Fakultet za menadžment Zaječar
Faculty of Management Zaječar
Univerzitet Džon Nezbit, Beograd
John Naisbitt University, Belgrade

ZBORNIK RADOVA
PROCEEDINGS

7. MEĐUNARODNI SIMPOZIJUM U UPRAVLJANJU PRIRODNIM RESURSIMA

7th INTERNATIONAL SYMPOSIUM ON NATURAL RESOURCES MANAGEMENT

Urednici/Editors
Dragan Mihajlović
Bojan Đorđević

Zaječar, Serbia
2017, May 31

7. Međunarodni simpozijum u upravljanju prirodnim resursima
7th International Symposium on Natural Resources Management

Izdavač/Publisher:	Faculty of Management, Zajecar, John Naisbitt University, Belgrade
Za izdavača/For the publisher:	Dragan Ranđelović, Executive Director
Urednici/Editors:	Full Professor Dragan Mihajlović Associate Professor Bojan Đorđević
Tehnički urednici/Technical editors:	Associate Professor Saša Ivanov Assistant Professor Gabrijela Popović Vesna Pašić Tomić, MSc
Tiraž/Copies:	**55**

ISBN: 978-86-7747-566-6

Zaječar, Serbia

2017, May 31

7. MEĐUNARODNI SIMPOZIJUM O UPRAVLJANJU PRIRODNIM RESURSIMA JE FINANSIJSKI PODRŽAN OD MINISTARSTVA PROSVETE, NAUKE I TEHNOLOŠKOG RAZVOJA REPUBLIKE SRBIJE

7th INTERNATIONAL SYMPOSIUM ON NATURAL RESOURCES MANAGEMENT IS FINANCIALLY SUPPORTED BY THE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGICAL DEVELOPMENT OF THE REPUBLIC OF SERBIA

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THE IMPACT OF FACTORS DESCRIBING SOCIAL GOVERNANCE ON ECONOMIC GOVERNANCE IN SUSTAINABLE DEVELOPMENT

Jan Polcyn1
Sebastian Stępień2

[1]*Stanisław Staszic University of Applied Sciences in Piła, Poland*
[2]*Poznań University of Economics and Business*

ABSTRACT

One of the important areas of scientific research on sustainable development includes factors affecting this development. As the nature of sustainable development is complex, it is necessary to examine various issues related to this development within four domains: environmental, economic, social and institutional-political. Mutual interactions between these governances are particularly interesting.

Data for the analysis were obtained from the website of Eurostat. Variables were assigned to individual domains and divided into stimulants, nominants and destimulants based on the description of the variables provided by Eurostat. These data were used to determine the synthetic measure of economic governance and to select those groups of variables describing social governance that most completely describe economic governance. Hellwig's taxonomic measure was used to achieve this goal.

Total values for groups of variables relating to economic governance and total values for groups of variables relating to social governance were determined for 28 selected European countries based on observation conducted over successive ten years. These results were then subjected to the procedure of panel data modelling. A fixed effects model was then selected as the most appropriate model.

The econometric model determined in the study describes economic governance based on four groups of variables selected from among seven groups characterizing social governance. The group of characteristics related to poverty and living conditions had the strongest positive impact on the direction of economic governance in the analysed period. The group of variables relating to consumption patterns and public health also had favourable effects on the synthetic measure of economic governance. Two groups of variables: 'demographic changes' and 'public security' had a negative impact on economic governance.

KEYWORDS

economic governance, social governance, sustainable development, synthetic measure

1. INTRODUCTION AND PURPOSE

Sustainable development refers to economic, social and environmental development (Baumgartner and Rauter, 2017, pp. 81-92). Institutional-political governance has been recently added to these domains. Data relating to these four domains are collected and appropriately grouped on the statistical website of Eurostat.

A review of scientific literature on sustainable development indicates that this development is measured in a variety of ways. One such concept emphasises that at the design stage of the production process, it is necessary to: estimate economic risk; assess the impact of this process on the environment; determine potential threats to wildlife and natural resources; measure the environmental efficiency of alternative solutions based on the identification of possible compromises; as well as make a quantitative and qualitative assessment of risks associated with these compromises (Gargalo et al., 2016, pp. 146-156).

The question of supporting sustainable development is so important that the related principles are incorporated into national policies and programmes. These principles relate to various aspects of human

activity, which – according to the concept of sustainable development – may be subject to intervention. The areas subject to intervention include in particular heating technologies, food security and agriculture. It should be emphatically stressed that the idea of sustainable development should be promoted and disseminated widely through the education system. Hence, it is important to properly develop education programmes for young people to adequately sensitize them to these issues (Klimova et al., 2016, pp. 223-239).

It should be mentioned in this context that the development and implementation of innovations, including primarily social innovations, is an important stimulator of sustainable development. Innovations enhance economic efficiency and can simultaneously bring significant benefits to the environment. Such solutions often create previously unknown opportunities to improve the quality of life of the entire society (Horst and Freitas, 2016, pp. 20-41).

As has been previously noted, sustainable development is affected by a variety of factors. Therefore, the complexity of sustainable development requires narrowing the focus of research to selected, yet key issues concerning the governances that shape this development. Thus, the objective of this study is to answer the question of whether and how individual variables describing social governance affect economic governance, expressed by means of synthetic measure. This article presents a novel approach to the study of relationships between various dimensions of sustainable development. The author believes that analytical solutions proposed in this paper will greatly contribute to the development of methodology allowing for a quantified description of the multi-dimensionality of economic governance.

2. METHODOLOGY

Data for the study were obtained from the website of Eurostat. The analysis included 28 selected European countries, which were examined from 2004-2013. Variables were assigned to individual governances and divided into stimulants, nominants and destimulants based on the description of the variables available in the Eurostat database (Tables 1-2).

Table 1. Groups of variables describing economic governance

No.	Specification	Type of variable
1.	**Economic development**	
1.1.	- gross domestic product growth per capita	stimulant
1.2.	- investment rate	stimulant
1.3.	- regional GDP per capita in purchasing power parity (PPP) at NUTS 3 level	destimulant
1.4.	- general government debt-to-GDP ratio	destimulant
1.5.	- the result (surplus/deficit) of the general government debt-to-GDP ratio	nominant
1.6.	- the energy consumption of transport and GDP – railway transport	destimulant
1.7.	- the energy consumption of transport and GDP – car transport	destimulant
1.8.	- the ratio between the energy consumption of transport and GDP	destimulant
1.9.	- GDP per capita in purchasing power parity (PPP)	stimulant

No.	Specification	Type of variable
2.	**Employment**	
2.1.	- the employment rate for people aged 20-64 years	stimulant
2.2.	- duration of working life	stimulant
2.3.	- the economic and social inactivity rate for young people aged 15-24 years	destimulant
2.4.	- the economic and social inactivity rate for young people aged 20-24 years	destimulant
2.5.	- economic activity rate	stimulant
3.	**Innovativeness**	
3.1.	- the share of net revenues from sales of innovative products in net revenues from sales	stimulant
3.2.	- human resources for science and technology	stimulant
3.3.	- work productivity	stimulant
3.4.	- R & D expenditure relative to GDP	stimulant
3.5.	- the number of patent applications filed by residents to the European Patent Office per one million inhabitants	stimulant
4.	**Transport**	
4.1.	- freight transport – rail transport	stimulant
4.2.	- freight transport – inland waterway transport	stimulant
4.3.	- passenger transport – trains	stimulant
5.	**Production patterns**	
5.1.	- resource efficiency	stimulant
5.2.	- the share of organic farms in the total agricultural area	stimulant
5.3.	- organizations registered in the Eco-Management and Audit Scheme (EMAS)	stimulant

Source: http://wskaznikizrp.stat.gov.pl/ [accessed 21 December 2016

Table 2. Groups of variables describing social governance

No.	Specification	Type of variable
1.	**Demographic changes**	
1.1.	- fertility rate	stimulant
1.2.	- the rate of international migration	stimulant
1.3.	- the rate of actual population growth/decline	stimulant
2.	**Public health**	
2.1.	- life expectancy at age 65 years in good health	stimulant
2.2.	- standardized mortality rates from cardiovascular disease	destimulant
2.3.	- standardized mortality rates from malignant neoplasms	destimulant
2.4.	- standardized mortality rates from chronic diseases of the lower respiratory tract	destimulant
2.5.	- standardized mortality rates due to diabetes	destimulant
2.6.	- Euro Health Consumer Index EHCI	stimulant
2.7.	- urban population exposure to excessive PM10 levels	destimulant
2.8.	- urban population exposure to air pollution by ozone	destimulant
3.	**Poverty and living conditions**	
3.1.	- the risk of persistent poverty	destimulant
3.2.	- the risk of poverty or social exclusion	destimulant
3.3	- inequality of income distribution	destimulant
4.	**Education**	
4.1.	- adults participating in education and training (%)	stimulant
4.2.	- public expenditure on education in relation to GDP	stimulant
4.3.	- young people not in further education	destimulant
4.4.	- the percentage of people aged 25-64 with at most lower secondary education	destimulant
5.	**Access to the labour market**	
5.1.	- the percentage of people in households without working people aged 0-17	destimulant

No.	Specification	Type of variable
	years	
5.2.	- the percentage of people in households without working people aged 18-59 years	destimulant
5.3.	- the rate of long-term unemployment	destimulant
5.4.	- the unemployment rate according to LFS	destimulant
5.5.	- gender-based wage differentials	destimulant
6.	**Public safety**	
6.1.	- victims of fatal accidents per one million population	destimulant
7.	**Consumption patterns**	
7.1.	- electricity consumption in households per capita	destimulant

Source: http://wskaznikizrp.stat.gov.pl/ [accessed on 21 December 2016]

The data collected in Tables 1-2 were used to determine the values of Hellwig's synthetic measure according to the procedure described in detail in the publication (Czyżewski and Polcyn, 2016, pp. 203-207). Total values were then calculated as a basis to carry out further stages of the study.

Total values obtained for groups of variables describing individual governances, which were determined for each of the 28 countries covered by the analysis based on observation conducted over ten consecutive years, were tested statistically in order to select the optimal version of the model and method of its estimation. The testing proceeded in the following steps:

1. Choosing between the classical least-squares (CLS) model and the panel data model

A Breusch-Pagan test was first performed. The result of the Breusch-Pagan test was 8.36554e-125. The low value of this statistic suggests that the CLS model should be rejected. Therefore, individual effects should be introduced.

Since an individual effect was present in the model covered by the analysis, a fixed effects estimator or a random effects estimator should be selected. The estimators are selected by analysing Hausman test results.

2. A panel-data estimator

2.1 A random effects estimator: individual effects are treated as random variables.

The p-value from the Hausman test for random effects is 2.0369e-010. This value suggests that a random effects estimator should not be used in the analysis (Hausman, 1978, pp. 1251-1271; Hausman and Taylor, 1981, pp. 1377-1398).

2.2 A fixed effects estimator is used to estimate the parameters of individual effects models.

The p-value from the Hausman test for random effects is 2.0369e-010. The value of $p < 0.05$ for the Hausman test indicates that a fixed effects estimator should be used in the analysis (Hausman, 1978, pp. 1251-1271; Hausman and Taylor, 1981, pp. 1377-1398).

Modelling was performed using software Gretl 2016d.

3. RESULTS AND DISCUSSION

The analytical procedure described in the previous chapter allowed for the designation of the model describing economic governance as a function of four groups of variables selected from among seven other groups.

Table 3. The results of the estimation of panel data for the dependent variable 'economic governance' and fixed effects

Independent variables	Models describing the formation of the dependent variable		
	(1)	(2)	(3)
const	1.877** (0.1746)	-0.1662 (0.1399)	0.1922** (0.07905)
Poverty and living conditions	-0.3551** (0.08071)	1.883** (0.1737)	1.776** (0.1489)
Demographic changes	0.5296** (0.1213)	-0.3505** (0.07967)	-0.3659** (0.07868)
Consumption patterns	1.403** (0.3806)	0.5382** (0.1190)	0.5424** (0.1190)
Public health	-0.3178** (0.1169)	1.412** 0.3792)	1.506** (0.3712)
Public safety	0.1889** (0.07947)	-0.3187** (0.1167)	-0.3278** (0.1166)
Education	-0.1694 (0.1404)	0.1866** (0.07912)	
Access to the labour market	0.03642 (0.09543)		
Additional criteria of model fit			
LSDV R^2	0.929	0.929	0.928
Within R^2	0.227	0.226	0.221
Logarytm wiarygodności	17.49	17.41	16.61
Kryt. bayes. Schwarza	162.23	156.76	152.73
Kryt. inform. Akaike'a	35.01	33.18	32.78
Kryt. Hannana-Quinna	86.04	82.75	80.89
Stat. Durbina-Watsona	1.5191	1.5227	1.5330
Autokorel. reszt – rho1	0.1403	0.1383	0.1353

Source: own study based on the data studied

Table 3 shows the successive steps in which the panel data model was improved by estimating fixed effects. The logarithm of likelihood was adopted as a criterion indicating the improvement of the model's explanatory properties and it was assumed that lower values of this measure pointed to more favourable explanatory properties of the model sought. The logarithm of likelihood in the model thus obtained was 16.61. This model had the lowest value and so was considered most preferred. Furthermore, the decreasing values of the Bayesian, Akaike and Hannan-Quinn information criteria indicate improvement of the explanatory properties of the model. Therefore, model (3) is the most appropriate model (Table 3) (Schwarz, 1978, pp. 461-464; Akaike, 1973, pp. 267-181; Akaike, 1973; Hannan and Quinn, 1979, pp. 190-195).

The value of LSDV R^2 in model (3) indicates that the model explains about 93% of variation. It is worth noting that the size of this indicator underwent minor changes in all models taken into consideration (Table 3). The within-group variance is 0.221. The within-group variance depends on differences within a group (in this case, differences within the time series studied) (Turczak and Zwiech, 2016, pp. 143-145).

Regularities in model (3) indicate that two of the five selected variables, i.e. 'demographic changes' and 'public safety', have a negative impact on the synthetic measure of economic governance. An increase in the

other three variables: ‘poverty and living conditions’, ‘consumption patterns’ and ‘public health’ contributes to the growth of the synthetic measure of economic governance.

A negative correlation of public safety and economic growth may be due to the intensification of events associated with breaking the law and the material condition of society.

The group of variables describing poverty and living conditions most contributes to an increase in economic governance. An increase in the variable ‘poverty and living conditions’ by one unit increases the synthetic measure of economic governance by 1.776. The trend demonstrated in this model is fully justified and indicates that gross domestic product per capita, the rate of investment and the value of other variables relating to the material situation of society go up with an increase in social welfare. As follows from the model presented, the level of poverty plays a considerable role in shaping the measure of economic governance. This shows that it is still necessary to implement the Millennium Development Goals, which involve increasing the level of awareness about the fight against poverty and the resulting socio-economic inequalities (Koff and Maganda, 2016, pp. 653-663). From the point of view of sustainable development and the fight against poverty, it is stressed that jobs need to be created outside agriculture and the economic productivity of land needs to be taken into account in the concept of governance. However, features assigned to rural areas in relation to economic governance should be considered in terms of local diversity (Adams et al., 2016, pp. 731-744).

The trend associated with the negative impact of demographic changes on economic governance is grounded in sociological processes. It is commonly known that the fertility rate declines when the material situation of society improves. Achieving the appropriate level of the material situation requires work commitment, which increases economic governance. This trend, however, leads in the long term to unfavourable changes associated with aging.

Public safety also adversely affects economic governance. An increase in the measure of public safety by one unit decreases the synthetic measure of economic governance by 0.3278. This regularity differs from the generally accepted conviction that the crime rate falls with an increase in social welfare. However, it should be noted that in this analysis, the variable ‘public safety’ is only associated with the variable ‘victims of fatal accidents per one million population’. This regularity shows that the number of means of transport goes up with an increase in economic governance, which is followed by an increase in the number of road fatalities.

In the category ‘consumption patterns’, there is only one variable describing energy consumption. This indicates that an increase in energy consumption affects the measure of economic governance. In this case, an increase in the measure of consumption by one unit increases the measure of economic governance by 0.5424. The explanatory properties of the aggregate measure of consumption should be strengthened by taking account of many other factors describing consumption patterns. Organic farming can be one such factor (Turczak, 2014, pp. 59-72).

The model presented above indicates that public health has a beneficial impact on economic governance. An increase in the aggregate measure of public health by one unit increases the synthetic measure of economic governance by 1.506. Health is often regarded as one of the important factors of human capital affecting productivity. This observation is confirmed by the correlation found in this model (Hnatyszyn-Dzikowska, 2009, pp. 37-48).

4. CONCLUSIONS

The analytical procedure proposed in this paper allowed for measuring economic governance and selecting variables that shape this governance.

This study made it possible to determine the econometric model describing economic governance based on the values of five groups of variables selected from among seven groups characterizing social governance.

The group of variables describing poverty and living conditions had the strongest positive impact. The group of variables relating to public health and consumption patterns also positively affected the synthetic measure of economic governance. In contrast, two groups of variables, i.e. ‘demographic changes’ and ‘public safety’ had a negative impact on economic governance.

The regularities presented in this article require further in-depth research on mutual interactions between individual domains of sustainable development. The aim of such research should be to identify new correlations, the knowledge of which will facilitate effective stimulation of sustainable development.

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