

SOCIAL CONVERGENCE IN THE EU-28 COUNTRIES IN THE LIGHT OF THE IMPLEMENTATION OF THE EUROPE 2020 STRATEGY. THE DEA APPROACH

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ABSTRACT

Increase in convergence of the European Union countries has been focal for the European Union leaders, from the very beginning. The aim of the study is to examine whether any social convergence occurred in the EU-28 from 2010 to 2016, in the context of the implementation of the recommendations and the social policy objectives formulated under the Europe 2020 strategy. This article is based on an overview of the literature on the subject and the statistics of Eurostat. The methods of assessing the effectiveness of objects is DEA and sigma convergence. It is a new approach to convergence measurement based on the assessment of the efficiency diversification of the European Union countries and it has clearly been the value added to the analyses conducted so far. The obtained results in the scope of the estimation of the effectiveness were then compared to the existing results produced with the use of the methods generally recognized and employed in the literature. Conclusions were presented in the final part of the study.

Key words: convergence, Europe 2020 strategy, DEA approach

JEL codes: O11, O15, I25, J21

INTRODUCTION

The issues of increasing the degree of convergence of the countries of the European Union have been in the centre of attention of the organization overlooking that topic practically from the beginning of its existence [Markowska-Przybyła 2011, Głodowska 2013]. It is reflected in all the projects and policies, especially in the policy concerning communities whose main aim is to eliminate developmental disparities. The strategy “Europe 2020”, which has been implemented since 2010, enlists three priorities: (a) intelligent development based on knowledge and innovations; (b) sustainable development based on supporting the economy which uses resources effectively and is friendly to the natural environment; (c) development

fostering social inclusion including high level of employment oriented towards ensuring social and territorial coherence. Detailed and measurable goals have been established within the aforementioned projects, which are meant to be realized by the countries of the European Union by 2020. Within the social area the goals are as follows: limiting the number of people most at risk of poverty to 20 million, increasing the index of employment for people between the ages of 20 and 64 to 75%, limiting the number of people leaving the education system prematurely to 10%, and finally increasing to 40% the number of people between the ages of 30–34 with higher education. The issues of maintaining the convergence and its measurement become particularly significant in the

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context of achieving the above mentioned goals. The aim of the work is researching whether convergence took place within the social area in the countries of the EU-28 between 2010 and 2016 in the context of realizing the recommendations formulated within the “Europe 2020” strategy. In the research the following hypothesis was put forward: convergence takes place in the social area in the countries of EU-28.

METHODOLOGY OF THE CONDUCTED RESEARCH

First of all, what was examined was whether convergence in social area in EU-28 countries occurs, on the basis of three selected indicators: material deprivation, an employment indicator and the percentage of people with higher education [Eurostat 2018]. A classic approach was employed in calculations [Batóg 2010]. Indicators describing spatial differentiation of the examined variables were calculated on the basis of positional coefficient of variation on a ratio scale:

$$V_Q = \frac{Q_3 - Q_1}{Me}, \text{ where } Q_3, Q_1, \text{ are the first and the third}$$

quartiles, Me is a median or an (unweighted) arithmetic mean (\bar{x}) from the value of the examined variable; standard deviation (S) according to the equation

$$S = \sqrt{\frac{\sum_{i=1}^{28} (x_{it} - \bar{x})^2}{28}}; \text{ average deviation according to}$$

$$\text{the equation } d = \frac{\sum_{i=1}^{28} |x_{it} - \bar{x}|}{28}; \text{ coefficient of variation}$$

according to the following equation $V_s = \frac{S}{\bar{x}}, V_d = \frac{d}{\bar{x}}$.

What was employed to measure sigma (σ) convergence¹ was standard deviation of the natural logarithms of the level of the analyzed variables x_{it} from arithmetic mean values (\bar{x}) in time t according to the

$$\text{following equation } \sigma = \sqrt{\frac{\sum_{i=1}^{28} (\ln x_{it} - \ln \bar{x}_t)^2}{28}}. \text{ Sigma}$$

convergence shows how the regions got closer to one another in time and what proves its occurrence is the

drop in the value of standard deviation from one period of time to another [Bal-Domańska 2009].

Secondly, the DEA (Data Envelopment Analysis) method was employed, which allowed for obtaining a value added to the conducted research in a form of the implementation of a new approach to the measurement of convergence based on the evaluation of the differentiation of the effectiveness of the EU-28 countries. It is a method of examining the effectiveness based on the function of production constituting an empirical envelope of data [Guzik 2009]. The DEA model based on variable economies of scale seems to be the most suitable one in regards to the specificity of the conducted research but, above all, in terms of the differentiation of the EU-28 countries in reference to their GDP from the absolutists point of view. The conducted research involves, in the standard approach, the application of the method of evaluating the effectiveness of particular subjects to determine the effectiveness of entire economies. What can be established on the basis of the data envelopment analysis is: an indicator of the effectiveness of objects, a level of economies of scale reached by the subjects, benchmarks for inefficient objects, the form and the structure of optimal technologies, inputs and outputs critical to the given objects. The empirical application of the DEA method became extremely popular in such areas as: the financial and insurance sectors, cultural institutions, healthcare facilities, sport and tourism, trade, transportation, production, legal sector, crime detection and prevention, company and product rankings as well as the analysis of the effectiveness of the performance of listed companies [Sathye 2001, Barros and Mascarenhas 2005, Kumar and Gulati 2008]. The DEA method was applied in this research to evaluate the differentiation of the EU-28 countries in the social area. The next steps in the DEA method are as follows [Guzik 2009]:

- a selection of evaluated objects (countries) O_1, \dots, O_p
- set N of the input as well as set R of the output through which the effectiveness of the objects will be evaluated

¹ The method of the measurement of sigma convergence was employed in this paper, which does not exhaust all the possibilities of measurement of the analyzed phenomenon.

- the value of particular results as well as particular inputs in particular objects:

yrj – the value of the result of an r -kind ($r = 1, \dots, R$) in a j -object ($j = 1, \dots, J$),

xpi – the value of the expenditure of the p -kind ($p = 1, \dots, N$) in a i -object.

A set of objects is usually assumed to be (almost) homogenous.

The following mathematical equations were employed to calculate results:

- an equation based on the input-oriented CCR model could be described as follows:

$$h_i = \sum_{r=1}^R u_r y_{ri} \rightarrow \max \sum_{p=1}^P v_p x_{pi} = 1,$$

$$\sum_{r=1}^R u_r y_{ri} - \sum_{p=1}^P v_p x_{pi} \leq 0, u_r \geq 0, v_p \geq 0$$

- an equation based on the output-oriented CCR model describes the following dependencies:

$$h_i = \sum_{r=1}^R u_r y_{ri} \rightarrow \min \sum_{p=1}^P v_p x_{pi} = 1,$$

$$\sum_{r=1}^R u_r y_{ri} - \sum_{p=1}^P v_p x_{pi} \geq 0, u_r \geq 0, v_p \geq 0$$

where:

h_i – the effectiveness of an object i ($i = 1, \dots, n$),

u_r – the value pertaining to particular effects ($r = 1, \dots, R$),

v_p – the value pertaining to particular effects ($p = 1, \dots, P$).

Since it is possible to make this model both input-oriented and output-oriented, which seems suitable from the point of view of the choice of methodology, the choice of the DEA model is the most fitting. The input-oriented model is based on the premise that a given country should strive to minimize the input in order to achieve a given effect. On the other hand, the output-oriented model is based on striving to maximize these effects with a given value of the input. From the economic point of view both aforementioned approaches together are a good example of the principle of reasonable (effective) management, the realization of which is based on striving to maximize the effectiveness, regardless of the applied way of achieving it.

However, the choice of the first of the presented variants seems to be more justified, since social goals are set at the same level or similar levels. It stems from the fact that the European Union strives to standardize the policy regarding equalizing the socio-economic development, whereas, the cost of input born by the member countries may significantly fluctuate. The period of analysis encompassed years from 2007 until 2016. The input-oriented DEA model was applied to 2007, 2010, and 2013, whereas the output-oriented DEA model was applied to 2010, 2013, and 2016. This paper was created on the basis of publications on the subject as well as statistical data taken from the Eurostat database.

THE PHENOMENON OF CONVERGENCE AND ITS TYPES

Convergence describes a process in which poorer countries (regions) become similar to richer countries (regions) making differences between them smaller, where poorer countries develop faster relative to richer countries [Łażniewska et al. 2011]. In a broad understanding of the term, we can enumerate so-called structural convergence, which is connected with becoming similar within economies which are alike in regards to the level of development of economical structures, including such structures as: creating GDP, employment, institutional structures or infrastructure [Batóg 2010]. The most common division of convergence in publications on the topic mentions such types of convergence as:

- beta convergence – when an economic system with a lower level of development shows a faster pace of growth in comparison to a more developed economic system;
- sigma convergence – when the difference in the income levels per capita or other economic variables diminish [Barro and Sala-i-Martin 1992];
- absolute convergence, unconditional (type β) – when poor countries or regions develop faster than the richer ones regardless of the initial level of development and conditions;
- conditional convergence, often referred to its club name – when the process of convergence refers to the group of countries or regions relatively homogenous, characterized by a similar structure and a similar level of income [Adamczyk-Łojewska 2011].

Beta convergence and sigma convergence are mutually related. The existence of beta convergence is a necessary condition, but in itself insufficient, to the existence of sigma convergence [Łażniewska et al. 2011]. The phenomenon of convergence and its measurement is the subject of numerous scientific publications, both theoretical and empirical ones. In this paper an attempt at examining the occurrence of convergence in the social area in the EU-28 countries has been made.

THE MEASUREMENT OF CONVERGENCE IN SOCIAL AREA IN EU-28 BETWEEN 2010 AND 2016

Poverty and social exclusion are inextricably connected with social areas of every economy. Poverty is of economic character and means the inability to satisfy all of one's needs. The index of material deprivation² was chosen to measure poverty. It is counted

on the basis of the results of the European research in the area of income and people's living conditions (EU-SILC) [Niezbędnik statystyczny 2015]. It defines the percentage of people in households who indicate the inability to satisfy at least 3 of 9 of their needs such as: (a) paying for a week's holiday away from for the whole family at least once a year; (b) a meal including meat, chicken, fish or their vegetarian equivalent every second day; (c) heating to keep the home adequately warm; (d) unexpected financial expenses; (e) mortgage or rent payments, utility bills, hire or purchase instalments or other loan payments; (f) owning a color TV set; (g) owning a car; (h) owning a washing machine; (i) owning a telephone (including a mobile telephone). The interpretation of this indicator is as follows: the number of people at risk of material deprivation grows together with the increase of the indicator. The results of statistical data analysis for this indicator are presented in Table 1.

Table 1. Selected indicators of positional coefficient of variation for material deprivation in EU-28 between 2010 and 2016

Indicators	2010	2011	2012	2013	2014	2015	2016	Relative change 2016/2010
Maximum	45.7	43.6	44.1	43.0	33.1	34.2	31.9	0.70
Minimum	0.5	1.2	1.3	1.4	0.7	1.1	0.8	1.60
Max./ min.	91.4	36.3	33.9	30.7	47.3	31.1	39.9	0.44
Q_1	4.7	5.0	5.2	5.1	5.0	4.5	4.2	0.89
Me	6.4	7.2	8.9	8.9	7.9	7.0	5.7	0.89
Q_3	12.3	13.6	15.2	15.0	13.7	13.8	12.6	1.03
Coefficient of variability (V_q)	0.59	0.60	0.56	0.56	0.55	0.67	0.74	1.25
Median	10.6	11.0	11.8	11.5	10.5	9.6	8.8	0.82
Standard deviation (S)	10.2	10.1	10.1	9.8	8.0	7.7	7.5	0.74
Coefficient of variability (V_s)	0.96	0.92	0.86	0.85	0.76	0.80	0.85	0.86
Average deviation (d)	7.3	7.4	7.7	7.2	6.0	5.9	5.7	0.78
Coefficient of variability (V_d)	0.68	0.67	0.65	0.62	0.58	0.61	0.65	0.96
σ -convergence	1.04	0.97	0.96	0.90	0.91	0.85	0.90	0.87

Source: own analysis on the basis of data from Eurostat [2018].

² There is also an indicator of deepened material deprivation which entails the inability of satisfying at least 4 of the 9 mentioned needs.

What can be concluded on the basis of the outcomes of the research is that the maximum value as well as the median decreased for the analyzed variable only after 2012. At the same time it is difficult to unambiguously determine the direction of the changes for the minimum value, since it fluctuated over time. Standard deviation decreased, which can indicate the occurrence of sigma convergence. A graphic illustration of σ -convergence is presented on Figure 1.

The evaluation of the occurrence of sigma convergence can be made on the basis of the analysis of

the direction of changes in standard deviation from Table 1. There is a decreasing trend which can be a reason for the occurrence of sigma convergence. The differentiation among countries in reference to the researched variable has decreased.

The second analyzed variable in this paper is the percentage of people between 30–34 years of age with higher education. The results are presented in Table 2.

What can be concluded on the basis of the outcomes of the research is that the maximum, the minimum and the median values for the measured variable

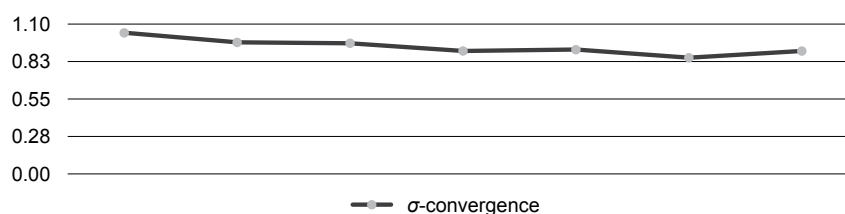


Fig. 1. σ -convergence on the basis of domestic indicators of material deprivation for EU-28 countries between 2010–2016
Source: own analysis on the basis of the data from Table 1.

Table 2. Selected indicators of positional coefficient of variation for the percentage of people between 30–34 years of age with higher education in EU-28 from 2010 to 2016

Indicators	2010	2011	2012	2013	2014	2015	2016	Relative change 2016/2010
Maximum	50.1	49.7	51.1	52.6	53.3	57.6	58.7	1.17
Minimum	18.3	20.3	21.7	22.5	23.9	25.3	25.6	1.40
Max./min.	2.7	2.4	2.4	2.3	2.2	2.3	2.3	0.85
Q_1	24.4	26.0	26.7	28.8	31.4	32.1	33.2	1.36
Me	34.8	37.2	39.2	40.6	41.6	42.0	43.2	1.24
Q_3	43.4	43.7	44.4	44.3	45.0	46.6	46.5	1.07
Coefficient of variability (V_q)	0.27	0.24	0.23	0.19	0.16	0.17	0.15	0.56
Median	34.3	35.3	36.5	37.9	39.5	40.5	41.3	1.20
Standard deviation (S)	10.1	9.8	9.9	9.5	9.1	9.2	9.0	0.89
Coefficient of variability (V_s)	0.29	0.28	0.27	0.25	0.23	0.23	0.22	0.76
Average deviation (d)	9.0	8.8	8.9	8.4	7.7	7.7	7.6	0.84
coefficient of variability (V_d)	0.26	0.25	0.24	0.22	0.19	0.19	0.18	0.69
σ -convergence	0.31	0.29	0.29	0.26	0.24	0.24	0.23	0.74

Source: own analysis on the basis of data from Eurostat [2018].

increased systematically in the analyzed period of time. The variability of the indicators decreased, the standard deviation declined, which means that the differentiation among the EU-28 countries significantly diminished in reference to the researched variable.

What can be concluded on the basis of the variability indicators (Table 2) as well as the graphic illustration of σ -convergence (Fig. 2) for this variable is that convergence occurred in the analyzed period of time.

The third variable analyzed in this paper is the indicator of employment. The results of the statistical analysis are presented below in Table 3.

What can be concluded on the basis of the data presented in Table 3 is that the maximum values for the analyzed variable increased systematically in the analyzed period of time. The median values increased only after 2013, whereas the minimum values fluctuated in the analyzed period of time. They decreased

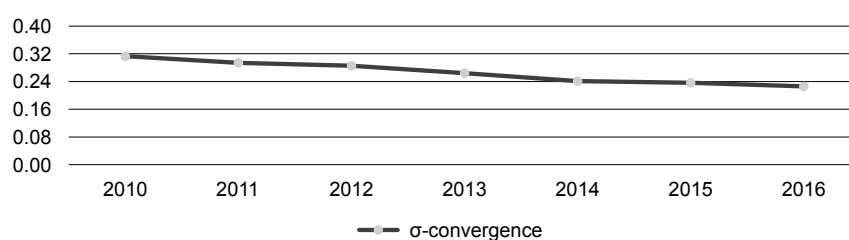


Fig. 2. σ -convergence on the basis of domestic indicators for the percentage of people between 30–34 years of age with higher education in EU-28 from 2010 to 2016

Source: own analysis on the basis of the data from Table 2.

Table 3. Selected indicators of positional coefficient of variation for employment in EU-28 between 2010 and 2016

Indicators	2010	2011	2012	2013	2014	2015	2016	Relative change 2016/2010
Maximum	78.1	79.4	79.4	79.8	80.0	80.5	81.2	1.04
Minimum	59.9	59.6	55.0	52.9	53.3	54.9	56.2	0.94
Max./min.	1.3	1.3	1.4	1.5	1.5	1.5	1.4	1.08
Q_1	64.3	63.6	63.6	64.8	66.3	67.6	68.5	1.06
Me	67.2	67.9	68.2	67.2	67.7	69.1	70.5	1.05
Q_3	73.1	73.4	72.7	73.3	73.7	74.4	75.6	1.03
Coefficient of variability (V_q)	0.07	0.07	0.07	0.06	0.05	0.05	0.05	0.71
Median	68.1	68.0	68.0	68.0	68.9	69.9	71.0	1.04
Standard deviation (S)	5.4	5.8	6.2	6.5	6.2	5.9	5.8	1.07
coefficient of variability (V_s)	0.08	0.08	0.09	0.10	0.09	0.08	0.08	1.00
average deviation (d)	4.7	4.8	5.0	5.2	4.9	4.6	4.4	0.94
coefficient of variability (V_d)	0.07	0.07	0.07	0.08	0.07	0.07	0.06	0.86
σ -convergence	0.08	0.08	0.09	0.10	0.09	0.09	0.08	1.00

Source: own analysis on the basis of data from Eurostat [2018].

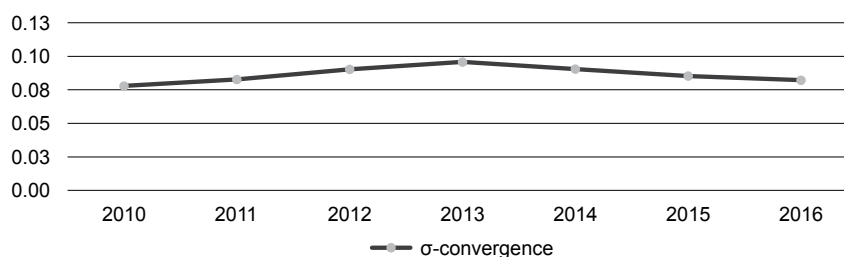


Fig. 3. σ -convergence on the basis of domestic indicators for employment in EU-28 between 2010 and 2016

Source: own analysis on the basis of the data from Table 3.

after 2013 and grew after 2016. The variability of the indicators and the standard deviation did not show a declining trend in the analyzed period of time. It indicates the lack of occurrence of sigma convergence which is confirmed further in Figure 3.

THE RESULTS OF THE ANALYSIS CONDUCTED WITH THE HELP OF THE DEA METHOD

The value of the standard deviation for the indicator of Lambda effectiveness of the EU-28 countries as presented in Table 4 for 2007, 2010 and 2013 (when it comes to input) and for 2010, 2013 and 2016 (when it comes to output). Any discrepancy among the years stems from the necessity of taking into consideration the time delay related to input influencing output. Data in Table 4 was taken from calculations of effectiveness based on the DEA model in three dif-

ferent variants: constant economies of scale (taking into account the input-oriented model or the output-oriented model since in both cases the outcomes were the same); variable economies of scale taking into account the input-oriented model; variable economies of scale for the output-oriented model. Arguments in favor of applying each of the three models can be given, hence, calculations regarding the value of standard deviations were made on the basis of all three models and they can be found in Table 4. However, the most adequate of the models seems to be the DEA model based on variable economies of scale since when it comes to the specificity of the of the conducted research, which was, above all, based on the application of the method of evaluating the effectiveness of objects (not determining the economic effectiveness of micro-objects, but entire national economies of the EU-28 countries).

Table 4. Comparison of the value of the standard deviation in the following years 2010, 2013 and 2016* depending on the applied DEA model

Years	Standard deviation* DEA 2016 ces in out**	Standard deviation DEA 2016 ves in***	Standard deviation DEA 2016 ves out****
2010	0.31535	0.27604	0.04732
2013	0.29969	0.30013	0.06568
2016	0.31084	0.35665	0.05416

Source: own analysis on the basis of data from Eurostat [2018] as well as calculations made in programme MaxDEA i MS Excel.

Explanations: * The value of standard deviation calculated for output for: 2010, 2013, 2016; and for input for: 2007, 2010 and 2013; ** Standard deviation DEA 2016 ces in out – standard deviation of the value of Lambda indicator calculated on the basis of the input-oriented DEA model and output-oriented DEA model with constant economies of scale; *** Standard deviation DEA 2016 ves in - standard deviation of the value of Lambda indicator calculated on the basis of the input-oriented DEA model with variable economies of scale; **** Standard deviation DEA 2016 ves out – standard deviation of the value of Lambda indicator calculated on the basis of the output-oriented DEA model with variable economies of scale.

What can be concluded on the basis of the data concerning the level of the indicator of the standard deviation presented in Table 4 is that when taking into account constant economies of scale (ces) regardless of the type of orientation of the model, input-oriented (inp) or output-oriented model (out)³, the degree of differentiation among EU-28 countries was maintained at a rather consistent level from 0.29969 for 2010 (input), and 2013 (output) to 0.31535 for 2010 (input), and 2013 (output).

We can notice significantly higher differentiation and divergence when taking into consideration variable economies of scale (ves) for input-oriented model in the respectful periods, since the values of standard deviation fluctuate between 0.27604 in the first analyzed period to 0.35665 in the third one.

By contrast, when taking into account variable economies of scale (ves) for output-oriented model in the respectful periods, what draws attention is the value of standard deviation which is relatively low and diversified to a relatively small degree (from 0.04732 in the first analyzed period to 0.06568 – in the second one). It means that we cannot draw the conclusion that convergence occurs in social area in the EU-28 countries.

CONCLUSIONS

On the basis of the conducted research the following conclusions can be made:

1. It is not possible to state that convergence in the EU-28 countries occurs in the social area characterized by the three aforementioned indicators in the years between 2010 to 2016 on the basis of the statistical analysis conducted in the first part of the paper since divergence exists in the job market. The decrease in differentiation can be seen only in the case of the indicator referring to the level of education. The analysis conducted on the basis of the DEA approach gives ambiguous results. It does not prove the hypothesis stated in this paper, that convergence in the social area occurs in the EU-28 countries.

2. The results are largely influenced by the applied method of examination.
3. There is a need for more precise selection of factors affecting convergence, for which the analysis of the main components can be used.
4. When applying the DEA approach it would be useful to consider which variant is the most plausible one to analyze convergence of the socioeconomic development of the European Union countries and whether the effectiveness measured with the use of that method is determining enough in regards to convergence.
5. The DEA approach is significantly limited. First of all, when taking into account only the statistical quantitative data. Secondly, it should be noted that the total number of inputs and outputs taken into account in the analysis should not be greater than 1/3 of the tested objects (in this article: EU-28 countries), and in practice it should be even much smaller to obtain reliable results. For this reason, only three variables were included in the study. And finally, due to surprising and volatile results obtained in the situation of significant correlation and the occurrence of linear correlations within inputs or outputs or between them. The above shortcomings might account for obtaining results which are plausible only to a limited degree when applying this approach.

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REFERENCES

- Adamczyk-Łojewska, G. (2011). Problemy konwergencji i dywergencji ekonomicznej na przykładzie krajów Unii Europejskiej, w tym Polski [Problems of economic convergence and divergence on the example of the European Union countries, including Poland]. *Ekonomista*, 4(16), 57–76.

³ In both cases practically identical results were obtained in the conducted analysis.

- Bal-Domańska, B. 2009. Ekonometryczna analiza sigma i beta konwergencji regionów Unii Europejskiej [Econometric Analysis of Sigma and Beta Convergence in the European Union Regions]. *Prace naukowe Uniwersytetu Ekonomicznego we Wrocławiu. Ekonometria*, 26, 11–23.
- Barro, R., Sala-i-Martin, X. (1992). Convergence, *Journal of Political Economy*, 100, 223–251.
- Barros, C.P., Mascarenhas, M.J. 2005. Technical and allocative efficiency in a chain of small hotels. *International Journal of Hospitality Management*, 24(3), 415–436.
- Batóg, J. (2010). Konwergencja dochodowa w krajach Unii Europejskiej. Analiza ekonometryczna. Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, 44–68.
- Europe 2020 – The strategy for achieving the goals of smart, sustainable and inclusive growth for the coming years. Retrieved from http://www.stat.gov.pl/cps/rde/xbcr/gus/POZ_Wskazniki_Europa2020.pdf [accessed 12.01.2018].
- Eurostat (2018). Retrieved from <http://ec.europa.eu/eurostat/data/database> [accessed 08.02. 2018].
- Głodowska, A. (2013). Konwergencja dochodowa i technologiczna państw Unii Europejskiej w latach 2000–2011. Nierówności społeczne a wzrost gospodarczy. Wydawnictwo Uniwersytetu Ekonomicznego w Rzeszowie, 30, 40–52.
- Guzik, B. (2009). Podstawowe modele DEA w badaniu efektywności gospodarczej i społecznej. Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu.
- Kumar, S., Gulati R. 2008. An Examination of Technical, Pure Technical, and Scale Efficiencies in Indian Public Sector Banks using Data Envelopment Analysis. *Eurasian Journal of Business and Economics*, 1(2), 33–69.
- Łażniewska, E., Górecki, T., Chmielewski, R. (2011). Konwergencja regionalna. Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, 66–73.
- Markowska-Przybyła, U. (2011). Integracja a konwergencja realna. Konwergencja regionalna w Polsce według klasycznych i alternatywnych metod badań [Integration versus real convergence. Regional convergence in Poland according to classical and alternative methods of research]. *Ekonomia*, 4 (16), 77–96.
- Niezbędnik statystyczny (2015). Retrieved from http://strateg.stat.gov.pl/slider/ns_2015_PL.pdf, 138 [accessed 10.02.2018].
- Sathye, M. (2001). X-Efficiency in Australian Banking: An Empirical Investigation. *Journal of Banking and Finance*, 25(3), 613–630.

KONWERCENCJA SPOŁECZNA W KRAJACH UE-28 W ŚWIETLE IMPLEMENTACJI STRATEGII EUROPA 2020. PODEJŚCIE DEA

STRESZCZENIE

Kwestie zwiększania stopnia konwergencji krajów Unii Europejskiej znajdują się w centrum uwagi kierujących tym ugrupowaniem, praktycznie od początku jego funkcjonowania. Celem pracy jest zbadanie czy występowała konwergencja w obszarze społecznym w krajach UE-28 w latach 2010–2016, w kontekście realizacji zaleceń i celów polityki społecznej sformułowanych w ramach strategii Europa 2020. W artykule podjęto próbę wykorzystania metody oceny efektywności obiektów (DEA) do zbadania konwergencji w analizowanym obszarze. Następnie dokonano porównania uzyskanych wyników z rezultatami analizy konwergencji metodami ogólnie przyjętymi w literaturze, tj. konwergencji sigma. Praca powstała na podstawie przeglądu literatury przedmiotu oraz danych statystycznych zaczerpniętych z bazy Eurostatu. Zaprezentowana w opracowaniu analiza pozwoliła na uzyskanie wyników w zakresie oceny efektywności oraz ich porównania z rezultatami badań konwergencji przeprowadzonych metodami ogólnie przyjętymi w literaturze.

Słowa kluczowe: konwergencja, strategia Europa 2020, podejście DEA