, supplemented by the suffix "a"; and non-metropolitan area samples – excluding the regions of capital cities, i.e. Prague, Central Hungary (Budapest's regions), Mazovian Voivodeship (Warsaw's region) and Bratislava region, supplemented by the suffix "b".

The conventional framework of disparity measurement that is based on the neoclassical growth model has been applied. In particular, the paper employs a combination of beta convergence approach, which is based on the assumption of an inverse relationship between the initial value of the respective indicator and its growth (Mankiw et al., 1992; DeLong, 1988; Barro, Sala-i-Martin, 2004), and sigma convergence, which is, on the contrary, a synonym for measuring disparities via the development of variability (Baumol, 1986; Quah, 1996; Barro, Sala-i-Martin, 2004).

The beta-convergence approach has been used only to illustrate the existing differences in terms of level of development and growth patterns among the regions and countries of Visegrad Group. However, the sigma convergence approach has been used to assess the development of regional disparities, since it offers a more comprehensive view and, at the same time, easier comparability of results from the measurement of different samples. Moreover, the beta convergence is formally necessary, but not a sufficient condition for the sigma convergence (Monfort, 2008; Islam, 2003). In fact, the applications of the beta convergence principles are used for obtaining the information about the structure of samples under examination. Moreover, it has been also used for a more comprehensive interpretation of the results of the sigma convergence, that may one suggest as a proportionate enhancement of both approaches (Zdražil, Applová, 2017).

Based on the beta convergence principle, the logarithmic transformation has been applied on the indicators assessed. This helped to eliminate the positive asymmetry of the distribution and reduce the issue of outliers (Minařík et al., 2013). Therefore, the logarithms of the initial values *(y_0)* and the average growths *(k)* in terms of the following equation (1) were calculated, where *(y_n)* means the value of last examined year and *(n)* is the length of period under examination. In the next step, based on the knowledge of logarithmic initial positions *(y_0)* and growth patterns *(k)*, the X-Y graphs were constructed, where the initial values were plotted against the average growth coefficients of particular indicators (the graphical parts of Fig. 1 to 5).

$$logk = \frac{1}{n}(log\ y_n - log\ y_0) \tag{1}$$

In terms of disparity development measured with the approach of sigma convergence (the tabulated parts of Fig. 1 to 5), the standard approach of assessing the coefficient of variation (CV) has been used, see equation (2), where *(σ)* means the standard deviation and *(x)* means the average.

$$CV = \frac{|\sigma|}{x} \tag{2}$$

The significance of the regional disparity development trends or the slopes of the variation coefficients (β) respectively, were verified by the standard approach for testing the significance of trends in time series. In particular, it has been based on the assessment of the statistical significance of the correlation coefficients (R).

To assess the impact of metropolitan areas on the development of regional disparity in the Visegrad Group countries, 5 relevant indicators were selected. These represented the traditional themes of economic and social development on which the regional policy is usually aimed. In fact, the knowledge on potential biases caused by the effect of metropolitan areas is very crucial for assessing the development of disparity in these indicators and shaping of further development interventions and strategies. In particular, this analysis examined the following indicators: gross domestic product per capita (GDP), disposable income of households per capita (Disposable income), long-term unemployment rate of active population (Long-term unemployment), tertiary education attained in population aged 25-64 (Tertiary education) and gross intramural expenditures on research and development per

capita (GERD). Finally, the indicators that could be influenced by the different developments of price levels are assessed in purchasing power standard, to increase the relevance of particular results.

The disparity development has been examined between 2000 and 2016. However, the examination of Disposable income has been limited to 2000-2015 and examination of GERD to 2001-2015. The reason for such limitations followed from the availability of data. All the data have been linked from the Eurostat's public regional accounts databases. (2017).

2 Analysis results and discussion

The analysis results of regional disparity development in all 5 indicators for both samples "a" (full sample) and "b" (except the metropolitan areas) are summarized in the following Fig. 1 to 5. The graphical part illustrates the initial positions and the average rate of growth in particular regions. This provides a specific view of the composition and development patterns of the samples analyzed, but also of their differences. The graphical part is divided into 4 segments, where the average values of both variables were used to determine the segment borders. Such a splitting up allows an easier orientation in results presented. This information is quite crucial for interpreting the disparity of both "a" and "b" samples evaluated through the sigma convergence approach (tabled part). Based on the β parameter of the linear regression equation of the development of CV, one can determine the predominant tendency of the development of regional disparity – regional convergence (trend of CV has a negative slope) or regional divergence (trend of CV has a positive slope), and the intensity of such a process. The correlation coefficient R then helps to evaluate the statistical significance of the trend observer and to formulate a conclusion on the development of regional disparity in the terms of the indicator under examination.

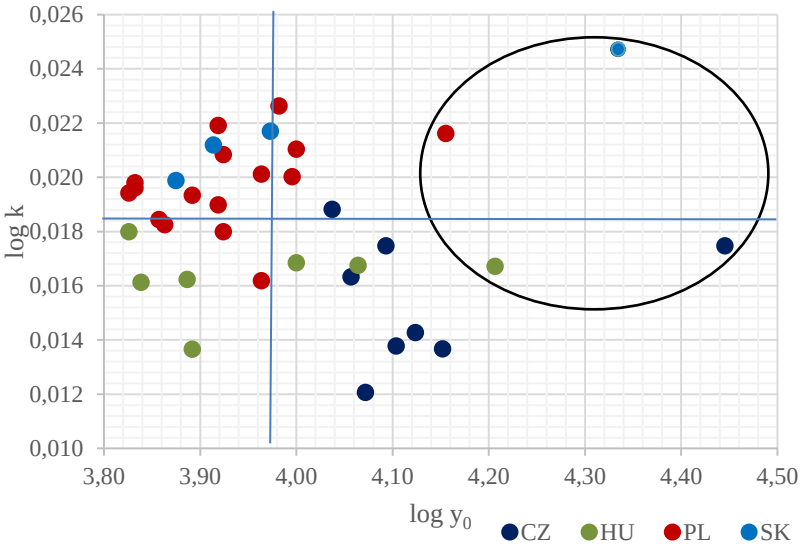
As shown in Fig. 1, the metropolitan areas of all the Visegrad Group countries are significantly more developed than the other regions, and at the same time, their average speeds of growth are high, within particular countries. Similarly, it is clear that such a distinction of metropolitan areas can influences the findings on the development of regional GDP disparities measured through the approach of sigma convergence, in some countries at least.

While in the case of full samples, the divergence is confirmed only among regions of Poland and Slovakia, the exclusion of metropolitan areas shows a slight divergence among the Hungarian regions as well. Moreover, among all the regions of Visegrad Group, then, in the sample "b", convergence is measured instead of an inconclusive result of sample "a". However, one can suggest the more significant result is revelation of the influence of metropolitan areas on the intensity of particular process. For instance, in the case of Slovakia, the intensity of divergence of sample "a" is approximately twice as large as the intensity of divergence of sample "b". Furthermore, for Polish regions, this difference is ca one third.

Although beyond the primary purpose of this paper, another undoubtedly an interesting finding follows from the GDP analysis results; in particular, from the segmentation of regions in the Czech Republic where the more developed regions of Bohemia formed a so-called "club" (see Baumol, 1986; McCann, 2013). In this club, the regions experience pretty large divergence. On the contrary, the 3 generally less developed regions of Moravia converge to these regions, due to the higher growth rates. These opposite processes, however, in total reduce each other; and hence, one cannot conclude on the general tendency of disparity among the regions of the Czech Republic for neither of the samples examined.

Fig. 1: Analysis results of the GDP indicator (2000-2016)

Initial level (y_0) and average growth rate (k) of regions



Sigma convergence

	β	R	Proc.
CZa	0,0015	0,3795	-
HUa	0,0011	0,2252	-
PLa	0,0031	0,9412	Div.
SKa	0,0058	0,8318	Div.
V4a	0,0007	0,1523	-
CZb	-0,0008	0,3920	-
HUb	0,0016	0,5044	Div.
PLb	0,0023	0,9473	Div.
SKb	0,0027	0,6054	Div.
V4b	-0,0032	0,8841	Conv.

Notes: metropolitan areas are highlighted in a circle; "β" refers to the time-series of coefficients of variation slope; "Proc. " refers to the result – "Conv." for a convergence process, "Div." for a divergence process and "-" for an uncertainty that resulted from the low significance of a regression model; suffixes "a" (full sample) and "b" (except the metropolitan areas) refer to particular samples

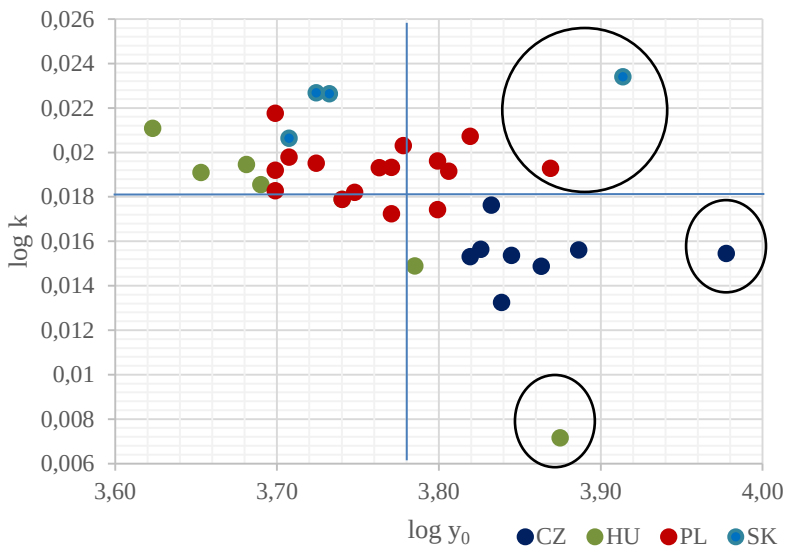
Source: Reifová (2018) and own processing based on Eurostat (2017)

The results of the Disposable income indicator, which are summarized in Fig. 2, can be considered to some extent analogous to the results of the GDP indicator. From a development level point of view, the metropolitan regions can, once again, be labeled as the most developed. However, they are not significantly different in terms of average growth rates from other regions in their country. In fact, there is only one exception from this rule – the region of Budapest, which is very distinct from the other regions of the Visegrad Group with a very low average growth rate.

The sigma convergence approach does not confirm any clear tendencies of disparity development among the regions of the Czech Republic in both samples "a" and "b". Nevertheless, the both results of Hungary and the Visegrad Group coincide with the reduction of regional disparities or convergence respectively. In the case of Hungary, however, a large difference in the intensity of this process is identified. In particular, the convergence intensity is ca 3.5 times lower when the metropolitan area is not involved in the analysis measurement. Considering the left part of Fig. 2, one can interpret such important difference as a catching-up process of the Hungarian regions to the very slowly growing metropolitan region of Budapest. However, in the whole Visegrad Group, the convergence intensity measured for sample "b" is about a quarter higher than for sample "a". Finally, the unclear results of full samples were specified as a weak divergence for samples "b" in the cases of the Polish and Slovak regions.

Fig. 2: Analysis results of the Disposable income indicator (2000-2015)

Initial level (y_0) and average growth rate (k) of regions



Sigma convergence

	β	R	Proc.
CZa	-0,0005	0,2562	-
HUa	-0,0121	0,8107	Conv.
PLa	0,0007	0,4839	-
SKa	0,0012	0,3234	-
V4a	-0,0021	0,5289	Conv.
CZb	0,0007	0,4427	-
HUb	-0,0035	0,7146	Conv.
PLb	0,0006	0,6475	Div.
SKb	0,0020	0,6593	Div.
V4b	-0,0027	0,7982	Conv.

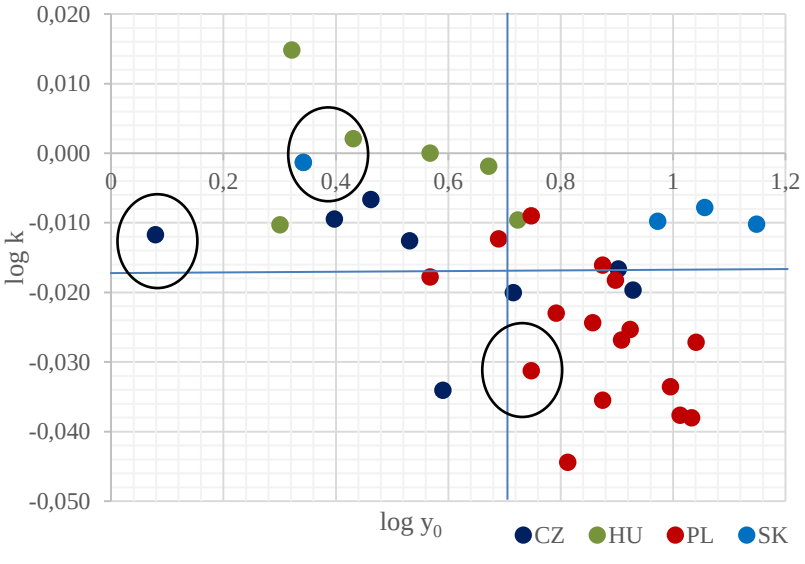
Notes: see notes below Fig. 1

Source: Reifová (2018) and own processing based on Eurostat (2017)

Before presenting the results of another indicator – Long-term unemployment; it is worth recalling that in terms of perception and development targeting, the nature of this indicator is different from the others in this analysis. In particular, the criterion of positive development of unemployment is not maximization of values but minimization instead. Although this difference does not affect the results and conclusions derived from the approach of sigma convergence, it has a major influence on the evaluation of the graphical part of Fig. 3, which compares the initial levels of unemployment and the average speed of growth rate in the regions.

Fig. 3: Analysis results of the Long-term unemployment indicator (2000-2016)

Initial level (y_0) and average growth rate (k) of regions



Sigma convergence

	β	R	Proc.
CZa	-0,0082	0,6149	Conv.
HUa	0,0200	0,5262	Div.
PLa	0,0029	0,4204	-
SKa	0,0001	0,0124	-
V4a	0,0000	0,0044	-
CZb	-0,0087	0,5644	Conv.
HUb	-0,0035	0,2821	-
PLb	0,0014	0,2298	-
SKb	0,0038	0,2614	-
V4b	0,0017	0,2056	-

Notes: see notes below Fig. 1

Source: Reifová (2018) and own processing based on Eurostat (2017)

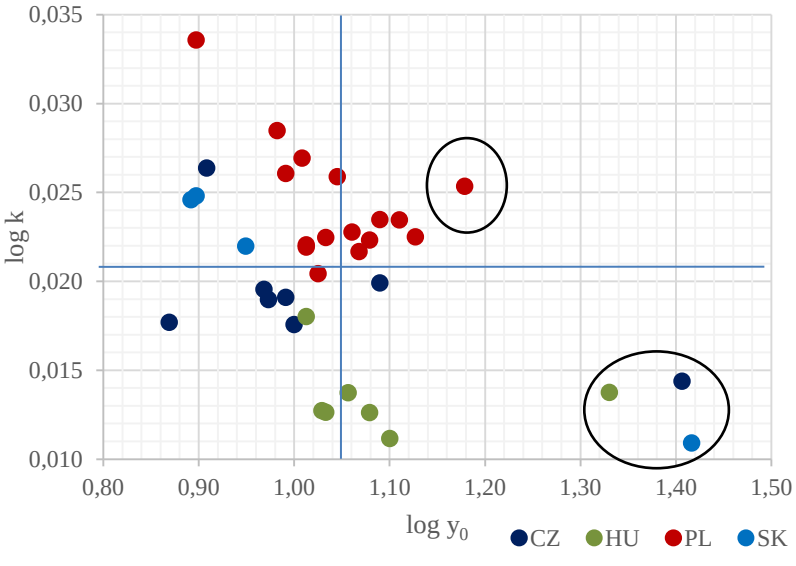
The Fig. 3 shows clearly also in the case of Long-term unemployment that the initial positions of metropolitan areas are either significantly better (Prague and Bratislava) or at least above average (Budapest and Warsaw), within particular country. However, in terms of growth rate, or the desired decrease respectively, these regions are rather weaker (except the region of Warsaw). On the other hand, it seems quite logical that, even with a higher job vacancy rate of metropolitan regions, no significant declines are measured in terms of a very low or even virtually non-existing unemployment.

One can consider the differences in results of the sigma convergence between the samples "a" and "b" for the Long-term unemployment are the least significant throughout the analysis. In both samples, only the convergence of the regions of the Czech Republic is found. Moreover, even in terms of the intensity of the process there is no noticeable difference in results. In fact, the only significant change is measured among the Hungarian regions, which show divergence for the sample with the metropolitan area, while there is no unambiguous tendency after excluding of that. The analysis results of Poland, Slovakia and Visegrad Group coincide with the uncertainty of the process.

The effect of metropolitan areas is, on the contrary, rather significant in the results of the evaluation of the Tertiary education disparity development, which are summarized in Fig. 4. The convergence is identified among the regions of the Czech Republic and Slovakia while analyzing sample "a", but the results of sample "b" are ambiguous in all the countries. Considering the entire Visegrad Group, the convergence tendency within the sample including the metropolitan areas is the result. However, after exclusion of metropolitan areas, the results show a slight divergence. Hence, there is only agreement between the results of Hungary and Poland that suggest ambiguous conclusions on the development of regional disparity.

Fig. 4: Analysis results of the Tertiary education indicator (2000-2016)

Initial level (y_0) and average growth rate (k) of regions



Sigma convergence

	β	R	Proc.
CZa	-0,0085	0,9021	Conv.
HUa	0,0001	0,0447	-
PLa	0,0001	0,0480	-
SKa	-0,0122	0,8964	Conv.
V4a	-0,0048	0,9369	Conv.
CZb	-0,0005	0,1681	-
HUb	-0,0008	0,2930	-
PLb	-0,0013	0,4392	-
SKb	-0,0003	0,0602	-
V4b	0,0023	0,6422	Div.

Notes: see notes below Fig. 1

Source: Reifová (2018) and own processing based on Eurostat (2017)

Similarly to the GDP and Disposable income indicators, the metropolitan regions are the most developed in terms of Tertiary education within their countries. However, while the growth of the metropolitan areas of Hungary and Poland can be characterized as slightly above average rate, in respect to particular countries, the growth rates of the Prague and Bratislava regions are rather lagging behind. This can be, to some extent, explained

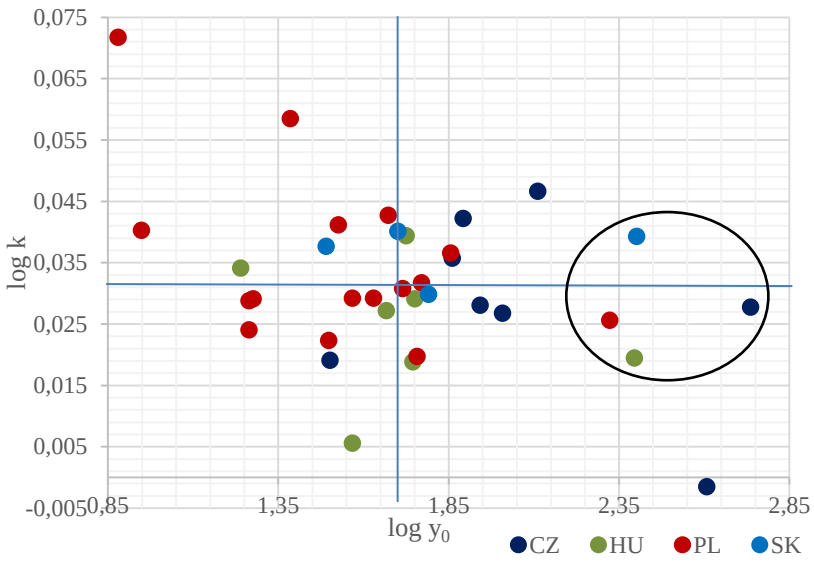
by the findings of convergence among the Czech and Slovak regions within the sample "a" and the ambiguity of the results within the sample "b". In fact, the strength of the ongoing catching-up process between metropolitan areas and the other regions is reflected in the conclusions of general trends of regional disparity.

The results of the last indicator under examination – GERD, which are captured in Fig. 5, once again, confirm the general conclusions of the analysis above. In particular, the effect of metropolitan area often plays an important role in the evaluation of regional disparities. In the case of the Czech regions, the convergence is apparent in both cases, however, the value of sample "a" is ca one half of that measured for "b", in terms of the process intensity. An analogous conclusion follows from the analysis of all regions of the Visegrad Group, where the difference in intensity of convergence processes is only slightly lower. Moreover, there is no unambiguous tendency in disparity development for regions of Hungary and Poland when excluding the metropolitan areas. However, there are results of convergence for the samples with metropolitan areas. In addition, the opposite conclusion applies to the regions of Slovakia where the effect of the metropolitan area changes the conclusion on the development of regional disparities from convergence to the inconclusiveness result.

From the initial positions point of view, the metropolitan areas are definitely the most developed, but in terms of growth rates they rank from average to below average values within their own countries (except the Bratislava region). Particularly in the case of metropolitan areas with lower growth dynamics (regions of Budapest and Warsaw), there can be no doubt about significant catching-up processes that trigger the convergence tendencies identified by the measurement of the sigma convergence approach.

Fig. 5: Analysis results of the GERD indicator (2001-2015)

Initial level (y_0) and average growth rate (k) of regions



Sigma convergence

	β	R	Proc.
CZa	-0,0121	0,5842	Conv.
HUa	-0,0194	0,8729	Conv.
PLa	-0,0183	0,8680	Conv.
SKa	0,0062	0,3373	-
V4a	-0,0181	0,6669	Conv.
CZb	-0,0254	0,6769	Conv.
HUb	0,0019	0,1575	-
PLb	-0,0051	0,4190	-
SKb	-0,0134	0,6548	Conv.
V4b	-0,0308	0,8356	Conv.

Notes: see notes below Fig. 1

Source: Reifová (2018) and own processing based on Eurostat (2017)

With all the above in mind, it can be said that the effect of metropolitan areas is pretty significant in the assessment of regional disparity. In fact, inclusion, or exclusion, of metropolitan area is very often the decisive reason for considering the convergence, or divergence, process to be significant. Perhaps even more important is the finding that metropolitan areas often have a significant impact on intensity of the convergence, or divergence, process. In fact, we found for several times that the results of intensity differ by hundreds of percent between the samples with and without the metropolitan areas.

On the other hand, the results are usually biased only in terms of intensity and significance. In general, the effect of metropolitan areas in Visegrad Group countries is not strong enough to make an "U-turn" in results and change the conclusion from convergence to divergence, and vice-versa. Thus, for instance, to wrongly resolve the real divergence tendencies of sample of regions that, at the same time, similarly experience a strong catching-up process to the metropolitan region is not very common. In fact, the analysis suggests that such a situation should not usually result to a false convergence conclusion.

Finally, given the fact that analysis examined samples of different sizes (from sample of 3 and 4 Slovak regions to 31 and 35 Visegrad Group regions respectively), the logical question is whether the effect of metropolitan areas depends on the size of particular sample. Considering the assumptions of statistical methods, in general, one should expect larger biases in small samples. However, based on the results, it is surprisingly not apparent that the size of the sample would be significantly related with the strength of the metropolitan areas effect.

Conclusion

The aim of this paper was to evaluate the influence of metropolitan areas on the development of regional disparity results in Visegrad Group countries. The paper focused on the assessment of disparities in terms of selected indicators that represent traditional themes of economic and social development, and that are usually considered and influenced by the regional policy. In particular the indicators of gross domestic product, disposable income of households, long-term unemployment, tertiary education and gross intramural expenditures on research and development were examined. The methodological framework was based on the conventional disparity measurement that was derived from the neoclassical growth model. In particular, the combination of the beta convergence and sigma convergence approaches has been used. The beta convergence was used to illustrate regional differences in terms of level of development and growth pattern of particular regions. On the contrary, the sigma convergence was used to evaluate disparity development, because it offers a more comprehensive view and easier comparability of results from the measurement of different samples. The analysis has been conducted at the NUTS 2 level of regions between 2000 and 2016. The conclusions were derived from the results of comparison of full samples (including metropolitan areas of Prague, Budapest, Warsaw and Bratislava) and samples excluding metropolitan areas.

The analysis results suggest that the influence of metropolitan areas on the results of regional disparity is large in many fields of development. In fact, inclusion, or exclusion, of metropolitan area is very often the decisive reason for considering the convergence, or divergence, process to be statistically significant. Moreover, regardless the indicators under examination, the metropolitan areas are generally more developed than other regions of particular country. However, the dynamics of their development is very different in both terms of the countries under review and the indicators assessed. Another important conclusion is that, although the weights of metropolitan areas bias the results, one cannot claim that metropolitan regions would universally bias the results in only favor of convergence or divergence tendencies.

However, the metropolitan areas do not bias only the results about tendency. The analysis suggests they are much more important in terms of intensity of particular processes. The results of intensity differ by hundreds of percent between the samples with and without the metropolitan areas. On the other hand, the results have been usually biased only in terms of intensity and significance. In general, the effect of metropolitan areas in Visegrad Group countries is not strong enough to change the results from convergence to divergence, and vice-versa. Moreover, it is not obvious from results that the size of the effect of metropolitan areas would be related to the size of the sample under consideration.

Therefore, the influence of metropolitan areas on the development of regional disparity in Visegrad Group countries is, as a rule, limited to the issue of identification of prevailing tendency rather than its orientation.

Finally, one can conclude that confirmation of the effect of metropolitan areas in conclusions about the development of regional disparity should be reflected in the practical activities related to the shaping of development interventions and strategies, as well as the evaluation of their achievements. The metropolitan areas, as the growth poles of national economies, would usually be in a completely different position from other regions of the country and would follow other developmental trajectories. On the other hand, they are an integral part of their countries and, therefore, they cannot be completely ignored within the analysis and decision-making process; despite they can be usually seen as the heavy outliers. We suggest the "dual evaluation" where, besides the evaluation of the full samples, attention is also paid to the evaluation of the samples without metropolitan areas, seems to be a fairly appropriate way of measuring disparities in detail. Considering such a broader insight into the whole issue, it would be possible to avoid some of the potential risks of overestimating or, on the contrary, underestimating of interventions implemented within the framework of regional policy. At last but not least, such a dual evaluation should also avoid some mistakes that follow from inaccurate materials based on full sample measurements, which are used as a knowledge base for the formulation of specific interventions, as well as more general development strategies.

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References

Barca, F., McCann, P., Rodríguez-Pose, A. (2009). The Case for Regional Development Intervention: Place-Based Versus Place-Neutral Approaches. *Journal of Regional Science*, 52 (1), pp. 134-152. DOI 10.1111/j.1467-9787.2011.00756.x.

Barro, R., Sala-I-Martin, X. (2004). *Economic Growth*. London: MIT Press.

Baumol, W. (1986). Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show. *American Economic Review,* 76 (5), pp. 1072-1085.

Capello, R., Nijkamp, P. (2009). *Handbook of Regional Growth and Development Theories*. Cheltenham: Edward Elgar.

Costanza, R., Hart, M., Posner, S., Talberth, J. (2009). Beyond GDP: The Need for New Measures of Progress. *Pardee Paper No. 4*, Boston: Pardee Center for the Study of the Longer-Range Future.

DeLong, B. (1988). Productivity growth, convergence and welfare: Comment. *American Economic Review*, 78 (5), pp. 1138-1154.

Dyba, W., Loewen, B., Looga, J., Zdražil, P. (2018). Regional development in Central-Eastern European Countries at the beginning of the 21st century: path dependence and effects of EU Cohesion policy. *Quaestiones Geographicae*, 37 (2), pp. 77-92. DOI 10.2478/quageo-2018-0017.

European Commission. (2015). Available Budget 2014-2020 – Regional Policy. [online]. Available at: http://ec.europa.eu/regional_policy/en/funding/available-budget [Accessed 27 04 2018].

Eurostat. (2017). Database. [online]. Available at: http://ec.europa.eu/eurostat/data/database [Accessed 31 03 2018].

Fujita, M., Krugman, P., Venables, A. (1999). *The Spatial Economy: Cities, Regions, and International Trade*. London: MIT Press.

Fujita, M., Thisse, J. (2002). *Economics of Agglomeration: Cities, Industrial Location and Reginal Growth.* Cambridge: Cambridge University Press.

Greenhut, J., Smith, D. (2006). Heterogeneous space in regional economics and beyond. *Pacific Economic Review,* 11 (4), pp. 431-448. DOI 10.1111/j.1468-0106.2006.00326.x.

Henderson, V. (1987). General equilibrium modeling of system of cities. In Mills, E. (eds.) *Handbook of Regional and Urban Economics. Volume 2: Urban Economics*. Amsterdam: Elsevier.

Islam, N. (2003). What have we learned from the convergence debate? *Journal of Economic Surveys,* 17 (3), pp. 309-362. DOI 10.1111/1467-6419.00197.

Kraftová, I., Matěja, Z. (2015). Production-consumption patterns of behaviour of European regions. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration,* 22 (34), pp. 52-62.

Krugman, P. (1996). Confronting the Mystery of Urban Hierarchy. *Journal of the Japanese and International Economies,* 10, pp. 399-418.

Mankiw, G., Romer, D., Weil, D. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics,* 107 (2), pp. 407-437. DOI 10.2307/2118477.

McCann, P. (2013). *Modern Urban and Regional Economics.* Oxford: Oxford University Press.

Minařík, B., Borůvková, J., Vystrčil, M. (2013). *Analýzy v regionálním rozvoji.* Praha: Professional Publishing.

Monfort, P. (2008). Convergence of EU regions: Measures and evolution. *European Union Regional Policy Working papers*, 1, pp. 1-19.

Morris, E., Mondschein, A., Blumberg, E. (2018). Is bigger better? Metropolitan area population, access, activity participation, and subjective well-being. *The Journal of Transport and Land Use,* 11 (1), pp. 153-179. DOI 10.5198/jtlu.2018.934.

Quah, D. (1996). Convergence Empirics Across Economies with Some Capital Mobility. *Journal of Economic Growth*, 1 (1), pp. 95-124. DOI 10.1007/BF00163344.

Reifová, L. (2018). *Regional disparities in the Visegrad Group countries*. [Master thesis]. Pardubice: University of Pardubice.

Rosenthal, S., Strange, W. (2004). Evidence on the Nature and Sources of Agglomeration Economies. In In Henderson, W., Thisse, J. (eds.) *Handbook of Regional and Urban Economics. Volume 4: Cities and Geography*. Amsterdam: Elsevier.

Zdražil, P., Applová, P. (2016). Growth disparities among regions of the Visegrad group countries: an evidence of their extent and nature. *E+M Economics and Management,* 19 (2), pp. 37-54. DOI 10.15240/tul/001/2016-2-003.

Zdražil, P., Applová, P. (2017). Visual Evaluation of Changes in Regional Growth and Disparities: Usage of a Pareto Chart. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration,* 24 (41), pp. 230-242.

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