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Impact of European structural and investment funds absorption on the regional development in the EU–12 (new member states)

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Abstract

Research background: European Structural and Investment Funds (ESIF) as the main instruments of cohesion policy (CP) in the EU, provide a broad source of financing opportunities for the EU member states. The biggest amount in the CP budget is oriented to convergence NUTS 2 regions that have GDP p.c. below 75% of the EU average. The new members of the EU (accessed in 2004 and 2007) had available 176.3 billion EUR in the period 2007–2013 and 217 billion EUR in the period 2014–2020. Even the absorption rate (in 2007–2013) of available ESIFs is high (above 90%), the real implications on their economies don't come automatically and they represent the area for examination.

Purpose of the article: The research aims to analyse the impact of ESIFs absorption in EU new member states in the period 2008–2016 on their GDP p.c.

Methods: As the sample has time and cross-sectional dimension, the panel data in static and dynamic form is employed. The analysis covers the major part of the financial framework 2007–2013 and a part of financial perspective 2014–2020 (depending on the available data).

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Findings & value added: The results indicate that increase in ESIF p.c. for 1% will contribute to the GDP p.c. increase for 0.0053 to 0.0064 % (static model) and for 0.008% (dynamic model). Although the impact of ESIFs is significant and positive, it is quite (and unexpectedly) small, and consequently new EU member states should not rely too much on them as the source of economic progress. It is necessary that countries should focus on channeling funds into specific segments (sectors, policies) that will result in increased competitiveness of their economies. The contributions lie in creating GDP p.c. determination function; in including all new EU member states; in including more recent available data and by observing ESIFs as a part of growth model.

Introduction

Numerous investment projects in the EU are financed through the EU's cohesion policy (CP). Its main aim is to boost the convergence process within the EU regions and to mitigate the regional disparities within the EU. It employs the instruments, i.e. European Structural and Investment Funds (ESIFs) to reach its objectives. The majority of the CF budget is available for the regions that are lagging behind in economic development, i.e. with the GDP p.c. below 75% of the EU average. Almost all regions in EU new member states belong to this group and with the joining to the EU, they strongly benefited from the absorbed ESIFs (in the absolute term of money they received). These funds are oriented towards different areas such as: infrastructure, institutions, support of SMEs and entrepreneurship, labour market, etc., but relatively little (scarce) analysis has been done analysing their impact. Usually, analyses were performed at the country level or even when some authors took a sample of countries, the existing bodies of research are focused on the previous programme period (2000–2006 or 2007–2013). Here, we wanted to add the available data for the financial perspective 2014–2020. The difference from the previous papers lies in the coverage of variables that we included in the analysis and in time framework. The main variable of our interest here is the absorbed ESIFs (that differs from allocated or contracted amount).

The existing literature about ESIFs contribution comprises, on the one hand, mainly descriptive articles, and on the other hand, articles which try to quantify the impact of ESIFs at the country level (Hruza *et al.*, 2019; Dumciuvienė & Stundziene, 2015) or on the particular group of countries (Butkus *et al.*, 2019; Mohl & Hagen 2010; Dall'erba & Le Gallo, 2007; Palevičienė & Dumčiuvienė, 2015).

The aim of this research is to find out the impact of ESIFs absorption on the GDP per capita of NUTS 2 regions of the EU12 (new member states).

The group of new EU member states includes the following countries: Cyprus, Malta, Hungary, Latvia, Lithuania, Estonia, Poland, Slovakia, the Czech Republic, Slovenia, and Romania and Bulgaria. The target regions

are 57 NUTS 2 regions of the EU new member states where the Croatian NUTS 2 regions are not included in this group due to the fact that Croatia joined the EU in the mid of 2013 and it started to absorb ESIFs only after accession. We employ panel data models that are suitable due to the fact that we include a group of countries and we have a time dimension (9-year period).

The contribution of this paper lies in a few facts: in covering the entire group of EU new member states that absorbed huge amounts of money from ESIFs in the period 2008–2016. We have included the data also for the financial period 2014–2020, even if the final data are not available (due to the “n+3” principle). Furthermore, we contribute to the existing literature through a created and applied methodological framework which includes main determinants of regional development (for NUTS 2 regions) by including all relevant data available at that level. The analysis results in potential solutions and recommendations for more efficient regional policy implementation through the use of ESIFs and for their stronger impact than it was realized in the observed period.

The structure of the paper consists of six sections, where the second one regards the literature review about the impact of ESIFs on regional development, the third section addresses description of data and methodology, the fourth is focused on the research results, and the fifth section is discussion of obtained findings. This is followed by the conclusion.

Literature review

The main advantage of absorption of ESIFs is that they represent grants that countries don't need to pay back (as they should in the case of bank loans) and also they are part of total investment and, therefore, should be treated as investment activity that can promote economic growth. Surely, the effects of investments depend on the sectors of investments, creation of new jobs, promoting new production, focusing on domestic demand and/or on export, etc.

The economic influence of ESIFs can be explained by means of theories of economic growth. ESIFs are part of public investments and the traditional approach indicates that if this money is invested in the regions with limited sources of capital, they will increase their growth rates and enable the faster convergence towards the stable path (Solow, 1956; Swan, 1956). However, in the long run, the changes in economic growth can't be expected due to the lowering of capital returns. Neoclassical approach highlights that only technological changes (as exogenous factors) can impact

economic growth. Endogenous growth model explains that growth is the result of internal changes/progress in technology thanks to the improvement of a nation's human capital. Due to the knowledge-based economy, we can expect that new public investments can attract more private capital and, in that way, they promote accumulation of capital in the regions recipients of ESIFs (Romer, 1986; Barro, 1990; Aschauer, 1989). However, neoclassical and endogenous growth theories don't consider the type (sectors) of public investments. Here, the theory of economic geography can provide explanations (Krugman, 1991; Fujita *et al.*, 1999). Investments in infrastructure can impact regional competitiveness (Krugman, 1991). The benefits will mainly go to the advanced regions with specialized labour market, knowledge and resulted in agglomeration of activities. Indirectly, through the spillovers, it will have an impact on profit increase in other regions because of their mutual relations (internal trade).

ESIFs cover a wide spectrum of investment area that goes from investments in road and rail infrastructure to the investment in innovation, renewable energy, SMEs etc. Because of this we can expect a positive impact of ESIF on economic growth (and development) especially in countries that received substantial amounts. However, it is difficult to predict the scope of their influence as the resulting impact is not the same for all the projects/investments, some will produce direct positive impact, some will produce indirect positive impact.

There are plenty of articles where authors have analysed the impact of Structural funds (or ESIFs) on economic growth, development, convergence, innovation, etc. A part of them deals with the descriptions of ESIF allocations, possibilities to finance a set of different objectives; analysis of operational programmes, micro-level data (enterprises) etc., but the focus in this analysis is on quantitative approach on macro (regional) level, so we will start with the overview of previous literature that relate to a specific country or on group of countries and which produce quantitative results.

Review of articles shows that they differ with regard to the sample country(-ies), methodology, covered period, funds. Many studies refer to just one country (usually Portugal, Greece, Spain or EU new member states: the Czech Republic, Lithuania, Poland, Romania) and explore the impact of Structural Funds on regional development (or growth), innovation, employment, etc. Some pioneering researches in that directions have been made by Fuente *et al.* (1995), Cappelen *et al.* (2003), followed by Dall'erba and Le Galo (2007; 2008), Mohl and Hagen (2010), Becker *et al.*, (2010), Pellegrini *et al.* (2013), Bouayad-Agha *et al.* (2013), Maynou *et al.* (2014), Fratesi and Perucca (2014), Rodríguez-Pose and Garcilazo (2015), Pellegrini (2016), Becker *et al.* (2018). Majority of the articles included the

implication of 2000–2006 financial perspective and have detected that Cohesion Policy (CP) is advantageous and transfers from structural funds had a positive influence on EU regional development. Kehagia (2013) provides a comprehensive review of papers that examine the implications of structural funds on convergence and papers that deal with the precondition to better exploitation of funds. It will be overambitious to go into detail elaboration of every article, so here we will focus on the newest ones and their contribution.

Hruza *et al.* (2019) made an analysis on the Czech Republic regions. By applying standard panel data regression techniques (pooled OLS and FE), and spatial panel data econometric he found a positive impact of ESIF on economic growth of NUTS 3 regions. The contribution of ESIF to regional economic growth is between 0.91–1.12 p.p. Dumciuviene and Stundziene (2015) have analysed the impact of ESIF in the period 2004–2013 on the socioeconomic development in Lithuania. They applied correlation methodology and found interconnections between EU funds and direct foreign investments, but they didn't prove the correlation between EU funds and other economic and social indicators. Caldas *et al.* (2018) analyse the absorption of ESIF in Portugal on municipality level. They found that ESIF in periods 2000–2006 and in 2007–2013 has strong relationship with the investment. Czudec *et al.* (2019) focus their research on the Eastern Polish regions and their income convergence in the period 2004–2015. They found that the EU funds didn't contribute to the decreasing of the structural gap. They highlighted the necessity to change the structure (beneficiaries) of ESIF funds in orientation towards the higher support for entrepreneurial activity that represent a room for creating new employment opportunities.

Apart from single country-study examples, some authors cover larger geographical areas. Tijanić and Obadić (2015) found that the EU's Structural and Cohesion Fund positively impacted competitiveness in the long run. Unfortunately, they can't prove the same for the regions that are lagging behind. Badoiu (2018) evaluates the possibility of achieving real convergence in Romania, Poland and Bulgaria, by analysing the factors directly influencing GDP including also European financing. Lovrinović and Nakić (2016) provide empirical analysis on ten transition economies over 14 years and found positive effects of analysed EU funds. They also warn about some characteristics of transition economies that can present the limitation for efficient EU funds usage. Palevičienė and Dumčiuvienė (2015) applied multivariate statistical analysis on the EU NUTS 2 level and results showed that even though there is a huge structural funds budget and allocations, the regional development gaps still exist. Dumciuviene *et al.* (2015) put emphasis on socio and economic development in the EU and they ob-

serve EU funds as factors that should lead to economic growth. They provide analysis for the period 2000–2013 and include 28 EU member states. By employing analysis of statistical data and correlation they found a non-significant relationship between the EU funds and main social and economic indicators. The reason may be that funds can be used ineffectively.

Butkus *et al.* (2019) examined the impact of ESIFs in 2000–2006 on EU25 NUTS 3 regions. They applied difference-in-differences estimator for ERDF and CF. By investigating total funds (ERDF and CF), they found that all expenditure categories didn't have a positive impact on the decreasing GDP per capita disbalances at NUTS 3 level. They only found positive results for ERDF Objective 1. They found that ESIFs absorption have positive impact on regional income, but this only applies to poor regions and this impact diminishes and becomes insignificant when a certain level of development is achieved as Pellegrini (2016) also founds.

On the other hand, some authors Bachtler and Wren (2006), Mendez (2011, 2013), Bachtler and Gorzelak (2007), Mirošník *et al.* (2014), Enguix *et al.* (2012) through exploring the influence of EU funds found that — structural funds are ineffective. Breidenbach *et al.* (2019) analyse 127 peripheral NUTS 1 regions of the EU–15 in the period 1997–2007 and found the unexpected impact of ESIFs — their contribution to income growth is insignificant or even negative for several peripheral EU regions. They explain such a negative link by spatial spillovers (production capacities, institutional qualities). According to those findings, the ESIFs will have distortionary effects on fostering income convergence within the EU.

The majority of reviewed articles found positive impact of ESIFs absorption on the economic growth and development and many also indicate the necessary improvement in capacities to better use of the funds. Tosun (2014) researched the determinants of European Regional Development Fund's (ERDF) absorption in 2000–06 programming period. He warns that fiscal decentralization negatively influences absorption. Kersan-Škabić and Tijanić (2017) includes 86 convergence regions and 186 developed EU NUTS 2 regions and found that the regional features influence on the absorption of EU funds. Incaltarau *et al.* (2020) have implemented panel data analysis (Tobit estimation technique) for the period 2007–2015 and they conclude that element of political stability/governance is important for attracting EU funds. They also suggested the focus should be on the improvement of administrative capacity and skills to be able to direct funds to selected sectors that can create added value and create new jobs.

Research method

The neoclassical beta-convergence model defined by Barro and Sala-i-Martin (1991) is widely used in determination of structural funds' economic impact on income growth. Also, the so-called beta and sigma convergence are explored. The beta-convergence pointed out that poorest countries' GDP should grow faster than richer countries (Durlauf *et al.*, 2005, p. 585). Beta convergence is usually calculated in a linear regression context, e.g., a neoclassical growth model. In that way the EU payments can be treated as investments (Ederveen *et al.*, 2006; Mohl & Hagen, 2009).

In Table 1, we provide the definition of variables included in the empirical model. Albeit not comprehensive, these variables allow us to control for regional specificities.

The regression model at regional level can be specified as an extended neoclassical convergence model similar to Acemoglu (2009) and Breidenbach *et al.* (2016):

$$\ln(\gamma_{i,t}) = \alpha_i + \delta \ln(\gamma_{i,t-1}) + \sum_{k=1}^K \varphi_{1,k} \ln(x_{i,t-1,k}) + \delta_t + \mu_{i,t} \quad (1)$$

where the subscript $i = 1, \dots, 55$ denotes the NUTS 2 region, and t denotes the time period of our sample ranging from 2008 to 2016. The dependent variable is the real GDP per capita (in PPS) of the region at time t . The variables on the right side of the equation (vector x) include real GDP per capita (in PPS) of the region at time $t-1$. Its value at time $t-1$ records conditional convergence. Also, *gfcf* represents gross fixed capital formation. To the best of our knowledge, there is a lack of quality data on education like those proposed at the state level by De La Fuente and Domenech (2006), Barro and Lee (2001). Therefore, the share of the total population with tertiary education is used as an approximation of the quality of human capital. An additional reason for choosing this variable is because the data are available in Eurostat, which makes it consistent and comparable in all regions in the sample. Křístková (2012, 2013) finds a positive impact of research and development activities on economic growth in the Czech Republic, so we think it is important to include an appropriate variable. Public expenditure on research and development is seen as the most appropriate candidate. It is expressed per capita (RD).

In addition, the model also controls for the share of employees in high-tech industries (*HTemp*), the employment rate (*employment*) and the period of financial crisis (*dummy crisis*). As countries experienced a financial and economic crisis during the period under review, we included a dummy variable that assumes a value of 1 in the crisis years (2008 and 2009) and

zero in the other years. The most important variable for our analysis is EU payments (absorption) from the ESIFs (*EU payments*) which are expressed in per capita terms. The reason we take payments rather than commitments is that annual commitments widely used in the literature have no effect (Breidenbach *et al.*, 2016), and recent discussions have shown that these commitments differ from the money effectively allocated.

Finally, by using regional fixed effects, the model removes the effect of those time-invariant characteristics that can lead to parameter bias (α_i). These effects control all differences between regions that do not change over time, so that the estimated coefficients of the fixed-effect model cannot be biased due to time-invariant characteristics. The model also includes time-fixed effects $\mu_{i,t}$ to control for unexpected events over time that may affect the outcome variable (GDP per capita) such as the financial crisis and the European sovereign debt crisis. It should be emphasized that all variables in the model, except the dummy crisis, are expressed in natural logarithm to reduce the problem of heteroscedasticity and allow for easy comparison of the effects across variables expressed in different units.

Results

Static model

Due to the possible problem of multicollinearity, six models were evaluated, in order to avoid the simultaneous inclusion of variables that are mutually correlated. Based on the correlation matrix for all independent variables (Table 2), we found that the partial correlation coefficients for the variables investment in research and development (*RD*) and the share of employees in high-tech industries (*HTemp*) have values that may indicate multicollinearity. In order to test the stability of the model in relation to the possible problem of multicollinearity, we alternately omitted these two variables in the model variations. Also, as an additional check, we alternately excluded the share of the population with higher education (*Ter*) and the share of employees in high-tech industries (*HTemp*) as these two variables serve as an estimate for the quality of human capital. Finally, we included all three variables together in the model.

Table 3 shows the results for the baseline model as well as for the extended model with additional control variables. The model evaluation procedure is similar to that of Mohl and Hagen (2010). The specification of fixed effects is consistent with Islam (2003) and Abreu *et al.* (2005), who highlighted that the specification of random effects is not acceptable under

the neoclassical growth framework. The reason is that it implies that individual effects are correlated with some regressors (which are expected to be exogenous). Random effects would thus create biased parameter estimates due to endogeneity. To avoid possible existence of a residual correlation not only within but also between regions we used Driscoll and Kraay standard errors (Hoechle, 2007). In this way, standard errors are robust for general forms of temporal and spatial correlation and heteroskedasticity.

The estimated results for the different model specifications are shown in Table 3. A model with regional and time fixed effects was used to evaluate the parameters.

In static models, although model 1 is the preferred choice, we presented the results of the model using alternative measures for human capital separately (Models 3 and 5) and together in Model 6. The estimated coefficients with all variables differ in some specifications by level of statistical significance, but are consistent in terms of the direction of the hypothesized effect because they retain the same sign in all specifications, even when statistically insignificant. In all specifications, the variables of gross fixed capital formation and employment have a very similar economic and statistical significance. Namely, the estimated coefficients with these variables are positive and statistically significant. If gross fixed capital formation increases by 1%, GDP per capita is expected to increase by slightly more than 0.63% (see Table 2 for the exact values of the coefficients by model). An increase in employment by 1% will result in an increase in GDP per capita by about 0.2% (coefficients vary from 0.18 to 0.23 in the different models in Table 2). Also, the dummy variable for the period of economic crisis, when included in the model, is expected to have a negative sign and is very statistically significant at the level of 1%. On average, the expected decrease in GDP per capita during the crisis period was slightly higher than 20% depending on the model compared to other periods in the model.

Coefficients of our variable of interest, ESI funds, when statistically significant, have an expected, positive coefficient in all regressions, implying that a larger distributed amount of EU funds per capita will result in an increase in GDP per capita. Specifically, the evaluated results show that an increase in EU funds per capita by 1% is expected to result in an increase in GDP per capita by 0.0053 to 0.0064%, *ceteris paribus*.

Other control variables are not statistically significant in any of the specifications. Specifically, investments in research and development, the share of highly educated people in the population and the share of employees in high-tech industries do not contribute to the increase in GDP per capita in the observed period that is in accordance with findings of Sterlacchini (2008), Hanushek (2016) and Holmes (2013).

Dynamic model

The assessment of the impact of the ESIFs on GDP per capita in the EU regions is further complicated by potential endogeneity which cannot be completely controlled by the inclusion of fixed effects. The criteria for allocating liabilities to the ESIFs are likely to correlate with the dependent variable leading to the problem of reversed causality. First of all, the distribution of ESIFs is based on the ratio of regional GDP per capita (in PPS, NUTS 2 level) and average EU GDP per capita. If this ratio is below 75 percent, the region is the so-called convergence region, which means that it is eligible for the largest transfers from ESIFs in relation to GDP. Moreover, the successfulness of the EU payments depends on the administrative ability of the regions to launch and manage these projects. Also, there can be unmeasurable variables (unobserved heterogeneity) or omitted variables¹, which have an impact on regional growth rates but are not included in the equation. They take part in the model error. The correlation of these omitted variables with one independent variable in the model, create the endogeneity of that explanatory variable. An example of such variables are spillovers, because the effect of cohesion policy in one region has an impact on other surrounding regions. This problem is even more acute in our case, because the regions are classified according to political rather than economic criteria.

The third problem is related to the specification of the model itself. Bearing in mind the theoretical settings of the model outlined in Section 3, it is obvious that the econometric approach requires the introduction of dynamics into the model. Simply including GDP per capita lagged one period to the right-hand side of equation leads to a correlation with the model error term, leading to so-called Nickell bias (Nickell, 1981).

To solve the first two problems, an Instrumental variable (IV) estimator combined with fixed effects or first differences will be employed (Stock & Watson, 2011). According to our knowledge, no convincing external instrument has been proposed in the literature. Therefore, identification must be based on internal instruments using General Method of Moments (GMM) evaluators (Arellano & Bond, 1991; Roodman, 2009). In addition, GMM estimators are also suitable for solving the third problem mentioned above, by instrumenting the level of income (GDP per capita) as well as other endogenous variables with their previous values.

To verify the validity of the instruments and the validity of the GMM estimator itself, we performed Arellano-Bond first- and second-order au-

¹ Due to the limitation in availability of data.

tocorrelation tests (m1 and m2), as well as Hansen test of over-identified constraints. Namely, for the instruments to be valid, they must be exogenous, and in the case of autocorrelation of time-varying errors of the order of one or more, this assumption is violated. The tests confirmed the expectations, confirming the existence of first-order autocorrelation and the absence of second-order autocorrelation in each specification, indicating that the instruments are valid.

One of the basic assumptions for the validity of the assessment is that the instruments need to be exogenous in order for the orthogonality condition to be met. Therefore, in the next step, we used the Hansen test of over-identified constraints, which serves to test the exogeneity of the instruments, i.e., whether the model specification is correct. The obtained p-values (Table 4) for all models suggest that there is not enough evidence to reject the null hypothesis about the exogeneity (validity) of the instruments. This implies that the instruments, taken together, are exogenous and as such adequate to treat the problem of endogeneity.

The results of the dynamic models are shown in Table 4.

In dynamic models, regardless of which model we start from, we find that the GDP per capita from the previous year is positive and statistically significant and less than 1, which corresponds to the predictions of the theory of neoclassical growth. In empirical studies for longer time periods (e.g., cross-sectional estimates; Barro & Sala-I-Martin, 2004) or for several five-year averages (Ederveen *et al.*, 2006), GDP per capita lagged one period provides evidence for conditional beta convergence. After controlling for other variables, this variable indicates whether the poorer region has reached the richer ones. Given the value of GDP per capita, which varies between 0.715 and 0.875, the results indicate relatively weak convergence between regions.

As for other control variables, the impact of R&D investment has a significant and positive impact on GDP per capita. Namely, if these investments increase by 1%, GDP per capita growth will increase by 0.08% in Model 2. Also, the high participation of employees in the labour force leads to an increase in GDP per capita between 0.083% in the basic model (column 1) and 0.115 % (column 5) due to an increase in participation by 1%. In contrast to the static model, the share of the highly educated in the population has a positive and statistically significant impact on the level of GDP per capita. On average, looking at all models, the increase in the share of the highly educated by 1% of GDP per capita increases by 0.04%.

Focusing on our variable of interest, we can see that ESIFs payments have a positive and statistically significant impact on income levels. Namely, by increasing payments from the ESIFs by 1% of GDP per capita in

transition countries, it increases by 0.008% in the basic model (column 1, Table 3), which is also the largest impact compared to other models.

Discussion

The main findings from the empirical research can be discussed in accordance with the provided methodological approach and they can be compared with the results from other authors (with the remark that they applied different methodologies, different samples of countries and different time period).

We started our analysis with the presumption that investment should positively influence on the level of development, which is in accordance with theories of economic growth. The investments here are observed as (1) ESIFs (as one kind of public investment) and (2) GFCF.

Even though we found positive and significant impact of ESIFs absorption to the GDP per capita in EU NMS, this impact is very small and varies from 0.0053 (in static model) to 0.008 (in dynamic models), which is in accordance with the findings by Palevičienė and Dumčiuvienė (2015) and also with Tijanić and Obadić (2015). It can be explained by the structure of ESIFs investments, and the neoclassical theory indicates that the technological progress is precondition to boost economic growth. However, one positive trend should be highlighted here, i.e. from the observed data we can confirm the findings by Dumciuvienė *et al.* (2015), who found the ESIFs absorption is growing higher than the GDP, but the problem remains in the effectiveness of their use. Hruza *et al.* (2019) found higher impact of ESIFs on regional economic growth (0.91 to 1.12 pp) but they include the dependent variable- economic growth and provided analysis just in the Czech Republic.

Our analysis goes a step further by employing static and dynamic panel data analysis and also, we have included the relevant variables that should impact on the GDP p.c. according to the economic theory and for which we have available data on NUTS 2 level. Beside the variable ESIFs, it is worth to point out that the variable gross fixed capital formation positively impacted to the GDP p.c. in static and dynamic models, as Caldas *et al.* (2018) proved for Portugal. Employment also positively influence on the development, which Czudec *et al.* (2019) highlighted as necessity that ESIFs should create new jobs. The weak beta convergence in NUTS 2 region in EU new member states was found through positive impact of the lagged dependent variable (for one period), such as Barro and Sala-I-Martin (2004) and Ederveen *et al.* (2006) have proved.

Dynamic models also resulted in the fact that investment in R&D also positively influence on the GDP p.c. that is in line with findings of Křístková (2012, 2013); that implies the necessity to take further steps to increase such kind of investments.

Obtained results indicate the necessity to put more effort to build the institutional (absorption) capacity through the educated people who will recognize the opportunities to get the funds from the EU, but also who will be able to prepare numerous project proposals from different sectors (Kersan-Škabić & Tijanić, 2017; Incaltarau *et al.*, 2020). Small ESIFs impact on the GDP p.c. also shows the need that other types of investments (GFCF) should prevail due to their higher influence on the level of development. Further, it is necessary to direct majority of ESIFs into projects that will develop new technology; into advanced industries (as Czudec *et al.*, 2019; pointed out for Poland) if a significant impact on the growth and development in NMS is to be achieved.

Conclusions

It seems that ESIFs play an important role as a source of grants aimed to improve the quality of lives and to promote regional convergence process within the EU. Here, we wanted to go a step further, and to perform an analysis that comprises quantification of ESIFs payments impact on the GDP per capita in EU new member states. The aim of this research is to examine the impact of absorbed (spent) money from ESIFs on NUT2 regional development (measured with GDP per capita) in new EU member states. The created models represent the GDP p.c. determination function as we also decide to include relevant variables available on NUTS 2 regions level that can impact economic development. Our analysis differs from the existing ones as it includes all new EU member states, includes more recent available data (that also includes a part of financial framework 2014–2020) and by observing ESIF as a part of growth model. Although there are some burdens, primarily reflected in the specification of the empirical model and variables that can impact on the convergence between regions (that exclusively depends on the available data on the NUTS 2 level); recent methodological developments in the field of panel data enable assessment of the effects of regional policy, and the impact of EU funds on the regional development.

The results of the static and dynamic model indicate the following. ESIFs have statistically significant and positive impact on the economic development of the NUTS 2 region. Nonetheless, their impact is (unex-

pectedly) quite small, which indicates that the new member states must not rely on ESI funds as the most important sources for investments in their economies. ESI funds create a base for economic growth, but only ESIF is not sufficient which is in line with the results of research by Lovrinović and Nakić (2016), Becker *et al.* (2018).

The reason for the very low impact of the ESIFs may lie in the fact that funds (in observed EU12) were contracted according to the principle of “n+3” years, which could consequently result in the delayed payments. Therefore, a substantial amount of ESIFs represents a relatively small part of current year GDPs. The third reason can lie in the structure of investments, i.e. all sectors don’t produce multiplicative effects on the economy. Majority of funds are oriented to creation or improvement of the precondition for economic growth and development, such as infrastructure, and a small part is focused to the innovative activities, high-skills industries, digital economy, etc. For greater spreading of the ESIFs, countries should promote investments in soft (new) skills, new industries, new technologies, in the area (sectors) that could produce higher value-added. Due to above mentioned factors and the fact that the financial period is still in progress and all data related to the financial perspective 2014–2020 are not complete (final), it would be interesting to extend the time series with updated data after 2016, as well as data for the whole financial perspective from 2014 to 2020 (at the time when these data will be collected and final).

There is a room for enlargement of the additional investigation, it would be of great interest to implement a spatial model to account for spatial spillovers between regions. Also, different components of ESIF funds are another potential avenue of research that can shed more light on the type of funds contributing to regional convergence. Even this research faces some research limitations, such as it doesn’t comprise different types of ESIF investments (in different sectors) and also, due to the data availability, it doesn’t include the entire period 2014–2020; this research can represent the quality base for future scientific research as it opened different questions that are valuable to be looked in more detailed inside.

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Annex

Table 1. Variables description

| Name | Definition | Abbreviation | Unit | Mean | St deviation | Max | Min |
|---|--|--------------|---------------------------------|------------------|------------------|-------------------|----------------|
| Gross domestic product per capita in purchasing power standards | The total worth of all produced goods and services reduced by the worth of the ones used for intermediate use in their production. Gross domestic product per capita in purchasing power standards removes differences in cost levels between regions. | lngdppc | euro | 17,437.92 | 8,273.10 | 55,300.00 | 6,700.00 |
| Gross fixed capital formation (GFCF) | Contains local manufacturers' investments, removing disposals, in fixed assets during a certain period of time. | lngfcf | euro | 3,970,000,000.00 | 2,720,000,000.00 | 23,100,000,000.00 | 408,000,000.00 |
| Public expenditure on research and development | Public expenditure on research and development in NUTS 2 region expressed in per capita terms. | lnRD | euro per inhabitant | 102.60 | 140.66 | 961.00 | 3.00 |
| Share of employees in high-tech industries | Share of employees in high-tech industries of total employee number in NUTS 2 regions. | lnHTemp | % | 0.03 | 0.02 | 0.10 | - |
| The employment rate | Number of employees divided by working age population in NUTS 2 region. | lnemployment | % | 0.42 | 0.07 | 0.56 | - |
| EU payments from the ESIFs | Annual EU expenditure data (on NUTS 2 level) for certain EU funds - ERDF, Cohesion Fund, EAFRD/EAGGF and ESF expressed in per capita terms | lnetfundspc | euro per inhabitant | 236.59 | 138.02 | 737.04 | - |
| Dummy crisis | The period of financial crisis in 2008 and 2009. | dummy crisis | 1 in 2008 and 2009, 0 otherwise | n/a | n/a | n/a | n/a |

Sources: European Commission (2022), Eurostat (2022).

Table 2. Correlation matrix

| | <i>lnGDPpc</i> | <i>lnGfcf</i> | <i>lnTer</i> | <i>lnRD</i> | <i>lnemployment</i> | <i>lnHTemp</i> | <i>lnexfunds_pc</i> |
|---------------------|----------------|---------------|--------------|-------------|---------------------|----------------|---------------------|
| <i>lnGDPpc</i> | 1 | | | | | | |
| <i>lnGfcf</i> | 0.7674 | 1 | | | | | |
| <i>lnTer</i> | 0.5619 | 0.3063 | 1 | | | | |
| <i>lnRD</i> | 0.8368 | 0.7073 | 0.5228 | 1 | | | |
| <i>lnemployment</i> | 0.5345 | 0.4049 | 0.206 | 0.4192 | 1 | | |
| <i>lnHTemp</i> | 0.7163 | 0.4707 | 0.416 | 0.7182 | 0.35 | 1 | |
| <i>lnexfunds_pc</i> | 0.041 | 0.0143 | -0.0579 | 0.1996 | -0.0006 | 0.1467 | 1 |

Table 4. Continued

| Models | (1) | (2) | (3) | (4) | (5) | (6) |
|---------------------|----------|----------|----------|----------|----------|----------|
| Dependent variable | lngdppc | lngdppc | lngdppc | lngdppc | lngdppc | lngdppc |
| #Instruments | 50 | 51 | 53 | 54 | 53 | 52 |
| AR(1) p-value | 0.000266 | 0.000405 | 0.000320 | 0.000294 | 0.000371 | 0.000257 |
| AR(2) p-value | 0.926 | 0.466 | 0.642 | 0.466 | 0.407 | 0.537 |
| Hansen Test p-value | 0.0688 | 0.0896 | 0.0646 | 0.138 | 0.138 | 0.146 |