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Social Aspects of Sustainable Competitiveness in the Selected European Countries in the Period 2012–2015

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Abstract The paper examines the impact of the social dimension of sustainable competitiveness on the economic dimension, where the social dimension is represented by Indicators of social sustainability, and economic dimension by the Global competitiveness index, GCI. This allows for the identification of various Indicators of social sustainability and their individual and aggregate impact on GCI, which allows for identifying strengths and weaknesses in building competitiveness (from social aspect) and gives recommendations for strengthening and improving competitiveness of the observed group of countries. In this regard, impact model of indicators of social sustainability on GCI is defined, and examined based on a sample of 30 European countries. Data in WEF Global Competitiveness Report for for 2012, 2013, 2014, 2015, 2016 and 2017 was used. Analysis included two sets of countries with data on: 17 old free market economy countries in Europe (Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK) and 13 post transition free market economy countries in Europe on the basis of the economic historical background (Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovak Rep., Slovenia).

Keywords Sustainable development · Sustainable competitiveness · Social dimension of sustainable competitiveness · Economic dimension of sustainable competitiveness · Indicators of social sustainability · GCI

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1 Introductory Remarks

Category of competitiveness is widespread in economic literature. An impressive number of theorists has been explaining it for years, seeking to better clarify the issues of crucial importance both for the growth of economic wealth and the ways of its distribution (Guarini and Porcile 2016; Sener and Saridogan 2011; Ülengin et al. 2011; Kwasnicki 2013). Due to the complexity of the concept, the diversity of factors, and the nature of the competitive process, the category of competitiveness is often very difficult to understand (Delgado et al. 2012).

Economic theorists have no single position that the level at which competitiveness is perceived is the most important aspect of this phenomenon (Annoni and Kozovska 2010; Kitson et al. 2004). In this regard, one usually makes a distinction between micro and macro competitiveness. Competitiveness at the micro level refers to the ability of firms to compete, to grow, and be profitable (Meyer-Stamer 1995; Yang et al. 2015). Competitiveness at the macro level is usually identified with the potential of the country to produce and sell goods and services to foreign markets, and is expressed by the dynamics of growth of real gross domestic product per capita (Marginean 2006; Fagerberg et al. 2007). In short, macro-competitiveness is about the country's ability to achieve faster economic growth than other countries and to increase the well-being with a change in the structure of the economy that allows for its efficient adaptation to international exchange trends (Zubović and Bradić-Martinović 2014).

Almost all definitions of competitiveness highlight the country's ability to achieve sustainably high economic growth rates of GDP per capita and the ability to produce goods and services that meet the test of the world market. In line with the diversity of the concept of competitiveness, different approaches to measuring competitiveness have arisen (Annoni and Dijkstra 2013; Snieška and Bruneckiene 2009; Naceur et al. 2012; Wu et al. 2014). In general, one can distinguish between two options in quantifying the country's competitiveness. The first is based on the movement of real gross domestic product per capita or productivity growth, and the second on determining the performance of observed countries in international trade. Regardless of the disagreement among a large number of economic theorists on the issue of quantifying the category of the country's competitiveness, the fact is that, over the last 30 years, this issue has been increasingly popular not just in theory but also in empirical studies (Porter et al. 2008).

Lately, however, the focus is more and more on the category of sustainable competitiveness of countries (Bilbao-Osorio et al. 2013; Sala-i Martin et al. 2013; Thore and Tarverdyan 2016), which is, in a way, a logical consequence of the fact that the concept of sustainable development has become a new development philosophy at all levels. This practically means that the category of the country's competitiveness, initially conceived primarily in economic terms, spread its reach to include the increasing number of environmental and social aspects of sustainable development (Despotovic et al. 2015; Cvetanovic et al. 2014). Thus, the category of sustainable competitiveness of the country, in addition to the growth of gross domestic product per capita, includes requirements for the growth of living standards while reducing inequality in the distribution and responsible attitude of people towards the environment (Milanovic 2007; Thorbecke and Charumilind 2002; Ambec et al. 2011).

The objectives of the concept of sustainable competitiveness are: understanding the importance of sustainable competitiveness as a key holder of sustainable prosperity, understanding the nature of relationships between determinants of long-term economic growth

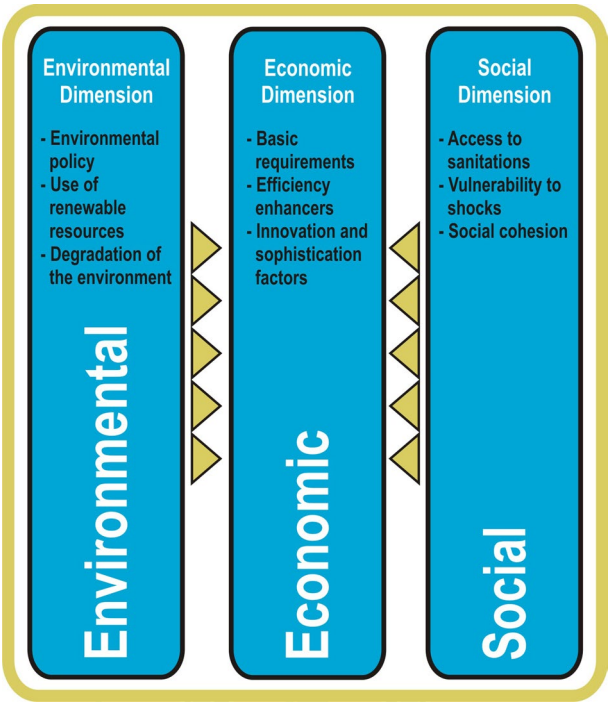


Fig. 1 Three dimensions of sustainable competitiveness

and social and environmental sustainability, providing preliminary comparative assessment of the situation in individual countries relating to various elements of sustainable competitiveness and focus on the lack of high-quality data that would enable countries to fully understand how to make progress in these critical areas. Without improving the quality and availability of data on sustainability, the country will have difficulty in monitoring the growth or decline of prosperity and quality of life of its citizens, and, therefore, will find it difficult to determine the appropriate policy (Schwab and Sala-i Martín 2011).

The results obtained in the work by Despotovic et al. (2015), dedicated to the research of the impact of social and environmental dimensions on the economic dimension of sustainable competitiveness of 34 European countries (Fig. 1), show a positive impact of social sustainability on the economic dimension, i.e. global competitiveness (impact factor 0.6436), and much lower positive impact of environmental sustainability (impact factor 0.0025) on the economic dimension.

Authors concluded an evident and rather worrying imbalance between the impact of social and environmental dimensions of sustainability (in favor of the first-mentioned) on the economic component, so that, according to them, this aspect of research into the category of sustainable competitiveness of countries must be the subject of more detailed future analyses (Despotovic et al. 2015).

The research subject in this paper is the social dimension of sustainable competitiveness, as seen, starting from 2011 to the present day, in the World Economic Forum reports (Crotti 2012, 2013, 2014). The parameters for examining the social dimension of sustainable competitiveness of countries are: Income Gini index, Youth unemployment, Access to sanitation, Access to improved drinking water, Access to health care, Social safety net protection, Extent of informal economy, Social mobility, and Vulnerable employment

(Schwab and Sala-i Martín 2011). The key research question is whether and to what extent the requirement for social sustainability of competitiveness of countries affects the economic dimension of this phenomenon.

The paper is structured as follows. After introductory remarks in a separate part, the critical presentation of nine indicators of social sustainability based on the methodology of the World Economic Forum is given. Within the next subheading, the authors' model is presented, by which the impact of the social dimension of competitiveness on the economic dimension of sustainable competitiveness is examined, following the case of the 17 old free market economy countries in Europe (Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK) and the 13 post transition free market economy countries in Europe on the basis of the economic historical background (Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovak Rep., Slovenia) in the period 2012–2017. This makes it possible to identify different Indicators of social sustainability and their individual and aggregate impact on GCI, which allows to establish strengths and weaknesses in building competitiveness (from the social aspect) and make proposals for strengthening and improving competitiveness of the observed group of countries.

Division in old and post transition Europe countries is based on thinking that in terms of competitiveness, but even more in terms of social structure these two groups still considerable differ (Despotović et al. 2016; Fenger 2007; Paldam and Svendsen 2000; Zinnes et al. 2001) regardless of their measurable indicators about reached level of economy and social sustainable competitiveness.

2 Sustainable Competitiveness: The Methodology of the World Economic Forum

The Global Competitiveness Report 2011–2012 (Schwab and Sala-i Martín 2011), in addition to GCI, also presents a Sustainability-Adjusted Global Competitiveness Index—SGCI. This index is introduced in its preliminary version with emphasis on the analysis of social and environmental elements that maintain high levels of long-term economic competitiveness. The index includes mainly all the elements presented in the GCI, which are important for understanding the competitiveness of countries in the short and long term (governance, education and health, infrastructure, the functioning of markets and innovation), but also a number of additional indicators (demography, social cohesion, environmental management). In this way, GCI is a short-term and medium-term view of the future, while the Sustainability-adjusted GCI presents a long-term view (for 20 years) on the phenomenon of competitiveness of countries. Such an approach makes it possible to highlight the link between competitiveness and sustainability (Fig. 2).

The ultimate sustainability (according to the analytical framework) is the result of two indices of sustainability: social sustainability-adjusted GCI and Environmental sustainability-adjusted GCI. For the pillar of social sustainability, the three following conceptual elements are defined: access to essential needs, economic exclusion, and social cohesion. For the pillar of environmental sustainability, the following three conceptual elements are defined: environmental policy, the use of renewable resources, and the degradation of the environment.

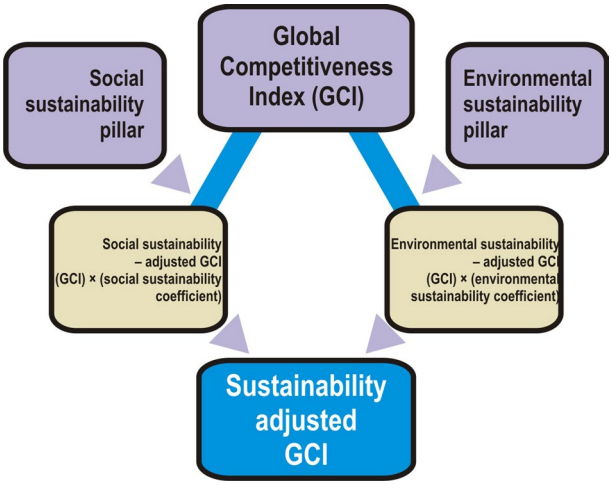


Fig. 2 The analytical framework of the sustainability-adjusted GCI [Modified according to Bilbao-Osorio et al. (2013), p. 52]

Presentation of the analytical framework in Fig. 2 indicates that competitiveness alone does not necessarily lead to a sustainable level of prosperity. The realization of economic progress is essential for improving living standards. However, within this process the ability of countries to generate prosperity for its citizens in a sustainable manner is assessed. In other words, competitiveness is a necessary but not a sufficient condition for social prosperity. Hence, there is a need for measures of competitiveness that are tailored to the requirements of social and environmental sustainability.

The methodology for measuring sustainable competitiveness index is based on the premise of a linear impact of socially sustainable and environmentally sustainable dimension of competitiveness. The result is a Sustainability-adjusted GCI as the average of Social sustainability-adjusted GCI and Environmental sustainability-adjusted GCI. Social and environmental dimensions of sustainability are treated as independent adjustments for the performance of each country in the global competitiveness index.

Since there is no clear theoretical guidance for assigning weights to individual elements, indicators were given equal weight within each pillar. Each pillar was transformed into an "adjustment coefficient" with a range of 0.8–1.2, which is then used to match the results of the global competitiveness index up or down within this range. This is manifested in a harmonized result that is maximum 20% lower or 20% higher than the basic value of the global competitiveness index.

Due to the fact that some of the aspects of sustainability are assessed within the pillars of social and environmental sustainability, the results reflect the overall performance of all aspects instead of a particular element. In a sense, this means that the poor performance in some aspects can be compensated by good results in other areas. For social sustainability, the Forum identifies three conceptual elements (Fig. 3).

Typically, higher levels of competitiveness lead to higher levels of economic growth, and, therefore, to prosperous societies, increasing the well-being of the population that can consume more accessible goods and services. However, in some cases—when the generated wealth does not reach some parts of the population, higher levels of competitiveness must not necessarily lead to higher levels of social sustainability. The societies in which parts of the population cannot contribute to economic activity, or where income disparities

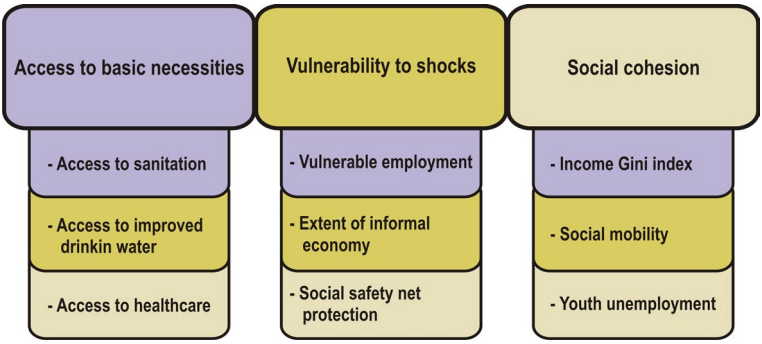


Fig. 3 Indicators of social sustainability. (*Source*: Bilbao-Osorio et al. 2013, p. 55)

are very high, are societies that probably do not benefit from the full potential of their resources and are more prone to social instabilities.

3 Subject and Research Methodology

Starting from the above theoretical and methodological framework, the subject of this study is to establish the impact of the social dimension of competitiveness on the economic dimension of sustainable competitiveness, where the social dimension is represented by: Indicators of social sustainability, and economic dimension by GCI.

Accordingly, the impact model of Indicators for social sustainability on GCI is defined, and examined based on a sample of 30 European countries (Fig. 4).

Analysis included two sets of countries with data for 2015 to 2017 (for GCI Rank), as shown in Table 1):

- (1) Group of 17 old free market economy countries in Europe (hereinafter named Western Europe), based on the economic historical background (Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK), and
- (2) Group of 13 post transition free market economy countries in Europe (hereinafter named Post transition Europe), also based on economic historical background (Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovak Rep., Slovenia).

The survey was conducted in the following 3 steps:

- search and analysis of the reference framework and the data is carried out,
- the data is then filtered, aggregated, and structured according to the needs of further analysis,
- analysis of validity of data obtained, application of statistical tools, and analysis of model significance are carried out.

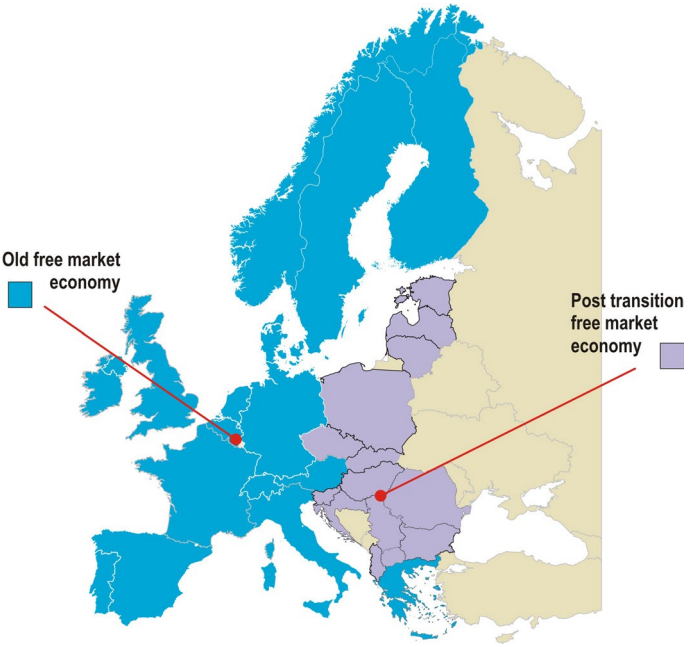


Fig. 4 Map of countries

Based on the analyzed literature, and the presented WEF analytical framework of the sustainability-adjusted GCI (Fig. 2), our impact model includes the following variables:

- For Social dimension of sustainability competitivenes (indicators of social sustainability)
  - S01—Income Gini index
  - S02—Youth unemployment
  - S03[1]—access to sanitation
  - S04—Access to improved drinking water
  - S05—Access to healthcare
  - S06—Social safety net protection
  - S07—Extent of informal economy
  - S08—Social mobility
  - S09—Vulnerable employment
- For Economic dimension of sustainability competitivenes
  - GCI–global competitivenes index

Figure 5 shows the initial impact model of Indicators of social sustainability on GCI. In this model, variable Y is defined as the aggregate rate of economic dimension of sustainable competitiveness.

[1] Variables S03.01, S03.02, and S03.03 are combined to form one single variable

Table 1 Two groups of countries—rank according to competitivenes

EU old free market economy countries				EU post-transition free market economy countries			
Country	(1)	(2)	(3)	Country	(1)	(2)	(3)
Austria	18	9	10	Bulgaria	49	41	45
Belgium	20	14	16	Croatia	74	55	59
Cyprus	64	48	38	Czech Rep.	31	24	25
Denmark	12	10	7	Estonia	29	25	24
Finland	10	3	4	Hungary	60	38	43
France	22	18	19	Latvia	54	26	32
Germany	5	4	5	Lithuania	41	27	30
Greece	87	62	68	Macedonia	68*	64	54
Ireland	24	20	21	Poland	39	34	39
Italy	43	40	42	Romania	68	53	53
Netherlands	4	5	3	Serbia	78	73	76
Norway	11	2	2	Slovak Rep.	59	43	49
Portugal	42	32	34	Slovenia	48	30	35
Spain	34	29	31				
Sweden	7	7	9	*GCI Report 2016–2017			
Switzerland	1	1	1				
UK	8	11	14				

(1) GCI Rank according GCI Report 2017–2018 of 137 countries

(2) Sustainability-adjusted GCI Rank 2014–2015 of 113 countries

(3) Social sustainability- adjusted GCI Rank 2014-2015 of 113 countries

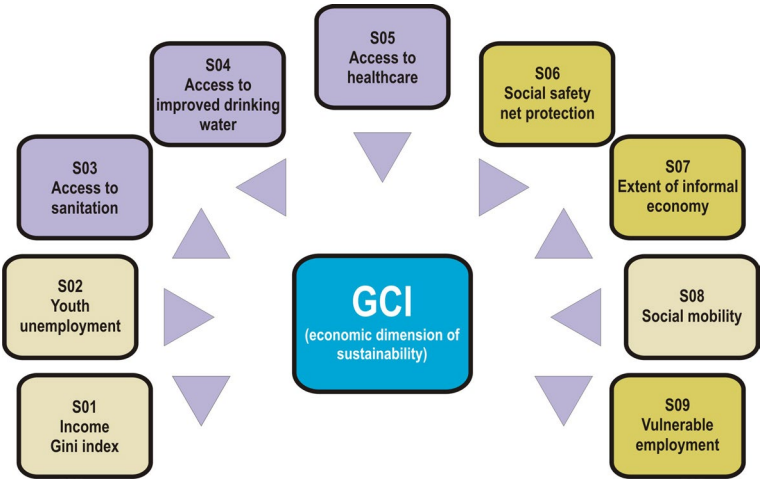


Fig. 5 Impact model of indicators of social sustainability on GCI

On the basis of the set initial impact model of Indicators of social sustainability on the economic dimension of sustainability, dependence of Y (GCI) on independent variables (variables X_1 to X_n) is defined. The basic hypothesis on the synergistic effect of Indicators of social sustainability on GCI is established.

Despite the various interpretations of the impact of well-being as an indispensable element of an efficient and competitive economy, we consider that, in terms of European countries, well-being is a key element of its global competitiveness. Strategically European competitiveness is in long-term based on innovation and, accordingly, human resources. We believe that social sustainability on the other hand has a key influence on the quality of human resources in a modern economy.

H0: The achieved level of Indicators of social sustainability (variables X_1 to X_n) has significant impact on endogenous variable, basic competitiveness (GCI-Y), in both groups of countries.

The hypothesis H0 is based on the assumption that improving the indicators of social sustainability has a positive impact on the based competitiveness (which is represented by the global competitiveness index—GCI). Looking at the Indicators of social sustainability at the first glance (Fig. 3), it seems that a strong positive relationship is undoubted (Schwab 2017; Luthans and Youssef 2004). However, it is more than intriguing when we consider, shall we say, mainstream perception that economic growth does not reflect the desired outcomes for society as a whole, as evidenced by the current social tensions in Europe.

In addition to the starting hypothesis, additional hypothesis is set, which should point to the significance of the impact of each individual Indicator of social sustainability on GCI:

H1: Desirable change in the level of each individually observed Indicator of social sustainability has a positive impact on increasing the level of competitiveness (GCI) in both groups of countries.

4 Research

In order to examine the character and significance of correlation between GCI and Indicators of social sustainability, we have opted for the use of panel data linear regression analysis according to the mentioned formula below.

$$Y_{i,t+l} = a_i + \sum_{j=1}^{9} b_{i,j} X_{j,t} \tag{1}$$

where i—observing country, t—time of observation, l—time lag between measurements of independent and dependent variable, a_i, $b_{i,j}$ (j = 1–9)—constants obtained by multiple regression, Y—GCI, X_1—income Gini index, X_2—youth unemployment, X_3—access to sanitation, X_4—access to improved drinking water, X_5—access to healthcare, X_6—social safety net protection, X_7—extent of informal economy, X_8—social mobility, X_9—vulnerable employment

Analysis would, among other things, require the involvement of the time dimension and the investigation of the so-called lag effect. This would require processing of the time shifted data (data used for the calculation of independent variables should be taken from the period preceding the time period from which the data for dependent variables is taken).

Statistical analysis procedure was realized for every considered group of countries in 3 steps:

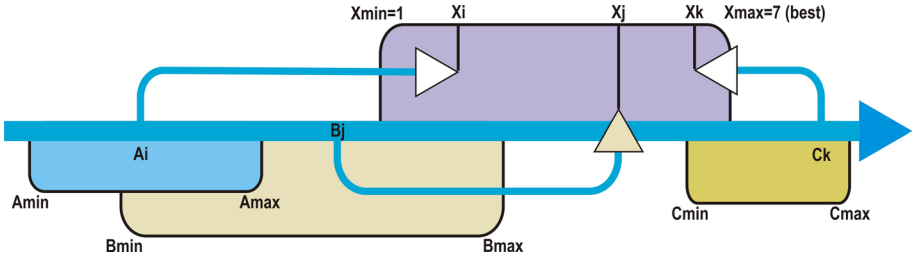


Fig. 6 Normalization of original indicator values

Table 2 Formulas for normalization

Indicator	Formula for normalization
S01 Income Gini index S02 Youth unemployment S07 Vulnerable employment	$X_i = -6\frac{\text{country\_score} - \text{sample\_min}}{\text{sample\_max} - \text{sample\_min}} + 7$
S03 Access to sanitation S04 Access to improved drinking water	$X_i = 6\frac{\text{country\_score} - \text{sample\_min}}{\text{sample\_max} - \text{sample\_min}} + 1$

1. In the first step, normalization of the values of non-normalized Indicators of social sustainability is carried out, and indicators that have very little influence in the observed group of countries are eliminated.
2. In the second step, the homogeneousness and level of multicollinearity of the observed data is examined by descriptive statistics and correlation analysis.
3. In the third step, the panel data multicorrelation between independent variables (X_1 to X_n) and dependent variable (YGCI) is examined.

4.1 Normalization and Regression Model

According to the WEF framework methodology, Indicators of social sustainability, Access to healthcare services, Social safety net protection, Extent of informal economy, and Social mobility, are displayed on a 1–7 (best) scale; Indicators of social sustainability, Income Gini index, Youth unemployment, Access to sanitation, Access to improved drinking water, and Vulnerable employment are shown in their original units—values. Since these indicators are measured by different units of measurement, they are transformed according to the UN international comparison methodology, based on multi-criteria analysis. The original values are re-expressed, using a 1–7 scale. Individual value of each indicator is reduced to mutually comparable value units (ranging from 1 to 7, where 1 is for the lowest and 7 for the best performance).

The procedure is shown in Fig. 6. By translation of original values into a new scale, each starting point Si, which is located between the minimum value in the population Smin and the maximum value in the population Smax, will receive the corresponding Xi on a new scale, which is expressed by formulas given in Table 2. Prior to normalization, the following should be mentioned: (i) original values of the indicator Access to sanitation

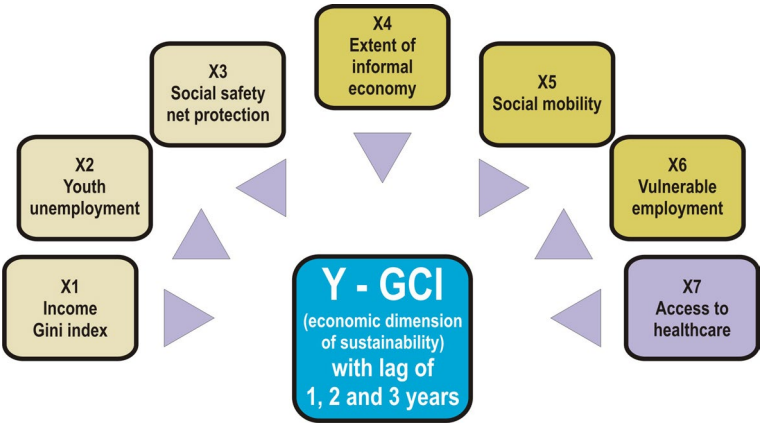


Fig. 7 Regression model

are expressed in natural logarithm form. The reason for this is the fact that the impact of this indicator on social sustainability is not linear, and (b) the scale is reversed in the case of three of the nine indicators (Income Gini index, Youth unemployment, and Vulnerable employment), since the higher value of these indicators is equivalent to lower social sustainability.

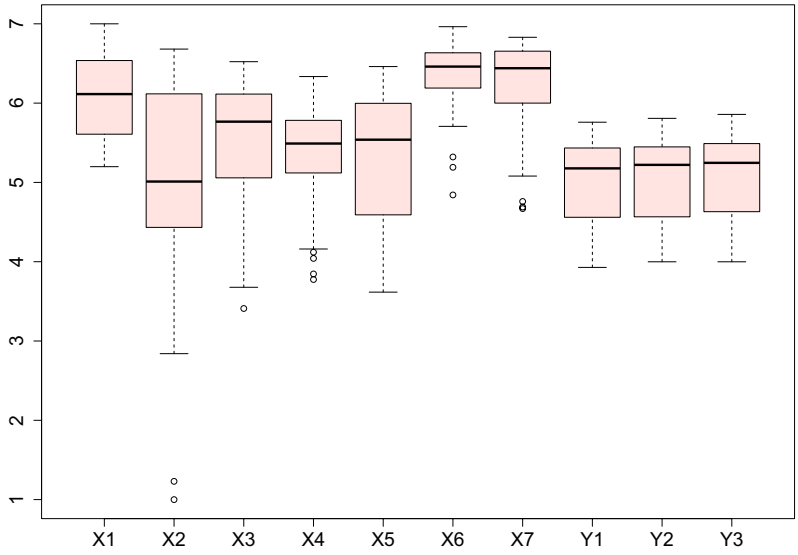
Aggregation of previously normalized indicators provides the value of Social sustainability pillar (SSP), whose influence on GCI of selected European countries was analyzed in Despotovic et al. (2015):

$$\mathrm{SSP} = \frac{\mathrm{X}_1 + \mathrm{X}_2 + \left(\frac{\mathrm{X}_3+\mathrm{X}_4+\mathrm{X}_5}{3}\right) + \mathrm{X}_6 + \mathrm{X}_7 + \mathrm{X}_8 + \mathrm{X}_9}{7} \tag{2}$$

Here should be noted that normalization of values of indicators of observed countries was done for range of values of all countries covered by GCI report. Applied normalization, as well as composite values in GCI report are based on arithmetic mean, which was critically discussed (Ebert and Welsch 2004; Zhou et al. 2007, 2017; Zhou and Ang 2009). However, in this paper we used this type of normalization as originally used method in calculation of values from GCI report (Schwab and Sala-i Martín 2012, ch. 1.2), which represents basic source of data for analysis in this paper.

Bearing in mind that: (a) in WEF calculation of the sustainability-adjusted GCI, indicators S03 Access to sanitation, S04 Access to improved drinking water, and S05 Access to healthcare are combined to form one single variable, and (b) that, after normalization, the obtained maximum values of indicators S03 and S04 are almost 7 for all countries in the group of Western European countries (which indicates that, in this case, their regression coefficient is zero), in further research, indicators S03 Access to sanitation and S04 Access to improved drinking water are abstracted from statistical analysis. Hence, the proposed regression model shown in Fig. 7 operates with seven independent variables:

S01 Income Gini index $\Rightarrow \mathrm{X}_1$
S02 Youth unemployment $\Rightarrow \mathrm{X}_2$
S06 Social safety net protection $\Rightarrow \mathrm{X}_3$



	X1	X2	X3	X4	X5	X6	X7	Y1	Y2	Y3
median	6.11	5.01	5.77	5.49	5.54	6.46	6.44	5.18	5.22	5.25
mean	6.09	4.97	5.45	5.37	5.31	6.36	6.22	5.05	5.07	5.11
SE.mean	0.07	0.18	0.12	0.10	0.12	0.06	0.08	0.07	0.07	0.07
CI.mean.0.95	0.15	0.36	0.23	0.20	0.24	0.12	0.17	0.14	0.14	0.15
var	0.27	1.68	0.69	0.49	0.73	0.18	0.37	0.25	0.26	0.27
std.dev	0.52	1.30	0.83	0.70	0.85	0.42	0.61	0.50	0.51	0.52
coef.var	0.09	0.26	0.15	0.13	0.16	0.07	0.10	0.10	0.10	0.10

Fig. 8 Summary statistics of correlation variables for Group of Western Europe

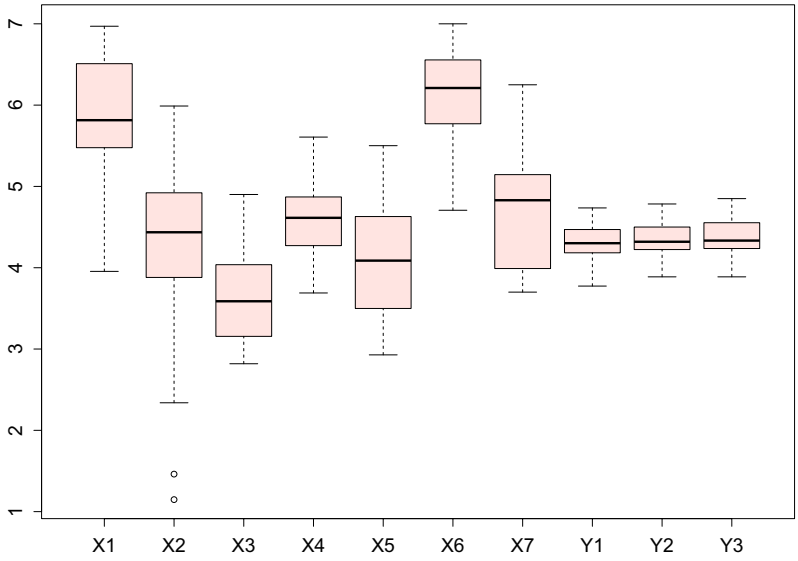
S07 Extent of informal economy $\Rightarrow X_4$
S08 Social mobility $\Rightarrow X_5$
S09 Vulnerable employment $\Rightarrow X_6$
S05 Access to healthcare $\Rightarrow X_7$

4.2 Descriptive Statistics

The summary statistics of all model variables for investigated groups of countries is shown in the box plot diagrams for the 3 years: (a) 2012, 2013, and 2014 for independent variables X_1 to X_7, and (b) 2013, 2014, 2015 for 1 year lag of dependent variable Y1, 2014, 2015, 2016 for 2 years lag of dependent variable Y2, 2015, 2016, 2017 for 3 years lag of dependent variable Y3 (Figs. 8, 9).

Based on summary statistics shown in Figs. 8 and 9, the following conclusion could be derived for observed groups of countries:

- The relatively low coefficient of variation with both the independent variable (X_1 to X_7) and the dependent variable (Y) in the model indicates that the variables have a sta-



	X1	X2	X3	X4	X5	X6	X7	Y1	Y2	Y3
median	5.81	4.44	3.59	4.61	4.09	6.21	4.83	4.30	4.32	4.33
mean	5.82	4.31	3.61	4.59	4.10	6.11	4.72	4.32	4.36	4.39
SE.mean	0.13	0.18	0.10	0.08	0.12	0.09	0.11	0.04	0.04	0.04
CI.mean.0.95	0.25	0.36	0.19	0.17	0.24	0.19	0.23	0.07	0.07	0.07
var	0.61	1.27	0.36	0.26	0.55	0.35	0.51	0.05	0.05	0.05
std.dev	0.78	1.13	0.60	0.51	0.74	0.59	0.72	0.22	0.22	0.23
coef.var	0.13	0.26	0.17	0.11	0.18	0.10	0.15	0.05	0.05	0.05

Fig. 9 Summary statistics of correlation variables for Group of Post transition Europe

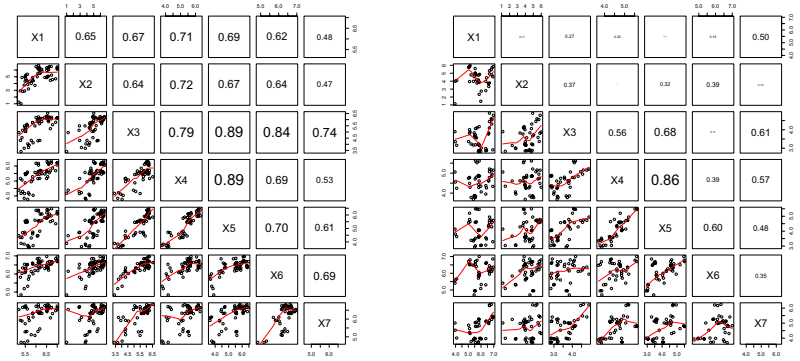
tistically low share of the noise, thus confirming the accuracy of the prediction of the behavior in the initial model.

- Within both groups of observed countries, the highest homogeneity of countries is noted within the dependent variable Y (which represents the economic dimension of competitiveness);
- The expected higher level of mean values for all variables observed in the group of Western European countries is noted. However, the different relative ratio of the mean values of variables X_1 to X_7 and Y in the two groups is interesting. It is observed that the group of Western Europe has a distinctly higher level of independent variables (Indicators of social sustainability) in relation to the dependent variable Y.
- There are some atypical values in terms of the extremely negative deviation (X_2, X_3, X_4, X_6, X_7—for Greece in 2013 and 2014 within the group of Western Europe and X_2—Youth unemployment in Macedonia and Serbia in 2014 within the group of Post transition Europe).

The average values and values of the quartiles and the median of the observed variables for both groups of countries that are included in the analysis show that the data is comparable and relatively homogeneous.

Table 3 Multicollinearity of independent variables

	EU old free market economy countries						EU post-transition free market economy countries					
	X_1	X_2	X_3	X_4	X_5	X_6	X_1	X_2	X_3	X_4	X_5	X_6
X_2	0.65***						0.17					
X_3	0.67***	0.64***					0.27	0.37*				
X_4	0.71***	0.72***	0.79***				0.20	0.07	0.56***			
X_5	0.69***	0.67***	0.89***	0.89***			0.08	0.32*	0.68***	0.86***		
X_6	0.62***	0.64***	0.84***	0.69***	0.70***		0.19	0.39*	0.17	0.39*	0.60***	
X_7	0.48***	0.47***	0.74***	0.53***	0.61***	0.69***	0.50**	0.16	0.61***	0.57***	0.48**	0.35*



*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

4.3 Multicollinearity

The multiple linear regression procedure was conducted with the collected data:

$$Y_i = \beta_{i,0} + \sum \beta_{ij} X_{ij} + \epsilon_i \tag{3}$$

where Y_i is the dependent endogenous variable, X_j is the regressor (exogenous, independent variable), and ϵ_i is the undetermined accidental variable (error, aberration).

Regarding the fact that there are 8 existing variables in the model (i = 7) by application of Fisher's statistics, relations within the model have been determined and it is confirmed that there is a linear correlation between independent variables X_1 to X_7 (problem of multicollinearity), but these variables (Indicators of social sustainability) within the very GCI framework are treated as independent adjustments of GCI (Schwab and Sala-i Martín 2012, p. 64). The level of their multicollinearity is shown in Table 3 by the value of the Pearson coefficient for both groups of countries.

From Table 3 it could be seen that multicollinearity is much more pronounced in the group of Western Europe countries. However, further analysis will use linear regression on panel data for both groups. If given confidence intervals will be still small enough to have

significant p values in spite of multicollinearity, then it is very likely that effect of dependent variables in predicted model can be detected.

4.4 Panel Data Multiple Linear Regression Analysis

In the third step, panel data linear regression analysis is performed, as a statistical process for assessing the relationship between variables involving time series aspect. This involves the use of the predefined model and analysis of variables with a focus on the relationship between GCI, as a representative of global economic competitiveness, and seven independent indicators of social sustainability. Such panel data multiple regression analysis helps us to understand the process of change in the value of the dependent variable when the value of some of the independent variables varies, assuming *ceteris paribus*.

We have panel data multiple regression model for 2 group of countries (where $i = 1, \ldots 17$ for Western Europe and $i = 1, \ldots 13$ for Post transition Europe) that is observed at several time periods $t = 1, 2, 3$ and with lag of dependence variable y of $l = 1$, 2 and 3 years.

$$\mathrm{y}_{i,t+l} = \alpha + x_{i,t}^{'}\beta + c_i + u_{i,t} \tag{4}$$

where $\mathrm{y}_{i,t+l}$ is dependent variable, α is intercept, $x_{i,t}^{'}$ is a K-dimensional row vector of explanatory variables, β is K-dimensional column vector of parameters, c_i is country specific effect and $u_{i,t}$ is error overall term.

The T (T = 3) observations for individual country i can be summarized as:

Dependent variable y_i, independent variable X_i (seven independent variables in regression) and overall error term matrix are represented by:

$$y_i = \begin{bmatrix} y_{i1} \\ y_{i2} \\ y_{i3} \end{bmatrix}_{3\mathrm{x}1} \qquad \mathrm{X}_i = \begin{bmatrix} x_{i1}^{'} \\ x_{i2} \\ x_{i3} \end{bmatrix}_{3\mathrm{x}7} \qquad u_i = \begin{bmatrix} u_{i1} \\ u_{i2} \\ u_{i3} \end{bmatrix}_{3\mathrm{x}1} \tag{5}$$

Let's denote the last country in set i with N, (N = 17 and 13), last year in set t with T, (T = 3) and K independent variables in regression (K = 7). Now we can write NT (N x T) observations for all countries and time periods as:

$$y = \begin{bmatrix} y_1 \\ \vdots \\ y_i \\ \vdots \\ y_{17 \text{ or } 13} \end{bmatrix}_{\mathrm{NT\ x\ 1}} \qquad \mathrm{X} = \begin{bmatrix} \mathrm{X}_1 \\ \vdots \\ \mathrm{X}_i \\ \vdots \\ \mathrm{X}_{17 \text{ or } 13} \end{bmatrix}_{\mathrm{NT\ x\ K}} \tag{6}$$

Accordingly, H0 hypothesis refers to the significant effect of independent variables X_1 to X_7 (indicators of social sustainability) on dependent variable Y (GCI) with lag from 1 to 3 years.

The analyzed dependencies between the observed groups of variables, using panel data multiple linear correlation expressed by coefficients, are given in Tables 4 and 5. Statistical analysis of the data in this research show max overall correlation coefficient of (a) $\mathrm{R}^2 = 0.577$ for group Western Europe and time lag of 2 years and (b) $\mathrm{R}^2 = 0.758$ for Post transition Europe and time lag of 3 years.

Table 4 Summary of panel data multiple regression analysis for Western Europe

Lag of Y in year	(1)	(2)	(3)
Variable	L1GCI	L2GCI	L3GCI
Income Gini index	0.213***	0.219**	− 0.0468
	(0.0755)	(0.0848)	(0.0894)
Youth unemployment	− 0.000658	0.0458**	− 0.0144
	(0.0163)	(0.0183)	(0.0193)
Social safety net protection	− 0.113*	− 0.166**	− 0.0238
	(0.0657)	(0.0738)	(0.0778)
Extent of informal economy	− 0.0593	− 0.0240	− 0.119
	(0.0652)	(0.0732)	(0.0772)
Social mobility	− 0.0176	0.105	− 0.00403
	(0.0675)	(0.0758)	(0.0798)
Vulnerable employment	− 0.172*	− 0.251**	− 0.138
	(0.0843)	(0.0947)	(0.0998)
Access to health care services	0.107	− 0.0145	− 0.0232
	(0.0766)	(0.0861)	(0.0907)
Constant	5.209***	5.678***	7.270***
	(0.591)	(0.663)	(0.699)
Observations	51	51	51
R-squared	0.495	0.577	0.447
Number of countries	17	17	17

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In both groups of countries the Hausman test showed adequacy of applying multiple regression model with fixed effect.

In group Western Europe, the most positive statistically significant impact comes only from the variable X_1 Income Gini index for lag of 2 years and with factor 0.219; the greatest negative statistically significant impact comes from variable X_6 Vulnerable employment with factor − 0.251, followed by variable X_3 Social safety net protection with factor − 0.166, both for time lag of dependent variable of 2 years.

In group Post transition Europe, the some positive and statistically significant impact comes only from variable X_3 Social safety net protection with factor 0.216 and only for Y lag of 1 year; the greatest negative and statistically significant impact comes from variable X_6 Vulnerable employment with factor − 0.410; − 0.248; − 0.310 and lag of Y of 1, 2, and 3 years respectively, followed by variable Social mobility with factor − 0.164; − 0.315; and lag of Y of 2 and 3 years respectively.

It could be said that the main hypothesis **H0** is only partially proved because there is statistically significant influence of some, but not all independent variables on dependent variable Y and their intensities drastically vary with change in time lag between independent variables and dependent variable.

A more detailed interpretation of the panel data multiple linear regression analysis shows a significant imbalance in impact of the observed independent variables, both in intensity and by direction of impact. In this context, the auxiliary hypothesis H1 could be completely rejected.

Table 5 Summary of panel data multiple regression analysis for Post transition Europe

Lag of Y in year	(1)	(2)	(3)
Variable	L1GCI	L2GCI	L3GCI
Income Gini index	− 0.00509	0.0717	− 0.0513
	(0.0727)	(0.0593)	(0.0555)
Youth unemployment	0.0367	− 0.0125	− 0.000577
	(0.0225)	(0.0184)	(0.0172)
Social safety net protection	0.216*	− 0.00446	0.00827
	(0.109)	(0.0891)	(0.0834)
Extent of informal economy	0.122	− 0.0347	0.182*
	(0.132)	(0.108)	(0.101)
Social mobility	− 0.157	− 0.164*	− 0.315***
	(0.107)	(0.0873)	(0.0816)
Vulnerable employment	− 0.410***	− 0.248***	− 0.310***
	(0.0960)	(0.0784)	(0.0733)
Access to health care services	− 0.0432	− 0.0184	− 0.0891
	(0.104)	(0.0849)	(0.0794)
Constant	6.196***	6.443***	7.431***
	(0.686)	(0.560)	(0.524)
Observations	39	39	39
R-squared	0.595	0.600	0.758
Number of countries	13	13	13

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5 Conclusion

For the selected group of old free market economy countries in Europe, one can see negative impact on economic competitiveness of the variable X_6 (Vulnerable employment) and some lower negative impact of the variable X_3 (Social safety net protection), while, on the other hand, there is a significant positive impact of variables X_1 (Income Gini index). Analysis shows that in this group of countries this effects vanishes when time lag reaches 3 years.

The group of post transition free market economy countries in Europe shows slightly stronger but also slightly structurally different impact of variables in the model. Here, the most significant negative impact on economic competitiveness comes also from variable X_6 (Vulnerable employment) and some lower negative impact of the variable X_5 (Social mobility), while lower and partially significant positive impact comes from variables X_3 and X_4 (Social safety net protection and Extent of informal economy). The only variable that in both groups shows the stronger negative direction but different intensity is variable X_4 (Extent of informal economy). All indicators that represent independent variables in model are normalized in such a way that greater values represent greater desirability in terms of social aspect. Hence, statistical negative influence on competitiveness represents also social undesirable scenario.

The results show the groundlessness of our assumptions about the unquestionable positive impact of socially sustainable competitiveness component on its economic dimension. Analysis shows that synergistic effect of indicators of social pillar of sustainability is not possible to depict with such a simple prediction model, so the application of panel data linear regression analysis represents only the first step in revealing this phenomenon. The contribution of the work lies in establishing significant intensities and directions of impact of some Indicators of social sustainability on GCI:

- For the European old free market economy countries (Income Gini index—(impact factor + 0.219), Youth unemployment (impact factor + 0.046), Social safety net protection (impact factor − 0,166) and Vulnerable employment (impact factor − 0.251).
- For European post transition free market economy countries Social safety net protection (impact factor 0.216) Extent of informal economy (impact factor 0.182) Social mobility (impact factor − 0.315) Vulnerable employment (impact factor − 0.410).

Results indicate that competitiveness in both groups is based on Vulnerable employment that represents socially undesirable scenario. In addition, it is also noticeable that in group of European post transition countries, the competitiveness is in negative correlation with Social mobility, while in Western Europe countries it is positively correlated with income inequality.

These relationships can be used as one of the starting hypotheses in the creation of social and economic public policies, especially in post-transition European countries that have lower level of social sustainable competitiveness. This approach can be applied analogously to improve strategy of development of social component of national competitiveness.

Detected problem of strong multicolinearity (particularly in group Western Europe) evidently disturbs robustness of developed model, which can be avoided in future research by transformation of independent variables by PCA (Principial Component Analisys), which will produce qualitative new and potentially plausible determinants of social sustainability from currently available data. In the relevant literature WEF it is noticeable similar trend of reconfiguration of total GCI framework.

What can be clearly concluded is that the increasing complexity of our global society means that the problems of sustainable development cannot be solved from one perspective, country, or scientific discipline. Achieving sustainable global competitiveness is far more complex than most of the problems that our civilization has faced in the past. This is a challenge that requires new paradigms and innovative methods, and continuing reflection on short-term and long-term goals and values in quantitative and qualitative terms.

We hope that our work, like many others before, will boost further analysis within this field, and that it will help in understanding, adjusting, and optimizing sustainable competitiveness of countries. To this end, it is a very modest contribution to necessary research, aimed at identifying the causal mechanisms underlying sustainable competitiveness of countries.

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