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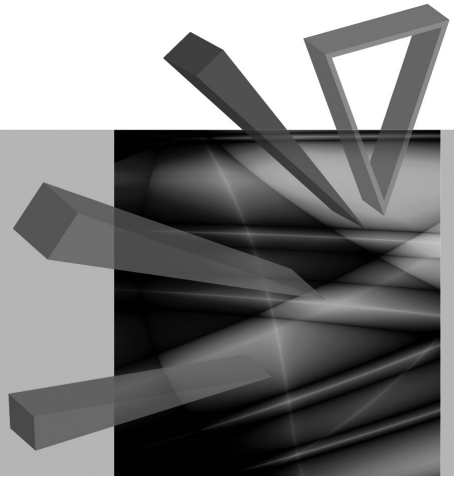

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DOES SMART GROWTH ENHANCE ECONOMIC COHESION? AN ANALYSIS FOR THE EU REGIONS OF NEW AND OLD ACCESSION COUNTRIES*

Summary: The objective of the paper is to assess relations between smart growth described by means of three pillars (smart specialization, creativity, innovation) and economic cohesion by measuring both the intensity and direction of their mutual relations. The study was conducted among NUTS 2 level regions of the European Union countries divided into the regions of new accession from 2004 and 2007 (EU12) and the remaining regions, i.e. old EU ones (EU15). The study covered the period of 2000–2009. An analysis of smart growth pillars' impact on economic cohesion confirmed that the key factor and also the one which develops most dynamically is represented by human capital creative resources (pillar II) in both the EU12 and the EU15 regions.

Keywords: smart growth, economic cohesion, NUTS 2 level regions of the European Union countries.

1. Introduction

Within the framework of the EU Europe 2020 strategy [*A Strategy*... 2010], smart growth is listed as one of the major policy goals aimed at the situation improvement in such domains as education, research, innovation and digital society. It can be demonstrated that smart growth represents the set of instruments stimulating dynamic growth and therefore enhancing economic and social cohesion, which results in upgrading the inhabitants' standard of living.

The Europe 2020 strategy defines three goals for the whole European Union, the aim of which is to support smart growth. They are as follows:

* The study was prepared within the framework of NCN nr 2011/01/B/HS4/04743 research grant entitled: *The classification of European regional space in the perspective of smart growth concept – dynamic approach* and constitutes a part of the series of analyses referring to these issues.

1) increase the overall level of public and private investment in research and development (R&D) up to 3% of EU GDP and ensure better conditions for R&D and innovation,

2) improve the employment rate for the population aged 20–64 up to 75%, mainly by means of enhancing larger numbers of women, youth, the elderly, low-skilled workers and legal emigrants entering the job market,

3) provide a better level of education by cutting the percentage of young people dropping out of the education system to below 10% and take up efforts resulting in at least 40% of the population aged 30–34 obtaining tertiary level education (or equivalent).

These indicators refer to goals set for the whole EU and additionally, for individual countries, national targets were also specified. With reference to Poland, goals regarding two indicators were defined at a slightly lower level, namely: 1.7% GDP for research and development, 71% in the case of the employment rate for the population aged 24–64. On the other hand, slightly higher requirements were put forward before the education system for which it was assumed that the number of students dropping out of school should not exceed 4.5% and the amount of higher education graduates should reach the level of at least 45%.

The objective of this paper is to provide an assessment of relations between smart growth and economic cohesion by measuring the intensity and direction of mutual relations. The study was conducted among NUTS 2 level regions of European Union countries divided into the regions of new accession from 2004 and 2007 (EU12), as well as the remaining regions of the, so called, old European Union (EU15). The study covers the period of 2000–2009.

2. Research procedure and data

The basic problem encountered while preparing the research was defining the adequate measures of smart growth and economic cohesion, since these are complex phenomena for which adequate measures are difficult to find.

The study presented in this paper was designed at a regional level (NUTS 2). The availability of data at this level is limited and not all smart growth indicators are available. Therefore the measures defined in the study by [Markowska, Strahl 2012] constituted the starting point for smart growth measurement. From them the measures for smart growth and economic cohesion measurement were selected. With reference to the analyzed approach, smart growth is defined by means of indicators grouped in 3 pillars: pillar I – smart specialization, pillar II – creativity (Knowledge Based Economy KBE) and pillar III – innovation.

Two qualities were used as smart growth measures in pillar I – **smart specialization (SS)**:

– 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 (%).

The above variables characterize the scale of employment in enterprises implementing advanced technologies and knowledge as well as requiring ongoing investment into research and development. Therefore it may be stated that they result from market and competition pressure on the development of knowledge and innovation based activities.

Qualities characteristic for human capital in a region, representing the basic factor enhancing regional creativity and the primary factor of innovation facilitating and implementing innovative solutions, were used as measures for pillar II of smart growth – **regional creativity** (**CR**). The study takes into account:

– TETR – share of tertiary education workforce in the overall number of workforce in a region (%),
– HRST – human resources in science and technology as a percentage of the active population (%).

The following measures were used in relation to pillar III – **innovation activities (INN)** potential and capacity:

– R&D – research and development expenditure in the business sector (GDP %).

This quality is responsible for identifying which part of financial means is allocated by enterprises to research and development regarding the size of GDP in a region. The results of such activities bring about positive effects for a region in which a given unit and research base is located and may also be disseminated to other regions.

All variables constituting smart growth pillars represent stimulants. Their higher values strengthen developmental processes focused on innovation and a knowledge-based economy, while the processes which accompany them enhance economic cohesion.

Economic cohesion (SGM_{ECON}) is described by means of GDP *per capita* in PPS. This indicator is regarded as a relatively good measure of economic results. For comparison these values were calculated per 1 inhabitant.

The study was performed following three stages which covered:

1) collecting statistical materials for the description of economic cohesion and smart growth of regions – the EUROSTAT[1] data base was the source of data for the indicators. This allowed for obtaining methodologically comparable data for the regions at EU NUTS 2 level. The selection of regions and the research period was limited by statistical data availability. The study covers 205 out of the 271 EU regions at NUTS 2 level, which constitutes 76% of the European Union regions population.[2]

[1] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/.

[2] The study does not cover the following 53 regions: Danish, Slovenian, Belgian, Romanian, Swedish, Malta, Luxemburg, Cyprus, Estonia, 5 out of 37 German regions (Brandenburg – Nordost, Brandenburg – Südwest, Dresden, Leipzig and Sachsen-Anhalt), 5 out of 37 British regions (Eastern Scotland,

Data gaps were filled by means of an extra and interpolation method. Among the regions chosen for analysis, 43 described the new accession countries (EU12) and 162 the old EU countries (EU15). The study covered the period of 2000–2009;

2) constructing synthetic measures for each of the smart growth pillars – smart growth measures are presented in a standardized form. Therefore the procedure of unitization with zero minimum and aggregate measures (AM) for composite variables (pillar I and II) were applied. This allowed for presenting each variable value in the range from [0;1]. In the process of AM construction, Euclidean distance and common growth pattern, defined for each variable, were used considering all regions in all studied years [Walesiak 2011, pp. 78–79].

3) estimating linear econometric models to describe relations which combine economic cohesion with particular pillars of smart growth by means of applying panel data in (NUTS 2) regions of EU15 and EU12 countries, which is presented in the form of the following model construction:

$$SGM^{\,l}_{ECON,it} = \alpha_i + \beta_l SGM^{\,l}_{SM,it} + \varepsilon_{it}, \tag{1}$$

where: $SGM^{\,l}_{ECON,it}$ – an aggregate describing economic cohesion in i-th region ($I = 1, 2, \ldots, N$) and ($t = 1, 2, \ldots, T$) t-th year;

$SGM^{\,l}_{SM,it}$ – variable for l-th l (l = I, II, III) smart growth pillar in i-th region and t-th year;

β_l – evaluations of parameters measuring the impact intensity and direction of l-th smart growth pillar on economic cohesion;

α_i – constant in time individual effects for i-th region.

Models in (1) constituted the grounds for the selection of variables used in model constructions allowing measurement of all smart growth pillars' joint impact on economic cohesion, which may be presented as follows:

$$SGM_{ECON,it} = \alpha_i + \sum_l \beta_l SGM^{\,l}_{SM,it} + \varepsilon_{it}. \tag{2}$$

In order to estimate evaluations of β_l structural parameters of models, adequate estimation techniques, typical for panel data, were applied [Maddala 2006; Wooldridge 2002; Verbeek 2000; Greene 2003; Dańska 2000]. LSDV (Least Squares with Dummy Variable) model was applied in the study. The final model (2) structure resulted from the selection of variables (pillars) based on the significance of

South Western Scotland, North Eastern Scotland, Highlands and Islands and also Northern Ireland), 1 out of 5 Finnish regions (Åland), 5 out of 26 French regions (Corse, Guadeloupe, Martinique, Guyane and Réunion), 2 out of 19 Spanish regions (Ciudad Autónoma de Ceuta (ES), Ciudad Autónoma de Melilla (ES)), 1 out of 19 Italian regions (Valle d'Aosta/Vallée d'Aoste), 3 out of 7 Portuguese regions (Algarve, Região Autónoma dos Açores (PT), Região Autónoma da Madeira (PT)) and 6 out of 13 Greek regions (Ipeiros, Ionia Nisia, Dytiki Makedonia, Voreio Aigaio, Notio Aigaio, Kriti).

structural parameters' evaluations in single regression models (1) and *a posteriori* elimination procedure [Nowak 2006]. In the process of econometric models estimation, certain problems related to meeting due assumptions, referring to the applied methods, may occur, e.g. autocorrelation, and heteroskedasticity. In order to minimize their possible negative effects, in assessing the significance of structural parameters evaluation, robust standard errors [Arellano 2003] were used. All estimations were performed in the GRETL programme.[3]

3. Statistical analysis of regional economic cohesion and smart growth

The level of economic cohesion in EU regions is extensively diversified in space. Major differences are observed in the level of growth regarding the group of EU12 and EU15 regions (see Figure 1). If the GDP aggregate in PPS is considered per 1 inhabitant it appears that the mean value for the EU12 group in 2000 was at the level of 9,311.63, while in the EU15 it was over twice as large (2.27) and amounted to 21,117.28. Slightly smaller differences (1.83) persisted in the final period of the study, i.e. in 2009 (EU12 – 15,305.16 and EU15 – 27,938.93), which may be observed as the decrease in differences between the old EU regions and those of the new accession.

The EU12 and EU15 regions differ between each other regarding smart growth (see Figure 2). The EU15 regions are better prepared for smart growth idea implementation in each of the analyzed areas (innovation, creativity and specialization). The largest differences between the groups of regions under analysis are observed in relation to the scale of investment in research and development made by enterprises (SGM_{INN}). In the EU12 regions (SGM_{INN}) value presented a very low level, i.e. less than 0.04. While in the case of the EU15 regions the measure median was ranging from 0.114 at the beginning up to 0.123 at the end of the studied period in the years 2000–2009. The situation in regional innovation improved only slightly. At the same time, extensive disproportions between regions persisted within each group, which is presented in Figure 2 in the form of outliers (at the top). This results from the fact that there are a few regions which are definitely the leading ones regarding the scale of investments in R&D. In the EU12 countries the following Czech regions were the leading ones in investing the largest part of GDP produced in a region into R&D: Střední Cechy, Jihovýchod and Střední Morava. In the case of the EU15, the top ranking positions were occupied by the German regions: Braunschweig (DE) and Stuttgart (DE).

The situation improved significantly in the case of both groups of regions (EU12 and EU15) in the creativity pillar (SGM_{CR}). (SGM_{CR}) median value in the EU12

[3] www.kufel.torun.pl.

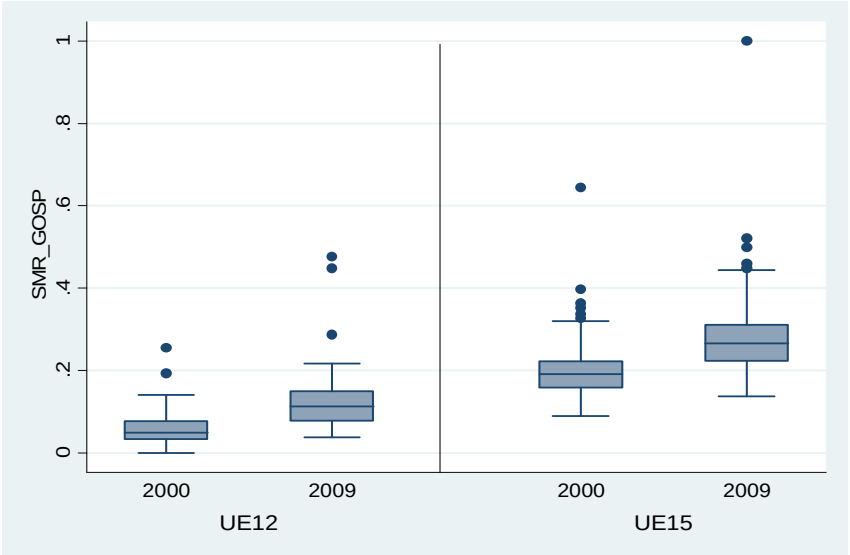

Figure 1. The distribution of economic cohesion measure in EU12 and EU15 regions in the years 2000 and 2009

Source: author's compilation in the STATA programme.

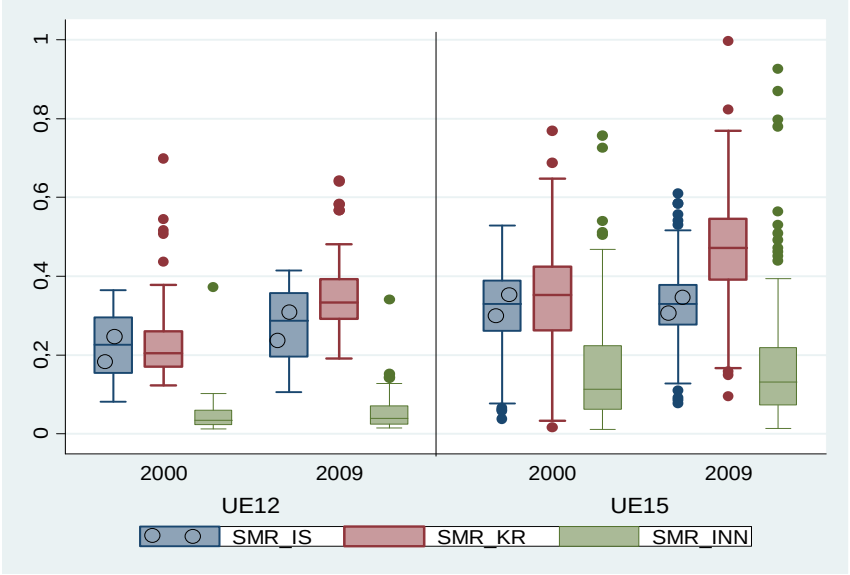

Figure 2. The distribution of smart growth synthetic measures values for EU12 and EU15 regions in the years 2000 and 2009

Source: author's compilation in the STATA programme.

group of regions increased from 0.205 in 2000 up to 0.33 in 2009. Therefore these regions came closer to (SGM_{CR}) value in the EU15 group of regions observed in the initial period of the study (in 2000 it was 0.353). As a result of the situation improvement in 2009 the measure, in the cross-section of the EU15 regions, increased to the level of 0.472.

A very similar situation referred to the EU12 and EU15 regions regarding smart specialization (SGM_{SS}). The mean value of SGM_{SS} (median) in 2000 for the EU12 was 0,227 and for the EU15 0.330, while in 2009 the respective values were 0.287 and 0.330 (as in 2000). A positive development is observed in the growing importance of knowledge-based economy sectors, in the analysed period, regarding the economic structure of the EU12 regions and therefore their situation was approaching that of the EU15 regions.

4. The assessment of smart growth influence on economic cohesion in regions

The strengthening of human capital, knowledge, science and innovation potential in a region results, in a long-term perspective, in regional economic and competitive position strengthening. Tables 1–4 present estimation results of models which allow for the assessment of each smart growth pillar impact on economic cohesion separately for the EU12 and the EU15.

Table 1. Linear models estimations (1) for each smart growth pillars and economic cohesion for (NUTS 2) regions of the new EU accession countries (EU12) in the period 2000–2009

Specification	$SGM^{l}_{ECON,it} = \alpha_i + \beta_l SGM^{l}_{SM,it} + \varepsilon_{it}$	Coefficient of determination R^2	Akaike information criterion	Test F (p-value)
SGM_{SS}	0.947*** [0.215]	0.878	–1215.38	40.26 (0.000)
SGM_{CR}	0.758*** [0.094]	0.911	–1353.14	119.48 (0.000)
SGM_{INN}	0.624 [0.623]	0.849	–1122.72	41.67 (0.000)

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

Source: author's compilation in the GRETL programme.

In the case of the EU12 new accession regions (see Table 1), two out of three smart growth pillars (model 1) presented a positive, statistically significant impact on economic cohesion, i.e. pillar I – smart specialization and pillar II – creativity.[4]

[4] However, the model in which SGM_{CR} is an independent variable represents a better option better due to the Akaike information criterion.

The statistically significant influence of regional innovation (pillar III) on economic cohesion could not be confirmed – which may seem surprising. The reasons should be found in the low level of outlay in research and development, as well as their rate of insignificant changes in time. In the period under analysis the size of financial means invested in research and development in relation to GDP was only slightly increasing. Therefore, one may conclude that these changes were insufficient and the observed increase of economic cohesion was inspired by other factors (e.g. the growing share of workforce in knowledge-based economy enterprises and the increase of creative resources in the region).

While assessing the simultaneous impact of both pillars (for which the statistically significant relation with economic cohesion was confirmed) it may be concluded that the increase in creative resources of human capital in a region (pillar II) represented the factor exerting the highest impact on economic cohesion improvement. The regions featuring an increase in the creative resources of human capital by a unit are also characterized by improved economic cohesion by 0.657 units *ceteris paribus* at each level of statistical significance. At the level of 0.05 statistical significance the statistically significant impact of smart specialization (pillar I) may also be confirmed. The situation improvement by a unit (SGM_{SS}) is also connected with a 0.348 increase in economic cohesion *ceteris paribus*.[5]

Table 2. Linear models estimations (2) of smart growth and economic cohesion for (NUTS 2) regions of the new accession countries (EU12) in the period 2000–2009

Specification	$SGM_{ECON,it} = \alpha_i + \sum_{l=1} \beta_l SGM^l_{SM,it} + \varepsilon_{it}$	Coefficient of determination R^2	Akaike information criterion	Test F (*p*-value)
SGM_{CR}	**0.657***** [0.088]	0.915	–1367.18	30.31 (0.000)
SGM_{SS}	**0.348**** [0.167]			

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

Source: author's compilation in the GRETL programme.

All three smart growth pillars (Table 3) were significantly related to economic cohesion regarding the old EU (EU15) regions. In the case of pillar I and II this

[5] Conclusions following the analysis of parameter estimation values referring to single structural regression indicate the stronger impact of smart specialization on economic cohesion than that of creativity. In the case of single regression this seems to result from overtaking the variability of other factors than these included in the SGM_{SS} variable. Multiple regression allowed for considering, at the same time, the impact of different variables and therefore separating variability into particular factors, hence the conclusions drawn should be regarded as final.

was true for any significance level, while in the case of pillar III to a lesser extent (at 0.05 significance level).

Table 3. Linear models estimations (1) for each smart growth pillars and economic cohesion for (NUTS 2) regions of the old EU accession countries (EU15) in the period 2000–2009

Specification	$SGM^{l}_{ECON,it} = \alpha_i + \beta_l SGM^{l}_{SM,it} + \varepsilon_{it}$	Coefficient of determination R^2	Akaike information criterion	Test F (p-value)
SGM_{SS}	0.187^{***} [0.067]	0.879	–6266.81	54.44 (0.000)
SGM_{CR}	0.502^{***} [0.025]	0.944	–7524.85	97.36 (0.000)
SGM_{INN}	0.112^{**} [0.052]	0.879	–6261.63	59.79 (0.000)

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

Source: author's compilation in the GRETL programme.

The economic cohesion of the EU15 regions persists under the influence of smart growth pillars included in two pillars – creative and innovative (Table 4) with the leading role played by the creative pillar (II). The situation improvement regarding creativity by 1 unit results in economic cohesion higher by 0.499 of a unit *ceteris paribus*. On the other hand, the measure increase for innovation pillar by a unit had an insignificant impact on the increase of economic cohesion (structural parameter was evaluated as 0.049).

Table 4. Linear models estimations (2) of smart growth pillars and economic cohesion for (NUTS 2) regions of the old EU accession countries (EU15) in the period 2000–2009

Specification	$SGM_{ECON,it} = \alpha_i + \sum_{l=1} \beta_l SGM^{l}_{SM,it} + \varepsilon_{it}$	Coefficient of determination R^2	Akaike information criterion	Test F (p-value)
SGM_{CR}	$\mathbf{0.499}^{***}$ [0.012]	0.945	–7532.61	96.89 (0.000)
SGM_{INN}	$\mathbf{0.049}^{***}$ [0.0167]			

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

Source: author's compilation in the GRETL programme.

In the summary of the obtained results, it may be easily noticed that the size of human capital creative resources in a region exerted the highest impact on economic cohesion (out of the pillars responsible for outlays – II and III). One of the reasons for such a situation is their comprehensive significance manifesting

itself not only in initiating and implementing innovative solutions, but in the overall performed activities, including the creation of social capital. The second reason is time. Bringing human capital to the market allows for positive results observations in a much shorter time than obtaining the effects from outlays on research and development. Another reason is the low dynamics of outlays on research and development as compared to changes in economic cohesion,, which suggests that economic cohesion dynamics is, to a larger extent, the effect of other sources.

5. Final remarks

The smart growth of regions, as the set of growth factors, influences the development processes enhancing the improvement of economic development and the inhabitants' living standards. Therefore it represents a tool of regional policy aimed at ensuring dynamic and self-supporting regional development in a long-term perspective by strengthening their competitive advantage and, at the same time, intensifying economic and social cohesion.

While analyzing the influence of smart growth pillars on economic cohesion in the cross-section of EU12 and EU15 regions, it was noticed that the key factor, and also the one which develops most dynamically, is represented by human capital resources (pillar III) both in the EU12 and in the EU15 regions. Additionally, in the new accession regions, pillar I of smart specialization characterizes regional economy structure (workforce employed in knowledge-based economy sectors). On the other hand, in the old EU regions a slight, but significant impact on economic cohesion in the period 2000–2009 was exerted by the investment rate in research and development (pillar III – innovation).

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CZY INTELIGENTNY ROZWÓJ SPRZYJA SPÓJNOŚCI EKONOMICZNEJ? ANALIZA DLA REGIONÓW PAŃSTW UNII EUROPEJSKIEJ NOWEGO I STAREGO ROZSZERZENIA

Streszczenie: Celem artykułu jest ocena relacji łączących inteligentny rozwój opisany trzema filarami (inteligenta specjalizacja, kreatywność, innowacyjność) oraz spójność ekonomiczną poprzez pomiar siły i kierunku zależności je łączących. Badanie przeprowadzono wśród regionów szczebla NUTS 2 państw Unii Europejskiej w podziale na regiony państw nowego rozszerzenia z 2004 i 2007 roku (UE12) oraz pozostałe regiony tzw. starej Unii (UE15). Badaniem objęto lata 2000–2009. Analizując wpływ filarów inteligentnego rozwoju na spójność ekonomiczną, zauważono, że czynnikiem kluczowym i jednocześnie najdynamiczniej się rozwijającym są kreatywne zasoby kapitału ludzkiego (filar II) zarówno w regionach UE12, jak i UE15.

Słowa kluczowe: inteligentny rozwój, spójność ekonomiczna, region Unii Europejskiej szczebla NUTS 2.