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ON THE RELATIONSHIPS BETWEEN SMART GROWTH AND COHESION INDICATORS IN THE EU COUNTRIES[1]

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ABSTRACT

Within the framework of the Europe 2020 strategy smart growth is listed as one of the leading policy objectives aimed at improving the situation in education, digital society and research and innovation. The objective of this article is to evaluate the relationships between smart growth and economic and social cohesion factors. Aggregate measures were used to describe smart growth pillars. Here, social cohesion is described by the level of employment rate as one of the conditions essential to the well-being and prosperity of individuals. Economic cohesion is defined by the level of GDP per capita in PPS. Observation of these three phenomena forms the basis for the construction of panel data models and undertaking the assessment of the relationships between smart growth and economic and social cohesion factors. The study was performed on the group of 27 European Union countries in the period of 2002-2011.

Key words: economic and social cohesion, smart growth, European Union countries, panel data analysis

1. Introduction

European economies face many challenges in the contemporary world. Actions outlined in the Europe 2020 strategy present the response of the EU member countries (a strategy for smart, sustainable and inclusive growth). It emphasises the importance of a balanced development of all countries and

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regions, particularly by unblocking and initiating growth processes through actions aimed to strengthen three priorities:

- smart growth – i.e. development of the knowledge-driven economy,
- sustainable growth – i.e. transformation towards low-carbon economy, which efficiently uses resources and benefits from competition,
- inclusive growth – i.e. fostering a high-employment economy bringing about social and territorial cohesion.

Countries that provide favourable conditions for smart growth are expected to gain a developmental advantage that manifests itself in the form of a higher level of social progress (for example noticeable in the larger number of workplaces available to individuals); and economic advancement (expressed in a higher output of goods and services).

The new endogenous growth theory (Romer, 1986), (Romer, 1990) directs the focus to the knowledge related factors. It implies the possibility of accumulation of the growth incentives, which creates a favourable environment for a constant development, but at the same time it may add to sustaining or even increasing differences between countries. In this approach, the long-term socio-economic development is based on the gains in human capital resources, physical and technological innovation, which in turn will increase the productivity of traditional growth factors through education, R&D, diffusion of innovation, along with positive spillovers related to the transfer of technology and assets. As (Fiedor, 2010) states, “this growth is based on the increase of the intellectual capital resources in the region by strengthening business support institutions oriented towards creating entrepreneurship and innovation, as well as, forming the web of linkages between the economy and the sphere of education, science and research.”

Economic and social cohesion – according to the European Union policy – is about reducing disparities between countries and the lagging behind of the advantaged regions. It should also promote more balanced, more sustainable ‘territorial development’.

This article attempts to assess the relationships between smart growth and social and economic cohesion in the EU countries. The focus of the research is not straightforwardly on the process of levelling off of the disparities but rather on establishing whether changes observed in smart growth level can or cannot influence the socio-economic situation and enable the levelling off processes as far as territorial disparities are concerned.

The definition of smart growth is based on the three conceptual pillars:

- innovativeness, as the driving force of economies towards knowledge and innovation,
- creativity, in the form of human capital resources,
- smart specialization, as the existing cutting-edge structures of highly advanced and specialised branches of economy.

The concept of smart growth pillars as well as social and economic cohesion were based on the assumptions made over the course of research study on: European regional space classification in the perspective of smart growth concept – dynamic approach (Markowska, Strahl, 2013).[4]

It is rather difficult to clearly indicate the directions of relationships that link smart growth and social and economic cohesion. It is more appropriate to state that they coexist and are interconnected. Smart growth is seen as the causative factor for achieving social and economic cohesion. Social and economic cohesion supports the expansion of spheres related to knowledge, human capital and innovation, which in turn are needed to create conditions for smart growth. Shifting growth to knowledge and high-tech sectors is not possible without achieving a certain level of socio-economic development, with reference to the aspects related to human capital formation, among others.

The review of selected regional development theories on the role of innovation was presented by Dominiak et al. (2012), Kawa (2007) and Strahl (2010), among others, while human capital aspects were discussed by, e.g.: Herbst (2007) and Cichy (2008).

This analysis of relationships between economic and social cohesion and smart growth is presented as the cross-section of the EU countries in the period of 2002-2011.

2. The research procedure and techniques

The analysis was conducted for all 27 EU Member States (excluding Croatia which joined the EU structures in 2013) in the period of 2002-2011. The Eurostat database[5] was the source of data for all the variables. This ensured comparability of data concerning the analysed countries.

The study was performed in three stages which covered:

I. Defining measures for smart growth, economic and social cohesion
II. Constructing aggregate measures for smart growth, economic and social cohesion
III. Estimating econometric models of economic and social cohesion with smart growth pillars

[4] Grant NCN no. 2011/01/B/HS4/04743.
[5] Internet service http://ec.europa.eu/eurostat.

Stage I. Defining measures for smart growth, economic and social cohesion

Multidirectional and multidimensional relations within socio-economic processes make their measurement a complex task. It is further hindered by limited access to the statistical data necessary to evaluate processes occurring in that area (especially at the administrative level, which is lower than the country level).

Economic cohesion is described by means of Gross Domestic Product *per capita* in PPS (*GDP*). This indicator is widely regarded as a relatively good measure of economic activity. For comparison purposes, these values were calculated as values per 1 inhabitant.

Social cohesion can be defined in the socio-cultural context as the willingness of members of a society to cooperate with each other in order to survive and prosper (Stanley, 2003). The OECD Development Centre describes a cohesive society as one which “works towards the well-being of all its members, fights exclusion and marginalisation, creates a sense of belonging, promotes trust, and offers its members the opportunity of upward social mobility” (OECD, 2011). On the basis of the works of the European System of Social Indicators (EUSI), social cohesion was measured in the context of a system of indicators, which distinguishes between two principle goals of social cohesion across a wide spectrum of life domains (Berger-Schmitt, 2000). The first goal is about reducing disparities, inequalities, and social exclusion within a society, while the second deals with the strengthening of the social capital in a society. Regarding the first goal, regional disparities are taken into account, for example with respect to access to transport, leisure and cultural facilities, educational and health care institutions, employment opportunities or the condition of the natural environment. The social dimension covers many diverse aspects reflected in local residents’ quality of life. Therefore, a question arises which social cohesion aspects present the strongest connections with smart growth. In the presented study the employment factor (expressed as the employment rate among population aged 20-64 in % (*EM*)) is defined as the key aspect of social cohesion. The impact of employment issues on social cohesion may be considered in terms of its significance to an individual. In the light of this approach, employment is the basic condition that provides financial means necessary to obtain goods and services. Being at work lays foundations for individual aspirations and advancement, and determines one’s social position, thus influencing the overall level of satisfaction derived from life and its quality.

A set of diagnostic indicators for smart growth was suggested. Among them the indicators for each pillar were selected, based on the availability and comparability of data over time for 27 countries (Table 1).

Table 1. The set of diagnostic indicators for smart growth pillars

SMART GROWTH		
Pillar I **SMART SPECIALIZATION**	Pillar II **CREATIVITY**	Pillar III **INNOVATION**
KIS – employment in knowledge-intensive services as the share of total employment (%) *HTMS* – employment in high and medium high-technology manufacturing as the share of total employment (%)	*TETR* – the share of tertiary education employment in total employment in a region (%) *HRST* – human resources in science and technology as the percentage of active population (%) *LLL* – participation in education and training of population aged 25-64 (as the share of total population (%))	R&De – research and development expenditure in enterprise sector (% of GDP) R&Dgov – research and development expenditure in government sector (% of GDP) *EPO* - patent applications to the European Patent Office per million labour force

Source: Authors' compilation based on: European regional space classification in the perspective of smart growth concept – dynamic approach (grant NCN no. 2011/01/B/HS4/04743)

Smart specialization emphasises the real scope and role of the high and medium technology sector in the employment structure of individual countries. Currently, knowledge- and innovation-based economies, i.e. the ones where a large proportion of GDP and workplaces comes from these sectors, are considered to be capable of gaining a competitive advantage on an international scale, thus guaranteeing the availability of workplaces to individuals. For knowledge-intensive services (KIS) knowledge is the main production factor as well as the good that they offer. In line with the Eurostat methodology, services are mainly aggregated into knowledge-intensive services (KIS) and less knowledge-intensive services (LKIS) based on the share of tertiary educated persons at NACE 2-digit level. KIS covers such activity as:

- knowledge-intensive high-tech services (post and telecommunications; computer and related activities; research and development);
- knowledge-intensive market services (excluding financial intermediation and high-tech services) (water transport; air transport; real estate activities; renting of machinery and equipment without operator, and of personal and household goods; other business activities);
- knowledge-intensive financial services (financial intermediation, except insurance and pension funding; insurance and pension funding, except compulsory social security; activities auxiliary to financial intermediation);
- other knowledge-intensive services (education; health and social work; recreational, cultural and sporting activities).

The high and medium high-technology manufacturing (HMMS) refers to such groups of economic activity as:

- high technology (basic pharmaceutical product and pharmaceutical preparation; computer, electronic and optical products; air and spacecraft and related machinery);
- medium and high technology (chemicals and chemical products; weapons and ammunition; electrical equipment, machinery equipment, motor vehicles, trailer and other; medical and dental instruments and supplies).

Creativity is the aspect that focuses on the quality of human capital across countries, as well as readiness to improve qualifications. Human capital is approximated by three variables: human resources in science and technology (HRST) - citing *the Canberra Manual,* this refers to those individuals who fulfil one of the following conditions: (1) successfully completed education at the tertiary (third) level in an S&T field of studies, (2) did not formally qualify as above, but are employed in a S&T profession, where the above qualifications are normally required. This variable helps to better understand the demand for and supply of highly skilled, specialized staff in S&T. Highly skilled human resources are defined as essential to the diffusion of knowledge, and form the crucial link between technological progress and economic growth, social development and environmental well-being. The second variable underlines the general level of formal knowledge in the society expressed by percentage of people who successfully completed tertiary education, and the third variable describes the level of inclination toward life-long learning.

Innovation is the pillar that represents the amount of R&D funds invested in the region, taking into consideration the character of the investor (business and public sector), along with the results of innovation activities in the form of patent applications (*EPO*). The total European patent applications refer to requests made for protection of an invention forwarded either directly to the European Patent Office (EPO) or filed under the Patent Cooperation Treaty and designating the EPO (Euro-PCT), regardless of whether they are granted or not.

To obtain the comparability of data among countries and their economies all features were defined as indicators (in relation to other phenomena, e.g. population, employed).

Stage II. Constructing measures for smart growth, economic and social cohesion

This stage of analysis covers (Hellwig 1968; Walesiak 2006; Bal-Domańska, Wilk 2011):

A. Defining the character of a variable in terms of its connection to the described phenomena as: (S) *stimulant* – when the increase in a variable indicates an improved situation; (D) de*stimulant* – when the increase in the value is interpreted as deterioration in the situation. (N) *nominant* – when a specified value is the only one to be regarded as having positive impact; the values below and above the nominal one have negative impact on the assessment of the situation. All variables applied to describe economic and social cohesion, as well as smart growth, were treated as stimulants.

Their higher values strengthen development processes.

B. Normalising diagnostic indicators by scaling between 0 and 1 in line with the following formula:

$$z_{itj} = \frac{x_{itj} - \min_i x_{itj}}{\max_i x_{itj} - \min_i x_{itj}} \tag{1}$$

where:

z_{itj} – value of j-diagnostic feature (indicator, variable) (j = 1, 2,…, K) in i-th object (country) (i = 1, 2,…, N) in t-th period (t = 1, 2,…, T) after the normalization by scaling between 0 and 1,

x_{itj} – implementation of j-diagnostic feature in i-th object in t-th period,

$\min x_{itj}$ ($\max x_{itj}$) – the lowest (highest) value of j-diagnostic feature x_{itj}.

The standardisation was simultaneously performed for values of the variable referring to all countries and years, which allowed comparison of the country's position in consecutive years.

C. Calculating aggregate growth measure (AGM) for l-th pillar of smart growth (l = SS, C, I; SS – smart specialization; C- creativity; I – Innovation) by:

- defining the global benchmark of smart growth z_{0t} for T periods together for each variable,

$$z_{0t} = [z_{0t1}\ z_{0t2} \ldots z_{0tK}], \tag{2}$$

such that: $z_{0tj} = \max z_{itj}$. (3)

- calculating aggregate growth measure for each of the K_l sub-measures of smart growth l-th pillar:

$$AGM^{l}_{SMART_{it}} = \frac{1}{K_l} \sum_{j=1}^{K_l} z_{itj}, \tag{4}$$

Each of the values is normalised between 0 and 1, so that 1 is the most favourable value.

Stage III. – Models of social and economic cohesion

Linear econometric models describe relations which combine smart growth with economic and social cohesion by means of applying panel data in the EU countries, which is presented in the form of the following model constructions:

$$AM_{ECON,it} = (AGSS_{it}, AGC_{it}, AGI_{it}, \alpha_{\mathrm{i}}, \alpha_{\mathrm{t}}, \varepsilon_{it}), \tag{5}$$

$$AM_{SOC,it} = (AGSS_{it}, AGC_{it}, AGI_{it}, \alpha_{\mathrm{i}}, \alpha_{\mathrm{t}}, \varepsilon_{it}). \tag{6}$$

where:

$AM_{ECON,it}$ - aggregate measure for economic cohesion for *i*-th country in *t*-th year, which is *GDP* (Gross Domestic Product *per capita* in PPS),

$AM_{SOC,it}$ - aggregate growth measure for social cohesion for *i*-th country in *t*-th year, which represents *EM* (the employment rate among population aged 20-64 in %),

$AGSS_{it}$ ($AGM^{SS}_{SMART,it}$) - aggregate growth measure for *smart specialization* pillar of smart growth for *i*-th country in *t*-th year,

AGC_{it} ($AGM^{C}_{SMART,it}$) - aggregate growth measure for *creativity* pillar of smart growth for *i*-th country in *t*-th year,

AGI_{it} ($AGM^{I}_{SMART,it}$) - aggregate growth measure for *innovation* pillar of smart growth for *i*-th country in *t*-th year,

α_i - constant in time individual effects for *i*-th country,

α_t - different intercepts in each year common for all objects (countries),

ε - error term.

In the model both individual effects for each country α_i, and time for each year α_t, were included. Incorporating individual effects into the model structure made it possible to take into account characteristics which are specific for each country and constant in time (such as geographic location and accompanying resources). Time effects introduce an additional incidental parameter bias (Wooldridge, 2002).

In order to estimate the parameters, adequate estimation techniques, typical for panel data, were applied. LSDV (*Least Squares with Dummy Variable*) model was used in the study (Greene, 2003), (Wooldridge, 2002). To assess the validity of introducing the individual effects α_i to the model, F test was performed.

$$F = \frac{(\sum e^2_{OLS} - \sum e^2_{LSDV})/(N-1)}{(\sum e^2_{OLS})/(NT - N - K)} \tag{7}$$

where:

$\sum e^2_{OLS} (\sum e^2_{LSDV})$ - the sum of squared residuals in the LSDV (Least Square Dummy Variable) and OLS (Ordinary Least Square) regression.

It is the test of null hypothesis, i.e. all the units share the same intercept against the alternative that they are different from.

Wald's test (chi-square) was applied to assess the validity of introducing α_t time effects to the model.

In the process of estimating econometric models, certain problems, may occur, e.g. autocorrelation, heteroskedasticity. In order to minimize their possible negative effects, robust standard errors (Arellano, 2003) were used in assessing the significance of structural parameters evaluation.

All calculations were performed in GRETL.

3. Econometric analysis results

The analysis begins with the distribution of aggregate values of growth measures for particular pillars of smart growth (Figure 1), as well as of economic and social cohesion (Figure 2) for 27 EU countries, in the period of 2002-2011.

The levels of smart specialisation (*AMSS*) and innovation (*AMI*) in the studied countries do not change significantly in the analysed years. A significant increase in the aggregate measure of growth is observed for creativity (*AMC*).

Innovation occurs to be the most diverse variable pillar of smart growth (in terms of variation coefficient) in the cross-section of the EU countries, while smart specialisation is the least one. In the analysed time periods (years) the levelling off of creativity, and to a lesser extent innovation, can be observed.

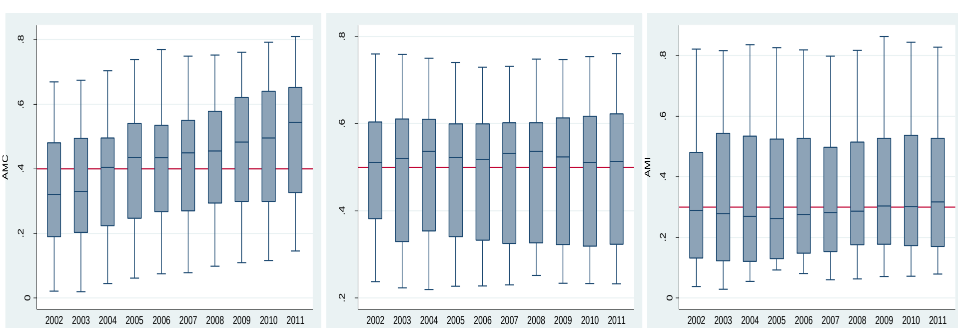

Figure 1. Values of aggregate growth measure of smart growth pillars for the EU countries in the period of 2002-2011

Source: Authors' work in STATA program.

Looking at the distribution of the values of economic cohesion (Figure 2) one can observe that *GDP* grows over the entire analysed period, except the years directly after the crisis (2008-2009). Attention should be paid to the level of *GDP* per capita for Luxemburg, which differs from other countries in each of the studied years (to be seen as outlier observations). In 2011 *GDP* per capita in PPS of Luxemburg was 68,100, in Netherlands – the second country in the range – 32,900, in Austria – 32,400 and in Ireland – 32,300, which is half of Luxemburg's *GDP* amount. The lowest *GDP* level was recorded in Romania and Bulgaria – about 11,700, a slightly higher one in Latvia – 14,700.

Within the analysed period, the processes of achieving economic cohesion are observed, which manifests itself in narrowing differences in the level of economy development among countries (measured as GDP per capita in PPS). These positive processes came to a halt in the years 2008-2011. However, disparities among countries in GDP per capita at the end of the analysed period are shown to be narrower than in the first year of the research.

The value of the employment rate (Figure 2) increased significantly (referring to the median and maximum value) during the period of 2004-2008. It can also be noticed that the minimum value of the indicator grows year on year, which seems to be a positive aspect, which indicates the increase of the employment rate even in the countries with the least favourable situation. In 2011, the highest employment rate was in Sweden (79%), Netherlands (77%), with values exceeding 75% also reported in Germany, Austria and Denmark. The lowest employment rate in 2011 (about 60%) was recorded in Greece, Hungary, Italy and Malta.

Until 2008, the processes leading to social cohesion among the EU countries were observed; it was manifested in decreasing disparities in employment levels among countries. However, in the years of the crisis and immediately after them the differences in employment levels were growing again.

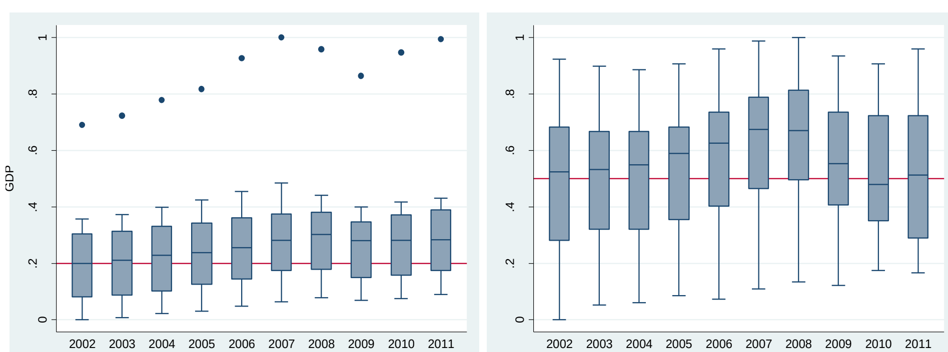

Figure 2. Values of economic and social cohesion indicators for the EU countries in the period of 2002-2011

Source: Authors' work in STATA program.

Out of the three smart growth pillars: creativity, innovation and smart specialization, only creativity could be identified as statistically significant (at the level of 0.1) in terms of its influence on economic cohesion (Table 2). This pillar represents the measure of the quality of the country's human capital, with special attention paid to the science and technology sector, the level of tertiary education and life-long learning. The increase in creativity level by 1 point was reflected in the growth of economic cohesion by 0.171 (ceteris paribus). The other pillars did not show any statistically significant relations. All time effects were statistically significant.

The values of *F* statistics amounting to 517 confirm that including α_i individual effects in the model is fully justified, since they improve estimation results as statistically significant. That means that major differences in economic cohesion between countries were observed. The value of determination coefficient informs that almost 98.8% of economic cohesion variability was explained by the model with dummy variable.

Table 2. The results of model estimations of economic cohesion and smart growth for 27 UE countries in the period of 2002-2011

Specification	$AM_{ECON,it} = (AGSS_{it}, AGC_{it}, AGI_{it}, \alpha_i, \alpha_t, \varepsilon_{it})$
AGC	**0.171* [0.037]**
AGSS	**-**
AGI	**-**
α_{2002}	0.156***
$\alpha_{2003}-\alpha_{2002}$	0.004***
$\alpha_{2004}-\alpha_{2002}$	0.015***
$\alpha_{2005}-\alpha_{2002}$	0.027***
$\alpha_{2006}-\alpha_{2002}$	0.048***
$\alpha_{2007}-\alpha_{2002}$	0.071***
$\alpha_{2008}-\alpha_{2002}$	0.069***
$\alpha_{2009}-\alpha_{2002}$	0.037***
$\alpha_{2010}-\alpha_{2002}$	0.051***
$\alpha_{2011}-\alpha_{2002}$	0.059***
R^2	0.988
Test F (*p-value*)	516.9 (0.000)
The Akaike information criterion	-1330.8

*** significant at the level of 0.001, ** significant at the level of 0.05, * significant at the level of 0.1. Arellano robust standard error HAC is quoted in parentheses [].

Source: Authors' estimations in GRETL programme.

The attempt to describe (by applying econometric models) the relationships between smart growth and social cohesion expressed in terms of employment rates proved to be a considerable challenge.

The main reson for this is the diverse nature of growth processes in each of the countries, particularly in the years after the crisis of 2008. Consequently, the attempt to apply the pillars concept in order to describe social cohesion failed. Figure 3 presents the changes of the employment rate $AGM_{EMPL,it}$.

Figure 3. Values of the employment rate (*EM*) as a social cohesion measure of the EU countries in the period of 2002-2011

Source: Authors' work in STATA program.

As can be seen, the run (distribution) of indicators differed among the studied countries in the period of 2002-2011. Taking into account the values of the employment rate, three main types of run can be identified:

- **increase** - this tendency was true for the employment rate in 5 countries: Austria, Poland, Germany, Malta and Belgium.
- **hill -** until 2008 an increase in the indicator was observed (sometimes very explicit, e.g. in Spain, Estonia, Bulgaria, Latvia, Lithuania, Slovakia, Ireland and Greece). Later a significant decline was observed.
- the third type referrs to the absence of changes (**stable**) - in that case changes are irrelevant and oscillate around a particular level. 10 such countries were identified.

It is an approximate division.

The situation was different during the analysis of smart growth pillars. In terms of creativity an increase was observed for the majority of countries. Only in few of them the changes smaller than 10% of *AGC* were recorded.

The level of innovativeness was constant, or increased in most countries. A decrease of over 10% of *AGI* was observed in the United Kingdom, Hungary, Cyprus and Bulgaria.

Looking at the smart specialization factor the situation improved in 7 countries (Czech Republic, Greece, Cyprus, Luxemburg, Portugal, Slovenia and Slovakia), whereas in another group of 7 countries (Denmark, Estonia, Ireland, Malta, Romania, Sweeden and United Kingdom) a decline in the value of *AGSS* was observed in the last assessment period compared to the initial one. In the remaining countries the value of *AGSS* remained at a relatively constant level.

The models for clusters of countries analysed in terms of the employment rate and smart growth pillars allowed for the identification of the following statistically significant relations (Table 3).

Table 3. The results of model estimations for the employment rate and smart growth pillars regarding clusters of the EU countries in the period of 2002-2011

Specification	*Increase*	*Hill*	*Stable*
AGC	-	-1.212** [0.594]	0.386*** [0.060]
AGSS	0.791***[0.285]	-	-0.358** [0.147]
AGI	-	-	-
α_{2002}	-0.1099	0.8835***	0.4280***
α_{2003}-α_{2002}	0.0039***	0.0155***	0.0075
α_{2004}-α_{2002}	0.0093	0.0361***	0.0137
α_{2005}-α_{2002}	0.0069***	0.0570***	0.0120
α_{2006}-α_{2002}	0.0157***	0.0656***	0.0142
α_{2007}-α_{2002}	0.0192***	0.0789***	0.0112***
α_{2008}-α_{2002}	0.0334***	0.0928***	0.0178*
α_{2009}-α_{2002}	0.0376***	0.1050**	0.0229
α_{2010}-α_{2002}	0.0331***	0.1079	0.0191**
α_{2011}-α_{2002}	0.0407***	0.1208	0.0199**
R^2	0.977	0.899	0.989
Test F (*p-value*)	277.10 (0.000)	44.5 (0.000)	275.4 (0.000)
The Akaike information criterion	-155.8	-275.9	-416.3

Designation as in Table 2.

Source: Authors' estimations in GRETL program.

For the “increase” class, a statistically significant relation (at the level of 0.001) related to smart specialization pillar was identified. A significance increase in employment in technology and knowledge-intensive sectors by unit was related to the increase in total employment rate by 0.791 (ceteris paribus).

In the case of the “hill” class, the relation between countries and creativity was negative, which suggests that despite the increase in the creativity level (observed for the majority of countries) the employment rate declined. It was influenced by other factors not included in the model. The employment rate did not depend on the level of innovativeness and smart specialization in a given country. The absence of statistically significant time effects for the years 2010-2011 indicates the trend breakdown regarding the employment rate in the period of crisis.

The role of employment in technology and knowledge-intensive sectors had a negative effect on the total employment rate in the “stable” class. Expanding the role of employment in the medium and high-tech manufacturing sector and, at the same time, the knowledge-intensive sector by unit reduces the employment rate by 0.358 (*ceteris paribus*). The negative sign of the parameter estimate indicates that changes in the employment rate resulted in changes in the employment structure in sectors other than knowledge. At the same time changes in the level of creativity were consistent with changes in the employment rate of 0.386 (*ceteris paribus*).

4. Conclusions

As a result of the research conducted by applying econometric tools the following conclusions for the EU regions in the period of 2002-2011 were drawn:

- A statistically significant relationship between the level of economic cohesion and the creativity level of the EU countries was confirmed. Enhancing human capital potentially favours a higher level of economic cohesion.
- It was not possible to identify (at a country level) statistically significant relationships for the two remaining pillars of smart growth: smart specialization and innovation.
- It was also not possible to identify any statistically significant connections between smart growth and social cohesion (employment). This might be due to the diverse and complex nature of links connecting these phenomena among the EU countries in the studied years.
- Within the clusters of countries, specified in terms of the employment rate, statistically significant relationships were identified for the chosen smart growth pillars. An increase in the employment rate (in the “increase clusters”) was related to the increasing role of employment in smart specialization sectors. Simultaneously, the countries from this cluster demonstrated the highest resilience against the consequences of the crisis manifested in the form of a decline in the employment rate.

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