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Convergence of Regional Human Development Indexes in Poland

Abstract

The subject of convergence became popular in Poland upon its accession to the EU in 2004. Since then Poland has been a beneficiary of the cohesion policy – a regional policy of the European Union aimed at increasing the level of economic, social, and territorial (spatial) cohesion. While the economic aspect is a very thoroughly researched area of convergence studies, the social aspects are less often covered by specialist literature. This is the issue raised in this paper which, along with separate measures of social convergence, constructs a region HDI measure to evaluate the social cohesion of Poland's regions¹. Values of regional HDIs in Poland were not known and required calculation, which allowed for drawing conclusions about the standards of living of inhabitants in specific provinces. In general, it was possible to determine that HDIs are rising in all regions, which means, simultaneously, an increase in the standards of living of the provinces' populations. At the same time, however, that growth was accompanied by increasing divergences in the HDI distribution among regions (sigma-divergence). The study of convergence of specific HDI components also allowed to note that HDI divergences are mainly caused by increasing economic inequalities between regions in Poland (measured by the Gross Domestic Product Index), and inequalities in education (measured by the Education Index).

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¹ In this article regions (provinces) are understood as the NUTS 2 territorial units, i.e. Polish voivodeships.

1. Introduction

The term ‘convergence’, as used in this article, emerged from neoclassical concepts of the growth theory (the 1950s and 1960s), where convergence meant a process of evening out per capita incomes among countries or regions. Convergence was most thoroughly researched worldwide in the 1980s and 1990s, while in Poland the subject of convergence became popular only upon Poland’s accession to the EU in 2004. Since then Poland has been a beneficiary of the cohesion policy – a regional policy of the European Union that strives to increase the level of economic cohesion, i.e. convergence. On one hand, according to some politicians and economists convergence is an expected outcome of integration, while on the other hand, numerous research studies cast doubt on the effectiveness of the cohesion policy. The doubts are mainly based on two facts: the inability of supported regions to grow on their own after external assistance ceases to be provided, and the presence of evidence confirming that interregional cohesion, being a standard until the late 1970s, does not occur anymore. These facts pertain to economic convergence, verified on the basis of economic activity measures, the most frequent being GDP per capita. However, the cohesion policy, carried out within the framework of the EU regional policy, has broader aspects: economic, social, and territorial (spatial) ones². This means that cohesion policy aims to raise the levels of not only economic but also social and territorial (spatial) convergence³. Social convergence means decreasing the differences in human and social capital, and the standard of living. Spatial cohesion is increased by eliminating barriers to the accessibility of regions, especially peripheral ones, through better communications and connections with centrally located areas⁴.

This article focuses on the issue of social convergence, which is measured by means of indicators describing the standard of living. In her 2010 article, the author proved that convergence occurs among provinces with respect to variables that characterize the labour market (convergence concerning the labour market is much faster than that for data describing economic growth). This article strives to examine a more general indicator characterizing the standard of living, i.e. the

² When convergence is discussed, its definition arising from the growth theory is most commonly assumed – i.e. economic convergence (reflected in decreasing disproportions in measures based on the gross domestic product), although the issue of convergence may also concern many other spheres of life. For example the PWN Encyclopaedia (1999, p. 392) defines the term of development convergence as convergence of evolutionary development and the convergence theory as a concept of political science popular in the West in the 1960s and 1970s and advancing a thesis that socialist and capitalist societies are gradually becoming similar.

³http://www.funduszeuropejskie.gov.pl/slownik/Strony/Polityka_spojnosci_Unii_Europejskiej.aspx

⁴ This type of convergence is examined in an article by Kusideł, Górniak (2012).

Human Development Index – HDI. To that end, an attempt was made to estimate regional HDIs in order to apply them in determining whether the standards of living of the population in specific regions are becoming similar (convergence), or the opposite (divergence). Data for 16 provinces of Poland for the 1995-2010 period was used.

2. Structure of Regional Human Development Indexes

The Human Development Index (HDI) is a geometric mean of three other measures describing the areas of health, education, and economic prosperity of a studied society. These are the:

- LEI – life expectancy index,
- EI – education index, consisting of the mean and expected years of schooling,
- GDPI – gross domestic product index.

To create LEI, EI and GDPI sub-indices minimum and maximum values (goalposts) need to be set in order to transform the indicators into indices between 0 and 1. These values, however, change over time and thus required reviewing all Human Development Reports for all the analysed years. Methods of measurement and calculation for specific components of regional HDIs are presented below.

2.1. LEI – Life Expectancy Index

The LEI is based on life expectancy at birth, which values are reported, for instance, by the Central Statistical Office (compare the Table entitled: *Przeciętne dalsze trwanie życia* [Average life expectancy]) The calculation of the index requires knowledge of the minimum and maximum values of life expectancy for countries for which the HDI is to be computed: $LEI = (LE - \min LE) / (\max LE - \min LE)$. In the Human Development Reports for the years 1999-2008, the minimum value of life expectancy was 25 years and the maximum value was 85 years. In the report for 2010 (Human Development Report 2010. Technical Note, p. 216), thanks to the research of UNDESA (2009), the goalposts were changed to 20 (as the minimum) and 83.2 years (the maximum observed in Japan⁵).

⁵ For comparison, the life expectancy in Poland's regions varies considerably between sexes: in 2010 the average lifespan for females was 80.6 years, whereas for males it was 72.1 years (moreover, considerable changes were taking place over time: in the analysed 1995-2010 period females' average lifespan rose by 5.5%, while for males it went up by 6.1%).

However, in order to be able to compare the results obtained with those provided previously by the Human Development Reports, the same goalpost values were assumed as those prior to 2010, i.e. 25 years as the minimum and 85 years as the maximum values. Finally, the above described data also served to obtain regional LEI values in the 1995-2010 period, two selected years of which are presented in Table 1, while provincial diversification of that index for all the analysed years is shown in Figure 1.

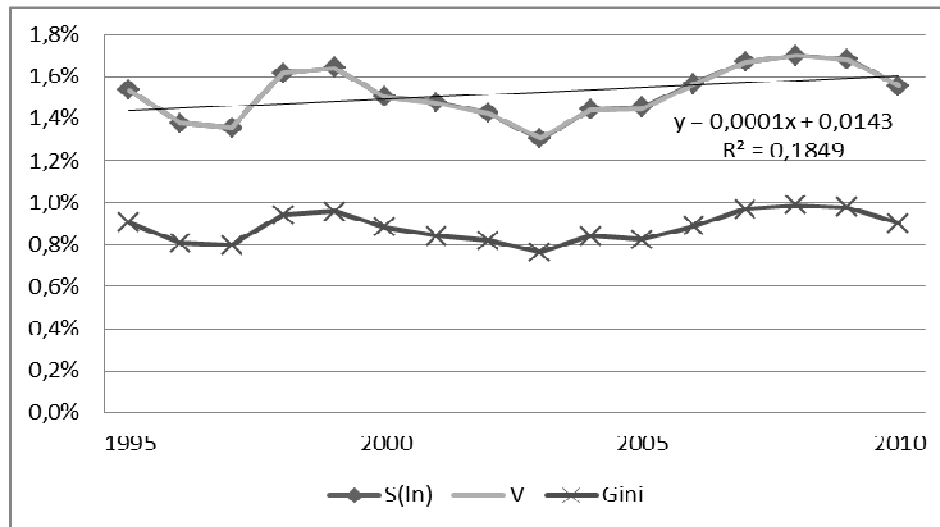
Table 1. Values of the regional life expectancy index (LEI) in the two extreme years of analysis, with the quotient of the maximum and minimum values for a given year provided in the last line.

	1995	2010
Dolnośląskie	0.78	0.86
Kujawsko-Pomorskie	0.77	0.85
Lubelskie	0.78	0.84
Lubuskie	0.79	0.85
Łódzkie	0.77	0.85
Małopolskie	0.76	0.83
Mazowieckie	0.80	0.88
Opolskie	0.79	0.86
Podkarpackie	0.79	0.86
Podlaskie	0.81	0.88
Pomorskie	0.80	0.87
Śląskie	0.79	0.87
Świętokrzyskie	0.78	0.84
Warmińsko-Mazurskie	0.80	0.86
Wielkopolskie	0.78	0.85
Zachodniopomorskie	0.78	0.86
Max/min	1.06	1.06

Source: own calculations.

Table 1 indicates that life expectancy rose in all regions. The rise was quite equal, which is proved by the identical relative range measure (the quotient of the LEI for a region of its maximum and minimum value). The lack of changes in the range provides a premise for concluding that there is a lack of divergence processes (which often accompany periods of particularly considerable growth in the studied variables). That fact is confirmed by the figure below.

Figure 1. Values of regional LEI diversification where the trend function was added to S(ln) measure⁶



Source: own work.

Figure 1 shows very low regional diversification of the LEI – only 1.5% on average. That means that there were only slight differences in life expectancy among the populations of specific provinces. The figure also indicates that over the 1995-2010 period there were no significant changes in LEI diversification among provinces (although positive, the trend function coefficient is statistically insignificant). Eventually, may be concluded that regional LEIs were characterized by diversification being constant in time, which means that there were neither convergence nor divergence processes.

⁶ The figure shows the following dispersion and concentration measures of regional LEI: s(ln) – standard deviation of logarithmic values, V – coefficient of variation (ratio of the standard deviation to the mean), Gini – Gini coefficient. These measures are thoroughly discussed in literature and thus are not described in this article.

2.2. Education Index – EI

The second component of the HDI is the education index – EI, composed of mean years of schooling of adults and expected years of schooling of children⁷. Values of those measures for Poland are provided in the table below.

Table 2. Values of the education index (EI) and its components for Poland

	1995	2000	2005	2006	2007	2008	2009	2010
Education index	0.733	0.789	0.810	0.812	0.814	0.816	0.820	0.822
Expected years of schooling (of children)	9.1	9.5	9.7	9.7	9.8	9.8	9.9	10
Mean years of schooling (of adults)	13.4	14.7	15.2	15.2	15.2	15.2	15.3	15.3

Source: <http://hdrstats.undp.org/en/tables/> and <http://hdrstats.undp.org/en/indicators/103706.html>.

Regional values of the above variables are unknown. Their calculation uses values of the education index for Poland (compare the first line of the above table) disaggregated to the provincial level by the gross enrollment ratio – GER, which in this article indicates the share of individuals attending post-secondary schools and higher education institutions in the population aged 7-24 (it will further be called GER 7-24)⁸. Eventually, regional GER 7-24s⁹ were estimated and applied to disaggregate the education index in Table 2 into values for regions, the results of which are shown in Table 3 and Figure 2.

⁷ Since the year 2010, thanks to the studies by Barro and Lee (2010) and by UNESCO (2010), the maximum values of mean years of schooling and expected years of schooling have been used, being 13.2 and 20.6 years. Previously, those goalposts were at 0 – which is used in this study.

⁸ GER 7-24 data is not directly known either; in order to calculate it, the following approach was adopted:

- for individuals aged 19-24 the share of those attending post-secondary schools and higher education institutions in the total population aged 19-24 was computed, where figures for 1995-2001, due to the lack of actual data, are trend function interpolations;
- percentage of the population aged 7-24 comprised by individuals aged 19-24 was calculated;
- enrollment rates for the 7-18 group (assumed at the level of the average value of enrollment rates at specific stages of education of individuals aged 7-18 years) and the 19-24 group were computed;
- GER 7-24 was calculated as an average weighted by the share of a given group: 7-18 and 19-24 in the 7-24 population.

⁹ In older versions of the Human Development Report (before 2010), the education index – EI consists of the gross enrollment ratio and the inverse of the illiteracy rate (which for Poland is assumed at 0.995) – this is the method applied in this article.

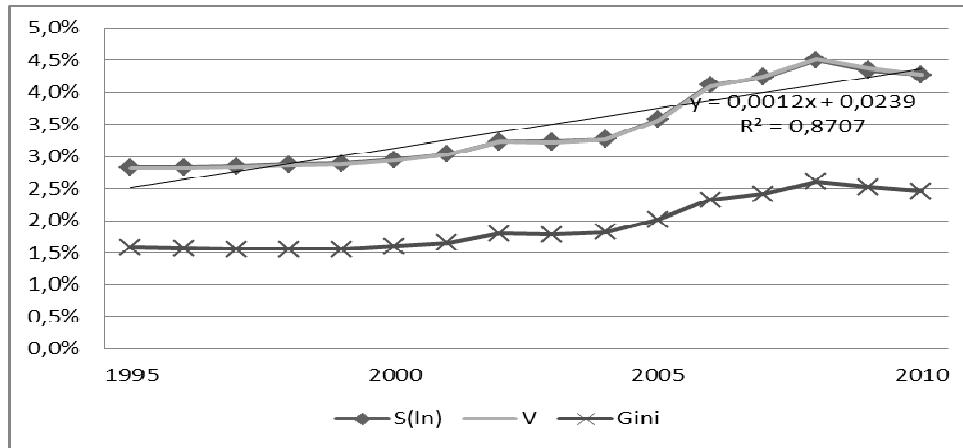
Table 3. Values of the regional education index (EI) for the two extreme years of analysis, with the quotient of the maximum and minimum values for a given year provided in the last line

	1995	2010
Dolnośląskie	0.72	0.85
Kujawsko-Pomorskie	0.73	0.80
Lubelskie	0.73	0.82
Lubuskie	0.74	0.75
Łódzkie	0.74	0.84
Małopolskie	0.71	0.84
Mazowieckie	0.77	0.88
Opolskie	0.68	0.76
Podkarpackie	0.71	0.76
Podlaskie	0.73	0.81
Pomorskie	0.71	0.82
Śląskie	0.74	0.82
Świętokrzyskie	0.75	0.81
Warmińsko-Mazurskie	0.73	0.78
Wielkopolskie	0.73	0.82
Zachodniopomorskie	0.75	0.80
Max/min	1.13	1.17

Source: own calculations.

Similarly to the LEI, EI values rose in all regions, but in the case of EI the rise was not as uniform. The EI increased the most in the Dolnośląskie and Małopolskie provinces, and the least in the Lubuskie and Warmińsko-Mazurskie provinces. These unequal changes in the EI were reflected in an increase in the range measure: from 1.13 in 1995 to 1.17 in 2010. That may indicate growing provincial inequalities with respect to that index. It ought to be noted, however, that the range concerns only extreme values; hence, a ultimate conclusion on the growth in inequalities is based on Figure 2, which shows that after 2000 indices measuring provincial EI diversification increased, indicating divergence of that phenomenon.

Figure 2. Values of regional EI diversification where the trend function was added to S(ln) measure



Source: own work.

2.3. Gross Domestic Product per Capita Index – GDPI

The third and final element of the HDI is the GDPI – the gross domestic product per capita index, measured as: $GDPI = (\log(GDP) - \log(\min GDP)) / (\log(\max GDP) - \log(\min GDP))^{10}$. In the above formula, the GDP is expressed in US dollars according to purchasing power parity – PPP, and minimum and maximum GDPs were established on the value of 100 and 40000 \$¹¹. The GDP in such a unit is provided only for Poland as a whole, and not for its specific regions. Thus, the first step was to convert the data concerning GDP per capita into the PPS (purchasing

¹⁰ The structure of the income index (GDPI) before the year 1999 was a little more complex. The world average income of 5,990 (PPP\$) in 1995 was taken as the threshold level, and any income above this level was discounted using the formulation based on Atkinson's formula for the utility of income (see: Human Development Report 1998, Technical note. Computing the indices, http://hdr.undp.org/en/media/hdr_1998_en_technote.pdf, p. 107).

¹¹ Those goalposts changed in the Human Development Report for 2010 where, thanks to the World Bank (2010) and IMF (2010) reports, the minimum and maximum values were set at \$163 per capita (the value for Zimbabwe) and \$108,211 per capita (the value for the United Arab Emirates). In this article, however, the previously used values of \$100 and \$40,000 were applied.

power standard) available in the Eurostat into the required currency unit¹². That was done based on the conversion coefficient for Poland between the GDP per capita in thousands of PPS and in thousands of USD, which is presented for two years of analysis in Table 4.

Table 4. GDP per capita in thousands of PPS and in thousands of USD (international constant)

	1995	2010
GDP pc (in thous. PPC)	6.3	14.7
GDP pc (in thous. of USD)	9	17.4
Conversion coefficient	1.43	1.18

Source: Eurostat, World Bank and own calculation (for conversion coefficient).

Regional GDP data was converted into GDPI according to the formula presented at the beginning of this chapter and provided in Table 5.

Table 5. GDPI used as the third component of the HDI for the two extreme years of analysis, with the quotient of the maximum and minimum values for a given year provided in the last line

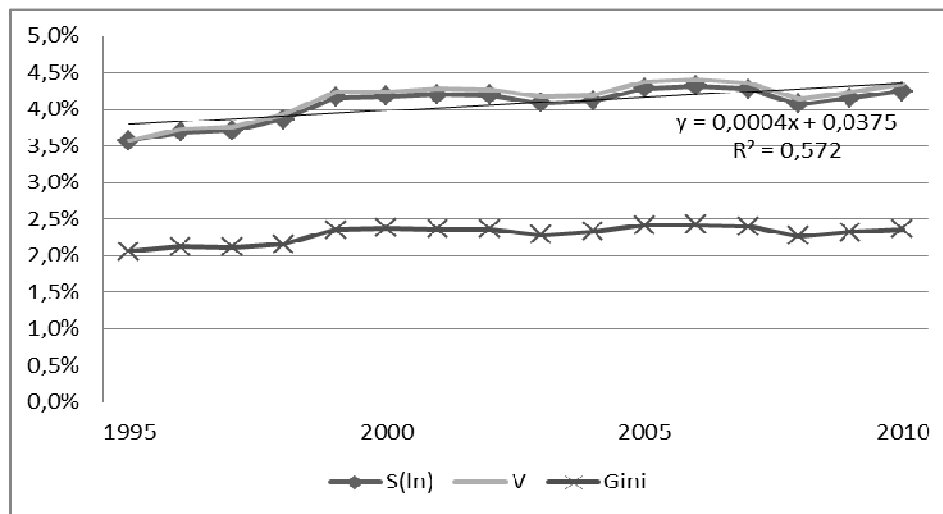
	1995	2010
Dolnośląskie	0.76	0.87
Kujawsko-Pomorskie	0.75	0.83
Lubelskie	0.71	0.79
Lubuskie	0.75	0.83
Łódzkie	0.73	0.84
Małopolskie	0.73	0.84
Mazowieckie	0.79	0.94
Opolskie	0.75	0.83
Podkarpackie	0.71	0.79
Podlaskie	0.71	0.81
Pomorskie	0.75	0.86
Śląskie	0.78	0.87
Świętokrzyskie	0.71	0.82
Warmińsko-Mazurskie	0.71	0.81
Wielkopolskie	0.75	0.87
Zachodniopomorskie	0.76	0.85
Max/min	1.12	1.19

Source: Table 4 and formula: $GDPI = (\log(GDP \text{ pc.}) - \log(100)) / (\log(40000) - \log(100))$.

¹² To put it quite simply, PPP is a set of price relations reflecting relations of prices of the same product or service in national currencies in different countries. In order to obtain a reference value for the calculation of PPP, one country of reference is usually selected and assigned the value of 1. In the case of the European Union, selecting a single country as a base seemed to be inappropriate. Thus, in the EU, in order to express values of aggregated economic data to be used in spatial comparisons in real terms, an artificial common currency of reference is applied, i.e. the PPS (based on "PKB na poziomie regionalnym" ["GDP at regional level"]). This article is available at the Eurostat website.

The above table indicates that the GDPI went up in all regions, “pulling” in its wake voievodship inequalities in that respect – which is shown by the last line of Table 5. That fact is confirmed in the Figure below. It should be added that increasing economic inequalities in Poland (measured by means of the GDP per capita) are a very well-known phenomenon, proven in a number of publications (e.g. Drązkiewicz et al., 2010, 2011, Kusideł, 2012a, 2012b)¹³.

Figure 3. Values of regional GDPI diversification where the trend function was added to the S(ln) measure



Source: own work.

3. Regional HDIs in Poland

Knowing the values of the specific HDI components (calculated in sections 1.1-1.3 above), we can calculate the HDI as a geometric mean according to the following formula:

$$HDI = LEI^{1/3} * EI^{1/3} * GDPI^{1/3}. \quad (1)$$

¹³ The phenomenon of achieving between-country convergence (understood as reducing the economic distance to the EU mean or other countries) with a simultaneous increase in diversification of the same indices within the country is not a phenomenon that can only be noted in Poland. It is observed in many countries – beneficiaries of the cohesion policy as well.

Chosen values of the index computed on this basis are presented in Table 6.

Table 6. Regional HDIs for the two extreme years of analysis and mean annual growth rate for the whole analysed period (1995-2010), along with the quotient of the maximum and minimum values for a given year provided in the last line¹⁴

	1995	2010	rate of growth
Dolnośląskie	0.75	0.86	0.71%
Kujawsko-Pomorskie	0.75	0.82	0.83%
Lubelskie	0.74	0.82	0.61%
Lubuskie	0.75	0.81	0.62%
Łódzkie	0.75	0.84	0.47%
Małopolskie	0.75	0.85	0.79%
Mazowieckie	0.78	0.90	0.83%
Opolskie	0.74	0.82	0.84%
Podkarpackie	0.74	0.81	0.65%
Podlaskie	0.74	0.83	0.55%
Pomorskie	0.75	0.85	0.65%
Śląskie	0.76	0.84	0.75%
Świętokrzyskie	0.75	0.83	0.61%
Warmińsko-	0.74	0.81	0.60%
Wielkopolskie	0.75	0.85	0.54%
Zachodniopomorskie	0.76	0.83	0.77%
Max/min	1.06	1.11	

Source: data in Tables 1, 3, 5 and formula (1).

The above table indicates that the HDI – describing the standard of living – rose in all regions (which means an increasing standard of living)– most considerably in Mazowieckie, Dolnośląskie, and Małopolskie (with the above 0.8% annual rate of growth), and least markedly in Podkarpackie, Warmińsko-Mazurskie, and Lubuskie (with an approximate 0.5% annual rate of growth). Another interesting observation can be made about the changing rankings of Poland's regions according to their HDIs, as presented in Table 7. Throughout the analysed period the top position was occupied by the Mazowieckie – such a strong position results from its high education index and GDPI values. In the

¹⁴ The values for Poland presented at: <http://hdrstats.undp.org/en/countries/profiles/POL.html> are slightly lower than the mean of results for a given year in Table 6, which arises as a result of the new goalposts assumed since 2010. On the other hand, the values calculated in the Table are comparable with those presented in earlier reports.

initial period of the study (the year 1995), the Śląskie province ranked second with respect to the HDI; however in the following years its ranking was considerably lowered and was replaced by the Wielkopolskie and, subsequently, Dolnośląskie. A completely opposite trend characterized the Dolnośląskie province: from its low ninth position in the 1995 ranking it climbed to the second position in 2010.

Table 7. Ranking of provinces according to their HDIs

	1995	2010
Dolnośląskie	9	2
Kujawsko-Pom.	7	11
Lubelskie	12	12
Lubuskie	5	16
Łódzkie	11	7
Małopolskie	10	3
Mazowieckie	1	1
Opolskie	16	13
Podkarpackie	15	14
Podlaskie	13	9
Pomorskie	8	5
Śląskie	2	6
Świętokrzyskie	4	10
Warmińsko-Maz.	14	15
Wielkopolskie	6	4
Zachodniopom.	3	8

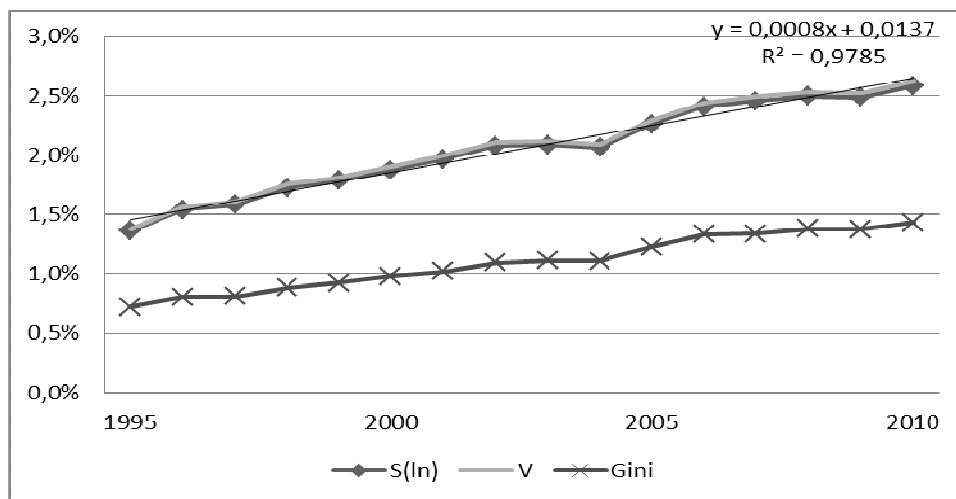
Source: own work based on Table 6.

4. Social Convergence of the Regional Human Development Index in Poland

The calculation of regional HDIs was the first stage of work performed within the framework of this study. Thanks to the computed values (see Table 6), it was possible to arrange the regions of Poland according to standards of living and observe their changes over time (set forth in Table 7). However, the main aim of the article is to determine whether standards of living of the populations of specific regions are becoming similar (convergence), or the opposite (divergence). Observation of the last line of Table 6 allows us to state that the quotient of the

maximum to the minimum HDI values was rising: in 1995 the maximum value of the HDI (for the Mazowieckie province) was higher by 6% than the minimum one (for the Opolskie province). In 2010 the difference was 11%, which means that diversification between the maximum and minimum HDI values was increasing over time and is an argument against convergence with respect to that phenomenon. The above data (max/min) take into account only extreme values. In order to gain a picture of diversification among all provinces, HDI dispersion and concentration measures were computed. The results are presented in Figure 4.

Figure 4. Values of provincial HDI diversification where the trend function was added to S(ln) measure¹⁵



Source: own work.

The above figure indicates that all dispersion measures of regional HDIs are rising over time and their increase is statistically significant. Thus, it can be stated that regional inequalities with respect to the standard of living (measured by the HDI) rose over the 1995-2010 period.

¹⁵ As with the preceding figures, Figure 4 shows the following dispersion and concentration measures of provincial HDIs: s(ln) – standard deviation of logarithmic values, V – coefficient of variation (ratio of the standard deviation to the mean), Gini – Gini coefficient.

5. Summary

The principal objective of this article was to determine whether inequalities in the standard of living of populations of specific Polish regions increase or decrease. The standard of living was measured applying the Human Development Index, whose regional values were not known and the calculation of which thus constituted a separate stage of work. Thanks to that stage, provincial values of indices characterizing the areas of health, education, and economic prosperity of the populations of Poland's provinces were computed, to be subsequently used in calculating provincial HDIs. That index served to arrange the provinces of Poland according to standards of living and observe their changes in the analysed period (1995-2010). In general, it was possible to determine that HDIs were rising in all provinces, which means, simultaneously, an increase in the standards of living of the provinces' populations throughout Poland. The key objective of the article, however, was to find out whether standards of living of populations in specific provinces are becoming similar, i.e. whether convergence of that variable occurs. The obtained result indicates that there is a quite opposite trend – the applied dispersion and concentration measures of provincial HDIs proved that standards of living of populations in specific Polish provinces are becoming more and more dissimilar – i.e. divergence of provincial HDIs is taking place.

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Streszczenie

KONWERGENCJA REGIONALNYCH WSKAŹNIKÓW ROZWOJU SPOŁECZNEGO W POLSCE

Temat konwergencji stał się w Polsce popularny wraz z akcesją do Unii w 2004 r., od kiedy to Polska jest beneficjentem polityki spójności – polityki regionalnej Unii Europejskiej, dążącej do podwyższenia poziomu spójności gospodarczej, społecznej

i terytorialnej (przestrzennej). O ile aspekt gospodarczy jest bardzo dobrze przebadanym obszarem badań nad konwergencją, to aspekty społeczne rzadziej pojawiają się w literaturze przedmiotu. Ten właśnie wątek jest poruszany w niniejszym referacie, w którym zbudowano wojewódzki miernik HDI do pomiaru spójności społecznej polskich województw. Dzięki oszacowaniu wojewódzkich HDI można było stwierdzić, że standard życia mieszkańców wszystkich województw rósł w okresie 1995-2010. Jednocześnie jednak wzrostom tym towarzyszyły narastające nierówności w rozkładzie HDI (sigma-dywersja). Badanie konwergencji poszczególnych składowych indeksu HDI pozwoliło stwierdzić dodatkowo, że głównymi sprawcami dywersji wojewódzkich HDI są narastające w Polsce nierówności gospodarcze (mierzone Indekssem Produktu Krajowego Brutto) oraz nierówności w wykształceniu (mierzone Indekssem Edukacyjnym).