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STRINGENCY OF ENVIRONMENTAL REGULATIONS VS. GLOBAL COMPETITIVENESS: EMPIRICAL ANALYSIS

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ABSTRACT. The article focuses on assessing the global competitiveness of countries in the context of their environmental regulatory stringency. The article analyzes the views of scientists on the need to slow down economic growth and transition to stable economy, the relationship between economic growth and environmental changes in the form of environmental Kuznets curve, as well as environmental policy instruments along with the degree of their stringency. The authors put forward and confirm the hypothesis that the quality of institutions and the value assessment of environmental goods directly affect the competitiveness of national economies, regardless of environmental stringency. A comprehensive statistical analysis of the perennial indices of global competitiveness, environmental performance and stringency of environmental regulations on a large sample of countries confirms the hypothesis that significant stringency of environmental regulations in welfare states can be internalized and that their global competitiveness remains high against the background of high-quality environmental goods.

JEL Classification: F64, L51, Q52, Q53, Q54, Q58

Keywords: sustainable development, ecology, environmental policy, stringency, competitiveness

Introduction

The concept of sustainable development, which is actively promoted internationally and implemented in national legislation of many countries, emphasizes that "sustainable development is aimed at meeting the needs of the present generation without sacrificing the ability of future generations to meet their own needs" (Butlin, 1987). In fact, sustainable development theory, with its emphasis on greening, is an alternative to the paradigm of extensive economic growth.

At the highest political level, environmental problems were proclaimed as an indispensable factor in long-term development at the Stockholm Conference in 1972, in which the sustainable development paradigm was considered dominant. The next international meeting on global environmental issues was held in 1992 in Rio de Janeiro, during which a number of important documents were adopted (Action Program – Agenda 21; Framework Convention on Climate Change – UN FCCC). Already in 1997, the UN Kyoto Summit agreed for the first time on specific carbon reduction decisions. Ukraine acceded to the Kyoto Protocol in 2004, but the countries that were the largest carbon dioxide pollutants did not ratify it (China, India, and Brazil). The next Copenhagen summit was held in 2009, which recognized the Kyoto Protocol as ineffective. The Copenhagen agreement provides for global warming to be contained within 2°C in the 21st century through the transition to new, environmentally friendly technologies, renewable energy sources, and through existing market-based emission reduction mechanisms foreseen in the Kyoto Protocol (Peel, Lin, 2019). In 2015, the Paris Agreement was adopted in the framework of the UN Framework Convention on Climate Change on the regulation of carbon dioxide emission reduction measures till 2020, which came into force in November 2016 and actually replaced the Kyoto Protocol, in contrast to which all states are responsible for reducing emissions into the atmosphere, regardless of their degree of economic development (Bouwer, 2018; Setzer, Byrnes, 2019).

However, in order to achieve the goals, set by the numerous international agreements, there is a need to develop appropriate environmental policy tools, which can become rigid in varying socioeconomic conditions.

1. Literature review

The beginnings of the study of the relationship between economics and the environment can be considered the era of Malthusianism, when in 1798 T. Malthus grounded his famous work "An Essay on the Principle of Population" (Malthus, 1798). An "overpopulation trap" associated with an increase in food supply in arithmetic progression, and population growth in geometric progression, which undermines the foundations of long-term development. Much later, in his book "The Population Bomb" (Ehrlich, 1968), P. Erlich argued that the limitless human needs and growing population of the planet were deforming the environment, which inevitably required clear population planning. This idea has been implemented by China in its demographic policy for over 30 years in the 1970s. However, the one-family-one-child policy has not only been recognized as ineffective preventing the aging of the population, but also violating human rights. Since 2016, the Chinese government has officially abolished this rule.

In the study of economic-ecological interconnection in the context of sustainable development, three main areas can be distinguished. The first concerns the need to slow down the economic growth and shift to the steady state economy.

In this aspect, D. Midovs, J. Randers, and W. Bahren, who in 1972 published the well-known work "The Limits to Growth" (Meadows, Meadows, et al., 1972), emphasized the need for a transition from quantitative to qualitative economic growth to "recover" the planet from the negative effects of pollution, overpopulation and overconsumption of resources. The same year saw the publication "Only One Earth" (Ward, Dubos, 1972), in which the authors emphasized the differences in the causes of environmental degradation in developed and developing countries. Thus, if in developed countries environmental problems are caused by industrialization and the decline of the consumption society, then in developing countries it is poverty and poor social development. After 20 years, D. Meadows and J. Randers's book has been reissued under another title and updated scripts (Meadows, Meadows, et al., 1992), in which the authors have emphasized that a stable future will require profound social and psychological transformations. In 2004, the same authors published a new paper (Meadows, Randers, et al., 2004), in which they recognized that many positive things had been done in recent years to preserve the environment. However, unfortunately, innovations and new technologies have not been able to significantly halt pollution growth. In 2012, a new work by J. Randers (Randers, 2012) was published, in which he emphasized the too slow response of humanity to environmental degradation and called for a rethinking capitalism concepts, economic growth, democracy, justice for sustainable development.

The second focus is on the relationship between economic growth and environmental change in the form of environmental Kuznets curve. In 1955 S. Kuznets became interested in the nature and causes of changes in inequality of personal income distribution in terms of economic growth of the country. The scientist suggested that in the early stages of development, when per capita incomes are rising, income inequality should also increase, but even when higher income levels are reached, inequality must be reduced, thus demonstrating the inverse relationship between income levels and economic inequality (Kuznets curve). Based on this concept, ecological economists hypothesized a similar relationship between the level of environmental degradation and income growth. Thus, in the writings (Čiegis, Štreimikienė, et al., 2008; Panayotou, 2003; Lapinskienė, Peleckis, et al., 2015; Lapinskienė, Tvaronavičienė, et al., 2014; Ginevičius, Lapinskienė, et al., 2017; Wang, 2013; Franklin, Ruth, 2012; Galeotti, Lanza, et al., 2006; Holtz-Eakin, Selden, 1995; Shafik, Bandyopadhyay, 1992; Grossman, Krueger, 1995; Grossman, Krueger, 1991; Apergis, Ozturk, 2015) emphasizes that at the stage of the pre-industrial economy, environmental pollution is increasing, however, when a certain level of GDP per capita (industrial stage of development) is reached, economic growth overcomes environmental problems. In their study, P. Dasgupta and K. Mahler (Dasgupta, Maler, 1994) called the U-shaped effect of the link between national income and the level of concentration of industrial pollution as the environmental Kuznets curve (EKC), which counteracts economic growth in environmental quality. Scientists linked the weakness of regulatory infrastructure to the processes of industrialization, which are becoming increasingly difficult to control through trade and investment liberalization. In their view, the removal of trade barriers has a negative impact on the environment by expanding economic activity, changing its composition and modes of production.

In their work T. Selden and D. Song (Selden, Song, 1994) emphasized the role of several important factors of sustainable development:

1) positive income elasticity for environmental quality;
2) change in production and consumption patterns;
3) raising the level of education and awareness of the environment;
4) development of more open political systems.

At higher stages of development, the demand for quality environment increases as the incomes rise (Grossman and Krueger, 1995). Studies (Roberts, Grims, 1997; AlSayed, Sek, 2013; Hilton, Levinson, 1998) have once again confirmed the U-shaped relationship between carbon emissions and GDP per capita in a group of developed countries, whereas in developing countries, dependency has not been established. Other researchers (Unruh, Moomaw, 1998;

Esteve, Tamarit, 2012; Kozlovskyi, et al., 2017a; Kozlovskyi, et al., 2017b) point out that it is the particularities of each country, global political and social upheavals, and not the level of income, that determine the change in the trajectory of environmental development. For example, in 1970, the oil crisis prompted the French authorities to replace the production of electricity from coal to a program of combined nuclear electricity and increase its efficiency, and the Spanish government – to change the attitude to ecology since the 1980s. Other group of scientists (Franklin, Ruth, 2012; Dinda, 2004; Stern, 2004; Galeotti, Lanza, et al., 2006; Fosten, Morley, et al., 2012) emphasizes that efficient technologies help to move energy-intensive and polluting industries to poorer countries, and change prices sources and global shocks determine the level of environmental degradation in each specific state. Thus, international cooperation on environmental issues is crucial for the implementation of international environmental standards, which can be an effective tool for managing climate change worldwide. In their writings on environmental economics, a group of Ukrainian economists led by V. Koziuk (Koziuk, Dluhopolskyi, 2018; Koziuk, Dluhopolskyi, et al., 2019; Dluhopolskyi, Koziuk, et al., 2019a; Dluhopolskyi, Koziuk, et al., 2019b; Koziuk, et al., 2019a; Koziuk, et al., 2019b; Dluhopolskyi, et al., 2018a; Koziuk, Dluhopolskyi, et al., 2018b) continued to work on the link between environmental quality as a public good and the quality of institutions, the educational and oligarchizational level of the economy and its resource dependence.

The third research area focuses on environmental policy instruments in terms of its stringency / softness in different types of economies. The stringency or softness of environmental policies can be defined by "the cost of pollution or other environmental damage" (Botta, Koźluk, 2014; Ferrari, 2018; Bilan et al., 2018; Simionescu et al., 2017). In Harring's study (Harring, 2008), environmental policy stringency is determined by the success of its implementation, as it depends on the government commitment to adhere to established environmental standards. However, these norms can be of different types of stringency, and therefore the effectiveness of achieving them in developed countries, where they are sufficiently rigorous, may be similar to that of developing countries, where they are not too rigid. E. Magnani (Magnani, 2000) emphasizes that specific property rights, democratic voting procedures and respect for human rights create synergies that increase the effectiveness of environmental policies. However, as studies of direct indicators of environmental policy stringency suggest (Sauter, 2014; Knill, Schulze, et al., 2012; Brunel, Levinson, 2013), there are many different opinion regarding the objectivity of their measurement by different methods (for example, survey results, methodology for evaluating performance indicators, public expenditure analysis, etc.).

The Paris Climate Agreement 2015, revised by the Kyoto Protocol, with its emphasis on strengthening environmental standards, has increased interest in the topic of climate change through the likely relocation of manufacturing and foreign investment to countries with less stringent government regulation (Druzin, 2016). In works (Cole, Elliott, et al., 2017; Birdsall, Wheeler, 1993; Dunning, 1998; Dunning, 1977; Moosa, 2002) emphasize, that capital and trade will flow from countries with strict rules to countries with less stringent environmental standards, however liberalization and openness of international trade will have a significant impact on both investment attractiveness and environmental degradation. As pollution-related activities, entails high regulatory costs in developed countries, according to M. Mani, D. Wheeler (Mani, Wheeler, 1998), comparative advantages can arise only when markets are deregulated. Therefore, governments with high levels of development and quality of institutions may face pressure toward deregulation of environmental standards to attract foreign direct investment (Cole, Elliott, et al., 2006; Levinson, 1996; List, Co, 2000; Madsen, 2009; Povitkina, 2018; Le Roux, Williams, et al., 2008). In this sense, the deregulation of environmental policy, which most often has a detrimental effect on the environment, is encouraged by "race to the bottom" in developing countries for which attracting foreign direct investment is more important than preserving the environment. In this context it is "short game". In general, environmental policy tools in the context of its stringency can be divided into market and non-market (IPCC, 2001). Market-oriented policies are designed to combine the additional costs of market forces associated with the interaction of economic agents with pollutant containment tools, rather than setting clear guidelines, standards or restrictions (Stavins, 2006). In this context, the quality of regulatory regimes is measured by the index method we use in our study to calculate the stringency of environmental regulations.

2. Methodological approach

In this research, we will try to slightly adjust the views of scientists on the stringency of environmental regulations as a barrier to competitiveness. Our working hypothesis is that if in some jurisdictions the quality of institutions and the value assessment of environmental goods are high, then the stringency of environmental regulations will inevitably be internalized and such a country will be characterized by high levels of environmental efficiency and global competitiveness. Otherwise (poor quality of institutions and lack of environmental preferences) the country will not achieve high levels of competitiveness and quality of environmental goods, even with low stringency of environmental regulations (Marikina, 2018; Fogarassy et al., 2018).

To test the working hypothesis, an array of time series data was used to reflect the current dynamics of the Stringency of Environmental Regulations (SER), Environmental Sustainable Index (ESI), Environmental Performance Index (EPI) and Global Competitiveness Index (GCI).

The value of the Stringency of Environmental Regulations Index is taken from "The Travel & Tourism Competitiveness Reports 2007, 2008, 2009, 2011, 2013, 2015, 2017" published by the World Economic Forum within the Industry Partnership Program for Aviation & Travel (The Travel & Tourism Competitiveness Report, 2017). This index (SER) is one of 90 indicators on which the Travel & Tourism Competitiveness Index (TTCI) is calculated. Data for SER are derived from the World Economic Forum's Executive Opinion Survey, which was conducted according to a scale of 1 to 7, where the answer of 1 corresponds to the lowest possible score and an answer of 7 corresponds to the highest possible score (The Travel & Tourism Competitiveness Report, 2017).

The Environmental Regulatory Regime index (ERRI) value, calculated for 71 countries using the original methodology (Esty, Porter, 2001), was used to characterize the stringency of environmental regulations during 2001-2002, taking into account the stringency of environmental pollution standards, sophistication of regulatory structure, quality of the environmental information available, the extent of subsidization of natural resources, the strictness of enforcement and the quality of environmental institutions.

The Environmental Sustainability Index (ESI), developed by the Global leader for tomorrow NGO in collaboration with the Yale University (USA) Environmental Law and Policy Center and the Center for International Scientific Information Networks of Columbia University (USA) in 2000, 2001, 2002, 2005 was used to evaluate the environmental performance of the countries (ESI Report, 2019). To assess the environmental state of the analyzed countries after 2005, we used the values of the Environmental Situation Index in 2006, 2008, 2010, 2012, 2014, 2016, 2018 (EPI Report, 2019), which was first developed in 2006 in the pilot project format mentioned above the research centers of the Yale and Columbia Universities with the support of the World Economic Forum (Switzerland) and the Center for Joint Research of the European Commission (Italy).

The levels of global competitiveness of countries have been estimated by the Global Competitiveness Index based on data from relevant reports (The Global Competitiveness Report, 2007-2017) published by the World Economic Forum as part of the System Initiative on Shaping the Future of Economic Progress. GCI values have many components grouped into 12 categories, among which are: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication and innovation.

Marking of countries on scatterplots was performed using the three-letter ISO 3166-1 system of codes (Country Codes – ISO 3166). The methods of descriptive statistics, correlation, regression and cluster analysis, multidimensional scaling using the appropriate STATISTICA application modules have been applied for the analysis of empirical data.

3. Conducting research and results

The time series analysis of the Stringency of Environmental Regulations values shows that during 2007-2017 this index varied slightly in almost all countries (*Fig. 1, Table A1 in Appendix A*). In most countries, the magnitude of variation of this index (the difference between the maximum and minimum values) for the above-mentioned time horizon did not exceed 1.5 points. Only in a few African countries (Chad, Lesotho, Tunisia, Zambia) and Saudi Arabia have significant variations in the stringency of environmental regulations been observed.

Since the methodological principles for building the stringency of environmental regulations indices we use are different (SER is a qualitative indicator and ERRI has a broader quantitative basis), it was necessary to check how comparable they are to the countries ranking. Conducted correlation analysis for a sample of 69 countries confirmed that both indices almost identically reflect inter-country differentiation in terms of environmental regulation (*Table 1*). Thus, the correlation coefficients between ERRI 2002 and SER 2007-2017 ($r = 0.830$-0.882) are highly significant ($p < 0.001$) and reflect a high level of correlation between them. High and significant correlation coefficients ($r = 0.909$-0.976) between SER values over seven years indicate a nearly unchanged countries ranking by this index.

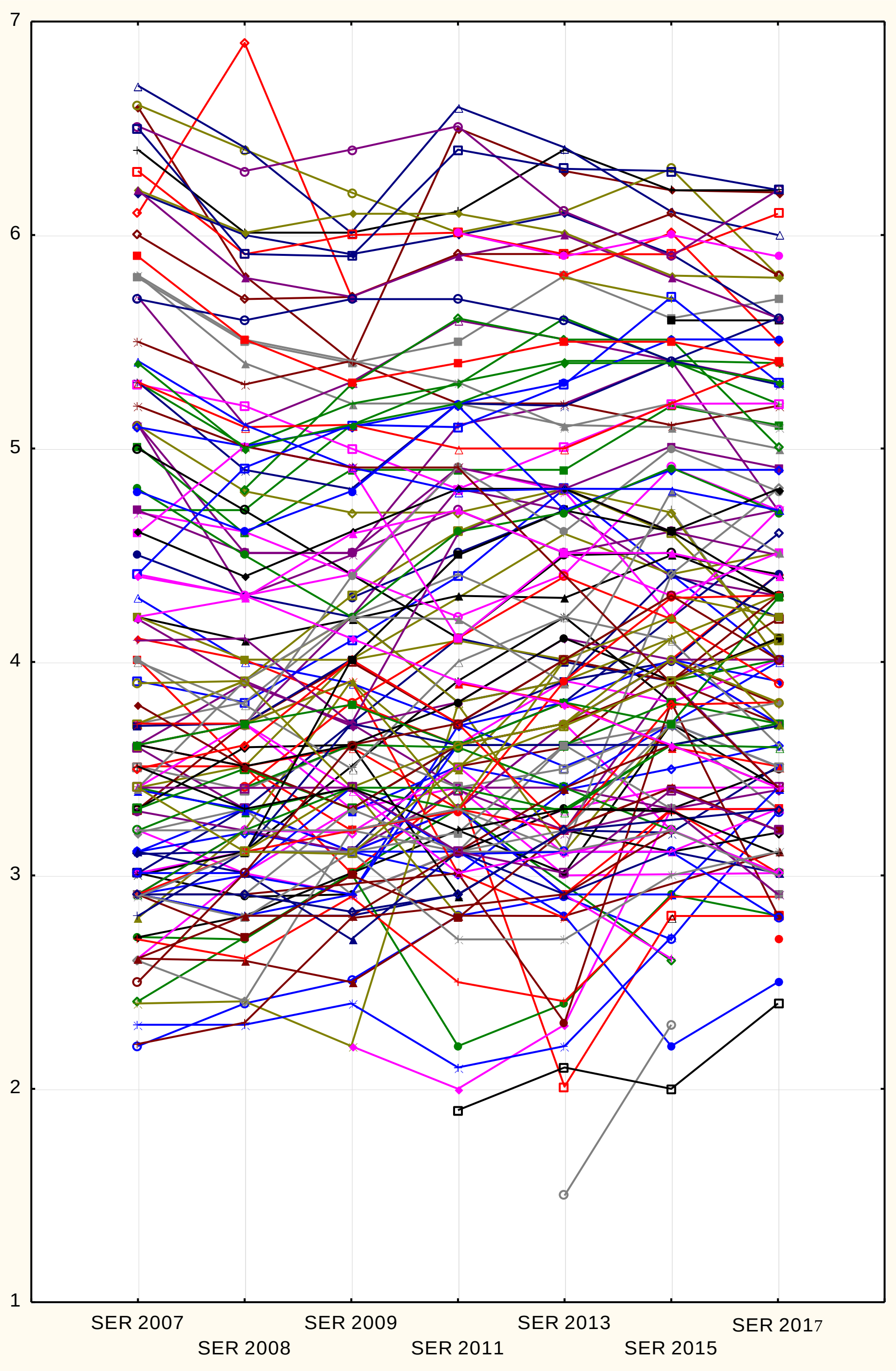

Figure 1. Dynamics of SER values during 2007-2017
Source: *own compilation*

Table 1. Correlation matrix between Environmental Regulatory Regime Index and Stringency of Environmental Regulations Index

	$ERRI_{2002}$	SER_{2007}	SER_{2008}	SER_{2009}	SER_{2011}	SER_{2013}	SER_{2015}	SER_{2017}
$ERRI_{2002}$	1,000	0,877	0,875	0,866	0,866	0,882	0,838	0,830
SER_{2007}	0,877	1,000	0,972	0,945	0,946	0,935	0,921	0,912
SER_{2008}	0,875	0,972	1,000	0,969	0,941	0,930	0,915	0,909
SER_{2009}	0,866	0,945	0,969	1,000	0,952	0,937	0,924	0,925
SER_{2011}	0,866	0,946	0,941	0,952	1,000	0,976	0,957	0,952
SER_{2013}	0,882	0,935	0,930	0,937	0,976	1,000	0,968	0,953
SER_{2015}	0,838	0,921	0,915	0,924	0,957	0,968	1,000	0,964
SER_{2017}	0,830	0,912	0,909	0,925	0,952	0,953	0,964	1,000

Source: *own compilation*

Engaging in correlation analysis other indices (ESI, EPI, GCI) yielded a broad correlation matrix (*Table B1 in Appendix B*), a detailed analysis of which showed a high likelihood of a linear relationship between the global competitiveness index, environmental performance index and stringency of environmental regulations. The results of simple regression analysis (*Table 2*) confirm this assumption. As we can see, the regression models obtained based on large sample of countries (114-145) are adequate and all their parameters are highly significant. The interpretation of the analytical equations of the constructed models shows that the improvement of the country environmental state by one unit of EPI can generate a competitiveness index gain of 0.031-0.041 points. Increasing the stringency of environmental regulations by one index unit causes a greater improvement in the global competitiveness (by 0.491-0.576 points).

Table 2. Results of simple regression analysis (dependent variable – Global Competitiveness Index, independent variables – Environmental Performance Index, Stringency of Environmental Regulations Index)

Models	Analitical form of model	Number of countries	Criterias of adequacy and significance of model parameters			
			R^2	F-test (Fisher)	p < for	
					inter-cept	regression coeficient (b)
1	$GCI_{2008} = 1,105 + 0,041EPI_{2008}$	114	0,440	88,1	0,0012	0,0000
2	$GCI_{2010} = 2,322 + 0,031EPI_{2010}$	123	0,307	53,7	0,0000	0,0000
3	$GCI_{2012} = 2,494 + 0,033EPI_{2012}$	118	0,248	38,3	0,0000	0,0000
4	$GCI_{2014} = 2,458 + 0,032EPI_{2014}$	145	0,654	270,3	0,0000	0,0000
5	$GCI_{2016} = 1,838 + 0,034EPI_{2016}$	139	0,507	141,0	0,0000	0,0000
6	$GCI_{2018} = 2,074 + 0,038EPI_{2018}$	135	0,551	163,2	0.0000	0,0000
7	$GCI_{2008} = 1,890 + 0,574SER_{2008}$	124	0,757	380,5	0,0000	0,0000
8	$GCI_{2009} = 1,889 + 0,576SER_{2009}$	127	0,731	339,4	0,0000	0,0000
9	$GCI_{2011}= 2,175 + 0,491SER_{2011}$	136	0,666	267,4	0,0000	0,0000
10	$GCI_{2013} = 2,156 + 0,503SER_{2013}$	137	0,674	279,4	0,0000	0,0000
11	$GCI_{2015} = 2,071 + 0,508SER_{2015}$	138	0,591	196,2	0,0000	0,0000
12	$GCI_{2017} = 1,962 + 0,555SER_{2017}$	133	0,639	232,3	0,0000	0,0000

Note: $F_{0,01}(1,100) = 6,90$

Source: *own compilation*

Assessment of the simultaneous effect of environmental performance and the level of stringency of environmental regulations on the global competitiveness was performed using Multiple Regression Analysis, which resulted in a number of two-factor linear regression

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models (*Table 3*). We used Global Competitiveness Index and Environmental Performance Index data to construct these models. As Stringency of Environmental Regulations estimations are published in odd years, the SER meter with time lag t-1 was considered in the model specification. As we can see, all two-factor regression models are reliable, as they consist well with the empirical information. The free term and regression coefficients in almost all models, except model №15, are significant at p = 0.01.

Table 3. Results of two-factor regression analysis (dependent variable – Global Competitiveness Index, independent variables – Environmental Performance Index and Stringency of Environmental Regulations Index)

Models	Analitical form of model	Number of countries	Criterias of adequacy and significance of model parameters			
			R^2	F-test (Fisher)	t-test (Student) for	
					inter-cept	regression coeficients (b_1/b_2)
13	$GCI_{2008} = 1,451 + 0,440SER_{2007} + 0,012EPI_{2008}$	111	0,785	197,2	6,84	13,11/3,49
14	$GCI_{2010} = 1,627 + 0,507SER_{2009} + 0,008EPI_{2010}$	122	0,735	164,9	9,52	14,03/2,69
15	$GCI_{2012} = 2,447 + 0,481SER_{2011} – 0,002EPI_{2012}$	117	0,696	130,7	12,97	13,15/-0,52
16	$GCI_{2014} = 2,041 + 0,294SER_{2013} + 0,018EPI_{2014}$	136	0,760	210,5	18,51	8,12/7,34
17	$GCI_{2016} = 1,349 + 0,341SER_{2015} + 0,020EPI_{2016}$	134	0,682	140,6	7,47	8,65/7,11
18	$GCI_{2018} = 1,547 + 0,366SER_{2017} + 0,021EPI_{2018}$	128	0,710	152,8	9,48	8,62/6,90

Note: $F_{0,01}(2,100) = 4,82$; $t_{0,01}(100) = 2,63$
Source: *own compilation*

From the interpretation of two-factor regression equations, the following conclusions emerge – an independent variable that characterizes the level of stringency of environmental regulations has a much greater impact on the integral assessment of global competitiveness than the environmental performance, which, of course, is derived from the magnitude of the stringency of environmental regulations are well traced on 2-D graphs (*Fig. B1 in Appendix B*). Coordination of countries confirms our working hypothesis, since the stringency of environmental regulations in welfare states, most of which are in the upper right sector of the scatterplots a-f (*Fig. B1 in Appendix B*), are delimited by the red line (Switzerland, Sweden, United Kingdom, USA, Finland, Canada, etc.), internalized due to the high quality of their institutions, and thus does not reduce their level of global competitiveness, while ensuring the high quality of environmental goods. In countries with weak institutions on charts a-f (*Fig. B1 in Appendix B*), they are localized in the lower left sector (Burundi, Guinea, Zimbabwe, Mali, Madagascar, Mozambique, etc.) weak environmental regulations, being one of the causes of poor environmental performance does not contribute to increasing the competitiveness of such economies.

The result of a cluster analysis of 50 countries using the k-mean clustering method for 31 variables characterizing their level of global competitiveness during 2007-2018, environmental performance in 2000-2018, stringency of environmental regulations in 2002, 2007-2017, is the allocation of three country clusters, the first of which is characterized by high values of the above indexes, the second – medium, and the third – low (*Table 4*).

The first group includes 20 countries, most of which are classic welfare states and, as we can see, have the highest values of global competitiveness and environmental performance, despite the heavy stringency of environmental regulations. The second cluster includes 17 countries, including several developed countries, such as Belgium, Italy, and Korea. The reason for this is the average of the environmental performance index in Belgium, especially in the first decade of the 21st century, and the average level of stringency of environmental regulations in Italy and South Korea. The third cluster brings together mainly developing and underdeveloped countries.

Table 4. Composition and characteristics of country clusters in terms of Global Competitiveness, Environmental Performance and SER indices

Variables	Clusters		
	№ 1 (20) AUS, AUT, CAN, DNK, FIN, FRA, DEU, ISL, IRL, JPN, NLD, NZL, NOR, PRT, SVK, ESP, SWE, CHE, GBR, USA	**№2 (17)** ARG, BEL, BRA, BGR, CHL, COL, CRI, CZE, GRC, HUN, ISR, ITA, MYS, POL, RUS, KOR, VEN	**№3 (13)** CHN, EGY, SLV, IND, IDN, JOR, MEX, PER, PHL, ZAF, THA, VNM, ZWE
$GCI_{2018-2019}$	78,53	66,26	60,17
$GCI_{2017-2018}$	5,30	4,53	4,31
$GCI_{2016-2017}$	5,26	4,47	4,28
$GCI_{2015-2016}$	5,21	4,44	4,24
$GCI_{2014-2015}$	5,17	4,44	4,25
$GCI_{2013-2014}$	5,13	4,40	4,21
$GCI_{2012-2013}$	5,16	4,43	4,19
$GCI_{2011-2012}$	5,14	4,44	4,20
$GCI_{2010-2011}$	5,09	4,40	4,17
$GCI_{2009-2010}$	5,13	4,36	4,11
$GCI_{2008-2009}$	5,22	4,41	4,15
$GCI_{2007-2008}$	5,22	4,41	4,12
EPI_{2018}	77,43	66,32	51,52
EPI_{2016}	86,92	79,97	66,87
EPI_{2014}	76,72	63,61	47,49
EPI_{2012}	64,67	59,59	48,84
EPI_{2010}	74,52	66,34	57,78
EPI_{2008}	86,58	82,14	72,98
EPI_{2006}	82,56	78,03	61,32
ESI_{2005}	60,16	52,19	45,88
ESI_{2002}	60,00	51,91	47,51
ESI_{2001}	68,38	53,02	43,80
ESI_{2000}	70,55	58,59	50,23
ECR_{2002}	3,19	1,85	1,57
SER_{2007}	5,94	4,52	3,72
SER_{2008}	5,58	4,40	3,64
SER_{2009}	5,55	4,28	3,60
SER_{2011}	5,74	4,30	3,64
SER_{2013}	5,71	4,39	3,70
SER_{2015}	5,66	4,44	3,78
SER_{2017}	5,60	4,39	3,84

Source: *own compilation*

It should be noted that the grouping of countries, carried out using another method of cluster analysis (hierarchical agglomerative), is almost identical to the above (*Fig. C1 in Appendix C*). As we can see, there are three clusters clearly in the distance of 150, uniting respectively 23, 12 and 15 countries. However, in the distance of 220 the last two groups merge into one. This is explained by the smaller difference between the averages of all 31 variables for the second and third clusters. The first cluster, in which the welfare states are grouped mainly in the classical sense, is characterized by much larger differences from the other two. It should be emphasized, however, that within the country clusters do not concentrate around their centers but are relatively evenly distributed around them. This is explained by the fact that in the countries ranking according to the values of the studied indices of their competitiveness, the environmental performance and the stringency of environmental regulations used for the analysis, there are no significant gaps, so the nature of the variables variation can be defined as clinal. The clinality of the transition from one cluster to another is visually confirmed by the uniform placement of countries on the 2D graph (*Fig. C2 in Appendix C*), which is obtained as a result of multidimensional scaling of the studied variables.

Conclusion

At the current stage of socio-economic development of the countries in the context of numerous international summits on climate change, the emergence problem of additional regulatory and tax burdens of environmental standards is nowadays actualized, which creates new challenges and opportunities for the competitiveness of national economies. The formation of a qualitatively new model of greening national economies in the context of welfare is linked to the emergence of radically new challenges: climate change, an aging population, environmental and food crises, new demands on the quality and quantity of public goods, etc. All this requires a review of the fundamental foundations of macroeconomic and institutional analysis of welfare states in the context of the ecological vector of development.

A comprehensive statistical analysis of long-term indicators of global competitiveness, environmental performance and the stringency of environmental regulations on a large sample of countries confirms the hypothesis that it is possible to internalize the significant stringency of environmental regulations in welfare states and maintain a high level of global competitiveness against the background of high quality environmental goods.

The clinal nature of the country ordination according to the studied indices indicates the absence of a wide gap between countries of different clusters and the possibility of increasing the global competitiveness and quality of the environmental performance of the lower groups by strengthening the stringency of environmental regulations while improving the quality of their institutions and inclusion (through the development of education, science, culture) into the system of individual and social values of environmental preferences.

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Appendix A

Table A1. Descriptive characteristics of Stringency of Environmental Regulations time series (2007-2017)

Cou3ntry	Valid N	Mean	Minimum	Maximum	Max-Min	Std.Dev.	Coef.Var.
Albania (ALB)	7	2,69	2,20	3,30	1,10	0,36	13,47
Algeria (DZA)	7	3,01	2,01	3,51	1,50	0,54	17,90
Angola (AGO)	3	2,77	2,41	3,31	0,90	0,48	17,13
Argentina (ARG)	7	3,20	2,91	3,41	0,50	0,20	6,11
Armenia (ARM)	7	3,15	2,90	3,50	0,60	0,23	7,27
Australia (AUS)	7	5,62	5,40	5,81	0,41	0,16	2,83
Austria (AUT)	7	6,15	5,41	6,60	1,19	0,41	6,69
Azerbaijan (AZE)	7	3,64	2,80	4,11	1,31	0,49	13,36
Bahrain (BHR)	7	4,25	3,61	4,81	1,20	0,46	10,76
Bangladesh (BGD)	7	3,05	2,81	3,51	0,70	0,26	8,60
Barbados (BRB)	7	4,21	3,81	4,81	1,00	0,35	8,34
Belgium (BEL)	7	5,99	5,50	6,90	1,40	0,45	7,45
Benin (BEN)	6	3,36	3,00	3,71	0,71	0,32	9,44
Bhutan (BTN)	2	5,60	5,60	5,60	0,00	0,00	0,00
Bolivia (BOL)	7	3,31	2,91	3,70	0,79	0,27	8,31
Bosnia and Herzeg. (BIH)	6	2,74	2,50	3,11	0,61	0,22	8,01
Botswana (BWA)	7	4,11	3,41	4,60	1,19	0,48	11,69
Brazil (BRA)	7	4,91	4,31	5,41	1,10	0,41	8,27
Brunei Darussalam (BRN)	3	4,51	4,30	4,71	0,41	0,21	4,56
Bulgaria (BGR)	7	3,28	3,00	3,61	0,61	0,23	6,98
Burkina Faso (BFA)	6	3,44	3,21	3,61	0,40	0,16	4,68
Burundi (BDI)	7	2,68	2,20	3,01	0,81	0,29	10,66
Cambodia (KHM)	7	3,21	3,01	3,71	0,70	0,24	7,63
Cameroon (CMR)	7	3,12	2,71	3,71	1,00	0,35	11,16
Canada (CAN)	7	5,26	5,00	5,81	0,81	0,27	5,16
Cape Verde (CPV)	4	3,73	3,51	4,01	0,50	0,22	5,97
Chad (TCD)	7	3,02	2,20	3,80	1,60	0,68	22,47
Chile (CHL)	7	4,67	4,51	5,11	0,60	0,22	4,61
China (CHN)	7	3,74	3,01	4,11	1,10	0,43	11,40
Colombia (COL)	7	3,88	3,51	4,30	0,79	0,26	6,66
Congo, Dem. Rep. (COG)	1	2,70	2,70	2,70	0,00	0,00	0,00
Costa Rica (CRI)	7	4,95	4,60	5,20	0,60	0,19	3,89
Cote d'Ivoire (CIV)	5	2,62	2,00	3,31	1,31	0,64	24,24
Croatia (HRV)	7	4,29	4,10	4,50	0,40	0,14	3,15
Cyprus (CYP)	7	4,15	3,71	4,71	1,00	0,35	8,31
Czech Republic (CZE)	7	5,28	5,11	5,50	0,39	0,14	2,57
Denmark (DNK)	7	6,21	5,81	6,61	0,80	0,26	4,24
Dominican Republic (DOM)	7	3,42	3,11	3,91	0,80	0,27	7,78
Ecuador (ECU)	6	3,56	3,10	4,60	1,50	0,59	16,69
Egypt (EGY)	7	2,88	2,20	3,31	1,11	0,40	13,87
El Salvador (SLV)	7	3,37	2,91	4,01	1,10	0,34	9,97
Estonia (EST)	7	5,15	4,71	5,41	0,70	0,32	6,19
Ethiopia (ETH)	7	3,47	2,61	4,01	1,40	0,52	14,88
Finland (FIN)	7	6,19	6,01	6,40	0,39	0,16	2,63
France (FRA)	7	5,35	5,10	5,81	0,71	0,25	4,75
Gabon (GAB)	2	3,81	3,71	3,91	0,20	0,14	3,71
Gambia, The (GMB)	7	4,29	3,71	4,81	1,10	0,40	9,42
Georgia (GEO)	7	3,54	3,31	3,90	0,59	0,21	5,99
Germany (DEU)	7	6,32	6,00	6,70	0,70	0,28	4,48
Ghana (GHA)	5	3,49	3,30	3,71	0,41	0,15	4,35
Greece (GRC)	7	3,95	3,61	4,41	0,8	0,27	6,82

Guatemala (GTM)	7	3,44	3,30	3,71	0,41	0,16	4,71
Guinea (GIN)	2	2,76	2,61	2,91	0,30	0,21	7,69
Guyana (GUY)	6	3,59	3,00	4,21	1,21	0,47	13,18
Haiti (HTI)	2	1,90	1,50	2,30	0,80	0,57	29,77
Honduras (HND)	7	3,84	3,31	4,20	0,89	0,29	7,55
Hungary (HUN)	7	4,69	4,01	5,11	1,10	0,33	7,10
Iceland (ISL)	7	5,42	5,11	5,71	0,60	0,20	3,72
India (IND)	7	4,16	3,81	4,50	0,69	0,26	6,30
Indonesia (IDN)	7	3,44	2,81	4,01	1,2	0,53	15,52
Iran, Islamic Rep. (IRN)	4	3,71	3,51	3,90	0,39	0,18	4,88
Ireland (IRL)	7	5,29	5,01	5,61	0,6	0,19	3,52
Israel (ISR)	7	4,62	4,21	4,91	0,7	0,24	5,18
Italy (ITA)	7	4,51	4,11	5,00	0,89	0,29	6,33
Jamaica (JAM)	7	3,52	3,40	3,71	0,31	0,11	3,10
Japan (JPN)	7	5,88	5,70	6,10	0,40	0,15	2,51
Jordan (JOR)	7	4,00	3,71	4,31	0,60	0,22	5,48
Kazakhstan (KAZ)	7	3,48	3,11	4,01	0,90	0,33	9,52
Kenya (KEN)	7	3,95	3,7	4,41	0,71	0,28	7,03
Kuwait (KWT)	7	3,19	2,91	3,41	0,50	0,22	6,80
Kyrgyz Republic (KGZ)	7	2,70	2,41	2,90	0,49	0,20	7,58
Lao PDR (LAO)	2	3,96	3,91	4,01	0,10	0,07	1,77
Latvia (LVA)	7	4,48	4,21	4,91	0,70	0,24	5,42
Lebanon (LBN)	4	2,10	1,90	2,40	0,50	0,22	10,29
Lesotho (LSO)	7	3,38	2,41	4,81	2,40	0,90	26,54
Libya (LBR)	3	3,11	2,81	3,41	0,60	0,30	9,64
Lithuania (LTU)	7	4,77	4,51	5,01	0,50	0,20	4,16
Luxembourg (LUX)	7	5,96	5,61	6,20	0,59	0,19	3,12
Macedonia, FYR (MKD)	7	3,41	2,91	4,01	1,10	0,46	13,38
Madagascar (MDG)	7	3,35	2,80	3,91	1,11	0,43	12,83
Malawi (MWI)	6	3,34	3,01	3,61	0,60	0,24	7,19
Malaysia (MYS)	7	5,11	4,81	5,30	0,49	0,17	3,36
Mali (MLI)	7	3,28	2,91	3,61	0,70	0,25	7,77
Malta (MLT)	7	3,89	3,50	4,21	0,71	0,26	6,71
Mauritania (MRT)	6	2,96	2,31	3,81	1,50	0,49	16,38
Mauritius (MRT)	7	4,12	4,01	4,31	0,30	0,12	2,96
Mexico (MEX)	7	3,96	3,70	4,20	0,50	0,17	4,34
Moldova (MDA)	7	3,00	2,70	3,11	0,41	0,15	5,01
Mongolia (MNG)	6	2,34	2,1	2,71	0,61	0,21	9,00
Montenegro (MNE)	6	3,97	3,41	4,40	0,99	0,35	8,73
Morocco (MAR)	7	3,55	3,31	3,81	0,50	0,19	5,36
Mozambique (MOZ)	7	3,17	2,91	3,51	0,60	0,19	6,02
Myanmar (MMR)	1	2,80	2,80	2,80	0,00	0,00	0,00
Namibia (NAM)	7	4,49	3,70	5,00	1,30	0,48	10,79
Nepal (NPL)	7	3,04	2,71	3,41	0,70	0,25	8,29
Netherlands (NLD)	7	6,01	5,80	6,21	0,41	0,15	2,55
New Zealand (NZL)	7	5,86	5,61	6,21	0,60	0,20	3,38
Nicaragua (NIC)	7	3,45	2,81	3,71	0,90	0,35	10,12
Nigeria (NGA)	7	3,08	2,80	3,41	0,61	0,18	5,93
Norway (NOR)	7	6,02	5,91	6,30	0,39	0,14	2,36
Oman (OMN)	6	5,29	4,81	5,61	0,80	0,32	6,02
Pakistan (PAK)	7	3,30	3,01	3,71	0,70	0,24	7,29
Panama (PAN)	7	3,81	3,51	4,11	0,60	0,24	6,42
Paraguay (PRY)	7	3,12	2,80	3,61	0,81	0,28	9,01
Peru (PER)	7	3,74	3,31	4,31	1,00	0,32	8,55
Philippines (PHL)	7	3,78	3,31	4,21	0,90	0,29	7,74
Poland (POL)	7	4,35	3,71	4,81	1,10	0,39	8,88
Portugal (PRT)	7	5,16	4,81	5,41	0,60	0,22	4,33

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Qatar (QAT)	7	5,12	4,41	5,71	1,30	0,40	7,83
Romania (ROU)	7	3,66	3,21	4,01	0,80	0,26	7,02
Russian Federation (RUS)	7	3,35	2,91	3,61	0,70	0,24	7,23
Rwanda (RWA)	4	5,95	5,90	6,01	0,11	0,06	1,02
Saudi Arabia (SAU)	6	4,21	3,10	4,71	1,61	0,60	14,17
Senegal (SEN)	6	3,34	2,91	3,81	0,90	0,35	10,47
Serbia (SRB)	7	3,11	2,61	3,61	1,00	0,38	12,17
Seychelles (SYC)	2	5,75	5,70	5,80	0,10	0,07	1,23
Sierra Leone (SLE)	3	3,14	2,91	3,31	0,40	0,21	6,58
Singapore (SGP)	7	5,62	5,41	5,70	0,29	0,10	1,83
Slovak Republic (SVK)	7	4,99	4,71	5,20	0,49	0,16	3,30
Slovenia (SVN)	7	5,16	5,00	5,41	0,41	0,16	3,02
South Africa (ZAF)	7	4,63	4,21	4,91	0,70	0,23	4,93
Korea, Rep. (KOR)	7	4,57	4,11	5,01	0,90	0,32	6,91
Spain (ESP)	7	4,67	4,40	4,81	0,41	0,15	3,31
Sri Lanka (LKA)	7	4,13	3,41	4,80	1,39	0,45	10,93
Suriname (SUR)	5	2,69	2,21	3,21	1,00	0,42	15,64
Swaziland (SWZ)	3	3,81	3,61	4,11	0,50	0,26	6,94
Sweden (SWE)	7	6,28	5,90	6,51	0,61	0,22	3,55
Switzerland (CHE)	7	6,22	5,90	6,50	0,60	0,23	3,73
Taiwan, China (TWN)	7	4,94	4,71	5,41	0,70	0,24	4,94
Tajikistan (TJK)	7	3,58	2,91	4,31	1,40	0,58	16,32
Tanzania (TZA)	7	3,79	3,61	4,30	0,69	0,24	6,25
Thailand (THA)	7	3,94	3,41	4,40	0,99	0,36	9,20
Timor-Leste (TMP)	1	2,90	2,90	2,90	0,00	0,00	0,00
Trinidad and Tobago (TTO)	7	3,18	3,00	3,31	0,31	0,10	3,09
Tunisia (TUN)	6	4,56	3,41	5,20	1,79	0,72	15,87
Turkey (TUR)	7	3,77	3,41	4,01	0,60	0,21	5,46
Uganda (UGA)	7	3,28	3,01	3,41	0,40	0,17	5,15
Ukraine (UKR)	6	3,01	2,83	3,31	0,48	0,20	6,50
United Arab Emirates (ARE)	7	5,11	4,61	5,51	0,90	0,37	7,20
United Kingdom (GBR)	7	5,50	5,31	5,90	0,59	0,19	3,43
United States (USA)	7	5,26	5,00	5,40	0,40	0,16	3,04
Uruguay (URY)	7	4,46	4,21	4,71	0,50	0,17	3,87
Venezuela (VEN)	7	3,31	3,10	3,51	0,41	0,13	3,98
Viet Nam (VNM)	7	2,95	2,70	3,11	0,41	0,19	6,31
Zambia (ZMB)	7	3,60	2,50	4,31	1,81	0,63	17,64
Zimbabwe (ZWE)	7	3,55	3,10	4,10	1,00	0,38	10,74

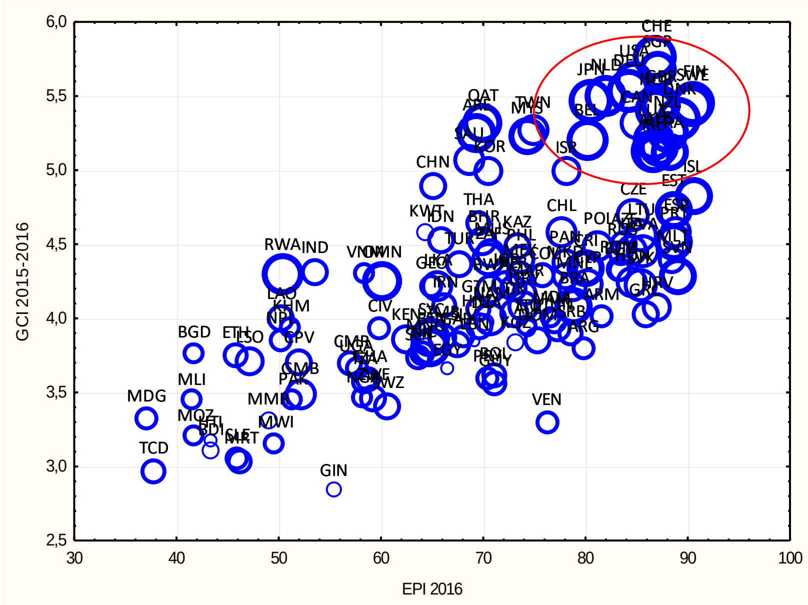
Source: *own compilation*

Appendix B

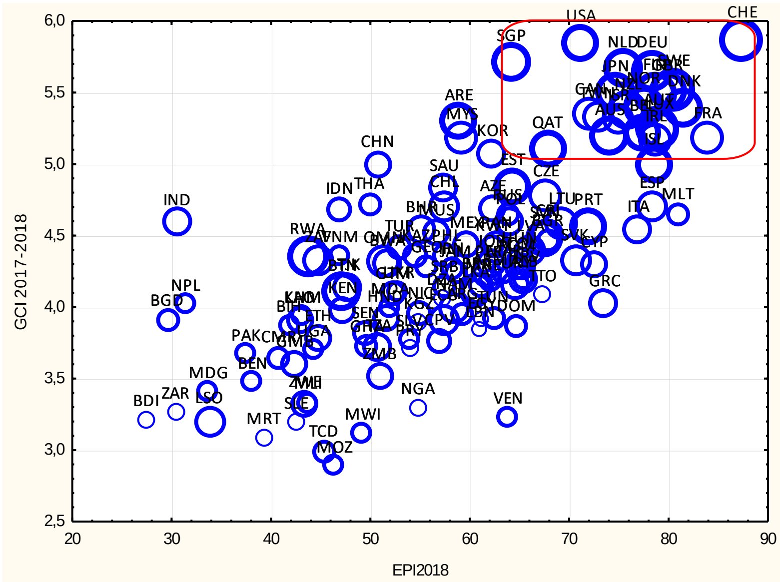
Table B1. Correlation matrix of variables that characterize global competitiveness, environmental status and burden of environmental regulation

	EPPI	SER 2007	SER 2008	SER 2009	SER 2011	SER 2013	SER 2015	SER 2017	EPI 2016	EPI 2014	EPI 2012	EPI 2010	EPI 2008	EPI 2006	ESI 2005	ESI 2002	ESI 2001	ESI 2000	GCI 2017-2018	GCI 2016-2017	GCI 2015-2016	GCI 2014-2015	GCI 2013-2014	GCI 2012-2013	GCI 2011-2012	GCI 2010-2011	GCI 2009-2010	GCI 2008-2009	GCI 2007-2008
EPPI	1,000	0,883	0,880	0,872	0,867	0,880	0,838	0,816	0,669	0,776	0,605	0,560	0,590	0,659	0,523	0,438	0,678	0,760	0,845	0,848	0,848	0,851	0,854	0,868	0,862	0,858	0,861	0,860	0,857
SER 2007	0,883	1,000	0,978	0,941	0,920	0,889	0,871	0,849	0,623	0,767	0,650	0,607	0,632	0,701	0,504	0,472	0,754	0,795	0,791	0,802	0,803	0,806	0,806	0,827	0,836	0,842	0,856	0,861	0,871
SER 2008	0,880	0,978	1,000	0,960	0,916	0,887	0,864	0,847	0,583	0,737	0,627	0,533	0,589	0,657	0,456	0,409	0,706	0,758	0,793	0,806	0,801	0,799	0,799	0,825	0,831	0,837	0,854	0,861	0,870
SER 2009	0,872	0,941	0,960	1,000	0,939	0,926	0,903	0,885	0,569	0,711	0,614	0,501	0,577	0,645	0,482	0,411	0,711	0,794	0,775	0,790	0,788	0,789	0,793	0,815	0,822	0,830	0,849	0,855	0,845
SER 2011	0,867	0,920	0,916	0,939	1,000	0,966	0,936	0,916	0,565	0,714	0,614	0,494	0,542	0,609	0,506	0,437	0,710	0,833	0,765	0,779	0,775	0,787	0,798	0,815	0,814	0,816	0,852	0,843	0,829
SER 2013	0,880	0,889	0,887	0,926	0,966	1,000	0,954	0,938	0,587	0,713	0,613	0,486	0,565	0,638	0,524	0,442	0,723	0,833	0,781	0,805	0,787	0,796	0,814	0,821	0,825	0,809	0,836	0,836	0,812
SER 2015	0,838	0,871	0,864	0,903	0,936	0,954	1,000	0,959	0,562	0,665	0,584	0,484	0,566	0,616	0,493	0,429	0,691	0,795	0,715	0,745	0,748	0,769	0,772	0,774	0,770	0,756	0,794	0,790	0,760
SER 2017	0,816	0,849	0,847	0,885	0,916	0,938	0,959	1,000	0,563	0,678	0,599	0,491	0,581	0,622	0,507	0,444	0,698	0,801	0,774	0,800	0,791	0,790	0,786	0,796	0,783	0,773	0,808	0,806	0,784
EPI 2016	0,669	0,623	0,583	0,569	0,565	0,587	0,562	0,563	1,000	0,878	0,565	0,754	0,865	0,860	0,507	0,558	0,708	0,804	0,741	0,710	0,712	0,720	0,711	0,698	0,684	0,699	0,694	0,700	0,693
EPI 2014	0,776	0,767	0,737	0,711	0,714	0,713	0,665	0,678	0,878	1,000	0,640	0,723	0,808	0,864	0,439	0,487	0,728	0,796	0,813	0,795	0,806	0,804	0,809	0,807	0,801	0,808	0,806	0,805	0,810
EPI 2012	0,605	0,650	0,627	0,614	0,614	0,613	0,584	0,599	0,565	0,640	1,000	0,676	0,679	0,711	0,583	0,593	0,707	0,643	0,520	0,498	0,502	0,506	0,486	0,489	0,498	0,492	0,481	0,484	0,493
EPI 2010	0,560	0,607	0,533	0,501	0,494	0,486	0,484	0,491	0,754	0,723	0,676	1,000	0,863	0,785	0,573	0,640	0,677	0,582	0,593	0,578	0,579	0,592	0,579	0,559	0,547	0,571	0,554	0,558	0,569
EPI 2008	0,590	0,632	0,589	0,577	0,542	0,565	0,566	0,581	0,865	0,808	0,679	0,863	1,000	0,884	0,530	0,621	0,726	0,694	0,697	0,678	0,684	0,713	0,699	0,685	0,683	0,692	0,662	0,665	0,664
EPI 2006	0,659	0,701	0,657	0,645	0,609	0,638	0,616	0,622	0,860	0,864	0,711	0,785	0,884	1,000	0,512	0,535	0,733	0,784	0,742	0,721	0,732	0,748	0,737	0,728	0,732	0,746	0,732	0,731	0,732
ESI 2005	0,523	0,504	0,456	0,482	0,506	0,524	0,493	0,507	0,507	0,439	0,583	0,573	0,530	0,512	1,000	0,856	0,821	0,744	0,410	0,375	0,351	0,371	0,386	0,394	0,395	0,385	0,376	0,377	0,367
ESI 2002	0,438	0,472	0,409	0,411	0,437	0,442	0,429	0,444	0,558	0,487	0,593	0,640	0,621	0,535	0,856	1,000	0,839	0,630	0,344	0,310	0,322	0,333	0,342	0,339	0,335	0,328	0,306	0,314	0,318
ESI 2001	0,678	0,754	0,706	0,711	0,710	0,723	0,691	0,698	0,708	0,728	0,707	0,677	0,726	0,733	0,821	0,839	1,000	0,893	0,634	0,608	0,611	0,625	0,629	0,632	0,626	0,622	0,625	0,627	0,629
ESI 2000	0,760	0,795	0,758	0,794	0,833	0,833	0,795	0,801	0,804	0,796	0,643	0,582	0,694	0,784	0,744	0,630	0,893	1,000	0,712	0,709	0,710	0,701	0,708	0,719	0,721	0,721	0,731	0,737	0,743
GCI 2017-2018	0,845	0,791	0,793	0,775	0,765	0,781	0,715	0,774	0,741	0,813	0,520	0,593	0,697	0,742	0,410	0,344	0,634	0,712	1,000	0,991	0,980	0,974	0,964	0,959	0,958	0,950	0,940	0,941	0,939
GCI 2016-2017	0,848	0,802	0,806	0,790	0,779	0,805	0,745	0,800	0,710	0,795	0,498	0,578	0,678	0,721	0,375	0,310	0,608	0,709	0,991	1,000	0,993	0,986	0,973	0,964	0,957	0,947	0,941	0,942	0,939
GCI 2015-2016	0,848	0,803	0,801	0,788	0,775	0,787	0,748	0,791	0,712	0,806	0,502	0,579	0,684	0,732	0,351	0,322	0,611	0,710	0,980	0,993	1,000	0,994	0,984	0,973	0,966	0,956	0,948	0,946	0,938
GCI 2014-2015	0,851	0,806	0,799	0,789	0,787	0,796	0,769	0,790	0,720	0,804	0,506	0,592	0,713	0,748	0,371	0,333	0,625	0,701	0,974	0,986	0,994	1,000	0,991	0,979	0,971	0,963	0,949	0,945	0,934
GCI 2013-2014	0,854	0,806	0,799	0,793	0,798	0,814	0,772	0,786	0,711	0,809	0,486	0,579	0,699	0,737	0,386	0,342	0,629	0,708	0,964	0,973	0,984	0,991	1,000	0,990	0,979	0,970	0,956	0,950	0,940
GCI 2012-2013	0,868	0,827	0,825	0,815	0,815	0,821	0,774	0,796	0,698	0,807	0,489	0,559	0,685	0,728	0,394	0,339	0,632	0,719	0,959	0,964	0,973	0,979	0,990	1,000	0,991	0,980	0,967	0,964	0,955
GCI 2011-2012	0,862	0,836	0,831	0,822	0,814	0,825	0,770	0,783	0,684	0,801	0,498	0,547	0,683	0,732	0,395	0,335	0,626	0,721	0,958	0,957	0,966	0,971	0,979	0,991	1,000	0,992	0,977	0,970	0,962
GCI 2010-2011	0,858	0,842	0,837	0,830	0,816	0,809	0,756	0,773	0,699	0,808	0,492	0,571	0,692	0,746	0,385	0,328	0,622	0,721	0,950	0,947	0,956	0,963	0,970	0,980	0,992	1,000	0,988	0,978	0,967
GCI 2009-2010	0,861	0,856	0,854	0,849	0,852	0,836	0,794	0,808	0,694	0,806	0,481	0,554	0,662	0,732	0,376	0,306	0,625	0,731	0,940	0,941	0,948	0,949	0,956	0,967	0,977	0,988	1,000	0,989	0,978
GCI 2008-2009	0,860	0,861	0,861	0,855	0,843	0,836	0,790	0,806	0,700	0,805	0,484	0,558	0,665	0,731	0,377	0,314	0,627	0,737	0,941	0,942	0,946	0,945	0,950	0,964	0,970	0,978	0,989	1,000	0,991
GCI 2007-2008	0,857	0,871	0,870	0,845	0,829	0,812	0,760	0,784	0,693	0,810	0,493	0,569	0,664	0,732	0,367	0,318	0,629	0,743	0,939	0,939	0,938	0,934	0,940	0,955	0,962	0,967	0,978	0,991	1,000

Source: *own compilation*



2016



2018

Figure B1. The relationship between the Environmental Performance Index, the Global Competitiveness Index and the Stringency of Environmental Regulations Index

Note: the greater the stringency of environmental regulations, the larger the diameter of the bubble is

Source: *own compilation*

Appendix C

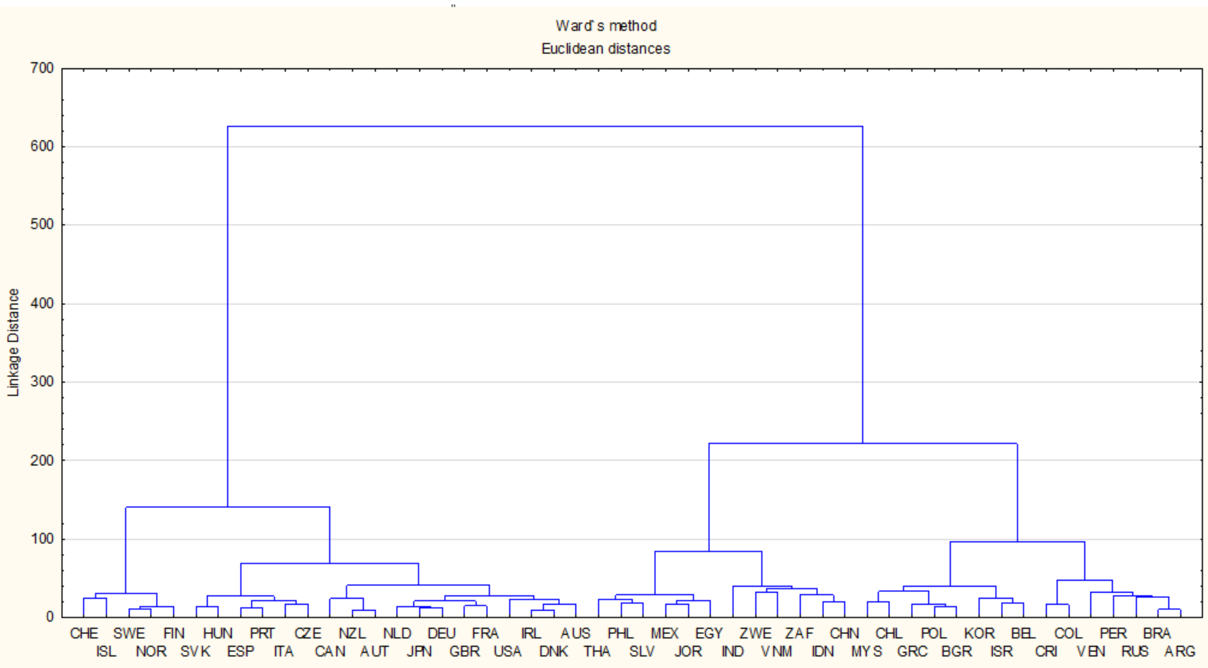


Figure C1. Dendrogram of hierarchical agglomerative analysis of countries by indicators of global competitiveness, environmental status and burden of environmental regulation
Source: *own compilation*

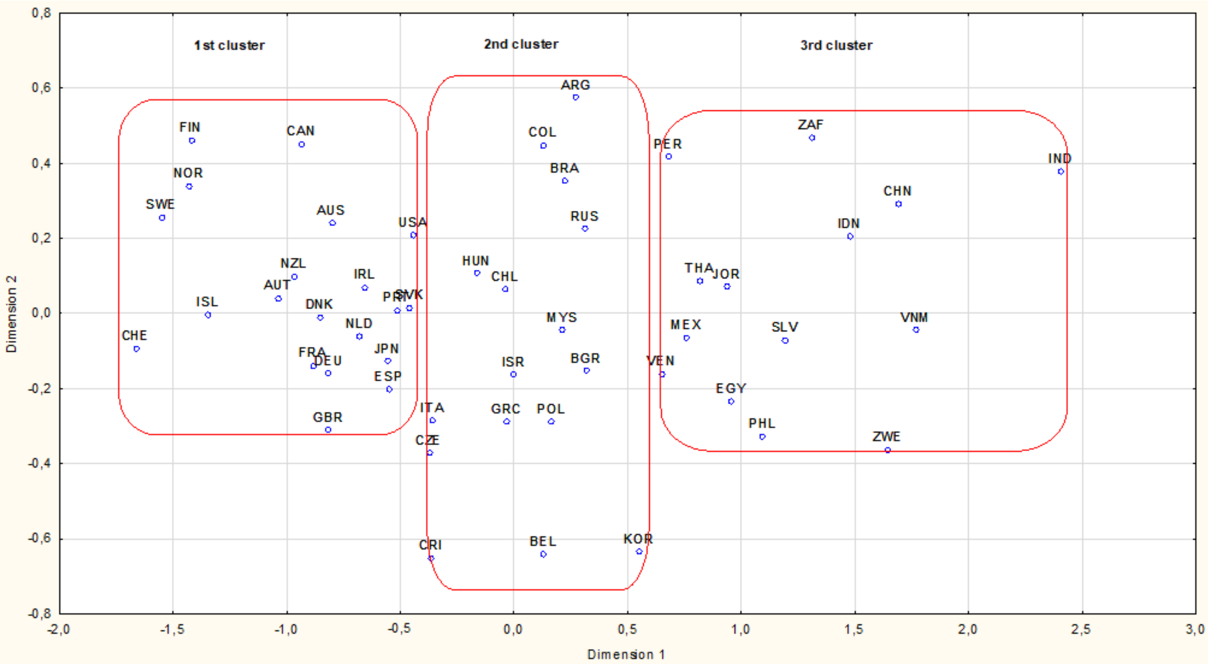


Figure C2. Coordination of countries in 2-D space as a result of multidimensional scaling of indicators of their global competitiveness, environmental status and burden of environmental regulation
Source: *own compilation*