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Spatial dependencies in the absorption of funds from Regional Operational Programmes on NUTS 3 regional level in Poland

Abstract

Financial support is the main instrument of regional development policy in the European Union. Concentration, programming and partnership, are presented as "core principles" for improving the effectiveness of structural expenditure based on compensating the structural disadvantage of the assisted regions.

The purpose of this paper is to analyze the spatial dependencies in level of absorption of funds in comparison to allocation criteria of intervention funded from Regional Operational Programmes. The research was based on data about the state of implementation of European funds in the subregions (NUTS 3) in 2007-2012., generated from the National Information System SIMIK 07-13.

Keywords: spatial dependencies, Regional Operational Programmes, funds absorption, Moran's I statistic.
JEL Classification: C12, R12, R58.

Introduction

The funds intervention in order to be effective, should support the regions in need of development (Pietrzyk 2002, p. 186), to 'compensate' the structural disadvantage of the assisted parts of the Community (Crescenzi 2007, p. 5). Consequently, financial aid should be focused on problems in regions at the lowest level of socioeconomic development.

Over time the need for an increase the geographical concentration of the structural funds expenditure has become progressively more apparent and 'concentration' has been crucial principle for the new programming period (Crescenzi 2007, p. 11). Insufficient spatial concentration of the funds may decrease their impact by reducing the amount of spatial externalities produced by the implementation of regional development programmes. In this respect Bradley (2006) highlights that without such external effects there is no evidence of long term benefits from the structural funds (Crescenzi 2007, p. 12).

On the other hand, the effective allocation of funds in supported regions depends on capacity of absorption by initiating and co-financing projects. These abilities are affected by the economic situation in regions (Mohl, Hagen 2010, p. 353). According to presented factors of EU funds implementation, absorption capacity is defined as the ability to spend fully the allocated financial resources from the EU funds in an effective and efficient way (Šumpíková, Pavel, Klazar 2003, p. 1). The absorption capacity is considered from two perspectives: 1) capacity of absorption on the side of the offer – the capacity of absorption of the institutional system established by a particular state to administer the funds and 2) capacity of absorption on the side of the demand – capacity of absorption on the side of the beneficiaries of the funds (Cace et al. 2009, p. 15).

The supply side of absorption capacity can be specified by the main factors: macroeconomic, financial and administrative. In connection with the regional scope of the analysis of the spatial distribution of the absorption of EU funds, this research concentrates on financial and administrative factors. Financial absorption capacity can be defined as the ability to co-finance EU supported programmes and projects, to plan and guarantee these national contributions in multiannual budgets, and to collect these contributions from several partners (state, regional and local authorities, private bodies) interested in a programme or project (Šumpíková, Pavel, Klazar 2003, p. 2). As practice demonstrates (Zaman, Georgescu 2009, p. 143) the most disadvantaged regions have also the greatest difficulties in the absorption of these funds. The main explanation for this situation lies in two factors: on the one hand, the difficulties of regional authorities due to lack of experience and qualifications, bureaucratic procedures and slow EU decision-making process. On the other hand, the ability to harmonize the co-financing depends on the willingness of various partners to provide funds, as well as on the technical and institutional abilities to collect contributions, as often the local authorities are reticent regarding the horizontal collection because of external interference and of potential control involved (Zaman, Georgescu 2009, p. 144).

Administrative capacity can be defined as the ability and skill of central, regional and local authorities to prepare suitable plans, programmes and projects

in due time, to decide on programmes and projects, to arrange the co-ordination among principal partners, to cope with the administrative and reporting requirements, and to finance and supervise implementation properly, avoiding irregularities as far as possible. The capacity is determined by design of the whole implementation system and also by its functioning (operationalization of rules). The capacity comprises structure, human resources, systems and tools. (Šumpíková, Parel, Klezar 2003, p. 2). The absorption of structural funds is a process that is composed of stages: 1) Structural Funds programming architecture (the number of priorities, their content, the management authorities, intermediate bodies and final beneficiaries); 2) The level of commitment (funds allotted to projects by the management authorities); 3) Payments to beneficiaries in various stages of implementation (Zaman, Georgescu 2009, p. 142). The aim of this paper is to verify some dependences in the spatial pattern of ROP funds absorption in accordance with the allocation among the voivodeships. Spatial dependences were defined as a similarity between nearby spatial units of total ROP funds absorption. The complexity of the procedures for obtaining funds, diversified infrastructure investments due to the nature and timing of their implementation, let to assume that the first period 2007-2009 was characterized by the presence of a large dispersion of spending among regions. Finished projects, implemented mainly in the subregions neighboring to urban centers, were characterized by a relatively low cost. In the following years the value of investments associated to the length of the projects showed an increase. To verify statistical significance of the spatial interactions of the value of ROP funds absorption, the global Moran's I statistics was applied. The first part of research contain description of Regional Operational Programmes, as a financial tool of polish regional policy. Next the assumption of algorithm of funds distribution among voivodeships and its main disadvantages was presented. The third section contains a description of the nature of spatial relationships and presentation of statistical tools – global Moran's I statistics. The following sections contain the results of tests of the spatial autocorrelation.

1. Regional Operational Programmes

Regional Operational Programmes (ROP) for voivodeships managed at the regional level should answer to the most vital local problems and needs in the regional and local areas, therefore seems to be more effective for regional development than other operational programmes. The major aim of preparation and implementation of 16 Regional Operational Programmes is programming decen-

tralization for "growth of regions, increasing the degree of effectiveness in executing development measures by public administration, enhancing the citizen and self-government dimension, as well as effective utilization of structural resources for the period of 2004-2006 within ROP". The ROP objectives are defined in relation to voivodeship development strategies, and included in objectives of National Strategic Reference Framework 2007-2013 (NSRF). The elementary objectives of ROP are related to improving competitiveness in regions and promotion of balanced development. Those objectives should be achieved through combined impact on establishing conditions for employment growth and growth of investments at a regional and local level. It is assumed that each ROP would have a similar arrangement, while their contents (including contents of undertakings) and financial resources would be defined on the regional level.

Spatial differentiation and the specific nature of particular geographical areas had been taken into account on the stage of programming 16 ROP in two ways: in the form of increased transfers (per capita) of funds (coming from the EU) for voivodeships with the lowest level of GDP per capita and the highest unemployment rate, within the defined list of priority axes and possibilities of designating by voivodeships of appropriate values of granted resources – depending on the scale of problems and own development strategy.

The algorithm of funds division among 16 Regional Operational Programmes had been selected on the basis of results of performed social consultations of NSRF. It is a continuation of an algorithm implemented in the Integrated Regional Development Operational Programme 2004-2006 within National Development Plan 2004-2006 (National Strategic Reference Framework 2007-2013, p. 32). The applied algorithm of means division was established on the basis of criteria.

Criterion I: Poland as a whole conforms to present eligibility criteria for areas comprised by Objective 1 of EU structural funds. This justifies the dominating role of the population criterion in a regional division of support resources. 80% of those resources were divided in proportion to the number of inhabitants in particular voivodeships.

Criterion II Taking into consideration inter-voivodeship differentiation in the level of GDP per capita, 10% resources were divided in proportion to the number of inhabitants in voivodeships, in which the average level of GDP per capita was lower than 80% of the average level per capita in Poland.

Criterion III Taking into consideration the high unemployment rate and the threat recorded in many poviats of lasting marginalization of considerable social groups, 10% of support resources were allocated for those poviats in which the average unemployment rate exceeded 150% of the national average value. (National Strategic Reference Framework 2007-2013, pp. 118-119).

It is assumed that, thanks to the application of the algorithm, differentiation of transfers per capita in particular voivodeships is maximum as 1:2.16. This still allows implementation of regional policy objectives other than regulating and restructuring ones – utilization of endogenic potential of all regions for establishment of competitiveness strength in all voivodeships. (National Strategic Reference Framework 2007-2013, p. 119). The spatial patterns of allocation of funds is illustrated on Figures 1-2.

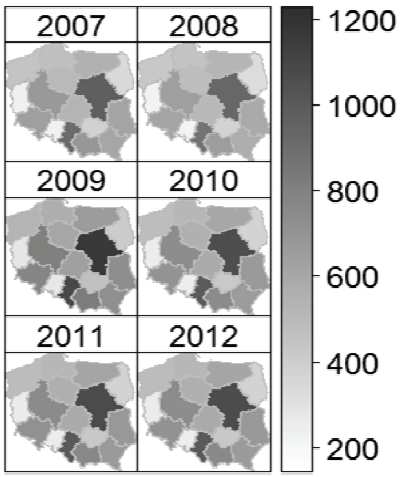


Figure 1. Total allocation (mln PLN)

Source: Calculations based on data from (National Strategic Reference Framework 2007-2013) with R Cran.

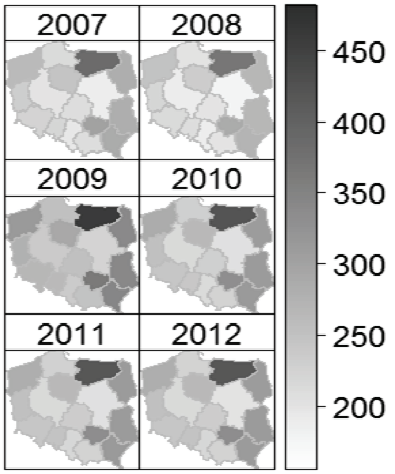


Figure 2. Allocation per capita (PLN)

Source: Calculations based on data from (National Strategic Reference Framework 2007-2013) with R Cran.

The implementation of this algorithm of the distribution of funds under ZPORR and ROP has become a cause of polemics on the validity of the criteria for allocation. Taking absolute level of intervention, the main beneficiaries of the aid are the most populated region. Correspond to the regions in which is located a large number of urban areas, a number of business environment institutions and research centers (Heller, Szczepaniak 2008, p. 112).

Assuming the full capital mobility aid funds from the European Union, despite the another nature of their purpose and predominantly go to the more developed regions, in accordance with the principle of extra-favored areas already richer. The literature studies conducted for this research shows that Poland is a net importer of foreign direct investment, but their spatial allocation varies considerably. These investments are concentrated mainly in the capital, a strong industrial centers (Silesia, Wielkopolska), around the main roads as well as along the western border of the country. It turned out that the most general determinant of FDI inflows to the region is level and stage of economic development of the region. The absorption of these investments in the regional takes place in Poland, according to identical regularities that characterize this movement between countries, in line with the theories of the flow of capital in the form of foreign direct investment described by M.E. Porter and T. Ozawa and J.H. Dunning (Heller, Warżała 2005, pp. 785-799). As a result, funding goes mainly to those regions which are the most urbanized, as it is the city absorb the major part of the funds. May be due to natural conditions for the efficient absorption and local needs are more visible and therefore easier to present and more efficient to implement.

2. Spatial dependencies

The problem of spatial dependence is extension of the first law in geography (Tobler 1970, p. 236): "everything is related to everything else, but near things are more related than distant things" (Dubé, Legros 2011, p. 20). Chasco and Lopez (2008, p. 102) pointed out that "spatial dependence has usually been defined as a spatial effect, which is related to the spatial interaction existing between geographic locations that takes place in a particular moment of time".

The spatial autocorrelation concept was bred at the University of Washington in the late 1950s, principally by Michael F. Dacey, mainly in the presence of William L. Garrison and Edward Ullman, two geographers influenced by the central place work of the 1930s German economic geographer Walter Christaller. Earlier, an extensive literature had been developed on the principal of nearness, that is, the strong effect that nearby area shave on each other versus

the relatively weak influence of areas further away (for example, Ravenstein 1885; von Thünen 1826; Zipf 1949) with the implication that near spatial units are similar to one an-other. Until 1964, in the social science and statistics literature, spatial autocorrelation had been called 'spatial dependence', 'spatial association', 'spatial interaction', 'spatial interdependence', among other terms (Getis 2010, p. 256.). The definition of the spatial autocorrelation is that it represents the relationship between nearby spatial units, as seen on maps, where each unit is coded with a realization of a single variable.

One of the most commonly used statistics for testing spatial dependence among variables and especially residuals of statistical models is Moran's I index (Moran 1948; 1950). Moran's I global statistics of spatial autocorrelation. It captures the positions of regions similarity of values in neighboring localizations. Contrary to classical concentration measures like Herfindahl's, Gini's, entropy indices, coefficient of variation or Theil's entropy measure, Moran's I statistic is not permutationally invariant. Different spatial patterns (from overdispered to agglomerated) can give the same value of concentration measure (Arbia, Piras 2009, p. 4471).

Moran's I statistic is structured as the Pearson product moment correlation coefficient. The crucial difference is that space is included by means of a **W** matrix and instead of finding the correlation between two variables, the goal is to find the correlation of one variable with itself vis-à-vis a spatial weights matrix (Getis 2010, p. 263).

It is an autocovariance function between the original variable and its spatially lagged variable (Haining 2009). The spatially lagged variable is defined as the mean value of neighboring observations. It is obtained by multiplying the vector of a particular variable by an exogenous spatial weights matrix that has to be constructed. There is a close link between Moran's I index and the regression coefficient obtained when the variable of interest is regressed over its spatially lagged variable. Thus, independent of the approach adopted to calculate Moran's I index, the spatial weights matrix plays a crucial role when testing for spatial autocorrelation:

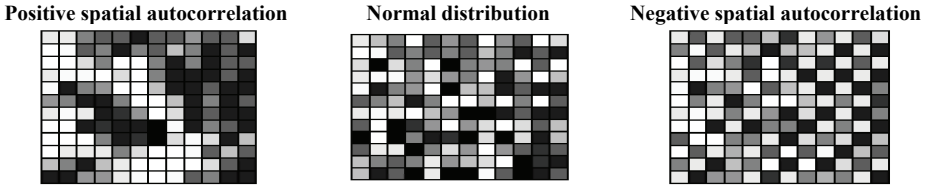
$$I_j = \frac{R}{\sum_{r=1}^{R}\sum_{i=1}^{R} w_{ri}} \frac{\sum_{r=1}^{R}\sum_{i=1}^{R} w_{ri}\left(x_r - \bar{x}\right)\left(x_i - \bar{x}\right)}{\sum_{r=1}^{R}\left(x_i - \bar{x}\right)^2} = \frac{R}{S_0} \cdot \frac{\mathbf{z'Wz}}{\mathbf{z'z}} \tag{1}$$

where: W is binary matrix with a value of 1 for contiguous units and 0 otherwise, z' = [z_1, z_2, … , z_R] – column vector with elements: $z_r = x_r - \bar{x}$. For **W*** row-standardized spatial queen contiguity matrix S_0=R, therefore:

$$I_j = \frac{\sum_{r=1}^{R}\sum_{i=1}^{R} w_{ri}^{*}(x_r - \bar{x})(x_i - \bar{x})}{\sum_{r=1}^{R}(x_i - \bar{x})^2} = \frac{\mathbf{z'W^{*}z}}{\mathbf{z'z}} \tag{2}$$

The value of Moran's I statistics usually ranges from –1 to 1. Significant, negative value indicates that nearby locations tend to have different values of analyzed variable. A non-significant value means that values of analyzed characteristics are distributed randomly among geographical units. A positive and statistically significant values inform that in nearby locations occur similar values (positive spatial autocorrelation). A non-significant value means that values of analyzed characteristics are distributed randomly among geographical units (lack of spatial autocorrelation). Significant, negative value indicates that nearby locations tend to have different values of analyzed variable (negative spatial autocorrelation).

Figure 3. Kinds of spatial distribution



Source: Suchecki (2010, p. 104).

3. Data

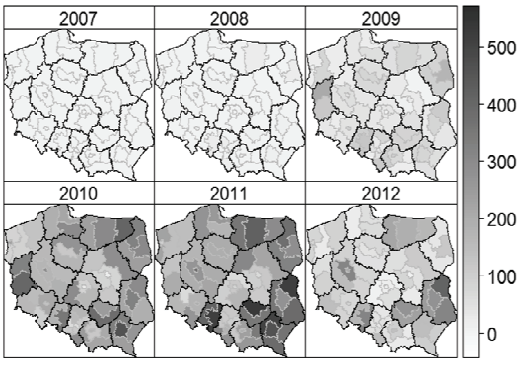
To verify the hypothesis about spatial dependences of the distribution of absorption of funds from Regional Operational Programmes for 16 voivodeships was generated data describes values of subsidies, which have been co-financing the finished grants in 66 subregions (NUTS 3) from 2007 to 2012. Data was obtained from SIMIK 2007-2013 Standard report on the status of implementation of structural funds generated periodically. Values of finished investments (with sygnet application for final payment) for provinces (NUTS 4) was aggregate to subregions level (NUTS3). The futher analysis are focused on four indcators:

- Value of total ROP support per capita – sum of total values of co-financing from Regional Operational Programmes per inhabitant (actually settled as at 31 December) in *i*-th subregion.
- Value of total ROP support per investment – sum of total values of co-financing from Regional Operational Programmes per investment in *i*-th subregion
- Value of total ROP support per investment and per capita – sum of total values of co-financing from Regional Operational Programmes per inhabitant (actually settled as at 31 December) per in investment *i*-th subregion.
- Share of total value of ROP co-financing in NUTS3 in allocation value in NUTS2 (per capita) – indicator approximates the subregion activity in obtaining funds from the ROP.

4. Results

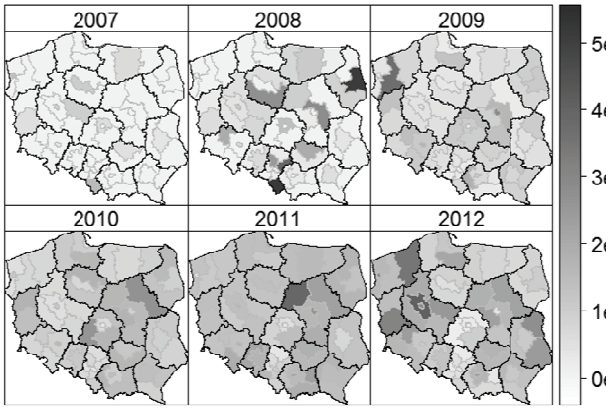
The spatial distribution of values of ROP co-financing among subregions in period 2007-2012, is illustrated on figures 4-7. In 2007, projects with a maximum value of per capita funding of projects were implemented in subregions Poznań (8,3 PLN), Wroclaw (7,13 PLN) olsztyński (4,13 PLN), Szczecin (3,40 PLN) and the subregion bielski (2.32), Silesia). In the following seven subregions grant amount has not exceeded 2 PLN, while the remaining 54 subregions have not completed any project. This structure shows the spatial dispersion and asymmetry of the co-financing of ROP (Fig. 4, 2007). On average, the most expensive financing were implemented in the subregion bielski (Silesia, 1,51 mln PLN), the city of Szczecin (PLN 1,38 mln), Bydgoszcz and Torun (1,02 mln PLN). The highest value of the average per capita of the project amounted to PLN 3,30 in the subregion city of Szczecin.

Figure 4. Value of total ROP support per capita in PLN



Source: Calculations based on data from (National Strategic Reference Framework 2007-2013 and Local Data Bank) with R Cran.

Figure 5. Value of total ROP support per investment in mln PLN

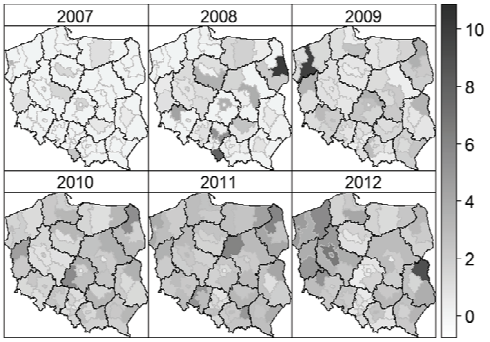


Source: Calculations based on data from (National Strategic Reference Framework 2007-2013 and Local Data Bank) with R. Cran.

The highest share of the total value of ROP support in NUTS3 in allocation value in NUTS2 (per capita) was located in subregion city of Poznań at the level of 4%. In the following year, the values of co-financing have increase in terms of the maximum funding per capita (29,10 PLN) in Poznań, funding per investment – bielski (5,15 mln PLN), białostocki (5,11 mln PLN). In 2009-2012, the maximum grant value per capita concentrated in subregion gorzowski, białostocki, opolski (2009), rzeszowski, ełcki, zieleniogórski, (2010), kielecki, opolski, bialski, tarnobrzeski (2011), bialski, opolski, poznański (2012). Half of the subregions have received a grant per capita at most 44.93 PLN (in 2009), 188,95 PLN (2010), 204,30 PLN (2011) and 76,85 PLN (2012).

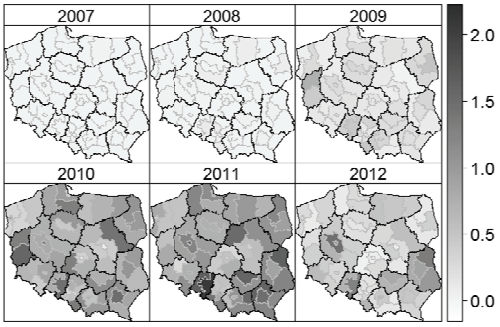
Average value of financing development projects in the period 2009-2012 were the highest in stargardzki subregion (PLN 3,6 mln) in city of Warsaw (PLN 2,8 mln) in 2009, ostrołęcko-siedlecki (PLN 2,7 mln) and sieradzki (2,6 mln PLN) in 2010. In 2011, the highest average amount of received projects in the subregion ciechanowsko-płocki (PLN 3,8 mln) and city of Warsaw (PLN 2,5 mln). The highest average level of funding assigned to one project was reported in Poznań subregion (PLN 4.0 mln), koszaliński (PLN 3,4 mln) and zieleniogórski (PLN 3,1 mln) in 2012.

Figure 6. Value of total ROP support per investment and per capita in PLN



Source: Calculations based on data from (National Strategic Reference Framework 2007-2013 and Local Data Bank) with R. Cran.

Figure 7. Share of total value of ROP support in NUTS3 in allocation value in NUTS2 (per capita)



Source: Calculations based on data from (National Strategic Reference Framework 2007-2013 and Local Data Bank) with R. Cran.

Comparing the value of shares in the values of project funding allocation in the regions per capita, it should be noted that the spatial distribution of the indicator mapping the distribution of GDP per capita funding.

Table 1. Moran's I statistics of global autocorrelation.

Indicators	2007	2008	2009	2010	2011	2012
Value of total ROP support per capita	–0.055 (0.706)	–0.057 (0.692)	0.125 (0.045)	0.288 (0.000)	0.409 (0.000)	0.333 (0.000)
Value of total ROP support per investment	–0.101 (0.859)	–0.070 (0.753)	0.095 (0.079)	0.117 (0.056)	0.269 (0.000)	0.388 (0.000)
Value of total ROP support per investment and per capita	–0.097 (0.856)	–0.055 (0.693)	0.049 (0.179)	0.078 (0.130)	0.163 (0.016)	0.405 (0.000)
Share of total value of ROP support in NUTS3 in allocation value in NUTS2 (per capita)	–0.048 (0.678)	–0.037 (0.606)	0.099 (0.082)	0.135 (0.038)	0.295 (0.000)	0.339 (0.000)

Note: In () was contained p-values of Moran's I statistics, which indicates the probability of that the null hypothesis (the lack of spatial autocorrelation) is true.

Source: Calculations based on data from (National Strategic Reference Framework 2007-2013 and Local Data Bank) with R. Cran.

Spatial distributions presented in figures 4-7 give evidence to request the formation of clusters of similar values of the analyzed variables in 2010-2012. In order to verify the statistical significance of this hypothesis statistics Moran's I was used. Negative values of statistics would indicate that there is considerable spatial diversity. Lack of statistical significance (indicated by p-value greater than the significance level 0.05) leads to the conclusion of a random distribution of high and low values of the total ROP support per capita in 2007-2008, share of total value of ROP support in NUTS3 in allocation value in NUTS2 (per capita) and value of total ROP support per capita in 2007-2009, as well as values of total ROP support per investment and value of total ROP support per investment and per capita in 2007-2010.

In the following years the values of variables have indicated concentrations in neighboring locations (positive autocorrelation of the variables values). The highest level of spatial concentration of funding per capita from the ROP took place in 2011. The value of statistics achieved the level on 0.409. The similarity in terms of high levels of co-financing per capita were reported in subregions East Poland and Opolskie voivodeship. The lowest levels were located in the Lodz voivodeship and south-eastern subregions of Mazowieckie. Considering the value of financing per investment, the highest level of concentration was observed in 2012 at level on 0.388. As shown in Figure 5 the first group of sub-regions with the highest co-financing investments were located in the Zachodniopomorskie subregions, Lubuskie and the Wielkopolska. The second subgroup was combined with subregions of the Lubeskie, the Mazowieckie and the Świętokrzyskie voivodeships. In terms of activities in the implementation of development projects in 2012 stand out subregions: poznański, nyski, opolski, bialski, chełmińsko-zamojski and subregions of the Świętokrzyskie voivodeship.

Conclusions

The aim of paper was to verity the dependences in the spatial pattern of ROP funds absorption in accordance with the allocation among the voivodeships.

Absorption of aid from ROP was characterized by positive spatial autocor-relation across subregions mainly in years 2010-2012. Significance of spatial dependence of support fund absorption was an increasing function of time. This spatio-temporal dependence may be caused by the fact that the long-term and 'expensive' investments have been finished at the end of programming period. Comparing the spatial allocation of ROPs per capita, the spatial distribution of absorption values coincided with the objectives set out in the National Strategic

Reference Framework 2007-2013. On the other hand, certain objections may raise the spatial distribution of absorption per a single investment. It turns out that on average the most expensive investments were not only carried out in Poland and Eastern Europe, but also in the western voivodeships and voivodeship of Mazowieckie.

Further researches require the verification of the relationship between the level of regional development and concentration of EU funds absorption. The one of crucial issue is seems to investigate where were located 'expensive' infrastructural investments, and if these projects were the answer to the most vital problems of regions. Another important thing is to examine the spatial trends in obtaining and implementing investment projects.

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