The spillover effect of European Union funds between the regions of the new European Union members

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Abstract

As the differences between the regions are more pronounced than among the countries, NUTS 2 regions of the new members that joined the EU after 2000 are considered. Due to the presence of externalities between the regions, the Solow growth model using interregional externalities is used. This is modelled by spatial econometrics, the method of maximum likelihood. According to previous research, the effects of European funds in the EU on reducing disparities are not unique, but contradictory. From the mentioned research for new members, we can conclude that the research shows a positive effect of European funds on growth rates. There is a noticeable lack of research analyzing the impact of EU funding on new members after the 2008 crisis, including their mutual regional interaction. The aim is to determine the impact of EU funding on reducing regional disparities as measured by GDP per capita. The paper shows that an increase in European funding increases growth rates, thus contributing to the reduction of interregional disparities. European funding, which is mostly targeted at less developed regions, represents an opportunity for new members and potential new members to move closer to more developed old members. The spillover effect of European funds represents the key contribution to the positive effect of EU funds, i.e. the advantage of the application of spatial econometrics. Also, these spillovers have proven to be an important factor whose omission in models estimated by the OLS leads to bias. Regional externalities should be taken into account in regional divisions by regional policymakers, and in creating the distribution of funds for the next programming period. The effect of funding in the region itself without the spillover effect does not contribute to reducing disparities, which represents a future opportunity, especially for the poorest regions, such as the regions in Bulgaria and Romania.

Keywords: convergence, European Union funds, regions, spatial econometrics.

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Introduction

Regional science is developing in the second half of the 20th century, in response to the emergence of regional disparities, to find appropriate measures to address this issue. There is a contrast between the north and south regions of the European Union (EU), the new and old EU members. Differences are largely generated by border areas in eastern Europe and regions related to large urban centers, most often capitals (centralization). Regionalization should be an instrument for reducing existing disparities, i.e. affecting the well-being of the region itself and the entire country. Through interregional solidarity based on regional cohesion policy, which began in 1975, efforts are being made to create the preconditions for the effectiveness of monetary policy and the EU's single market.

The objectives of the European cohesion policy are to strengthen the EU economy, and social and territorial cohesion, which is predominantly oriented towards underdeveloped regions where the gross domestic product (GDP) per capita is less than 75% of GDP per capita on the EU27 average. The European Structural and Investment Funds make up about a third of the EU budget. Cohesion policy and the common agricultural policy are important policies of the European Union implemented through the European Regional Development Fund (regional and urban development), European Social Fund (social inclusion and good governance), Cohesion Fund (economic convergence of less developed regions), European Agricultural Fund for Rural Development, European Maritime and Fisheries Fund. These funds make up more than half of the total funds.

Criteria for regionalization are subject to change due to different evaluations of the characteristics of regions in certain phases of economic development. One of the most important criteria is the homogeneity and functionality of an area from an economic, political, demographic, and social aspect, taking into account the availability of natural resources. Certainly, an important factor is the influence of the larger regional centers to which the region gravitates. Ignoring these characteristics leads to regional disagreements that take on political characteristics and can have opposite effects from those that regionalization should bring. The EU has opted for one criterion, population. This demographic indicator serves for the Nomenclature of territorial units for statistics (NUTS) on three levels. NUTS 2 is the most frequently used and most acceptable indicator in empirical research. Therefore, to compare the results with other papers on similar topics, but also because of the regional European policy based on Structural Funds policy at this level, the NUTS 2 level is also considered.

Most of the papers analyze the old EU members, and only a small part includes the new EU members (Croatia, Slovenia, Romania, Bulgaria, Hungary, Slovakia, Poland, the Czech Republic, Lithuania, Latvia and Estonia), i.e. Central and Eastern European (CEE) countries. Therefore, the paper focuses on the regions of CEE countries. CEE countries are characterized by a similar development path after the transition from a command to a market economy. Although there are differences between them in size, population, and economic structure, we can consider them as a homogeneous whole. In addition to economic connections, they are characterized by geographical and transport connections, which is an important prerequisite for regional interaction.

The income of CEE countries is generally insufficient for large infrastructure projects at the regional level because most are spent on current consumption and little is left for savings and investment. Structural funds that increase investment are used as an important instrument at the EU level. Efficient use of structural funds and well-designed projects are the basis of regional development, especially in times of crisis.

The main goal of the research is to determine the impact of European funds on GDP growth rates per capita of the new members in the period from 2008 to 2019, taking into account interregional interaction. The scientific objectives are: to determine the existence of regional spillovers between regions, to establish the effect of European funds on reducing regional disparities, to determine the effect of direct and indirect effects on regional interaction. The application objectives are: to point out the problem of bias and inconsistency of estimator due to the omission of regional interaction in the empirical model and to provide guidelines for adequate regional distribution and distribution of European funds.

The obtained results indicate the importance of funds for regional growth. The key contribution is made through the spillover of effects between regions. Therefore, interregional externalities with EU funds should be taken as an important factor in creating economic policy.

The chapters are structured as follows. The second chapter provides an overview of previous research on European funds on growth rates and reducing disparities. The third chapter describes the methods of spatial econometrics that allow the measurement of interregional spillovers. The fourth chapter analyzes the data used in the model. The interpretation of the obtained results is contained in the fifth chapter. Finally, the sixth chapter contains the main conclusions of the research, recommendations for economic policymakers, and suggestions for future research.

Literature review

Most research looking at the impact of European funds and convergence on regional economic growth is based on neoclassical growth theory. Therefore, regions converge if they achieve the same rate of savings, depreciation and population growth, with the same technology. We should also mention the theory of endogenous growth, which emphasizes the role of innovation and human capital to achieve growth. Then there is the new economic geography, which believes that the development of transport infrastructure amplifies the differences between the core and the periphery. The theory of comparative advantage emphasizes that regions focus on those sectors in which they have an advantage over other regions. European funds can accelerate convergence due to the effects of declining returns on capital (Dall'erba, Le Gallo, 2008). According to previous research, the effects of European funds on reducing disparities are not unique, but contradictory. The reasons for the different results according to Mohl and Hagen (2010) stem from the period of consideration, the spatial units involved in the analysis, the model specifications, and the way the model is estimated. Also, the variables that measure the impact of funds differ: depending on the funds involved, given the objectives set by the European Commission, the ratio of funds to GDP or population, and the difference between the time of realization and receipt of funds. Estimator bias may be caused by endogeneity resulting from the omission of variables in the model. Therefore, this study uses Regional Competitiveness Index (RCI) components to solve the problem of omitted variable bias. The omission of interregional externalities can also contribute to the bias of results.

Previous research has shown GDP per capita convergence for the new EU members (Grela et al., 2017; Smetkowski, Wójcik, 2012). The effect of Cohesion policy on reducing the disparities of the Visegrad Group countries is particularly pronounced for underdeveloped regions that are far from the EU core (Horridge, Rokicki, 2017). For the research of the new EU members, it is worth mentioning the positive effect of European funds on growth rates at the NUTS 3 level, which varies in intensity between individual regions (Bourdin, 2018). Romania, Bulgaria and Croatia were left out of the study.

The first research at the NUTS 2 level that includes spatial interaction includes the old EU members, and later research after the EU enlargement includes new members. For the period between 1989 and 1999, the impact of funds on regional convergence is lacking for the old EU members, for the core and peripheral countries related to the Mediterranean belt (Dall'erba, Le Gallo, 2008). The same was shown for the old members in the period from 1995 to 2009 (Antunes et al., 2020). For the period 2000 to 2014, the impact of the cohesion policy shows positive effects on economic growth, especially among the new members, and this is reflected throughout the EU, but lacking for the old members (Védrine, Le Gallo, 2021). The positive effect of funds on GDP growth per capita after 2008 has been shown for all NUTS 2 regions of the EU (Römisch et al., 2020). Experience with funding, which is mainly related to the old members and their less developed regions, indicates the possibility of a lack of impact of the funds if the adequate regional policy is not implemented. This is explained by the new economic geography, where the core and periphery are polarized due to the reduction of transport costs and the development of transport infrastructure that increases regional disparities. From the mentioned research for new members, we can conclude that the research shows a positive effect of European funds on growth rates. The largest beneficiaries of the funds are the new members with the lowest GDP per capita in the EU. There is a noticeable lack of research analyzing the impact of EU funding on new members after the 2008 crisis, including their mutual regional interaction. Therefore, the effect of funds on the reduction of regional disparities of the new EU members measured by GDP per capita in the period 2008-2019 is investigated.

Methodology

The methodological procedure is based on the beta convergence study (regions with lower initial levels of GDP per capita achieve higher growth rates) based on Solow's growth model which says that the return from additional factors of production becomes smaller as the country gets richer (Solow, 1956). Absolute beta convergence models have been extended to conditional beta convergence models that include factors that differentiate regions (Mankiw et al., 1992). The first papers on beta convergence of EU regions show poor convergence (Barro, Sala-i-Martin, 2003; Sala-i-Martin, 1996). Tobler's law says that everything is connected to everything, but that closer objects are more connected than more distant ones. This refers to the region whose distance from each other significantly affects their economic interaction. This law derives from the geographical concept of friction of distance, which says that movement requires some form of cost (physical effort, energy, time) that is proportional to the distance. Therefore, denying the effect of spatial interaction in the model, which is difficult to imagine at a time of increasing integration processes between countries and regions, leads to biased and inconsistent estimators. The conditional beta convergence model is used in the context of the spatial model due to the presence of regional spillovers, as shown in a large number of regional studies (Annoni, de Dominicis, Khabirpour, 2019; Dall'erba, Le Gallo, 2008; Le Gallo, Ertur, 2003; Ertur, Le Gallo, Baumont, 2006; López-Bazo, Vayá, Artís, 2004; Mohl, Hagen, 2010).

Spatial econometric analysis is based on a weight matrix that allows the interaction between regions to be measured. It is a square, usually exogenous matrix. Exogenous means that the elements in the matrix are not functionally related to the phenomenon under investigation. The number of rows and columns corresponds to the number of regions, and each position within the matrix describes the relationship between the two regions. The matrix used in the paper is based on first-order neighbours. The elements in the matrix are normalized by rows.

$$w_{ij} = \begin{cases} 1, & if\ i\ and\ j\ are\ spatially\ linked\ to\ each\ other \\ 0, & otherwise \end{cases} \quad (1)$$

Positive spatial autocorrelation is a global measure of the overall clustering of NUTS 2 regions, meaning that regions with similar characteristics are grouped together relative to the average. Those with higher values than the average are one group, and those with lower values are another. One of the reasons for choosing NUTS 2 regions is that the choice of smaller regional units can seemingly increase the importance of spatial autocorrelation. The existence of a regional interaction of a variable loses the meaning of the assumption of the spatial independence of the variable, which can cause the absence of the influence of spatially autocorrelated variables on the variable of interest.

The Moran index as a measure of spatial autocorrelation can take positive and negative values and zero. Zero would mean the absence of any meaningful grouping of regions according to a certain indicator, and negative values indicate the grouping of regions with opposite characteristics. A positive value means that regions with similar characteristics are grouped. It is used to test claims in the form of a statistical hypothesis in which the null hypothesis is the absence of autocorrelation, and the alternative hypothesis is the existence of autocorrelation (positive or negative).

The Moran index is a global indicator of autocorrelation, but there is also a local version of it, the Local indicators of spatial association (LISA). The sum of local indices is proportional to the Moran index. It can be used to determine the local character of autocorrelation for each individual region (Anselin, 1995). It is possible to identify spatial clusters and outliers. Outliers are regions that have values greater / less than the mean of the variable, and outliers have opposite values relative to the average.

The spatial model can contain endogenous interaction (dependent variable), exogenous interaction (independent variable) and interaction between model errors. In general, a model can contain all three forms, but in practice, no more than two of the three forms of interaction are used. Models that have the first two interactions, the Spatial Durbin model (SDM), or only the first, the Spatial autoregressive model (SAR), are preferred because they generate global and local spillovers between regions, and this is a condition for the existence of indirect effects that are absent in the third type of interaction. Global spillovers allow spillovers to any region and a feedback effect, unlike local spillovers that stop after the first row of neighboring regions. The paper selection process is based on LeSage and Pace (2009) comparing complex SDM model with their restrictions: SAR, Spatial error model (SEM) and Spatial lag model (SLX). Spatial models are estimated by the method of maximum likelihood. The importance of spatial connectivity will be investigated using the Likelihood ratio (LR) test by comparing the SDM model with each of the previously mentioned three models. The null hypothesis means that SDM and the corresponding simpler model are equal, i.e. that the simpler model is contained within the SDM model, and there is no need for the SDM model. The alternative hypothesis, i.e. the rejection of the null hypothesis, gives an advantage to the SDM model over the simpler model. If in all three cases the null hypothesis is rejected when comparing SDM with its potential simpler forms, SDM is the model used in the analysis.

In case the null hypothesis is not rejected, a simpler spatial model has an advantage over SDM. The LR test is re-applied to compare the simpler spatial model with the model estimated with the ordinary least squares (OLS) method. Rejecting the null hypothesis means that a simpler spatial model is used in the analysis, and not rejecting the advantage of a model without regional interaction. Therefore, spatial effects are absent only if the LR test gives an advantage to the model estimated by the OLS method, and in all other cases, spatial econometrics is used to model regional connectivity.

The importance of interregional spillovers is reflected through direct, indirect and total effects. As a rule, the direct effect does not differ much from the estimated coefficients from the initial model. The difference is in the feedback that arises due to the change of some of the variables in one region, and this effect is transferred to other regions and eventually returned to the starting region. The indirect effect analyzes the effect on one region due to changes in other regions. The total effect is the sum of the two previous effects and allows you to determine which effect is predominant, direct or indirect. Direct and indirect effects can take on opposite signs (Elhorst, 2010).

The SDM model has the following form with 59 regions and 17 variables:

$$g_i = \beta_0 + \rho \sum_{j=1}^{59} W_{i,j}\, g_j + \sum_{k=1}^{17} \alpha_k\, X_{ik} + \sum_{k=1}^{17} \sum_{j=1}^{59} \beta_k W_{ij} X_{jk} + \varepsilon_i, i = 1, \ldots, 59 \qquad (2)$$

where g_i is GDP growth per capita for the i-th region in the period 2009-2019; W: non-negative weight matrix; X is matrix of independent variables; ε: normally distributed model errors. The label for regions is i, and k is the label for variables.

This model allows growth rates to depend on the regional characteristics of each region and its neighboring regions. The parameter ρ denotes the spatial correlation of growth rates. $\sum_{j=1}^{59} W_{i,j}\, g_j$ and $\sum_{k=1}^{17} \sum_{j=1}^{59} W_{ij} X_{jk}$ represent spatially weighted linear combinations in neighboring regions.

Empirical data

The survey covers 59 NUTS 2 regions of the new EU member states (Croatia, Slovenia, Romania, Bulgaria, Hungary, Slovakia, Poland, the Czech Republic, Lithuania, Latvia and Estonia) according to the 2016 NUTS classification. Data sources are: Cambridge Econometrics, Eurostat, European Regional Competitiveness Index (RCI).

The dependent variable is the GDP per capita growth rate. European funds as an independent variable in the center of consideration refer to the funding periods 2000-2006, 2007-2013, 2014-2020 looking at when the projects were implemented, not when a refund from the EU was made. The project implementation period refers to the period from 2008 to 2019.

The independent variables in Table 1 were selected on the basis of previous regional research in the EU. In addition to traditional variables such as the initial level of GDP per capita in 2009, investment, population, employment, human capital and innovation, there are variables related to individual sectors of the economy: industry, agriculture, finance and construction. The same as Annoni et al. (2019) the paper uses RCI index components to increase the number of variables that are relevant for the model. This index is issued by the European Commission every three years starting in 2010.

Table 1 Variables in the model

Variable name	Variable definition	Source
Initial GDP per capita	Initial GDP per capita in 2009 (log).	Cambridge Econometrics, Real GDP per capita in millions of euros at constant 2015 prices.
GDP growth	Share (%) of GDP per capita in 2019 in 2009 (log).	Cambridge Econometrics, Real GDP per capita in millions of euros at constant 2015 prices.
Investments	Share (%) of investments in GDP. Average 2008-2019.	Cambridge Econometrics, Gross fixed capital formation in millions of euros at constant 2015 prices. Real GDP per capita in millions of euros at constant 2015 prices.
Population	Share (%) of the population in the current year compared to the base year 2008. Average 2008-2019.	Cambridge Econometrics, Population.
Industry	Share (%) of the industrial sector in total GVA. Average 2008-2019.	Cambridge Econometrics, GVA of the industrial sector in millions of euros at constant 2015 prices. Total GVA in millions of euros at constant prices from 2015.
Agriculture	Share (%) of the agriculture, forestry and fisheries sectors in total GVA. Average 2008-2019.	Cambridge Econometrics, GVA of agriculture, forestry and fisheries in millions of euros at constant 2015 prices. Total GVA in millions of euros at constant 2015 prices.
Construction	Share (%) of the construction sector in total GVA. Average 2008-2019.	Cambridge Econometrics, GVA of the construction sector in millions of euros at constant 2015 prices. Total GVA in millions of euros at constant 2015 prices.
Finance	Share (%) of employees in the finance and insurance sector in the total number of employees. Average 2008-2019.	Eurostat, Cambridge Econometrics, Number of employees in the finance and insurance sector. Total number of employees.
EU funds	Share (%) of total European funds for the period 2008-2019 in relation to the average GDP for the period 2008-2019.	European Structural and Investment funds, Total amount of European funds in millions of euros at constant 2015 prices. Real GDP per capita in millions of euros at constant 2015 prices.
Institutions	Institutional quality is defined as a multidimensional concept consisting of high impartiality and quality of public service delivery, with low corruption.	RCI index component that mainly covers the period 2013-2016.
Infrastructure	Quality of transport infrastructure based on road, air and rail transport.	RCI index component that mainly covers the period 2013-2016.
Basic education	The proportion of 15-year-olds with poor grades in reading, mathematics and science according to PISA (OECD Program for International Student Assessment) tests.	RCI index component that mainly covers the period 2013-2016.

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Table 1 Variables in the model - continued

Variable name	Variable definition	Source
Higher education	Indicator related to access to higher education, lifelong learning and early school leaving.	RCI index component that mainly covers the period 2013-2016.
Labor market efficiency	Indicator related to employment, unemployment, labor productivity and the position of women in the labor market.	RCI index component that mainly covers the period 2013-2016.
Market size	Indicator related to disposable income, population and GDP.	RCI index component that mainly covers the period 2013-2016.
Technological readiness	Indicator related to internet access and online shopping.	RCI index component that mainly covers the period 2013-2016.
Business sophistication	Indicator obtained on the basis of innovative cooperation of small and medium enterprises, and employment and GVA of the sector from K-N according to the economic classification of activities.	RCI index component that mainly covers the period 2013-2016.
Innovation	An indicator based on the number of patents, scientific publications, employees and spending in science and research.	RCI index component that mainly covers the period 2013-2016.

Results and discussion

From Figure 1, which shows the spatial distribution of GDP per capita for 2009, it is obvious that looking from west to east, GDP per capita at the regional NUTS 2 level is declining, and the regions where the capitals are deviating from neighboring regions. Spatial grouping of regions with similar GDP per capita, i.e. spatial autocorrelation measured by the Moran index is statistically significant and positive, $I = 0.2363$. The graph of this index in Figure 1 shows the space-weighted average of the GDP of the neighboring regions of the i-th region with respect to the GDP of the i-th region. The four quadrants represent how the regions are spatially grouped. The first quadrant represents HH (High-High) regions with higher than average GDP, surrounded by neighboring regions whose spatially weighted average is higher than average GDP. The other quadrants are formed analogously, the third quadrant LL (Low-Low), the second LH (Low-High) and the fourth HL (High-Low). LL and HH cases are the most common, and they generate positive spatial autocorrelation. In LL, the regions in the east predominate, and the regions in the west in the HH part. The LH quadrant, which refers to poor regions surrounded by rich ones, has almost no regions. The last fourth quadrant, HL, highlights the main cities that deviate from the surrounding regions. The Moran index is a global statistical test for spatial autocorrelation. Its local variant that examines this property only for a certain region is the LISA index. This indicator indicates the dominance of the grouping of the regions of Bulgaria and Romania in terms of GDP per capita. The significant contribution of the western regions is missing, with the exception of the Prague area.

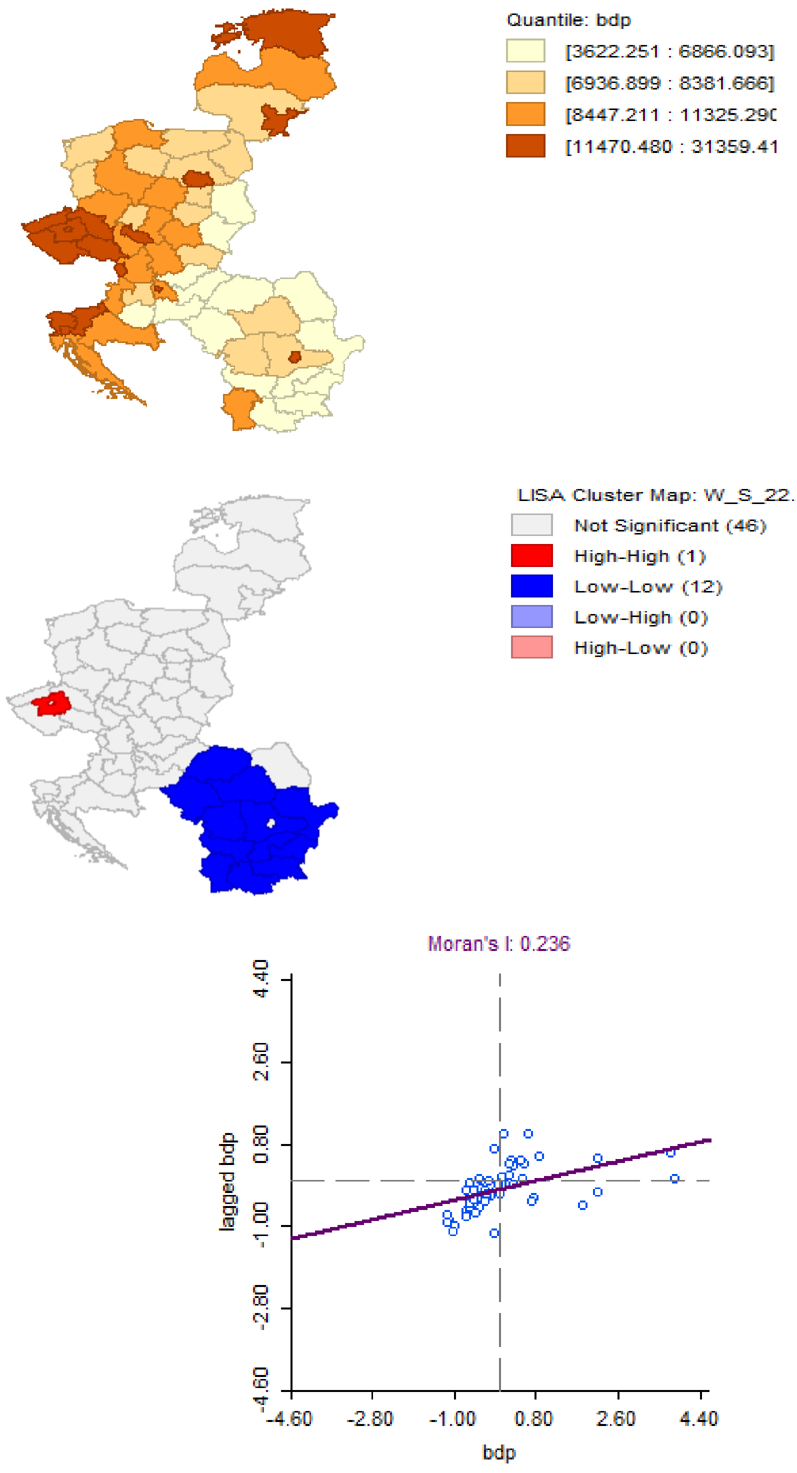

Figure 1 Moran scatterplots, quantile and LISA cluster maps for real per capita GDP (2009)

Source: Author's illustration.

In Figure 2, the distribution of European funds is particularly pronounced in the regions stretching from the Baltic countries, eastern Poland and Hungary to selected regions of Bulgaria. Other regions, the west and the east of the new members, use European funds equally. The Moran index is 0.307, and again shows a positive, statistically significant spatial autocorrelation. The first quadrant, HH, refers to the

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aforementioned regions that use above average European funds along with their surroundings. LL are regions that use below average resources as well as their environment. Other regions are almost all in the LH quadrant, meaning regions that use less than average funds in an environment that uses funds above average. The LISA index is confirmed for some of the mentioned HH and LH regions, but highlights Adriatic Croatia and Slovenia as weak beneficiaries of European funds, the LL region. The absence of a higher concentration of European money in Slovenia may be due to the best position in relation to all new members upon accession to the EU, and in the Croatian case due to its later accession in 2013.

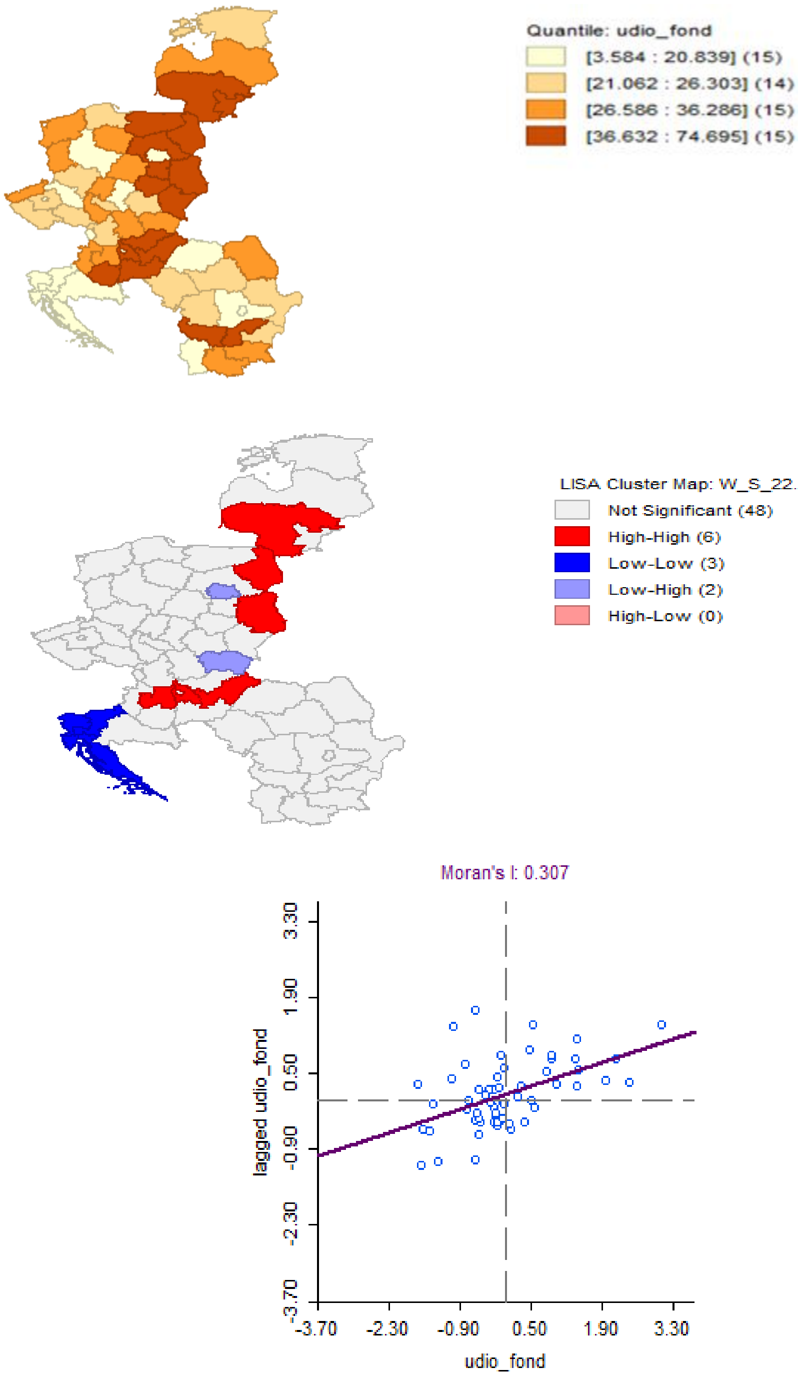

Figure 2 Moran scatterplots, quantile and LISA cluster maps for EU funds (average 2008-20019)

Source: Author's illustration.

Table 2 Estimation results

	(1)	(2)	(3)	(4)	(5)
	OLS	SAR	SEM	SLX	SDM
Initial GDP per capita	-0.228***	-0.231***	-0.29***	-0.208***	-0.235***
EU funds	0	0	0	-0.002*	-0.002*
Population	-0.01*	-0.01*	-0.015***	0.003	-0.002
Construction	0.011	0.011	0.006	0	0
Industry	-0.003	-0.003	-0.004**	0.008**	0.005*
Agriculture	-0.007	-0.008	-0.014***	0.005	0.001
Finance	0.045**	0.046**	0.151***	0.16***	0.206***
Investments	0.013***	0.013***	0.009***	0.023***	0.017***
Institutions	-0.016	-0.012	0.145**	-0.023	0.048
Infrastructure	0.017	0.021	0.121**	-0.145*	-0.081
Basic education	-0.002	-0.002	-0.037*	0.011	-0.02
Higher education	0.047	0.048	0.076**	0.139***	0.119***
Labor market efficiency	-0.038	-0.034	0.059	0.007	0.052
Market size	-0.005	-0.007	-0.05	-0.133	-0.11
Technological readiness	0.011	0.011	0.006	-0.059	-0.01
Business sophistication	-0.256***	-0.254***	-0.195***	-0.175***	-0.177***
Innovation	0.289***	0.283***	0.056	0.12	0.04
_cons	30.034***	30.084***	40.186***	-20.194	30.771
/var(e.GDP growth)	0.007***	0.007***	0.004***	0.004***	0.003***
W: GDP growth		-0.047			-0.868***
W: e.GDP growth			-10.425***		
W: EU funds				0.232	-0.122
W: Population				0.02***	0.014***
W: Construction				-0.009	-0.024**
W: Industry				-0.022	-0.014
W: Agriculture				0.024**	0.016
W: Finance				-0.123***	-0.096***
W: Investments				0.344***	0.445***
W: Institutions				0.016	0.011
W: Infrastructure				0.997***	0.718***
W: Basic education				-0.243	-0.118
W: Higher education				-0.324***	-0.233***
W: Labormarket efficiency				0.221*	0.279***
W: Market size				0.067	0.096
W: Technological readiness				0.016	-0.054
W: Business sophistication				-0.471***	-0.261**
W: Innovation				0.037	-0.181
W: Innovation				-0.322**	-0.242*
Pseudo R^2	0.573	0.568	0.332	0.778	0.613

*** p<0.01, ** p<0.05, * p<0.1
Source: Author's calculation.

Table 3 LR test

LR test	Statistic	p-value
SAR-SDM	49.98	0***
SEM-SDM	38	0.0025***
SLX-SDM	11.55	0.0007***

*** p<0.01, ** p<0.05, * p<0.1
Source: Author's calculation.

Based on the conducted analysis of GDP and funds, we conclude that there is a spatial interaction between the regions of the new members. Therefore, we estimate the SDM model and compare it with its restrictions by the LR test. Rejecting the null hypothesis according to Table 3, where the SDM model is compared with its spatial restrictions from Table 2 (models 2-4), indicates that the SDM model is used in the paper. This confirms the importance of the relative location of NUTS 2 regions of the new EU Member States.

The SDM model in Table 2 indicates a decrease in the regional disparities of new members, i.e. poorer regions converge by achieving higher growth rates (Solow, 1956). This is proven by a negative and statistically significant initial level of GDP per capita. In the model, spatial autocorrelation is statistically significant with a dependent variable and is -0.87.This means that a 1% increase in the growth rate in the neighboring regions of the i-th region, leads to a 0.87% decrease in growth in the i-th region. The aforementioned effect is in contrast with Antunes et al. (2020) and Annoni et al. (2019).

Table 4 Spillover for the SDM model

	Direct	*Indirect*	*Total*
Initial GDP per capita	*-0.255****	*0.064*	*-0.191***
EU funds	*-0.006***	*0.012****	*0.006***
Population	*0.003*	*-0.017***	*-0.014***
Construction	*0.003*	*-0.011*	*-0.008*
Industry	*0.002*	*0.009*	*0.011*
Agriculture	*0.025**	*-0.076****	*-0.051****
Finance	*0.141****	*0.207****	*0.348****
Investments	*0.018****	*-0.003*	*0.015***
Institutions	*-0.117*	*0.527****	*0.410****
Infrastructure	*-0.07*	*-0.037*	*-0.107*
Basic education	*0.033*	*-0.168***	*-0.135****
Higher education	*0.076*	*0.137**	*0.213****
Labor market efficiency	*0.04*	*0.039*	*0.079*
Market size	*-0.12*	*0.032*	*-0.087*
Technological readiness	*0.052*	*-0.197***	*-0.145**
Business sophistication	*-0.171***	*-0.021*	*-0.192***
Innovation	*0.107*	*-0.216***	*-0.108*

*** p<0.01, ** p<0.05, * p<0.1
Source: Author's calculation.

The interpretation of other variables in the model is observed through the effect of spatial externalities between regions that are generated in particular through an indirect effect that represents a significant contribution to the overall effect (Table 4). The differences between the direct effects and the coefficients of the SDM model from Table 1 represent the feedback effect that is present at the direct effect. Somewhere, these differences are more pronounced and somewhere negligible, but where they are statistically significant, they represent the contribution of the spatial model.

Observing the effect of European funds on growth rates, we conclude that the overall effect of increasing EU funds on rates is positive and statistically significant so that the funds represent a variable that contributes to reducing regional disparities. It is important to point out the opposite effect of direct and indirect effects. The direct effect has a divergent effect on reducing disparities, which means that an increase in funding within the same region does not have a positive effect on growth rates for that region. Indirect impact through the spillover effect of European funds between regions has a positive effect on growth and reduces the gap. The indirect effect (1.2%) is stronger than the direct effect (-0.6%), which contributes to the positive effect of the overall effect (0.60% = 1.2% -0.6%) of the EU funds. The spillover effect of

European funds represents the key contribution to the positive effect of EU funds, i.e. the advantage of the application of spatial econometrics.

The overall effect of population growth is negative, and one explanation is that population growth in neighboring regions leads to an increase in labor supply that attracts investment in the surrounding regions (Annoni et al., 2019). The effect of investments is positive in accordance with the theory of growth, and this effect is achieved through the direct effect that investments achieve through growth in regions where they arose without a statistically significant spillover effect. Human capital is observed through higher education and the results of 15-year-olds on PISA tests indicate the expected results. The growth of the highly educated has a positive effect on growth, and basic education has a negative one. This explains the important role of education, especially in the earlier stages of economic growth.

Looking at the economic sector, the agricultural sector has a negative effect on growth and the financial sector a positive one. The impact of agriculture is in line with the study by Dall'erba, Le Gallo (2008) which interprets the negative impact of agriculture as a positive impact on the industrial sector. The mentioned effect of the industry is absent, it is not statistically significant for the countries of Central and Eastern Europe. While the financial sector has a positive impact on growth, which is in contrast to Ezcurra and Rios (2015) and most research that refers to the financial sector. The effect of the institutional framework is positive and contributes to reducing regional disparities. The effect of technological readiness does not contribute to reducing disparities, which is an important factor in increasing regional competitiveness. The indirect effect is negative, which means that increased IT skills in the neighborhood of the i-th region are more attractive for investments which thus leads to a negative impact on the i-th region. Also, a business environment that measures the impact of specialization on production that creates high added value has a negative effect on growth, thus increasing disparities.

Conclusion

The paper shows that an increase in European funding increases growth rates, thus contributing to the reduction of interregional disparities. European funding, which is mostly targeted at less developed regions, represents an opportunity for new members and potential new members to move closer to more developed old members. Regional spillover of funds have proven to be key to achieving the positive impact of the European Cohesion policy. It did not overcome the polarizations of the core and periphery advocated by the new economic geography. Also, these spillovers have proven to be an important factor whose omission in models estimated by the OLS leads to bias. Regional externalities should be taken into account in regional divisions by regional policymakers, and in creating the distribution of funds for the next programming period. The effect of funding in the region itself without the spillover effect does not contribute to reducing disparities, which represents a future opportunity, especially for the poorest regions, such as Bulgaria and Romania. Likewise, those more developed members need to think carefully about the policy of using European funds so as not to fall into the middle-income trap. Therefore, as a proposal for future research, a local survey at the NUTS 3 level or some other division of new members is imposed as a complement to the conducted global survey to determine the local character of funds at growth rates through an individual coefficient for each region. Also investigate the impact of individual funds on regional growth rates.

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