

## The Analysis of Social and Economic Potential of Central and Eastern European Economies\*

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### Abstract

This analysis is a voice in the public and scientific discussion on the economic potential of Central and Eastern European economies, in particular the ones belonging to the European Union. The research method used in the study is based on a linear ordering. The analysis covered variables that characterise multi-aspect development processes. As a result of the study, an order of economies according to a synthetic development index has been established. In a sense, this research may be seen as a complement to the European Commission analyses.

**Keywords:** Central and Eastern European, social and economic potential, linear ordering

### Introduction

Economic potential is treated as one of the main factors that have endogenous impact on the intensification of economic development processes. Such potential may be created by certain drivers, so it should be treated as being subject to changes, in particular in a long-term perspective. Therefore, one our talk about activation of the economic potential of individual national economies in specific circumstances, which in turn may be identified with a concept of ex ante strengthening of their competitiveness.

It should be noted that the development potential should be presented in a specific analytic context. But in such case, in our opinion, it is inadvisable to analyse it as an absolute value. Therefore, the literature provides us with numerous opinions on presentations and analyses of economic potential, and for instance this topic is in the field of scientific interests. In our opinion, for the purpose of research one should in particular use such methods that enable a relatively objective treatment of the issue of the economic potential on the regional scale, including an assessment of inter-regional differences.

The purpose of this paper is to define the social and economic potential of the Central and Eastern European economies, which is essential in the post-crisis circumstances of year 2011 and in the perspective (and reality) of their functioning in the Economic and Monetary Union. The research tool used for this purpose is taxonomic analysis, or more precisely linear ordering. On the basis of an analysis of every national economic system, it is possible to define the relative synthetic economic development ratio, and then on the basis of this ratio, to make their ranking list and examine their distance from the economy serving as a reference sample that is understood to be the country characterised by the highest level of development among all economies that are subject of this analysis.

## The method of defining different social and economic potential of Central and Eastern European Economies

It is believed that the most useful methods of comparative analysis of the development potential are the methods ensuring common ground for numerous characteristics in the different aspects of the social and economic potential. The linear ordering within the scope of taxonomical methods is one of such tools.

The taxonomical analysis methodology (and more specifically, linear ordering) used in this papers is as follows [Hallwig, Z., Siedlecki J., Siedlecka U., 1997]:

- the subject of examination is a set of Central and Eastern European economies belonging to the European Union, that is Bulgaria, Croatia, Czech Republic, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia, Hungary-  $\Omega = \{\Omega_1, \Omega_2, \dots, \Omega_m\}$ . Due to the specific nature of the Community's economic system based on the concept of the Single European Market [Proniewski, M., Niedźwiecki, A., 2004] with the internal system of economic freedoms and supporting policies, the other countries of this region, that is Albania, Bosnia and Herzegovina, Serbia, Montenegro, Macedonia, Belarus and Ukraine were excluded from the classification presented in this paper;
- a set of analytic variables that describe the development potential of examined national economies  $\Omega = \{X_1, X_2, \dots, X_n\}$ , characterising elements of set  $\Omega$  shall serve as the classification space,
- used variables from set  $X$  should point out to a considerable differentiation level of the economic potential. In order to define, how “strongly” the development differentiation of national economies is defined by selected measures, coefficients of variations are used, that are calculated as a standard deviation of the values in the examination set of analytic variables divided by their arithmetic mean,
- analytical variables are written in a form of a matrix:

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix},$$

where  $i^{th}$  line of  $X$  matrix, that is  $x_i = [x_{i1}, x_{i2}, \dots, x_{in}]$  includes observations of  $n$  number of analytical variables characterising the economic potential of a given country  $\Omega_i (i= 1, 2, \dots, m)$ ,

- variables are uniformed through a transformation of respective ratios – destimulants into ratios which are stimulant. They are then written respectively as:

- stimulant:

$$x'_{ij} = x_{ij},$$

- destimulant:

$$x'_{ij} = x_{ij},$$

while in case of destimulants it is also possible to use – for instance – the following dependence:

$$x'_{ij} = 2\bar{x}_j - x_{ij},$$

where:

$$\bar{x}_j = \frac{1}{m} \sum_{i=1}^m x_{ij}$$

is the arithmetic mean of a given adjusted partial ratio of the development potential used in the analysis of differentiation of the examined national economies.

The adjusted observation matrix  $X'$  of partial ratios of the social and economic potential of individual countries is created on the basis of the calculations made:

$$X' = \begin{bmatrix} x_{11}' & x_{12}' & \dots & x_{1n}' \\ x_{21}' & x_{22}' & \dots & x_{2n}' \\ \dots & \dots & \dots & \dots \\ x_{m1}' & x_{m2}' & \dots & x_{mn}' \end{bmatrix},$$

- f) the adjusted observation matrix  $X'$  is transformed into standard observation matrix of partial ratios of the social and economic potential:

$$Z = \begin{bmatrix} z_{11} & z_{12} & \dots & z_{1n} \\ z_{21} & z_{22} & \dots & z_{2n} \\ \dots & \dots & \dots & \dots \\ z_{m1} & z_{m2} & \dots & z_{mn} \end{bmatrix},$$

while:

$$z_{ij} = \frac{x_{ij}' - \overline{x_j'}}{S_j},$$

where:  $S_j$ - is the standard deviation of the development level,

- g) correlations between individual partial measures of the social and economic potential are defined, which makes it possible to remove variables that are too strongly correlated and variables in case of which interdependence is defined as too low. Thanks to this, the analysis becomes more stable. The value of a correlation, in case of which a given partial measure is not taken into account in the further analysis, is defined by means of the expert method that uses a standard deviation,
- h) respective weights are assigned to the adjusted partial indicators of the development potential (determining the hierarchy of the examined features); weight coefficients  $\alpha_j$  are defined proportionally to their variance; variance weights are calculated according to the following formula:

$$\alpha_j = \frac{V_j}{\sum_{j=1}^n V_j},$$

where the coefficient of variation is expressed with the following dependence:

$$V_j = \frac{S_j}{\overline{x_j'}},$$

- i) synthetic feature  $Z_i'$  is computed for all national economies in order to illustrate the development potential of each one of them:

$$Z_i' = \sum_{j=1}^n \alpha_j z_{ij},$$

- j) for the purpose of a relatively full presentation of the differentiation of the examined national economies, the relative synthetic ratio of the development level  $W_i$ - "economy" is defined for every one of them and it may have values in the interval of  $<0;1>$ ; it is also defined that the higher is its value, the higher development potential is characteristic for an examined economic system:

$$W_i = \frac{\sum_{j=1}^n z_{ij}'}{\sum_{j=1}^n \{z_{ij}'\}},$$

where:

$\{z_{ij}\}$ ,

- k) an entity characterised by the highest development level  $W_{i\max}$  is selected among the examined countries. Thanks to this, a relative “deviation” level from the “best” national economy defined in the ranking list of the values of respective ratios defined for the other countries ( $c_i$ ) is defined:

$$c_i = - \frac{W_{i\max} - W_i}{W_{i\max}},$$

which means by what per cent the value of a relative synthetic development ratio defined for a given economic system is lower than the highest value of such indicator among examined national economies.

### **Analytical variables defining the social and economic potential of the Central and Eastern European economies**

The use of linear ordering for the assessment of economic potential, that gives quite accurate results, depends considerably on substantive selection of analytical ratios that illustrate the differences among individual national economies. In our opinion, the ratios of the development potential used in the analysis should meet the following criteria:

1. selection of analytical features should result from experience related to analysis of social and economic potential,
2. analytical features (diagnostic variables) should point out to different elements of the economic structure of a given state, in particular in the category of possibilities to fulfil social needs perceived both from the perspective of production capacities of companies (in competitive environment) and demand (presented by individual entities),
3. number of features should ensure necessary transparency of the analysis, and at the same time it should ensure a relatively explicit evaluation of the differentiation of the economic conditions characteristic for individual national economies,
4. ratios should be the applied analytical features. Therefore, the analysis should present the problems of efficiency, that is an important issue in the economic examinations, on the one hand,
5. statistical information should be as recent as possible; the analysis should point out to the formation of development processes in a specific time perspective,
6. the analysis should include in particular the variable classified as development stimulants and (or) development destimulants.

The set on analytical variables for the purpose of evaluation of the social and economic potential of the national economies subject to the examination was selected in the basis of an analysis of literature (in general according to the data as of the end of 2015 and 2021). The subject of comparative analysis in this paper are years 2015 and 2021, that is in general the period before the global economic crisis that affected, among other, the countries of Central and Eastern Europe. Therefore, the analysis covered variables that described stable grounds of social and economic development rather than short-term economic situation. Selected variables illustrate the relative economic result, productivity of work and unemployment rate, transport availability (transport infrastructure), satisfaction of social needs as regards environmental protection, housing industry and possibilities of employment, financial potential and openness of the economy. To be more specific, the following variables were initially used in this examination:

1. POPULATION CONNECTED TO WASTEWATER TREATMENT PLANTS,
2. GROSS MONTHLY MINIMUM WAGES AND SALARIES IN PPS (Purchasing Power Standard),
3. UNEMPLOYMENT RATE- total (%)- destimulant,
4. GROSS ENROLMENT RATE (higher education institutions (ISCED 5–8)),
5. EMPLOYMENT IN RESEARCH AND DEVELOPMENT ACTIVITY (researchers per 1000 of total employment),

6. GROSS DOMESTIC EXPENDITURE ON RESEARCH AND DEVELOPMENT ACTIVITY (in % GDP),
7. FIXED BROADBAND INTERNET SUBSCRIBERS (per 1000 population),
8. ELECTRICITY SUPPLY PER CAPITA (in KWh),
9. EXPORTS - fob (current prices, in million USD),
10. GROSS DOMESTIC PRODUCT AT PURCHASING POWER PARITY PER CAPITA (current prices, in international dollars),
11. GROSS DOMESTIC PRODUCTa (current prices, total in billion USD).

Specified variables (after a transformation of a one of the listed features into a stimulant) were left for the further stage of the analysis, while taking account of the research methodology defined above.

Diagnostic variables used in the taxonomical analysis of the economic potential of the examined national economies are presented in the following tables.

**Table 1. Partial measures of the social and economic development (2015)**

Country	POPULATION CONNECTED TO WASTEWATER TREATMENT PLANTS	GROSS MONTHLY MINIMUM WAGES AND SALARIES IN PPS (Purchasing Power Standard)	UNEMPLOYMENT RATE - TOTAL	GROSS ENROLMENT RATE (Higher education institutions (ISCED 5–8))	EMPLOYMENT IN RESEARCH AND DEVELOPMENT ACTIVITY (researchers per 1000 of total employment)	GROSS DOMESTIC EXPENDITURE ON RESEARCH AND DEVELOPMENT ACTIVITY (in % GDP)	FIXED BROADBAND INTERNET SUBSCRIBERS (per 1000 population)	ELECTRICITY SUPPLY PER CAPITA (in KWh)	EXPORTS - fob (current prices, in million USD)	GROSS DOMESTIC PRODUCT AT PURCHASING POWER PARITY PER CAPITA (current prices, in international dollars )	GROSS DOMESTIC PRODUCT (current prices, total in billion USD)
	1	2	3	4	5	6	7	8	9	10	11
Bulgaria	86.80	370.08	90.80	70.30	4.90	0.95	220.89	5 369.00	25 371.00	18 391.90	50.77
Croatia	98.30	586.70	83.80	66.49	4.10	0.83	231.79	4 298.00	12 925.00	23 338.22	50.24
Czech Republic	80.80	504.50	94.90	64.48	7.70	1.92	280.00	6 733.00	157 878.00	33 899.29	188.03
Estonia	88.00	503.05	93.60	72.17	6.90	1.47	296.86	7 202.00	12 836.00	29 175.93	22.89
Lithuania	76.66	467.59	90.90	69.74	6.30	1.04	281.16	4 141.00	25 392.00	28 834.43	41.44
Latvia	77.22	491.99	90.10	74.30	4.20	0.62	252.77	3 681.00	12 286.00	24 972.79	27.26
Poland	94.20	725.70	92.50	66.95	5.30	1.00	188.46	4 328.00	199 124.00	26 822.66	477.11
Romania	47.80	397.67	93.20	46.73	2.40	0.49	214.11	2 990.00	60 595.00	21 624.52	177.88
Slovakia	54.00	537.60	88.50	50.70	5.80	1.16	234.83	5 389.00	75 146.00	30 054.12	88.90
Slovenia	91.70	919.10	91.00	80.26	8.80	2.20	273.46	7 267.00	31 929.00	31 628.25	43.11
Hungary	76.59	551.84	93.20	48.96	5.90	1.34	276.18	4 505.00	98 524.00	26 798.85	125.17

Source: own analysis on the basis of 'International Statistics Yearbook 2023'.

**Table 2. Partial measures of the social and economic development (2021)**

Country	POPULATION CONNECTED TO WASTEWATER TREATMENT PLANTS	GROSS MONTHLY MINIMUM WAGES AND SALARIES IN PPS (Purchasing Power Standard)	UNEMPLOYMENT RATE- TOTAL	GROSS ENROLMENT RATE (Higher education institutions (ISCED 5–8))	EMPLOYMENT IN RESEARCH AND DEVELOPMENT ACTIVITY (researchers per 1000 of total employment)	GROSS DOMESTIC EXPENDITURE ON RESEARCH AND DEVELOPMENT ACTIVITY (in % GDP)	FIXED BROADBAND INTERNET SUBSCRIBERS (per 1000 population)	ELECTRICITY SUPPLY PER CAPITA (in KWh)	EXPORTS - fob (current prices, in million USD)	GROSS DOMESTIC PRODUCT AT PURCHASING POWER PARITY PER CAPITA (current prices, in international dollars )	GROSS DOMESTIC PRODUCT (current prices, total in billion USD)
	1	2	3	4	5	6	7	8	9	10	11
Bulgaria	90.40	597.51	94.70	73.38	5.40	0.77	327.28	5 590.00	41 157.00	28 113.12	84.04
Croatia	96.50	790.44	92.50	67.72	5.80	1.24	258.24	4 700.00	21 878.00	34 721.87	69.00
Czech Republic	84.70	749.30	97.20	65.59	9.50	2.00	375.70	6 910.00	226 564.00	45 630.04	281.79
Estonia	88.00	672.00	93.80	74.23	8.70	1.77	374.43	7 390.00	21 541.00	43 476.85	37.19
Lithuania	79.80	894.17	92.90	72.01	8.40	1.10	287.93	4 740.00	40 706.00	43 796.78	66.80
Latvia	80.90	626.01	92.40	94.86	5.50	0.75	261.38	4 070.00	20 833.00	35 018.45	39.44
Poland	96.90	1 021.83	96.60	69.18	8.40	1.43	226.57	4 690.00	340 634.00	38 134.83	681.35
Romania	58.30	824.55	94.40	51.35	2.50	0.47	315.63	3 170.00	87 388.00	36 277.32	285.40
Slovakia	57.00	694.05	93.20	46.43	6.90	0.92	325.77	5 590.00	103 891.00	34 528.66	118.58
Slovenia	96.50	1 163.22	95.20	77.88	11.60	2.13	316.92	7 230.00	57 352.00	43 974.22	61.83
Hungary	83.50	657.71	95.90	52.44	9.60	1.64	348.32	5 020.00	141 830.00	36 773.31	182.09

Source: own analysis on the basis of 'International Statistics Yearbook 2023'.

## Results of the analysis of the social and economic potential of Central and Eastern European economies

The relative synthetic ratios of the level of social and economic development of Central and Eastern European economies and the positions of these systems in a respective decreasing ranking list were defined by means of a taxonomical method – linear ordering, as defined in the beginning of this paper. They are presented in Table 3 and Chart 1 and Chart 2.

**Table 3. Relative synthetic ratios of the level of social and economic development – changes (2015 vs. 2021)**

Country	Relative synthetic ratio of the level of social and economic development (2015)	Relative synthetic ratio of the level of social and economic development (2021)	change	Position in the ranking list in 2015	Position in the ranking list in 2021	change
Bulgaria	0.3367	0.3354	-0.0012	9	7	2
Croatia	0.3164	0.3258	0.0093	10	8	2
Czech Republic	0.7220	0.7157	-0.0063	2	1	1
Estonia	0.6017	0.5525	-0.0492	3	4	-1
Lithuania	0.4490	0.4172	-0.0318	6	6	0
Latvia	0.3399	0.2783	-0.0616	8	10	-2
Poland	0.5988	0.6562	0.0574	4	3	1
Romania	0.1840	0.2355	0.0516	11	11	0
Slovakia	0.3768	0.2815	-0.0954	7	9	-2
Slovenia	0.7572	0.7108	-0.0464	1	2	-1
Hungary	0.4825	0.4896	0.0071	5	5	0

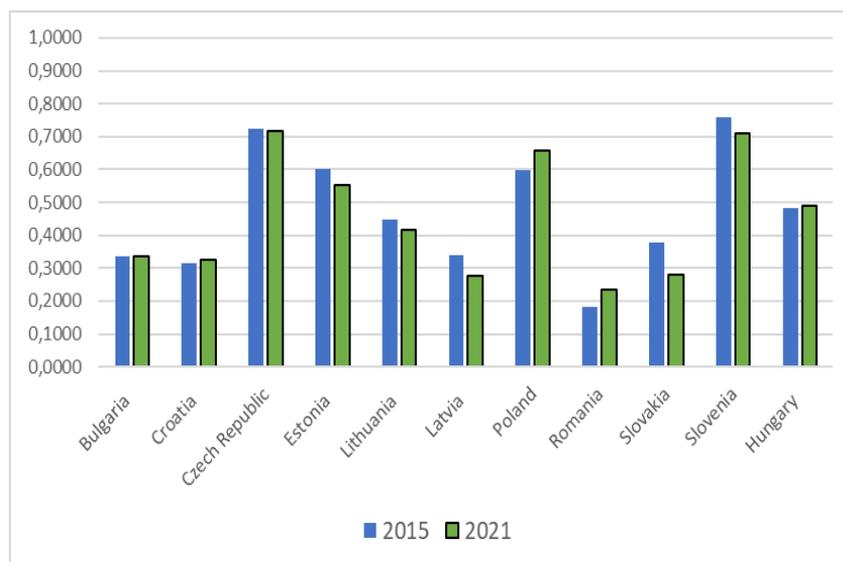
Source: own analysis on the basis of Tables 1 and 2.

The analysis shows that Slovenia has the considerably highest economic potential as compared to the Central and Eastern European countries. Among other countries characterised by a quite high social and economic potential (by means of the technique based on standard deviation) one may also list the economies of the Czech Republic, Poland, and Estonia, that were characterised by a relatively high potential for years 2015 and 2021. The Estonian example is very significant, since as of the end of 2007, Estonia qualified together with Slovenia to the group of economies characterised by the relatively highest social and development potential. In case of this country, the stable development grounds had an impact on the Estonian accession to the Economic and Monetary Union on 1 January 2011. The ranking position of Hungary also improved in the examined period,

since the country moved from a group characterised by an average development potential to the group with relatively high capabilities of development. The remaining countries are characterised by a relatively “poor” development potential and the relatively lowest level is typical for the Romanian economy, which reflects, to a certain extent, the ranking list prepared by the European Commission for the whole European Union.

While comparing the presented measures of the social and economic potential of Central and Eastern European countries, it should be stated that the analysis points out to a relatively high level of differentiation among them, with a significant predominance of the values of respective ratios of Slovenia as compared to the ratios calculated for the other economic systems. As it is believed, it may be related not only to the “small scale effect” that is characteristic for this economy, but mainly to its significant external openness and financial stability, which resulted in Slovenia’s accession to the Euro zone as from 1 January 2007.

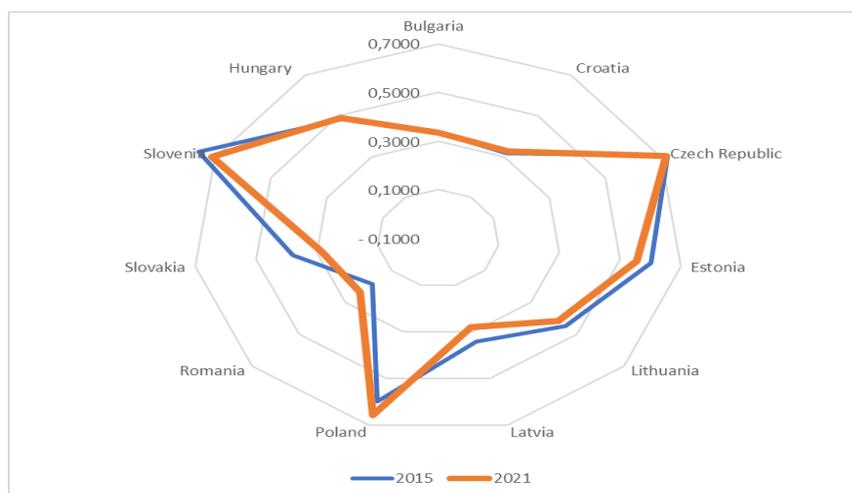
On the basis of the conducted analysis it should be also noted, that in case of comparisons 2015 vs. 2021 one may observe a general tendency (with some exceptions) of growth of the value of individual synthetic efficiency ratios which move towards balancing development disproportions in the international scale in case of the Central and Easter European countries that are EU Member States. This is related to a dualism of opinions on the shape of the EU policy of international competitiveness that emphasize an absolute need to undertake actions aimed at balancing development disproportions within the group, also within the scope of the implemented regional policy, and on the other hand – underlying the activating role of relatively well developed countries [Dębski, J., 2001]. In our opinion, the problem is even more up-to-date in 2021 (and 2025), that is in the post-crisis circumstances in the global scale, while crisis symptoms are still visible in some EU economies (so called PIGS).



**Fig. 1. Relative synthetic ratio of the social and economic development in 2015 and 2021**

*Source: own analysis on the basis Tables 1, 2 and 3.*

It should be mentioned that in the context of comparison of the results of development potential analysis as of the end of 2015 and 2021, a specific polarity characterising the regional economic structures in Central and Eastern Europe was maintained, with a predominant role of the bigger economies (including Poland), that are not however so effective and so satisfactory in regard to social needs as smaller countries (in particular Slovenia).



**Fig. 2. Relative synthetic ratio of the social and economic development level in 2015 and 2021, radar chart (scale of 0.7000)**

Source: own analysis on the basis Tables 1, 2 and 3.

In result of the analysis conducted, one may notice certain changes in the ranking positions of quite big national economies (Poland, Hungary) that are also active in the field of policy conducted in (and by) the European Union and commonly recognized as important for the region. In our opinion, in spite of a considerable absolute economic potential, those countries are insufficiently competitive in the contexts of efficiency comparisons with smaller countries, in particular those that are members of the Economic and Monetary Union.

## Conclusions

To sum up, one should state that the linear ordering as a taxonomical method may be a relatively simple tool of measurement of social and economic potential, that at the same time yields explicit results. The analysis proves that development processes took place in the economies of the Central and Eastern Europe in 2015-2021. In result of such processes a relative (although) small reduction of development disproportions (distances of synthetic measures) among individual economic systems took place. However, changes in the potential of individual countries in the examined period were not strong enough to result in changes in a strongly polarised efficiency system in the examined economic space.

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