FACTA UNIVERSITATIS
Series: **Economics and Organization** Vol. 15, N^{o} 4, 2018, pp. 295 - 304
https://doi.org/10.22190/FUEO1804295S

Original Scientific Paper

HUMAN AND SOCIAL CAPITAL AS FACTORS OF INEQUALITIES IN ECONOMIC DEVELOPMENT OF EU COUNTRIES

UDC 005.96:330.34(4-672EU)
330.342:330.34(4-672EU)

Iwona Skrodzka

University of Bialystok, Faculty of Economics and Management, Bialystok, Poland

Abstract. *The importance of human and social capital in the processes of growth and economic development has been broadly discussed in the literature. There are many theoretical models of economic growth considering human or social capital. However, there is still a shortage of empirical studies concerning the dependencies between these phenomena. The purpose of this study is to examine the role which human and social capital play in the processes of economic development in the European Union countries. Empirical analysis concerns the year 2015. Owing to the fact that neither of these categories is measurable, the research uses the soft modelling method. It allows users to examine links between variables which are not directly observable (latent variables). The conducted research has demonstrated that human capital as well as social capital had a statistically significant, positive impact on the economic development of the EU countries. The obtained results also made it possible to create the rankings of the examined countries according to their stocks of human and social capital and the level of economic development.*

Key words: *human capital, social capital, economic development, soft modelling, European Union*

JEL Classification: C59, E24, O11, Z13

1. INTRODUCTION

The importance of human and social capital in the processes of growth and economic development has been broadly discussed in the literature (Benhabib & Spiegel, 1994;

Received July 16, 2018 / Accepted September 18, 2018
Corresponding author: Iwona Skrodzka
Faculty of Economics and Management, Bialystok, ul. Warszawska 63, 15-062 Bialystok, Poland
E-mail: i.skrodzka@uwb.edu.pl

Bourdieu, 1986; Coleman, 1988, 1990; Lucas, 1988; Mankiw et al., 1992; Putnam et al., 1993; Romer, 1989). Moreover, the significance of human and social capital for the processes of socio-economic development is appreciated by many international institutions conducting research in this field. The most important projects include: "Social Capital Initiative" (World Bank), "The Well-being of Nations: The Role of Human and Social Capital" (OECD) as well as "The Contribution of Social Capital in the Social Economy to Local Economic Development in Western Europe" (European Commission).

The concepts of human and social capital were developed as a response to the difficulties in explaining cross-country inequalities in economic growth. The production factors considered earlier: physical capital and labour did not sufficiently explain the differences between the rate of economic growth or levels of development in individual countries. Therefore, researchers began investigating human, social, cultural, political, and psychological factors.

In the literature there are many theoretical models of economic growth considering human or social capital. However, there is still a shortage of empirical studies concerning the dependencies between these phenomena. The purpose of the paper is to analyze the impact of human and social capital on the level of economic development of the EU countries. In this study the following definitions were adopted:

- human capital is defined as embodied in inhabitants stock of unobserved characteristics such as: education, stock of knowledge, health. It is increased through investment and it is an important factor of economic development (Skrodzka, 2015).
- social capital includes the institutions, the relationships, the attitudes and values that govern interactions among people and contribute to economic and social development (OECD, 2001).

This paper proposes the following research hypotheses:

H1a: human capital is positively associated with the level of economic development of the EU countries.

H1b: social capital is positively associated with the level of economic development of the EU countries.

Because of the multi-dimensional and intangible character of the studied phenomena, a soft-modelling method was applied. The obtained results allowed the author to realise the research objective and verify the proposed research hypotheses.

2. Research Method

The soft modelling method was developed by H. Wold (1980; 1982). The soft model consists of two sub-models: an internal one (structural model) and an external one (measurement model). The internal sub-model depicts the relationships between the latent variables on the basis of the assumed theoretical description. The external sub-model defines latent variables by means of observable variables (indicators). Indicators allow for direct observation of latent variables and are selected according to the assumed theory or the intuition of the researcher (Rogowski, 1990). A latent variable can either be defined (with the use of indicators) inductively: the approach is based on the assumption that the indicators make up latent variables (formative indicators), or deductively: when it is assumed that indicators reflect the respective theoretical notions (reflective indicators). Under the deductive approach, the latent variable, as a theoretical notion, is a point of departure for a search of empirical data (the variable is primary to a given indicator). In the inductive approach, it is the indicators that are

primary to the latent variable which they comprise. Both the approaches use latent variables that are estimated as the weighted sums of their indicators. However, depending on the definition, indicators should be characterized by different statistical properties – no correlation in the case of inductive definition and high correlation in the deductive one.

The estimation of the parameters of the soft model is performed by means of the partial least squares method (PLS method). The description of the method can be found in: (Lohmoller, 1988) or (Westland, 2015). The quality of the model is assessed with the use of determination coefficients (R^2), established for each equation. The significance of the parameters is checked by means of the standard deviations calculated with the Tukey's cut method ("2s" rule: a parameter significantly differs from zero if double standard deviation does not exceed the value of the estimator of this parameter). Besides, in the case of the external sub-model, the estimators of factor loadings can be treated as the degree in which the indicators match the latent variable that they define. The prognostic property of the model can be evaluated by means of the Stone-Geisser test, which measures the accuracy of the forecast obtained as a result of the model's application as compared with a trivial forecast. The test statistics take values from the range $<-\infty,1>$. In the ideal model, the value of the test equals 1 (the forecasts are perfectly accurate in comparison with trivial forecasts). When the value of the test equals zero, the quality of the model's forecast and the trivial forecast tend to be virtually identical. Negative values indicate a low quality of the model (its weak predictive usefulness compared with a trivial forecast).

Using the partial least squares method, it is possible to obtain the estimated values of latent variables, which can be regarded as the values of synthetic measures. They can be employed for linear ordering of the examined objects (Rogowski, 1990).

3. Specification of Soft Model

The model which was used for realization of the research objective contained the following equation

$$ED = \alpha_1 \cdot HC + \alpha_2 \cdot SC + \alpha_0 + \xi \tag{1}$$

where ED – the level of economic development, HC – human capital, SC – social capital, α_0, α_1, α_2 – structural parameters of the model, ξ – random component.

The latent variables were defined by means of observable variables on the basis of the deductive approach, i.e. the latent variable, as a theoretical concept, serves as a starting point to identify empirical data. The indicators for the model were selected based on criteria of substantive and statistical nature. The statistical data came from the Eurostat, OECD and World Bank databases. Using the available domestic and international literature, primary sets of indicators of the variables *HC*, *SC* and *ED* were developed. The selection of the research period (2015) was determined by the availability of statistical data. The developed database was checked in terms of missing data. Data shortages were overcome by using naive prognosis, consisting in replacing the lacking values by the value for the previous year.

From the statistical point of view, the following considerations were taken into account: variability of indicator values (coefficient of variation above 10%) and analysis of the quality of the estimated model (ex post analysis). The indicators which passed substantive and statistical verification are presented in Table 1.

Table 1 Indicators of latent variables

Symbol of indicator	Description of indicator	Source	Type[2]
	HUMAN CAPITAL		
*HC*1	Percentage of population aged 15-64 having completed tertiary education (%).	E	Stimulant
*HC*2	Percentage of population aged 25-64 participating in education and training (%).	E	Stimulant
*HC*3	Percentage of employees aged 15-64 having completed tertiary education (%).	E	Stimulant
*HC*4	Percentage of employees aged 25-64 participating in education and training (%).	E	Stimulant
*HC*5	Graduates at doctoral level per 1000 of population aged 25-34 (person).	E	Stimulant
*HC*6	Young people neither in employment nor in education and training (% of population aged 15 to 29).	E	Destimulant
*HC*7	Underachievement in reading, mathematics or science (% of 15-year-old students)	OECD	Destimulant
*HC*8	Percentage of population declaring their health status as very good and good (%).	E	Stimulant
*HC*9	Death rate due to chronic diseases (number per 100 000 persons aged under 65)	E	Destimulant
*HC*10	Infant mortality rate (person).	WB	Destimulant
	SOCIAL CAPITAL		
*SC*1	Participation in voluntary activities (% of people aged 16 and over).	E	Stimulant
*SC*2	Active citizens (% of people aged 16 and over)[3].	E	Stimulant
*SC*3	Frequency of getting together with relatives and friends – every week (% people aged 16 and over).	E	Stimulant
*SC*4	Public-private co-publications (per million population).	E	Stimulant
*SC*5	International scientific co-publications (per million population).	E	Stimulant
*SC*6	Communication via social media – daily (% of people aged 16 and over).	E	Stimulant
	THE LEVEL OF ECONOMIC DEVELOPMENT		
*ED*1	Gross domestic product per capita (in PPS).	E	Stimulant
*ED*2	Gross value added per employee (in PPS).	E	Stimulant
*ED*3	Agriculture, value added (% of GDP).	WB	Destimulant
*ED*4	R&D expenditure in the public sector (% of GDP).	E	Stimulant
*ED*5	R&D expenditure in the business sector (% of GDP).	E	Stimulant
*ED*6	Employment rate in age group 20-64 (%).	E	Stimulant

Source: author's own elaboration

A schematic diagram of the soft model, taking into consideration both the internal and external relationships is presented in Figure 1[4].

[2] Stimulant of latent variable – the higher the value of an indicator, the higher the level of the latent variable. Destimulant of latent variable – the higher the value of an indicator, the lower the level of the latent variable.
[3] Active citizenship in the 2015 ad-hoc module is understood as participation in activities related to political groups, associations or parties, including attending any of their meetings or signing a petition.
[4] The solid line represents internal model relationship, while the broken line – external model relationships.

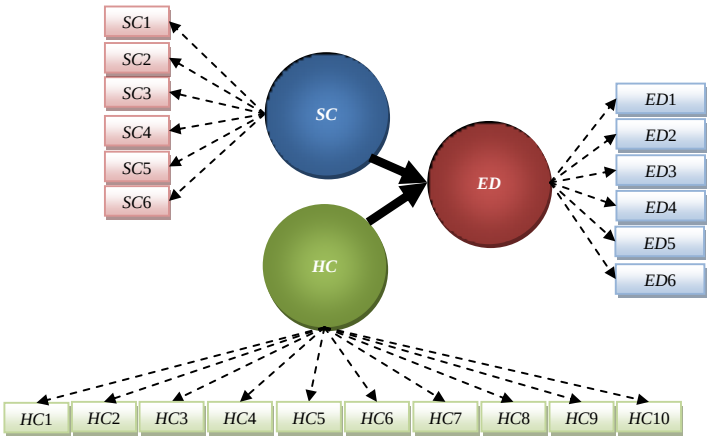

Fig. 1 Diagram of internal and external relationships in soft model
Source: author's own elaboration.

The model was estimated by means of the PLS method, which involves simultaneous estimation of the external model parameters (weights and factor loadings) and the internal model parameters (structural parameters). The estimation was conducted using the PLS software. The software was developed by J. Rogowski, professor at the Department of Economics and Management at University of Bialystok, and is available free of charge.

4. Results of Estimation

The results of the estimation of the external model are presented in Table 2. Each weight represents the relative share of a given indicator's value in the estimated value of a latent variable. Factor loadings are coefficients of correlation between indicators and latent variables, thus indicating the degree and direction in which the variability of an indicator reflects the variability of a latent variable. The ordering of indicators according to weight is performed when a latent variable is defined inductively. In the deductive approach, which was applied in this research, it is the factor loadings that are interpreted. The following interpretation of the π_{ij} factor loading was assumed:

– $|\pi_{ij}| < 0.2$ – no correlation,
– $0.2 \leq |\pi_{ij}| < 0.4$ – weak correlation,
– $0.4 \leq |\pi_{ij}| < 0.7$ – moderate correlation,
– $0.7 \leq |\pi_{ij}| < 0.9$ – strong correlation,
– $|\pi_{ij}| \geq 0.9$ – very strong correlation.

In terms of the signs of the estimated parameters, the results are consistent with the expectations. Stimulants have positive estimations of weights and factor loadings and destimulants (*HC*5, *HC*6, *HC*9, *HC*10, *ED*3) have negative ones. Moreover, all the parameters are statistically significant, in accordance with the "2s" principle (see table 2, columns "Standard deviation").

Table 2 Estimations of external relationships parameters in the soft model

Symbol of indicator	Weight	Standard deviation	Factor loading	Standard deviation
*HC*1	0.1269	0.0040	0.6946	0.0072
*HC*2	0.1838	0.0018	0.8995	0.0017
*HC*3	0.0704	0.0054	0.4889	0.0101
*HC*4	0.1819	0.0009	0.8911	0.0021
*HC*5	0.1408	0.0049	0.6470	0.0051
*HC*6	-0.1854	0.0098	-0.7085	0.0112
*HC*7	-0.1555	0.0089	-0.6939	0.0111
*HC*8	0.0962	0.0075	0.4036	0.0152
*HC*9	-0.1586	0.0102	-0.6999	0.0114
*HC*10	-0.1230	0.0025	-0.5683	0.0025
*SC*1	0.2699	0.0066	0.8740	0.0044
*SC*2	0.1897	0.0042	0.7035	0.0033
*SC*3	0.1673	0.0053	0.7773	0.0044
*SC*4	0.2065	0.0066	0.8365	0.0028
*SC*5	0.2442	0.0022	0.9403	0.0010
*SC*6	0.1491	0.0108	0.6588	0.0084
*ED*1	0.2246	0.0085	0.8169	0.0246
*ED*2	0.1993	0.0009	0.7308	0.0274
*ED*3	-0.2387	0.0109	-0.8622	0.0306
*ED*4	0.2202	0.0267	0.6944	0.0728
*ED*5	0.2500	0.0294	0.7499	0.0309
*ED*6	0.1894	0.0396	0.6584	0.0645

Source: author's own elaboration

Indicators reflecting education and training (*HC*2, *HC*4 and *HC*6) were the most important for *HC* variable. The *SC* variable was most strongly reflected by indicators related to scientific co-operation (*SC*4 and *SC*5) as well as voluntary activities (*SC*1). The *ED* variable was strongly correlated with four of the six indicators (*ED*3, *ED*1and *ED*5).

The outcomes of the internal model estimation are illustrated by the following equation

$$\hat{ED} = \underset{(0.1173)}{0.3938} \cdot HC + \underset{(0.1173)}{0.5200} \cdot SC + \underset{(0.1173)}{2.1105} \quad R^2 = 0.81 \ . \tag{2}$$

The brackets contain standard deviations calculated by means of the Tukey's test. The structural parameters are statistically significant ("2s" rule). The value of the coefficient of determination R^2 justifies the conclusion that, to a very high extent, the independent variables *HC* and *SC* determine the variability of the dependent variable *ED*. The values of the Stone-Geisser test, which verifies the soft model in terms of its predictive usefulness (see Table 3) are positive, which proves the model's high prognostic quality.

Table 3 Values of the Stone-Geisser test

Symbol of indicator	Value of S-G test
*ED*1	0.3831
*ED*2	0.2888
*ED*3	0.4663
*ED*4	0.3437
*ED*5	0.4786
*ED*6	0.2721
General	0.3072

Source: author's own elaboration

The estimations of the internal model parameters indicate a positive and statistically significant impact of human capital as well as social capital on the level of economic development of EU countries in 2015. This means that those countries which reported higher stocks of human capital also had a higher level of economic development. Moreover countries with higher stocks of social capital also had a higher level of economic development. Therefore, there are no grounds to reject the *H1a* and *H1b* hypotheses that were formulated in the study. Furthermore the impact of social capital on economic development was stronger than the impact of human capital.

Based on the synthetic measures of the variables *HC*, *SC* and *SG*, which were obtained during modelling, three rankings of the studied countries were created: a ranking of human capital, a ranking of social capital and a ranking of the level of economic development. The results are shown in Table 4.

Table 4 Rankings of the EU countries according to *HC*, *SC* and *ED* in 2015

Country	*HC*	*SC*	*ED*
Austria	7	6	5
Belgium	14	7	9
Bulgaria	27	27	27
Croatia	26	22	26
Cyprus	16	15	22
Czech Republic	15	20	12
Denmark	1	2	3
Estonia	12	13	13
Finland	3	4	8
France	9	10	11
Germany	11	11	4
Greece	23	16	25
Hungary	25	23	23
Ireland	8	9	6
Italy	21	17	18
Latvia	24	26	24
Lithuania	18	24	19
Luxembourg	5	5	1
Malta	19	18	17
Netherlands	4	3	7
Poland	20	25	21
Portugal	17	19	16
Romania	28	28	28
Slovakia	22	21	15
Slovenia	10	12	14
Spain	13	14	20
Sweden	2	1	2
United Kingdom	6	8	10

Source: author's own elaboration

The next step consisted in dividing the countries into typological groups. The boundaries of the groups were established with the use of the arithmetical mean values and standard deviation of the synthetic variable z_i (equalling 0 and 1 for each of the latent variables, respectively). The ranges assumed the following forms: group I (very high level of latent

variable): $z_i \geq 1$, group II (high level of latent variable): $0 < z_i \leq 1$, group III (low level of latent variable): $-1 < z_i \leq 0$, group IV (very low level of latent variable): $z_i \leq -1$. The results of grouping are presented in Figures 2, 3 and 4.

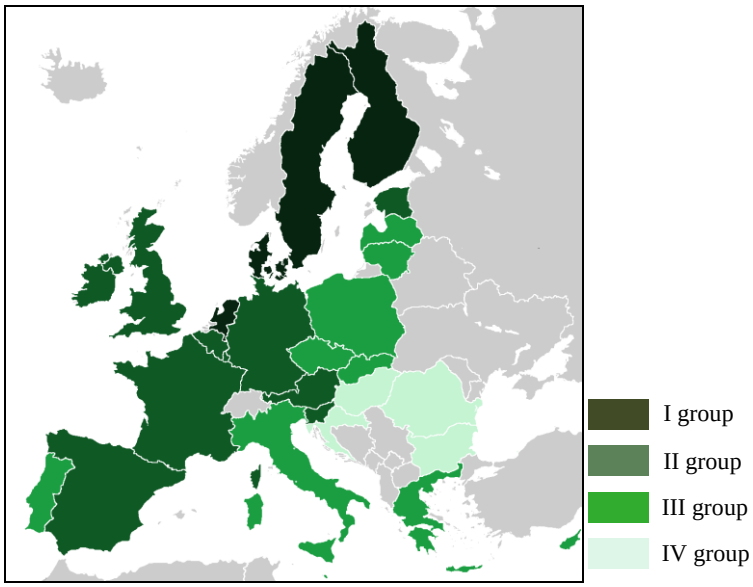

Fig. 2 The EU countries according to *HC* in 2015
Source: author's own elaboration.

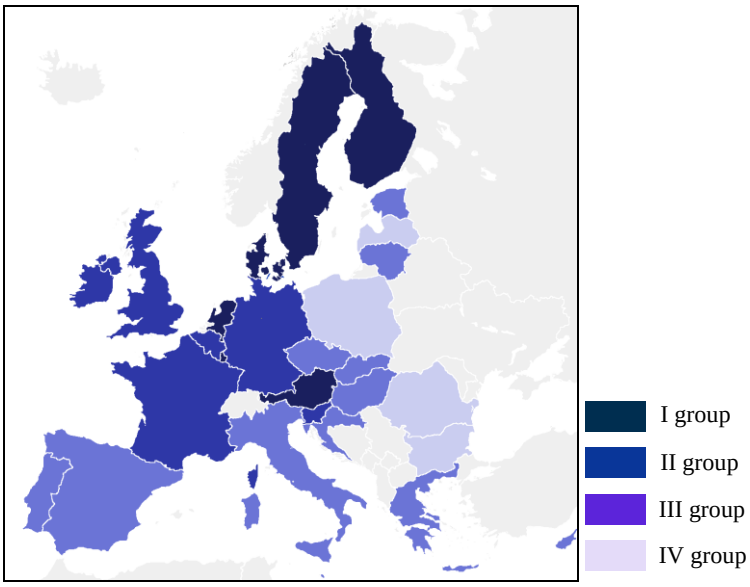

Fig. 3 The EU countries according to *SC* in 2015
Source: author's own elaboration.

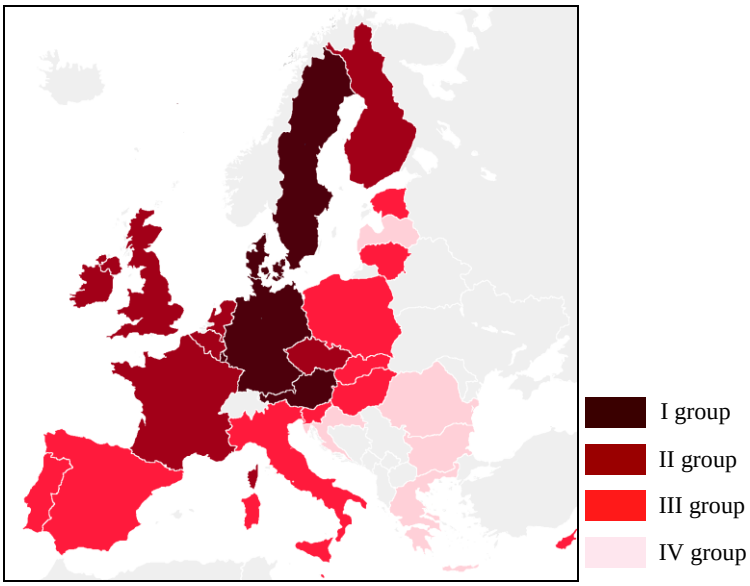

Fig. 4 The EU countries according to *ED* in 2015
Source: author's own elaboration.

5. CONCLUSIONS

The conducted research has demonstrated that human capital as well as social capital had a statistically significant, positive impact on the economic development of the EU countries.

The obtained results also made it possible to create the rankings of the examined countries according to their stocks of human and social capital and the level of economic development. Denmark and Sweden ranked high in all the six categories, whereas Romania and Bulgaria came at the bottom of the rankings.

The division into typological groups showed the differentiation of the EU countries in terms of human and social capital and the level of economic development. Very high stocks of human capital were observed in the following countries: Denmark, Sweden, Finland, the Netherlands. Four countries were characterised by very low stocks of human capital: Hungary, Croatia, Bulgaria and Romania. Six countries were qualified for the group of economies at very high stocks of social capital: Sweden, Denmark, the Netherlands, Finland, Luxemburg and Austria. Low stocks of social capital were reported for Poland, Latvia, Bulgaria and Romania. Five countries made up the group with a very high level of economic development: Luxembourg, Sweden, Denmark, Germany and Austria. A very low level of economic development was recorded in: Latvia, Greece, Croatia, Bulgaria and Romania.

Acknowledgement: *Some parts of the paper have been presented at the Second International Scientific Conference on Economics and Management – EMAN 2018.*

REFERENCES

Benhabib, J. & Spiegel, M.M. (1994). The role of human capital in economic development: Evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34 (2), 143-173, DOI: 10.1016/0304-3932(94)90047-7.

Bourdieu, P. (1986). The forms of capital. In: Richardson, J. (Ed.), *Handbook of Theory and Research for the Sociology of Education* (pp. 241–58). New York: Greenwood Press.

Coleman, J. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94 (Supplement), S95–S120, DOI: 10.1086/228943.

Coleman, J. (1990). *Foundations of Social Theory*. Cambridge. Mass.: Harvard University Press, DOI: 10.1007/BF00997791.

Lohmoller, J.B. (1988). The PLS Program System: Latent Variables Path Analysis with Partial Least Squares Estimation. *Multivariate Behavioral Research*, 23 (1), 125-127. DOI: 10.1207/s15327906mbr2301_7.

Lucas, R.E. (1988). On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22(1), 3-42, DOI: 10.1016/0304-3932(88)90168-7.

Mankiw, N.G., Romer, D. & Weil, D.N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107 (21), 407-437, DOI: 10.3386/w3541.

OECD (2001). *The Well-being of Nations: The Role of Human and Social Capital*. Paris: OECD.

Putnam, R., Leonardi, R. & Nanetti, R. (1993). *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press.

Rogowski, J. (1990). *Modele miękkie. Teoria i zastosowanie w badaniach ekonomicznych* [Soft models. Theory and application in economic research]. Białystok: Wydawnictwo Filii UW w Białymstoku.

Romer, P. M. (1989). Human capital and growth: Theory and evidence, *Carnegie-Rochester Conference Series on Public Policy*, 32, 251-286, DOI: 10.1016/0167-2231(90)90028-J.

Skrodzka, I. (2015). *Kapitał ludzki polskich województw – koncepcja pomiaru* [Human capital of Polish provinces - the concept of measurement]. Białystok: Wydawnictwo Uniwersytetu w Białymstoku.

Westland, J. C. (2015). Partial Least Squares Path Analysis, In: Westland, J. C., *Structural Equation Models: from Paths to Networks* (pp. 23-46). Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-16507-3.

Wold, H. (1980). Soft modelling: Intermediate between Traditional Model Building and Data Analysis, *Mathematical Statistics*, 6 (1), 333-346.

Wold, H. (1982). Soft modeling: The basic design and some extensions, In: Joreskog, K.G. & Wold, H. (Eds.), *Systems under indirect observation: Causality, structure, prediction* (pp. 1-54). Amsterdam: North Holland.

LJUDSKI I DRUŠTVENI KAPITAL KAO FAKTORI NEJEDNAKOSTI U EKONOMSKOM RAZVOJU ZEMALJA EU

O značaju ljudskog i društvenog kapitala u procesima rasta i ekonomskog razvoja se široko raspravljalo u literaturi. Postoji mnogo teoretskih modela ekonomskog rasta koji uključuju ljudski ili društveni kapital. Međutim, i dalje postoji nedostatak empirijskih studija koje proučavaju zavisnosti između ovih pojava. Svrha ove studije je da ispita ulogu koju ljudski i društveni kapital igra u procesima ekonomskog razvoja u zemljama Evropske unije. Empirijska analiza se odnosi na 2015. godinu. Zbog činjenice da nijedna od ovih kategorija nije merljiva, istraživanje koristi metod mekog modeliranja, koji omogućava korisnicima da ispitaju veze između varijabli koje se ne mogu direktno posmatrati (latentne varijable). Sprovedeno istraživanje je pokazalo da ljudski kapital kao i društveni kapital imaju statistički značajan, pozitivan uticaj na ekonomski razvoj zemalja EU. Dobijeni rezultati su takođe omogućili rangiranje ispitanih zemalja u skladu sa njihovim zalihama ljudskog i društvenog kapitala i nivoom ekonomskog razvoja.

Ključne reči: *ljudski kapital, društveni kapital, ekonomski razvoj, meko modeliranje, Evropska Unija*