

Marcin Spychala

Poznan University of Economics and Bussines, Department of Public Finance

e-mail: marcin.spychala@ue.poznan.pl

ORCID: 0000-0002-3860-303X

THE ABSORPTION OF EU FUNDS AND THE SOCIO-ECONOMIC DEVELOPMENT IN THE SUBREGIONAL DIMENSION IN POLAND

ABSORPCJA FUNDUSZY UNII EUROPEJSKIEJ A ROZWÓJ SPOŁECZNO-EKONOMICZNY W UJĘCIU SUBREGIONALNYM W POLSCE

DOI: 10.15611/pn.2020.3.07

JEL Classification: O11, O20, O47

Summary: The purpose of the article is to specify the interdependencies between the absorption of EU funds and the changes in socio-economic development. The research was conducted on subregional level in three stages. At the first stage, the level of development of 380 districts in Poland was specified. At the second stage, the differentiation in EU fund absorption in those districts was shown. At the third stage, the interdependencies between the size of the absorption and the changes in the level of development in the arrangement of factors of the said development based on the analysis of regression was specified.

Keywords: EU funds, socio-economic development, a synthetic gauge.

Streszczenie: Celem artykułu jest próba określenia zależności między absorpcją funduszy Unii Europejskiej a zmianami poziomu rozwoju społeczno-ekonomicznego w Polsce. Badania przeprowadzono na poziomie subregionalnym w trzech etapach. W pierwszym określono poziom rozwoju 380 powiatów w Polsce. W drugim etapie przedstawiono zróżnicowanie przestrzenne absorpcji środków unijnych w tych powiatach. W trzecim etapie badania określono zależności między wielkością tej absorpcji a zmianami poziomu rozwoju społeczno-ekonomicznego w układzie czynników tego rozwoju na podstawie analizy regresji.

Słowa kluczowe: fundusze unijne, rozwój społeczno-ekonomiczny, miernik syntetyczny.

1. Introduction

The funds that come from the general budget of the European Union were supposed to contribute to an increase in regional dynamism, for which there were high hopes. Not uncommonly, the role of a kind of a *capo di tutti capi*¹ of the socio-economic changes in the regions in Poland was ascribed to them. The results of the first research conducted suggested their impact on the economy was extremely significant² (Institute of Research on a Market Economy, 2010; Bradley, Zaleski, Tomaszewski, and Zembaty, 2007). Subsequent studies showed, however, that the impact of EU funds on the increase in GDP is visibly lower than initially expected³ (Korneluk, 2015; Dziadek, 2012).

In light of the abovementioned, the presentation of the impact of EU fund absorption on socio-economic development became the basis for undertaking this research, the purpose of which is to attempt to specify the interdependencies between the absorption of structural funds and the Cohesion Fund in Poland and the changes in the level of socio-economic development in the regional dimension. The level of development was specified from the standpoint of the factors of its development, differentiating between: human capital, material capital, the natural environment and innovativeness. In the research, projects co-funded by the EU realised in the period 2007-2016 were taken into consideration. A change in the level of development was established for 2009-2018. A change in the time-frame of the impact of the results of the application of EU funds on economic development was taken into account. The authors of other research projects usually indicate that there is a two or three-year delay in the impact of EU funds on the economy (Grosse, 2004; Kozarova, 2013; Kološta, 2016). The hypothesis according to which the absorption of EU funds has to the largest extent influenced the development of the material capital and innovativeness was put forward.

The research was conducted in three stages. At the first stage, the level of the regional development was specified. For that purpose an original synthetic gauge of the level of development based on the Bank of Local Data of the Main Statistical Office was created. The research was conducted on the level of districts due to the accessibility of empirical data. At the second stage, spatial differentiation of the EU fund absorption in the districts in Poland was demonstrated, using data from the ICT systems of the Ministry of Funds and Regional Policies. At the third stage, the interdependencies between the extent of the absorption and the changes in the level of development in the arrangement of the factors of the said development based on the regression analysis were specified.

¹ From the Italian: the person of the highest stature, the boss of all bosses, the most significant factor.

² For example, the first analyses with the use of the HERMIN and MaMoR3 models were conducted by the Institute of Research on the Market Economy and the Wrocław Agency of Regional Development, and indicated that EU funds impact the GDP level by as much as 11.2%.

³ Most often it was indicated that EU funds impacted the GDP level by around 2.5%.

2. The differentiation in the level of development of Polish districts in the period 2009-2018

The differentiation in the level of socio-economic development is a natural phenomenon which stems from an imbalanced access to the means of production such as: capital, natural resources and labour (Romer 2000; Spychała 2014). The differences in the potential of the regions are convergent with the majority of theories of regional development (Knapińska, 2017). However the theories originating from different scientific orientations explain the differentiation of economic processes in different ways. The first group of theories stemming from neoliberal thought assumes minimising state interventionism, and treats the free market as a regulating force (Churski, 2008; Krugman, 1991; Smętkowski, 2013). The second group of theories, however, representing neokeynesian economic thinking, considers interventionism to be an indispensable and the most important regulating mechanism of regional development (Grosse, 2004; Schumpeter, 1995; Stankiewicz, 2007).

In order to specify the differentiation in the level of the socio-economic development of districts in Poland, a synthetic gauge of the deviation from the role model was used. The research procedure consisted of four consecutive steps (Spychała 2018, p. 243): an adjustment of variables, a reduction in multi-feature space, an indication of the level of the socio-economic development and a classification of all 380 districts on the scale of the level of socio-economic development.

In the first part of the research, a geographic information matrix based on 43 indicators (Table 1) was constructed. It indicated the changes in the level of development of districts in 2009-2018 in relation to human capital, material capital, the natural environment and innovativeness. The linear correlation coefficients between the researched departure indicators were then calculated for their change in the period between 2009 and 2018. The indicators selected for a synthetic gauge should not be heavily correlated with one another in order for their information capacity to be different (Spychała, 2017a, p. 295). The correlation coefficient matrices constructed constituted the basis for conducting a reduction in the departure variables using Hellwig's method (i.e. for separating the indicators taken into account in the next procedure). The procedure of reducing the variables was conducted five times: separately for the level of the socio-economic development and separately for the level of the development of each of the four capitals constituting the factors of development. In Table 1, a bold font was used to emphasise the indicators that were chosen for a synthetic gauge of distance from the model.

In the next step of the research, a model and an anti-model of the development were devised, and subsequently a taxonomic distance of each district from the assumed model of development was selected. In the last part of the research, for each

Table 1. Indicators taken into account in the analysis specifying the level of development

Factor of development	Indicators
The material capital	the length of commune roads and ‘powiat’ (county/district) roads per 100 km²; the length of commune roads and ‘powiat’ roads per 10 000 inhabitants; the percentage of people using the sewage network in the total number of inhabitants; the percentage of people using the water supply network in the total number of inhabitants; the percentage of people using the gas network in the total number of inhabitants; the number of people visiting museums per 10 000 inhabitants; the collection of books or manuscripts of public libraries per 1000 inhabitants; the number of doctors per 10 000 inhabitants; the percentage of children in kindergarten institutions; the percentage of children under the age of three being under the care of creche facilities; the average gross monthly salary
The natural environment	the percentage of people using the sewage plant in the total number of people; the percentage of legally protected areas in the area in total; the usage of water per 1 inhabitant; the emission of dust pollution per 1 sq. km of the surface; the share of parks, greens and estate green spaces in the total area; the number of tourists using the accommodation places per 1000 inhabitants; the number of accommodation places per 1000 inhabitants; the use of electricity per 1 inhabitant
The innovativeness	the percentage of foreign companies in the total number of companies; the percentage of private entities in the total number of companies; the number of micro-enterprises per 1000 inhabitants; the number of natural persons conducting an economic activity per 1000 inhabitants; the share of entities conducting financial activity in the total number of economic entities; the share of entities conducting service activity in the total number of economic entities; the share of economic entities running an educational activity in the total number of economic entities; the percentage of people working in services in the total number of the employed; the percentage of newly registered entities of the creative sector in the number of newly registered entities in total
The human capital	the birth rate per 1000 inhabitants; the migration ratio per 1000 inhabitants; the feminization coefficient; the percentage of people of the post-production age in the total number of people; the percentage of people of the production age in the total number of people; the percentage of people of the pre-working age in the total number of people; the number of people of the post-working age per 100 people of the pre-working age; the number of people of the non-working age per 100 people of the working age; the scholarisation coefficient for primary schools net; the passing of ‘matura’ (A-level exams) in high-schools; the rate of registered unemployment; the share of unemployed below 25 years of age in the number of the unemployed in total; the share of unemployed with higher education in the number of unemployed in total; the number of divorces granted per 1000 inhabitants; the number of marriages entered into per 1000 inhabitants

Source: own compilation based on the research carried out.

Table 2. Extreme values of the synthetic gauge within the respective factors of the socio-economic development in 2009-2018

The highest values of the synthetic gauge		The lowest values of the synthetic indicator	
District	Value	District	Value
The material capital			
Piaseczyński	0.45	Zielona Góra	0.19
Warszawa	0.43	Wałbrzyski	0.23
Wieruszowski	0.43	Jaworski	0.26
The natural environment			
Łomżyński	0.56	Leszno	0.19
Wrocławski	0.53	Kalisz	0.26
Jastrzębie-Zdrój	0.51	Lublin	0.26
The innovativeness			
Piaseczyński	0.69	Żarski	0.17
Przemysł	0.58	Sulęciński	0.18
Rzeszów	0.55	Jelenia Góra	0.18
The human capital			
Strzelecki	0.59	Suwalski	0.28
Kartuski	0.57	Łomżyński	0.32
Wałbrzych	0.55	Łobeski	0.34
The level of socio-economic development			
Kraków	0.48	Staszowski	0.31
Piaseczyński	0.48	Starogardzki	0.36
Warszawa	0.48	Gdański	0.36
Rzeszów	0.46	Grajewski	0.37
Bielsko-Biała	0.46	Zielona Góra	0.37

Source: own compilation based on the research carried out.

district a synthetic gauge constituting an indicator of the level of the socio-economic development was indicated.

A synthetic gauge of the level of development, with values from 0 to 1 were assumed. The higher the value, the higher the level of development of the phenomenon considered. Based on the calculated indicators, 380 districts in Poland were divided into five groups: very high, high, average, low and very low change in the level of socio-economic development in the period 2009-2018.

In Figure 1 and Table 2 the results of the research conducted are shown. Table 2 presents districts of the highest and lowest values of the synthetic gauge within the

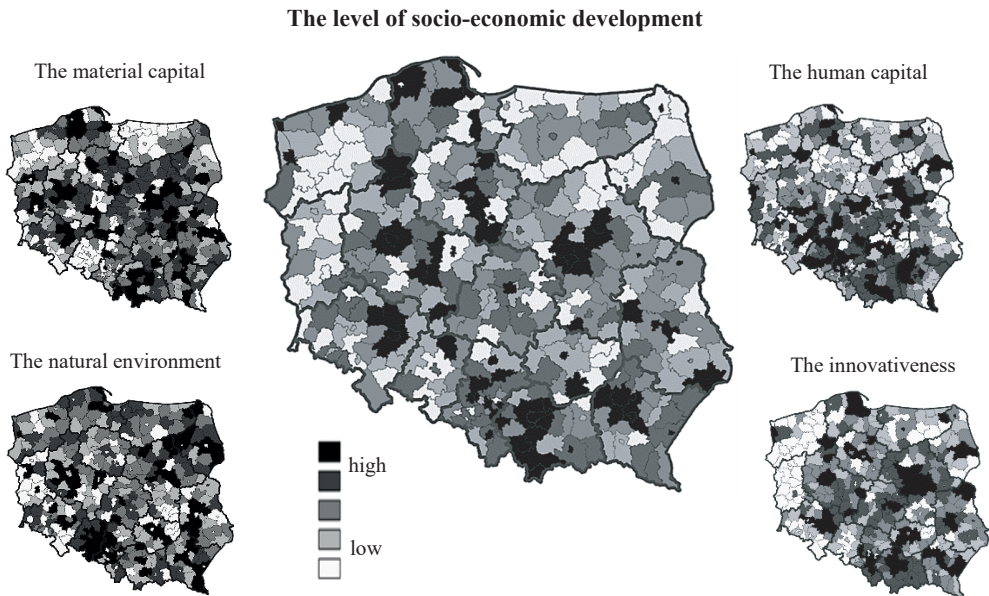


Fig. 1. Spatial differentiation of the level of socio-economic development and its aspects in Poland in the arrangements of districts (2009-2018)

Source: own compilation based on the research carried out.

respective factors of socio-economic development. Figure 1 contains choropleths presenting the spatial differentiation of the changes in level of the socio-economic development of 380 districts in Poland in the period 2009-2018.

3. The absorption of EU funds in Polish subregions

At the second stage of the research, the size and structure of the absorption of EU fund in Poland on the level of districts was examined. An analysis of the use of EU funds was carried out using the database "A list of beneficiaries of operation programmes", generated from the SIMIK 2007-2013 National IT System, the SL2014 central ICT and the one published by the Ministry of Funds and Regional Policy on the website of the EU Fund Portal.

In the period 2007-2016 over 180 thousand projects co-funded from EU funds were realised in Poland, and the total value of co-funding obtained by the beneficiaries for the purpose of realising those projects amounted to bn PLN 289.6 (Spychała, 2017b, p. 352).

Table 3. Districts of the highest and lowest values of the absorption of EU funds per capita calculated for the respective factors of development

The highest values of EU funds' absorption (in PLN thousand per capita)		The lowest values of EU funds' absorption per capita (in PLN thousand per capita)	
District	Value	District	Value
The material capital			
Świnoujście	52.31	Zwoleński	0.32
Warszawski zach.	26.33	Gostyniński	0.32
Ostródzki	24.18	Przysuski	0.33
The natural environment			
Świnoujście	13.83	Rybnicki	0.67
Nowodworski	10.49	Gostyniński	0.70
Ostródzki	9.10	Kolski	0.71
The innovativeness			
Nowodworski	13.44	Rybnicki	0.57
Bielski	10.25	Olecki	0.58
Opolski	6.98	Zgorzelecki	0.65
The human capital			
Szczycieński	12.68	Piaseczyński	0.83
Nowodworski	10.12	Rybnicki	1.19
Świdnicki	9.49	Lubiński	1.22
The level of socio-economic development – total absorption			
Świnoujście	68.66	Rybnicki	3.20
Nowodworski	56.64	Olecki	3.60
Ostródzki	44.69	Mysłowice	3.68
Warszawski zach.	39.08	Jastrzębie-Zdrój	3.68
Olsztyński	38.56	Śremski	3.79

Source: own compilation based on the research carried out.

A comparison of the size and structure of EU funds' absorption in the intraregional arrangement required the introduction of data relativity. For that purpose the number of inhabitants was used, and the respective sets of data were employed in the per capita dimension. The scope of the analysis of that stage of research was the specification of the spatial differentiation of the absorption of EU funds according to the structure of intervention in relation to the factors of socio-economic development: human capital, material capital, the natural environment and innovativeness. The results of the research conducted constituted the basis for specifying the interdependencies between EU funds' absorption and the change in the level of socio-economic development.

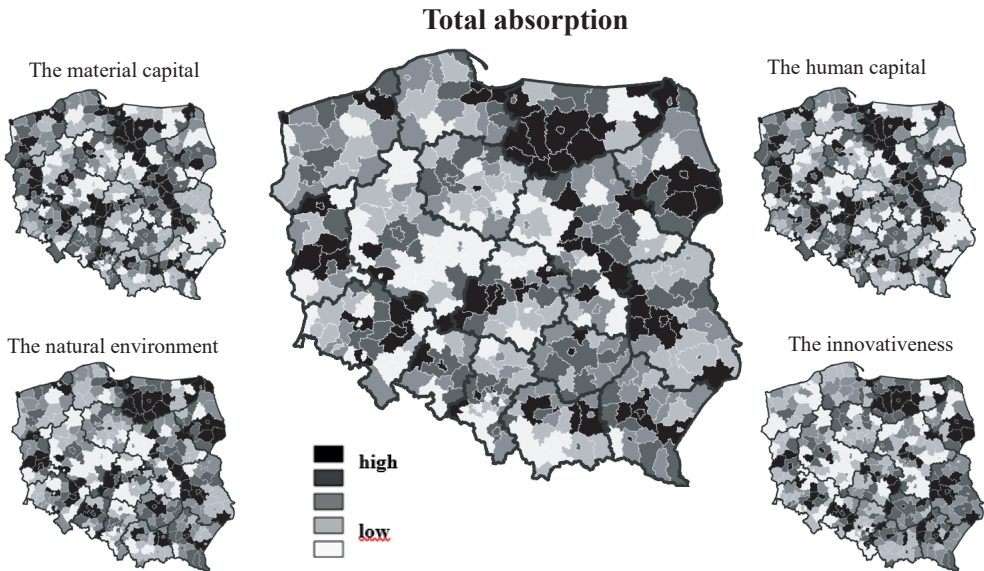


Fig. 2. The absorption of EU funds per capita in Poland in the arrangement of districts (in PLN)

Source: own compilation based on the research carried out.

The results of the research are presented in Figure 2 and Table 3. Table 3 presents the districts of the highest and lowest values of EU funds' absorption per capita. Figure 2 contains choropleths presenting the spatial differentiation of that absorption in Poland in the subregional dimension.

4. The size of the absorption and the level of development in the intraregional arrangement

At the last stage of the research the interrelation between the size of the absorption of EU funds and the level of the socio-economic development of 380 districts was stated. The abovementioned relations were researched separately for each specific factor of development as well as for the socio-economic development as a whole. Based on the average value of the synthetic gauge characterising the change in the level of development as well as the average value of EU funds' absorption supporting the development of the given per capita capital, the researched districts were divided into four groups (Figures 3 and 4):

- no 1, in which were categorised the units that registered an above-average change in the level of development of a given factor as well as an above-average absorption of EU funds;
- no. 2, in which were categorised the units that registered an above-average change in the level of development as well as an absorption of EU funds below the average calculated;

- no. 3, in which were categorised the units that registered a change in the development of a given factor below the average, as well as EU funds' absorption below the average;
- no. 4, in which were categorised the units that registered a change in the level of development of a given factor below the average as well as an above-average absorption of EU funds.

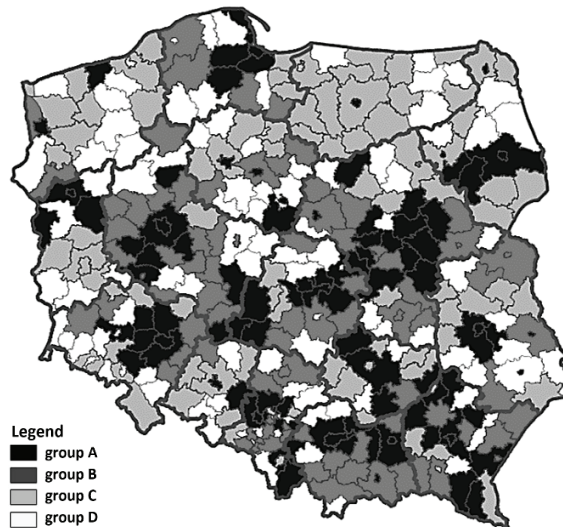


Fig. 3. Classification of districts based on the absorption of EU funds and the change in the level of development

Source: own compilation based on the research carried out.

Group 1 contains those districts in which the highest change in the level of development of a given factor in 2009-2018 and at the same time, a high absorption of EU funds allocated for the purpose of the development of the researched capital were observed. Group 2 comprises the districts ('powiat') in which a high change in the level of development of the researched capital with a simultaneously low absorption of EU funds devoted to the development of that factor were observed. Group 3 was made up of districts with a relatively low absorption of EU funds supporting the development of the researched capital as well as a relatively low value of the synthetic gauge. Group 4 comprises units of the lowest efficiency of the Community funds used – despite the above-average absorption of EU funds, the development of the given capital in 2009-2018 was achieved to a low extent.

In the next step of the research procedure, models of the straight line linear regression between the researched variables within the respective factors of development (Table 4) were built. A positive correlation was observed between the size of the absorption of EU funds supporting the development and the change in the

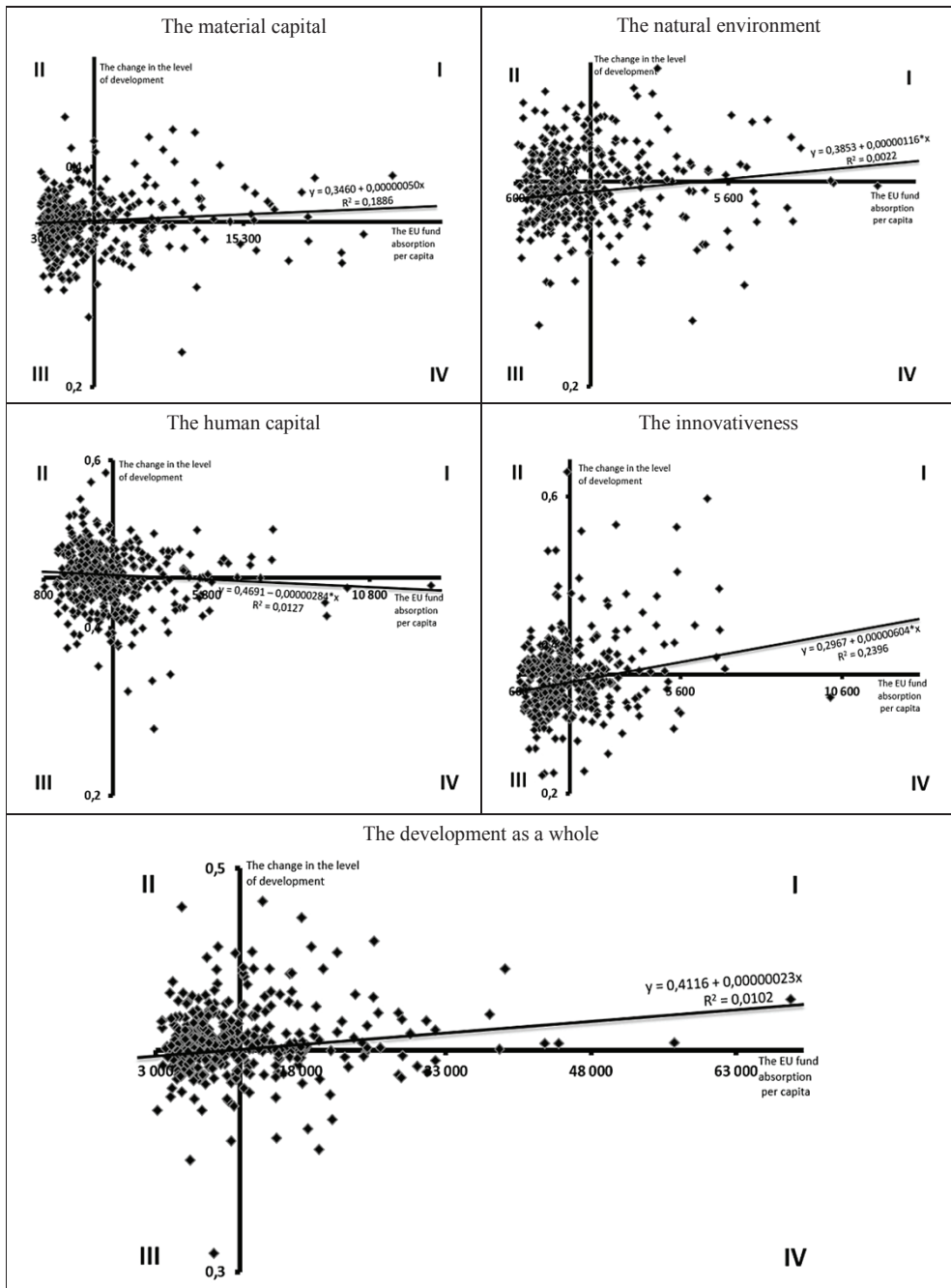


Fig. 4. EU funds' dispersion and changes in the level of the socio-economic development of the districts ('powiat') in Poland

Source: own compilation based on the research carried out.

level of development in 2009 and 2018 in the case of the material capital, the natural environment, the innovativeness and the general development (Table 5). In the case of the human capital, however, a negative correlation was observed.

Table 4. Models of linear regression between the researched variables

Factors of development	A pattern of the model of regression
The material capital	$y = 0.3460 + 0.00000050*x$
The natural environment	$y = 0.3853 + 0.00000116*x$
The innovativeness	$y = 0.2967 + 0.00000604*x$
The human capital	$y = 0.4691 - 0.00000284*x$
Total socio-economic development	$y = 0.4116 + 0.00000023*x$

Source: own compilation based on the research carried out.

Based on the selected statistics of the obtained models, the explanatory power of the regression functions obtained was assessed as relatively low. The highest value for the R^2 determination coefficient was obtained in the case of the model specified for innovativeness (0.24). Regarding the factor of development, the variability of the dependent variable was thus explained by the independent variable in almost 24%. One may thus conclude that the direction of EU fund intervention supporting the development of innovativeness was correct, and the proper direction of EU funds' intervention into the development of innovativeness was confirmed by the high absorption of EU funding devoted to that goal, the high number of highly innovative companies set up as well as the modern solutions being implemented in the economy. The highest quality of the regression model estimated for innovativeness is also confirmed by the fact that the explanatory variable turned out to be significant already at the significance level of 2.5% (value p for the F-Snedecor parametre and statistics (Kufel, 2013) – the probability of making a mistake). One may thus conclude that in the case of innovativeness, the regression model has stated the correct, positive correlation, between the EU funds' absorption and the change in the level of innovativeness.

The synthetic gauge of the empirical value dispersion around the theoretical values is a residual component standard deviation. It carries information concerning the average deviation of empirical data of the explanatory variable from the theoretical values obtained from the regression function. The more the value of the residual element standard deviation increases, the more the statistical appropriateness of the adjustment of a particular regression function to empirical data decreases (Sobczyk, 2007). In the research conducted, positive and negative residues were identified. Positive residues demonstrate that the observed explanatory variable size is higher than expected, resulting from the model, the negative residues attest to the reverse situation. The lowest value of the standard mistake was registered in the case

Table 5. Parametres specifying the quality of regression models in the arrangement of the respective factors of regional development

Description	Material capital	The natural environment	Innovativeness	Human capital	The development as a whole
The correlation: absorption vs. development	positive	positive	positive	negative	positive
The R ² determination coefficient	18.86%	0.22%	23.96%	1.27%	1.02%
Value p for the F test	6.68%	35.66%	2.48%	2.82%	4.89%
The standard residue mistake	2.67%	3.86%	5.36%	3.61%	1.73%
The sum total of residue squares	77.63%	145.46%	108.47%	106.68%	27.33%
The residual variability coefficient	7.68%	9.96%	17.28%	7.83%	4.18%
Akaike's information criterion	-1672.10	-1389.02	-1143.97	-1444.68	-2002.64

Source: own compilation based on the research carried out.

of the model assessed for the level of socio-economic development in total (1.7%). The square residual sum constitutes only 27.3% of the average for the change in the level of development in general, attesting to the fact there are relatively low distances of the observations from the lines of trend, and therefore quite a good match of the model. Moreover, taking into account the coefficient of residual variability, one may consider the model relatively well-matching, as the value of that coefficient was 4.2%⁴ (this part of the average value of the explained variable constitutes its standard residual variation). The real change in the socio-economic level as a whole in districts in Poland – with few exceptions – is relatively not very different from the value obtained from the regression model.

5. Conclusion

Concluding the research conducted in the article concerning the impact of the spatial variation of the absorption of EU funds on the changes in the level of socio-economic development, as well as the respective factors of the said development in the subregional dimension, i.e. in the arrangement of districts in Poland, one may observe that the positive dependency between the size of EU funds' absorption per capita and the change in the level of development were found in the case of the material capital, the natural environment, the innovativeness as well as the development in general. In the case of the human capital, a negative dependency has been identified. One

⁴ In the subject literature, the regression model is considered to be admissible when the residual variable coefficient assumes a value lower than 20%.

may thus observe that the absorption of EU funds has positively impacted the development of the said factors, within which most EU fund allocations had been granted, the latter being related to, for instance, the economies of scale. A negative influence was registered for those factors in which intervention turned out to be relatively low.

Among all the assessed regression functions, a model built within an analysis of the level of the development of the innovativeness which explains 24% of the variability of the dependent variable, shall be considered of the highest value. Its explanatory variable turned out to be significant already at the significance level of 2.5%. The satisfactory quality of the model may also result from the liberal approach to the manner in which that particular factor of development is characterised, and its extensive indirect indexing. The model built for material capital was also characterised by the relatively high determination coefficient (18.9%). The model built within an analysis of the socio-economic development as a whole based on an analysis of residue was considered to be the most reflective of the reality, in the case of which the respective coefficients assumed the lowest values. Summarising the research conducted, one may conclude that the absorption of EU funds impacted the changes in the level of the development of the material capital and innovativeness in Polish districts to the greatest extent. This confirms the appropriate direction of EU funding intervention, the funds having been made available above all to develop the material capital and innovativeness. Those factors of development received the most funding from the EU's general budget, and the results of EU funds' absorption supporting innovativeness and the material capital are visible in a relatively short time interval.

In relation to the abovementioned, one should however conclude that in light of the research conducted it cannot be unanimously declared that the existence of EU funds' absorption and the change in the level of socio-economic development, and the results of the research procedure conducted are based solely on a statistical dependency and the interpretation thereof needs to be done in a careful manner. It is beyond doubt that EU funds have had a positive impact on the socio-economic development of districts. It is very difficult to unambiguously state the scale of that impact, as the development registered in the research stemmed from a combination of different kinds of stimulæ in operation. Moreover, it is well worth noting that in the case of human capital, within which a negative correlation was observed, the results of the projects financed from EU funds will be visible only in the long-term perspective, they have thus not been taken into account in the research conducted. Additionally, gauging innovativeness or the state of the natural environment is a huge difficulty due to the lack of widely accessible objective indicators that would directly reflect the factors of development enumerated. Owing to the specificity of spending funds from the general budget of the EU, it is worth considering an extension of the researched period in similar analyses in order to prolong the research period in order to take into account also the long-term impact of EU funds.

References

- Bradley, J., Zaleski, J., Tomaszewski, P., and Zembaty, M. (2007). *Wskaźniki realizacji Regionalnych Programów Operacyjnych na lata 2007-2013. Ocena makroekonomicznego wpływu 16 RPO na gospodarki regionalne przy użyciu modeli HERMIN*. Wrocław: Wrocławska Agencja Rozwoju Regionalnego.
- Churski, P. (2008). *Czynniki rozwoju regionalnego i polityka regionalna w Polsce w okresie integracji z Unią Europejską*. Poznań: Wydawnictwo Naukowe UAM.
- Dziadek, K. (2012). Makroekonomiczny wymiar przedsięwzięć finansowanych dotacjami unijnymi w Polsce, *Zeszyty Naukowe Uniwersytetu Szczecińskiego*, (45), 21-36.
- Grosse, T. G. (2004). *Poland and the EU new cohesion policy*. Instytut Spraw Publicznych.
- Institute of Research on a Market Economy. (2010). *Wpływ realizacji polityki spójności na kształtowanie się głównych wskaźników dokumentów strategicznych NPR 2004-2006 i NSRO 2007-2013*. Gdańsk-Warszawa: Prevision.
- Knapieńska, M. (2017). Zróżnicowanie rozwoju społeczno-gospodarczego krajów i regionów świata – perspektywa makroekonomiczna. *Studia Oeconomica Posnaniensia*, 5(5), 38-58.
- Kološta, S. (2016). *Učiaci sa región – východiská, podstata, kritika, využitie*. Banská Bystrica: Univerzity Mateja Bela v Banskej Bystrici.
- Korneluk, Ł. (2015). *Rola środków z budżetu Unii Europejskiej w rozwoju społeczno-gospodarczym Polski w latach 2007-2013*. Olsztyn: Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego w Olsztynie.
- Kozarova, I. (2013). The impact of driving forces of globalization on the nature of border effects in Slovakia. In L. Krticka (Ed.), *Political factors of economic growth and development in transition economies* (pp. 78-89). Ostrava: University of Ostrava.
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, 99(3), 483-499.
- Kufel, T. (2013). *Ekonometria. Rozwiązywanie problemów z wykorzystaniem programu GRETL*. Warszawa: Wydawnictwo Naukowe PWN.
- Ministry of Funds and Regional Policy. (2019). Lista beneficjentów Funduszy Europejskich. Warszawa: Ministry of Funds and Regional Policy. Retrieved from <https://www.funduszeuropejskie.2007-2013.gov.pl>
- Romer, D. (2000). *Makroekonomia dla zaawansowanych*. Warszawa: Wydawnictwo Naukowe PWN.
- Schumpeter, J. (1995). *Kapitalizm, socjalizm, demokracja*. Warszawa: Wydawnictwo Naukowe PWN.
- Smętkowski, M. (2013). *Rozwój regionów i polityka regionalna w krajach Europy Środkowo-Wschodniej w okresie transformacji i globalizacji*, Warszawa: Wydawnictwo Naukowe Scholar.
- Sobczyk, M. (2007). *Statystyka*. Warszawa: Wydawnictwo Naukowe PWN.
- Spychała, M. (2014). Wielkość i struktura pomocy de minimis w Polsce w okresie kryzysu finansowego. *Studia Oeconomica Posnaniensia*, 2(6), 96-112.
- Spychała, M. (2017a). Zróżnicowanie rozwoju społeczno-gospodarczego w powiatach województwa wielkopolskiego. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, (487), 293-305. <http://doi.org/10.15611/pn.2017.487.26>
- Spychała, M. (2017b). Zróżnicowanie przestrzenne absorpcji funduszy unijnych perspektywy finansowej 2007-2013 a zmiany poziomu wzrostu gospodarczego województw w Polsce. *Nierówności Społeczne a Wzrost Gospodarczy*, 49(1), 348-358. <http://doi.org/10.15584/nsawg.2017.1.26>
- Spychała, M. (2018). Poziom rozwoju społeczno-gospodarczego powiatów w Polsce. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, (527), 242-254. <http://doi.org/10.15611/pn.2018.527.21>
- Stankiewicz, W. (2007). *Historia myśli ekonomicznej*. Warszawa: PWE.