THE INFLUENCE OF THE ECONOMIC SITUATION ON THE SOCIO-ECONOMIC DEVELOPMENT IN THE EUROPEAN UNION COUNTRIES BY MEANS OF THE MODIFIED HDI INDEX

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Abstract: The aim of the research is an analysis of the influence of the economic indicators on the socio-economic development of EU countries. The synthetic measure of socio-economic development is calculated by means of the following determinants: 'Economy and Finance', 'Science and Technology', 'Health', 'Education' and 'Living Conditions'. This index of the socio-economic development of residents of the European Union countries has been created as an arithmetic mean of indicators, counted for particular determinants. The index, which has been created, is treated as a modified Human Development Index due to the fact that it is completed with the added information. The data has been collected from the Eurostat for the years 2006–2016. In the second part of the research there have been developed the models for the synthetic measure of socio-economic development in terms of particular economic indicator, used in the analysis, as well as the analysis of the relationship between the synthetic measure of socio-economic development in EU countries, and the selected economic measures: unemployment rate, GDP per capita, indicator of real expenditure per capita, and the percentage of people at risk of poverty. The results are obtained, using the Statistica 12 program.

Keywords: socioeconomic development, Human Development Index, synthetic measure.

1. Introduction

The measure of a country's development is one of the most critical and highly debated issues in economic research [1]. However, the first issue that should be addressed in considering the essence of socio-economic development is the information that development is more than just the economic growth of a given country. Therefore, non-economic factors should also be included in research on this topic. Development, as a concept, is ambiguous and is used in variety of contexts. It is, first and foremost, understood as a chain of on-going targeted and irreversible changes in the structures of complex bodies, i. e., systems [2]. Human development finds its theoretical underpinnings in Sen's capabilities approach which holds "a person's capability to have various functioning vectors and to enjoy the corresponding well-being achievements" to be the best indicator of welfare [3, 4].

The Human Development Index (HDI) is one of the most commonly used measures of socio-economic development [5]. Until 2010, HDI was calculated according to the following procedure – it consisted of three components [6, 7]:

– Gross domestic product per capita;
– Estimated length of human life;
– Citizenship level of education

$$I = \frac{P_f - P_{\min}}{P_{\max} - P_{\min}}, \tag{1}$$

where I – general index formula; P_f – actual value of the variable; $P_{\min}$ – minimum value of the variable; $P_{\max}$ – maximum value of the variable.

$$HD1 = \frac{1}{3}I_{le} + \frac{1}{3}I_e + \frac{1}{3}I_{PKB}, \tag{2}$$

where I_{le} – life expectancy index; I_e – educational index; I_{PKB} – index for GDP per capita.

In 2010, the HDI calculation method was changed. Currently, it is calculated on the basis of four diagnostic variables: average life expectancy, national income per capita, calculated according to purchasing power parity, the average number of years of education and the share of people who could read and write with understanding. However, researchers believe the index needs further modification [2, 3, 6]. Gross domestic product (GDP) or any other aggregate, computed per capita may not provide an accurate assessment of the situation, in which most people find themselves [12].

In an effort to construct a more comprehensive measure of socio-economic development in this paper, the following determinants of socio-economic development will be used:

1. Economy and Finance.
2. Science and Technology.
3. Health.
4. Education.
5. Living Conditions.

The aim of the research is an attempt to assess the impact of the economic situation on the synthetic indicator of socio-economic development of EU countries, based on the estimation of the model, in which the synthetic measure will be a dependent variable. The implementation of the objective required the use of descriptive statistical methods, in particular, the linear regression method. The Pearson's linear correlation coefficient was also used to study the relationship between quantitative variables.

2. Materials and Methods

The construction of the synthetic measure of development requires that the diagnostic variables are grouped as either stimulants or destimulants. The variables, included in the set of stimulants, have been marked with the sign (+), while the (–) denote destimulants.

The synthetic measure of socio-economic development will be calculated by the following formula:

$$u_i = \frac{1}{r}\sum_{q=1}^{r} u_{iq}, (i = 1,...,n; q = 1,...,r), \tag{3}$$

where u_{iq} – synthetic variable value for the i-th country, calculated on the basis of variables, belonging to the q-th determinant; r – number of determinants.

The following variables will be used for the construction of indicators for each individual determinant of the quality of life:

I. Economy and Finance

1. Unemployment rate (–).
2. GDP per capita 1 (+).
3. Real consumption expenditures per 1 inhabitant (+).
4. The number of poor people per 1000 inhabitants (–).

II. Science and Technology

1. Gross domestic expenditure on R&D (% of total expenses) (+).
2. Human resources in science and technology (% of the active population) (+).

3. Number of patent applications, submitted to the state-sanctioned patent-governing office per million inhabitants (+).
4. Number of researchers per 1000 inhabitants (+).

III. Health

1. Subjectively-perceived long-standing limitations in usual activities due to the health problem (–).
2. Self-reported unmet needs for medical care due to being too expensive (–).
3. Healthy life years (+).
4. Number of doctors per 1000 inhabitants (+).
5. Number of beds in hospitals per 100 000 inhabitants (+).

IV. Education

1. Participation rates in education and training (persons aged 25 to 64 years old) (+).
2. Percentage of people with at most high school education and with no education beyond the age of 18–24 years old (–).
3. Percentage of people, obtaining college education between the age of 20 and 24 years old (+).
4. Percentage of people with a college degree aged 15 to 64 (+).
5. Percentage of people with high-school education between the age of 15 to 64 (+).

V. Living Conditions

1. Percentage of people who are unable to meet unexpected financial expenses (–).
2. Percentage of people who are unable to make 'ends meet' (–).
3. Percentage of people at risk of poverty (–).
4. Share of people, living in under-occupied dwellings (+).

3. Research results

Table 1 presents the values of Pearson's linear correlation coefficients between the economic indicators and the synthetic measure of socio-economic development of EU countries. The following economic indicators were used in the research: unemployment rate, GDP per capita, indicator of real expenditure per capita and percentage of people at risk of poverty.

The analysis shows that GDP per capita has a strong, statistically significant effect on the synthetic measure of socio-economic development. This is demonstrated by the value of the Pearson linear correlation coefficient (0.75). To a similarly high degree (0.77), the indicator of socio-economic development is affected by the indicator of real expenditure per capita. In the case of unemployment rate it was obtained, that this variable had the moderate, negative impact on the synthetic measure of socio-economic development (–0.44). The synthetic indicator of the percentage of people at risk of poverty has the greatest negative impact on the synthetic measure of socio-economic development, for which the Pearson's linear correlation coefficient was obtained at the level of –0.68.

In **Fig. 1–4**, estimated linear regression functions are presented, in which individual economic indicators are independent variables of the model, while the created synthetic measure has become a dependent variable. In this way, we obtain information on how the increase of the independent variable by 1 affects the dependent variable of the model.

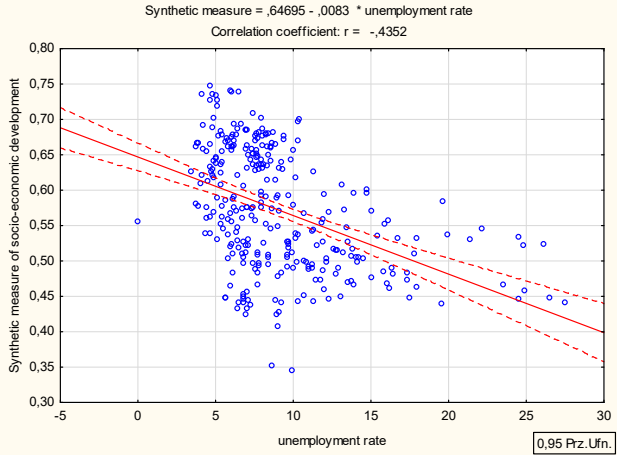

Fig. 1. Regression function parameters – synthetic measure in terms of unemployment rate
Source: author's calculations

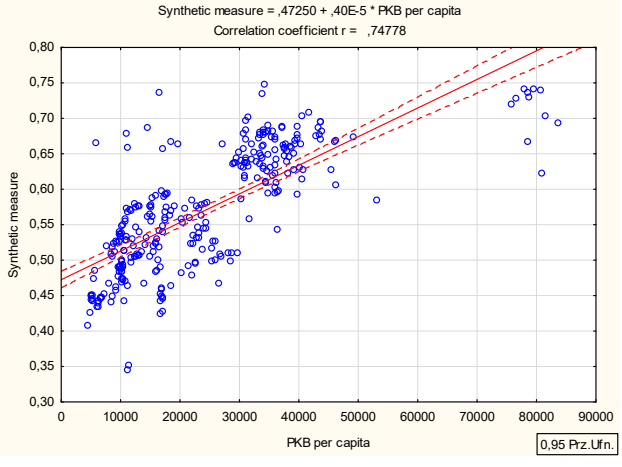

Fig. 2. Regression function parameters – synthetic measure in terms of GDP per capita
Source: author's calculations

Table 1
Correlation coefficients between economic indicators and synthetic measure of socio-economic development in EU countries

Variable	Correlations (marked correlation coefficients are statistically significant for p<0.05)				
	Unemployment rate	GDP per capita	Indicator of real expenditure per capita	Percentage of people at risk of poverty	Synthetic measure of socio-economic development
Unemployment rate	1.00	–0.31	–0.32	0.27	–0.44
GDP per capita	–0.31	1.00	0.86	–0.45	0.75
Indicator of real expenditure per capita	–0.32	0.86	1.00	–0.47	0.77
Percentage of people at risk of poverty	0.27	–0.45	–0.47	1.00	–0.68
Synthetic measure of socio-economic development	–0.44	0.75	0.77	–0.68	1.00

Source: author's calculations

Models of regression functions (presented in **Fig. 1–4**) allowed obtaining estimated parameters for each of the economic measures, used in this analysis. Their interpretation will allow stating if the synthetic measure increases or decreases, if each variable increases by 1. This will allow estimating which determinant has the greatest impact on the socio-economic development of EU countries.

The models of regression functions (presented in **Fig. 1–4**) provide estimates of marginal effects for each of the particular economic indicator, as well as the model fit statistics. The marginal effects reveal the expected magnitudes of change in the synthetic measure, associated with one unit increases in the value of each variable used. The model fit statistics allows assessing which of the economic indicators has the greatest individual ability to predict the socio-economic development of EU countries. It can be observed, that the indicator of real expenditure per capita (r=0.77) and GDP per capita (r=0.75) have the greatest impact on socio-economic development.

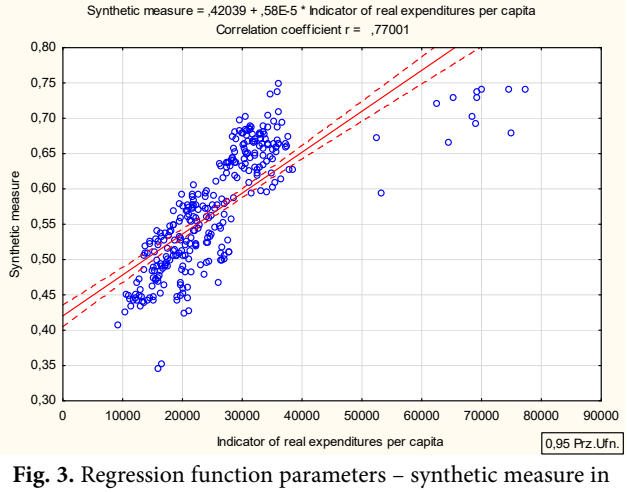

Fig. 3. Regression function parameters – synthetic measure in terms of indicator of real expenditure per capita
Source: author's calculations

The estimated marginal effects reveal that a one unit increase in measurement of the determinant is expected to decrease in the synthetic measure by 0.008, if the unemployment rate is a determinant. The estimated marginal effects reveal that a one unit growth in measurement of the determinant is expected to increase in the synthetic measure by 0.00004, if GDP per capita is the determinant. The estimated marginal effects reveal that a one unit increase in measurement of the determinant is expected to increase in the synthetic measure by 0.00006, if the real expenditure per capita is the determinant. The estimated marginal effects reveal that a one unit increase in measurement of the determinant is expected to decrease in the synthetic measure by 0.005, if the people at risk of poverty are the determinant.

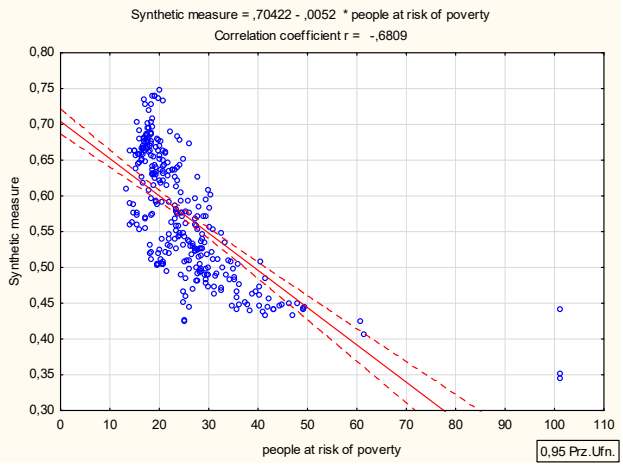

Fig. 4. Regression function parameters – synthetic measure in terms of people at risk of poverty
Source: author's calculations

4. Discussion

On the basis of Eurostat data from the years 2006–2016, an attempt was made to assess the impact of the selected economic measures: unemployment rate, GDP per capita, indicator of real expenditure per capita, percentage of people at risk of poverty on the socio-economic development of the European Community countries. In pursuing the goal of the publication, a research hypothesis that economy has the positive impact on the living standards of EU residents was adopted. The synthetic meter, characterizing the standard of living, was created on the basis of selected determinants: Economy and Finance; Science and Technology; Health; Education and Living Conditions.

It can be observed, that the indicator of real expenditure per capita (r=0.77), followed by GDP per capita (r=0.75), has the greatest impact on the socio-economic development of EU citizens. The results of the correlation analysis indicate a high level of correspondence between GNP per capita and various composite social indices [12]. The unemployment rate has the negative impact (r=–0.44) on the socio-economic development of EU residents. The percentage of people at risk of poverty has the greatest negative impact (r=–0.68) on the socio-economic development. Action against poverty is needed in all developing regions [13]. EU governments should allocate funds to combat poverty.

It is planned to develop the research about socioeconomic development in the European Union countries by using a multi-equation model.

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