EconPol
WORKING PAPER

73
2022

January
Vol. 6

Effects of Policy Mix on European Regional Convergence

Ignacio Sacristán López-Bravo (Universidad Carlos III de Madrid),
Carlos San Juan Mesonada (EconPol Europe, Universidad Carlos III de Madrid)

EUROPE
econPOL
European Network for Economic and Fiscal Policy Research

headed by

ifo INSTITUTE
Leibniz Institute for Economic Research
at the University of Munich

EconPol WORKING PAPER
A publication of EconPol Europe
European Network of Economic and Fiscal Policy Research

Publisher and distributor: ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 89 9224-0, Telefax +49 89 9224-1462, Email Dolls@ifo.de
Editors: Mathias Dolls, Clemens Fuest

EconPol Europe: www.econpol.eu

ABSTRACT

This paper analyses the impact of the fiscal-monetary policy mix on the convergence on per capita income of the least developed regions (Objective 1) of the European Union (EU 28) during the implementation of the three European Structural and Investment Funds (ESIF) programmes between 2000 and 2020. The Solow-Swan growth model with control variables allows us to assess the absorption capacity of regions in the different phases of the economic cycle. The empirical results show the effectiveness of EU Regional and Cohesion Policy. However, the combination of fiscal and monetary policy shows an impact that is asymmetric, depending on the region. Thus, a policy mix of fiscal restraint and monetary expansion would boost growth in all regions, but would slow down the convergence process in Objective 1 regions.

Keywords: convergence, ESIF, policy mix, spatial dependence, asymmetric impact.

TABLE OF CONTENTS

1. INTRODUCTION

One of the EU's primary objectives is to achieve economic, social, and territorial cohesion with the aim of advancing the process of economic integration and homogenising the degree of development among all member states. But asymmetric shocks and the single monetary policy have had diverse effects on regional convergence, empirical analysis of which has been rather scarce in the available literature, despite being one of the principal suspects in driving the main centrifugal forces. Moreover, most of the available work either does not analyse several ESIF programmes or does not include all EU28 regions[1]. Empirical evidence on short- and long-term differences in convergence and different speeds of convergence between Eastern and Western regions is therefore rare.

The effectiveness of Regional and Cohesion Policy designed through the European Structural and Investment Funds (ESIF) is examined here. Three ESIF programmes are considered for the periods 2000-2006, 2007-2013 and 2014-2020 and all EU28 regions are included. The question is whether different combinations of policy mixes affect the speed of regional convergence and whether this is different depending on whether the phase of the economic cycle is expansionary or recessionary. In particular, we analyse whether a combination of restrictive fiscal policy with expansionary monetary policy generates different effects on the speed of convergence of certain regions and on growth. We also try to answer the question of whether less developed regions in the East have converged at the same speed as Objective 1 (hereafter OBJ1) or less developed regions in the West.

Barro and Sala-i-Martin (1991, 1992a, 1992b) demonstrated the existence of conditional economic convergence between US states and between European regions, inferring that each state or region converges to a different steady state. This analysis departs from the hitherto prevailing concept of absolute convergence, which states that all countries converge to the same steady state by exhibiting similar preferences, technology, institutions, and production functions. This argument could be defended in the case of European regions, since they all have certain similar characteristics, but the

[1] The non-EU regions, Norway, that do not receive ESIF, as well as the UK which during the period under review was part of the EU28 and therefore received ESIF, are included in our EU29 database.

available literature insists on the specificity of each region (regional base versus single regional policy debate. On the other hand, after the accession of Eastern European countries to the EU and the 2008 crisis, the regions show different levels of development and integration.

The ESIF are divided into five funds[2]: the European Regional Development Fund (ERDF); the European Social Fund (ESF); the Cohesion Fund (CF); the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF). There are also two ancillary regional funds, the Fund for European Aid for the Most Deprived (FEAD) and the Youth Employment Initiative (YEI). The European Commission (EC) is responsible for approving and co-financing the ESIF and the regions are responsible for project design, management, and implementation of the investment. Finally, ESIF are allocated at NUTS 2 level under the nomenclature of the National Units of Territory level 2 (NUTS 2), which is developed by Eurostat to delimit the European regions.

The EU has established that those regions whose GDP per capita expressed in Purchasing Power Parity (PPP) is less than 75% of the EU average, will have the status of Objective 1 (OBJ1) regions, or Least Developed Regions (in its current denomination). Conversely, those regions that are OBJ1 and that exceed the GDP per capita threshold set by the EU will become phasing-out or transition regions, with the consequence of a reduction in the allocation of ESIF. This rule meant that, following the successive accession of the Eastern countries (with a lower GDP per capita) in 2004, many European regions that were OBJ1 automatically transitioned to phasing-out status, as there was a general decline in the EU average GDP per capita. However, they continued to receive funds to complete ongoing projects. For this reason, it is not advisable to analyse the effects of ESIF on a budget-period basis.

On the other hand, when a country joins the EU, its monetary policy slack is reduced (and in the Eurozone there is a single monetary policy) and, on the other hand, its fiscal policy is restricted because of the Stability and Growth Pact (SGP), which limits the

[2] Article 174 of the TFEU states that the EU shall aim to reduce disparities between the levels of development of the European regions, and in particular shall establish the necessary mechanisms for the regions whose development is lagging behind to catch up. Article 175 of the TFEU goes on to make it explicit that, in order to achieve this objective, the European Structural and Investment Funds (ESIF) are essential.

margin of response to an eventual asymmetric shock. For this reason, the economic policy of the Member States is constructed through a combination of monetary policy led by the ECB and followed or implemented by the Central Banks of the Member States (MS). Fiscal policy, too, has limited scope for action under the SGP. This policy mix has impacted unevenly depending on whether the region is an OBJ1 region and receives a larger ESIF envelope, or whether it is an advanced (NOOBJ1) region and has received a smaller ESIF envelope. In addition, many of the ESIF programmes are co-financed by the regions (or the MS), so the projects submitted must have a sufficient local budget of their own.[3].

In the 2000-2018 period, the OBJ1 regions, including most of the Eastern European regions that joined the EU recently, caught up with the more developed regions. Thus, the growth of these regions could be explained by the impact of European funds, but it is also necessary to control for other factors, such as gross fixed capital formation, or investment in human capital. However, the 2008 financial crisis had a significant impact on all European regions, and especially on some of those that were lagging behind.

Therefore, the question arises as to whether expansionary monetary policy, implemented through unconventional instruments, has had an unfavourable bias towards the OBJ1 regions. On the other hand, fiscal policy, when it has restricted public spending, may also have had negative effects on the absorptive capacity of certain OBJ1. Has this been the case in the less developed regions of the EU28, as San Juan Mesonada & Sunyer Manteiga (2020b) point out for the EU12?

2. REVIEW OF THE LITERATURE

2.1 Theoretical Literature

There are three predominant theories of economic growth in the literature: the neoclassical growth theory (Solow, 1956; Swan, 1956), the endogenous growth theory (Romer, 1990) and the new economic geography theory (Krugman, 1991).

[3] This condition was eased from 2011 onwards as the Commission found that OBJ1 deficit regions, in many cases, also had large deficits that prevented them from implementing co-financed projects or caused delays in implementation.

According to neoclassical theory, regions with similar rates of savings, depreciation, population growth and technological frontier converge in GDP per capita levels towards the same steady state, assuming diminishing returns to capital. In this perspective, the inclusion of ESIF provides an injection of capital that would help European regions and specifically the OBJ1 regions to grow faster towards their steady state. Also, the introduction of an expansionary monetary and fiscal policy in the model would have the same impact on the growth of the regions. For this reason, once the regions reach the steady state, it would not be necessary to continue with Regional and Cohesion Policy, and therefore its effects would be more significant in the short term than in the long term (Dall'erba and Le Gallo, 2008).

Continuing with the endogenous growth theory, we stress that returns to capital are constant and technological or technical progress is endogenous. For this reason, investment in capital would lead to an increase in the productivity of private capital. This productivity increase would occur through the acquisition of human capital (Lucas, 1988) and through investment in Research and Development (R&D) (Romer, 1986). Under this theory, the ESIF, as well as the combination of monetary and fiscal policy, would have long-run effects on growth.

Finally, under the perspective of the new economic geography that assumes increasing returns to scale and the existence of an economic centre and a periphery, the ESIF and the policy mix could contribute to convergence or, on the contrary, to divergence. First, if investment is aimed at increasing the competitiveness of less developed regions (investments in infrastructure, innovation, and human capital), ESIF and a policy mix oriented towards this objective would imply convergence. Conversely, the reduction of transport costs or the concentration of capital goods would imply an increase in the competitiveness of the more advanced regions, pushing the less competitive regions to the periphery. For example, the construction of high-speed trains (De Rus and Nombela, 2007) or the concentration of industry (Krugman, 1991) would contribute more to divergence than to convergence according to this theory.

None of the above theories entirely correspond to the empirical evidence, but only approximate it. The neoclassical conditional convergence model developed by Barro and Sala-i-Martín (1991, 1992a, 1992b) is the best applied model for our study, in which we want to assess the impact of ESIF and the policy mix on economic growth of GDP per capita. Their model assumes that for β-convergence to exist there must be a negative relationship between the growth rate of GDP per capita and the initial level of GDP per capita. In other words, it predicts that those economies with a lower initial level of per capita income will converge faster to their steady state than those with a higher initial level of per capita income. However, the neoclassical convergence model has econometric drawbacks as there is a risk of autocorrelation between different regions, hence the need for a special delimitation of each region (Baltagi, 2008).

2.2 Empirical Literature

There are currently three predominant theories in the literature to analyse the effects of public investment on economic growth. Firstly, studies based on Dynamic General Equilibrium modelling, whose ex-ante evaluations allow positive effects to be found (e.g. Boscá et al., 2016) while the literature focusing on ex-post analysis shows ambiguous results (Dall'erba and Fang, 2017; Pieńkowski and Berkowitz, 2016).

Another theoretical proposal addressed is the construction of counterfactual scenarios to evaluate the impact on *treated regions* (OBJ1 regions receiving ESIF) against the scenario of *untreated regions*. Cerqua and Pellegrini (2019) consider the Regression Discontinuity Design (RDD) as the most credible non-experimental design for the evaluation of strategies that allow the causal estimation of the impact of regional policies on economic growth.

Other authors (Brunsdon et al. 1999; Fotheringham and Brunsdon, 1999) use the Geographically Weighted Regression (GWR) method which measures the influence of ESIF on economic growth without assessing its net impact on the same. Therefore, as Bourdin (2019) points out, the spatial heterogeneity of growth in the regions must be complemented with a prior analysis of the origin of the heterogeneity.

However, in the estimations of the neoclassical convergence model there is a risk of autocorrelation between different regions, especially if they are neighbours, so it is advisable to use estimators that take the spatial correlation and cross-sectional heterogeneity between regions into account (Baltagi, 2008; Baltagi and Li, 2004).

The problem of spatial heterogeneity is addressed for the case of neoclassical convergence models, such as the one we use in our analysis. When using spatially structured panel data it is highly likely that spatial interactions between the different units studied will be found, resulting in spatial heterogeneity and spatial autocorrelation. When this happens it is advisable to delimit the spatial structure of the model and, therefore, we introduce a dummy variable that takes the value one if the region OBJ1 borders a developed region and cero if it does not, to control for spatial dependence between regions and spillovers.

Currently, most studies on regional convergence take regional interdependence into account, since, if it is not considered, the existence of spatial autocorrelation could bias the results. To capture these spillovers, some papers (San Juan and Sunyer, 2020b; Bouayad-Agha et al., 2013; Mohl and Hagen, 2010) include in the econometric model a matrix containing spatial information on the regions (distance between the centre and the periphery of each region) to, in this way, delimit each region spatially.

The issue of spatial heterogeneity is also addressed with a different methodology in our work through panel data estimation with the Generalised Method of Moments (GMM) in which we employ lags to avoid endogeneity bias and spatial autocorrelation and include control variables such as human capital, population density and growth.

As Mohl and Hagen (2010) noted, studies were initially based on cross-sectional data (Rodríguez-Pose and Fratesi, 2004; Fratesi and Perucca, 2014). However, panel data analysis has certain advantages over analyses using cross-sectional data (Fratesi and Perucca, 2019). These advantages include the possibility of getting rid of unobserved heterogeneity across regions and the presence of less collinearity between the independent control variables.

Recent studies controlling for spatial dependency across regions on the impact over time of ESIF programmes in European regions are manifold (San Juan and Sunyer, 2020a, 2020b, 2021; Bachtrögler et a.l, 2019; Becker et al., 2018; Cartone et al., 2021). Similarly, there are also studies that analyse operational programmes separately, such as those carried out for those covering the periods 1989-1993, 1994-1999, 2000-2006, 2007-2013 (Mohl and Hagen, 2010; Puigcerver, 2007). In addition, some analyses take the economic cycle the regions are passing through when receiving ESIF into account (Becker et al., 2018), and others show the impact of the policy mix in the Balkan candidate countries and their convergence with European regions (Krstevska, 2018).

Some studies find positive results of ESIF (Becker et al., 2008), while others conclude that there is no impact on per capita income growth (Dall'erba and Le Gallo, 2008), or that there is even a negative impact (Eggert et al., 2007).

Moreover, in line with more recent literature, Monfort et al. (2013) show that there are "convergence clubs" (clusters) and that there are significant differences between Eastern and Western Europe, with both converging towards a different steady state. In turn, Cartone et al. (2021) find differences in the determinants of growth between Eastern and Western countries and, furthermore, that there is convergence of the East with respect to the West. For this reason, many studies focus on the North-South, East-West or Centre-Periphery approach, showing the existence of a "two-speed" EU (Piris, 2011).

Numerous studies have observed different speeds of convergence between European regions: Sala-i-Martin (1996) found a speed of convergence of 1.5% for 90 regions in the period 1950-1990. Similarly, Geppert et al. (2005) in their study of 108 regions for the period 1980-2000, found a speed of convergence of 2.4%.

Another limitation of a considerable part of the literature on structural effects is that it does not use data on realised investments (appropriations) but data on "budgeted" expenditures. Therefore, their results are affected by the bias of the fact that, as the Commission obliges the co-financing of projects, the OBJ1 regions tend to have public deficit problems and tend to delay or fail to implement projects. On the contrary, in the expansionary phases of the cycle or when fiscal policy is expansionary, the percentage of execution over the volume of budgeted investments tends to be higher. For this reason, another of the contributions of our work is that we use data on realised investments and expenditures. In addition, to control for the phase of the cycle we use Government Bonds Yields Spreads (GBYS) which allows us to focus on the effects on the absorptive capacity of regions during expansions and contractions. We also take into account other 'conditioning factors' such as human capital (Fratesi & Wishlade, 2017), employment density and quality of institutions (Becker, Egger, & Von Ehrlich, 2010; Accetturo, de Blasio, & Ricci, 2014; Rodríguez-Pose & Garcilazo, 2015).

The relationship between policy mix and convergence has been less addressed in the literature. Some authors, however, have already highlighted the relevance of spending intensity (Cerqua & Pellegrini, 2018), the regional context in which projects are carried out (Bachtrögler, Fratesi, & Perucca, 2020) and the structure of the region (Percoco, 2017).

But few studies focus on measuring the isolated effect of monetary or fiscal shocks on the convergence of European regions (Hein and Truger, 2003; Coelho, 2019). Similarly, Mazzola and Pizzuto (2020) and San Juan Mesonada and Sunyer Manteiga, 2021 argue that since 2008, regions' over-indebtedness has contributed to divergence. They further add that the inadequacy of conventional monetary policy conducted by Central Banks caused a liquidity trap that weighed on consumption and investment demand, further increasing divergence across regions. Finally, they conclude that it is necessary for the policy mix to be adapted coherently to the specificities and local characteristics of each region and, in particular, to the economic cycle of a given region. San Juan Mesonada and Sunyer Manteiga (2020a) take this line in their study on the convergence of Spanish regions: they find that ESIF are less effective in the most indebted regions, which tend to coincide with the OBJ1 regions. The authors also stress the need to adapt the EU's Regional and Cohesion Policy to the economic cycle in which the region finds itself, increasing the volume of ESIF funds in the contractionary phases of the cycle and forcing the co-financing of projects in the expansionary phases.

Another of the added values of our work with respect to the previously published literature is that in many cases articles are published in which the innovative nature of the methods used is valued more highly than the quality and breadth of the sample used (for example, no data from any region of Eastern European countries is included) to test the hypothesis to be demonstrated. That is why in our work we cover the longest possible period using data not only for all regions of the EU, but also for the European Economic Area, thus including data from Norway (in addition to the UK, which was part of the EU in the period analysed).

3. DATA AND DESCRIPTIVE STATISTICS

3.1 Data

Our database expands the number of countries with regional data to 29. In addition, we add the ESIF accessory funds (FEAD and YEI) and introduce variables that capture the effect of monetary and fiscal shocks. We also take the enlargements that have taken place in the EU since 2004 into account. Thus, in 2004 countries such as the Czech Republic, Cyprus, Slovakia, Slovenia, Estonia, Hungary, Latvia, Lithuania, Malta, and Poland joined the EU. In 2007, Bulgaria and Romania and in 2013, Croatia.

The data cover 288 NUTS 2 regions corresponding to the 28 EU Member States plus Norway, for a time period of 18 years (2000-2018). It is important to note that Norway does not receive ESIF funds, but it is interesting to include it in the policy mix study. The source of the data used is multiple: first, for the variable of interest, the annual growth rate of GDP per capita expressed in PPP, the data come from the *Cambridge Econometrics Regional Database*. The reason why we have chosen GDP expressed in PPP is that it is the variable used by the Commission to delimit which regions are OBJ1 and which are not. Secondly, the ESIF data originate from the *Directorate General for Regional and Urban Policy*, which keeps the regional allocations of funds to the states up to date until 2018. As the data are in current prices, we have used the national GDP deflator (base 2005) available in the World Bank database. We have not taken into account the budgeted funds, but those actually transferred to the regions for the 2000-2006, 2007-2014 and 2014-2020 multiannual framework programmes.

The control variables used, such as population, employment, or gross fixed capital formation, are from the *Cambridge Econometrics Regional Database*. Other control variables, such as the level of education expressed as the percentage of the population aged 25-64 with only primary education, are obtained from Eurostat.

Moreover, the variable we choose to measure the effects of fiscal policy is the deficit at the national level, which is expressed as a percentage and is also obtained from Eurostat. Similarly, to quantify the effects of monetary policy and to control for the economic cycle in which a given region finds itself, we follow Becker et al. (2018) and San Juan Mesonada & Sunyer Manteiga (2020b) by constructing a GBYS (Government-bond-yield spreads) variable that takes the difference between the long-term and short-term interest rate for a given country and year (the greater the difference between the rates, the greater the impact of the recession is assumed to be). The long-term interest rate used is the 10-year government bond rate and the short-term interest rate chosen is the rate on the ECB's main refinancing operations for Eurozone countries. For non-Eurozone countries, we choose the 3-month interest rate. The ECB interest rates are from the *ECB Statistical Data Warehouse* and for the remaining or non-Eurozone countries, the rates are from the OECD *Monetary and Financial Statistics Database*.

Finally, in order to differentiate and delimit which regions are OBJ1 and which programmes they are in, we have consulted various provisions contained in the EU Official Journal. In particular: L 194, Volume 53, 27.7.1999 and L 243, Volume 44, 6.9.2006, with which we have also been able to construct our dummy variable of spatial dependence between regions.

3.2 Descriptive statistics

Table 1 shows the descriptive statistics of the control variables plus national innovation expenditure over the period 2000-2018 according to whether the region is an OBJ1 region or not. The *GDP per capita* variable is expressed in PPP and the *ESIF per capita* and *GFCF per* capita variables in euros. *Population Density* is obtained by dividing the population of the region by the area in square kilometres. Similarly, *Employment Density* is calculated by dividing the number of people employed in each region by the area in square kilometres. The *Innovation* variable represents the percentage of expenditure in terms of GDP for each country and *Primary Education* is expressed as the percentage of the population with only a primary level of education. Finally, the *Deficit* variable quantifies the government deficit as a percentage of GDP and the *GBYS Difference* represents the difference between long-term and short-term interest rates.

Table 1: Descriptive statistics 2000-2018

	Objective 1 regions				**Non Objective 1 regions**			
Statistics	Mean	Std.Dev	Min	Max	Mean	Std.Dev	Min	Max
GDP per capita	17071.2	4992.15	6782.78	50911.5	27245.7	12868.4	3232.65	200674
ESIF expenditure	242.68	200.58	0	1371.21	55.33	90.37	0	1056.15
FBCF (Total Invest)	3351.08	1864.23	491.99	11756.7	6720.98	3189.67	246.88	30726.9
Population density	181.6	454.26	1.94	5223.07	515.89	1273.68	3.09	11143.7
Employment density	72.57	177.02	0.5	2028.84	303.44	1194.73	1.39	18303.4
R&D expenditure	1.2	0.67	0.38	3.9	1.87	0.74	0.22	3.9
Primary education	30.36	21.65	2.2	87.7	26.77	12.28	2.4	81.9
Deficit	-3.44	3.15	-15.1	6.9	-2.27	4.02	-32.1	18.63
GBYS difference	1.96	2.6	-3.39	21.75	1.18	1.73	-8.17	21.75

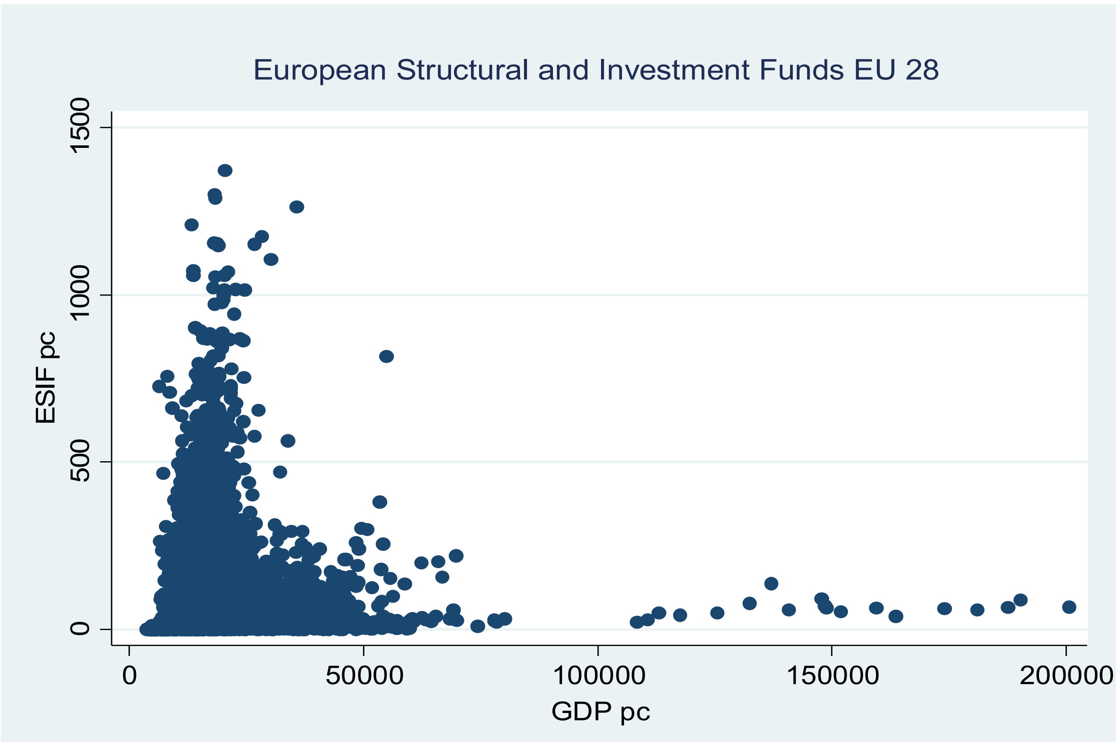
Compiled by the authors. Source: ARDECO, Eurostat, European Commission, data from the ECB and the OCDE.

As can be seen in Table 1, OBJ1 regions have lower GDP and investment per capita, as well as lower population and employment density. They also suffer from lower innovation expenditure, higher deficits and interest rate differentials, showing that the crisis has hit these regions harder. Moreover, the level of population with only primary education is slightly higher in OBJ1 regions. In addition, the maximum GDP per capita of the NOOBJ1 regions is about four times higher than that of the OBJ1 regions.

OBJ1 regions receive approximately four times more funds per capita than developed or transition regions. **Figure 1** shows this distribution of funds according to GDP per capita.

Figure 1 relates the GDP per capita variable to the ESIF per capita variable in the period 2000-2018 for the 28 Member States. Each point represents a region *i* in a given year *t*. We observe that those regions with a GDP per capita below ≅25 000 received more ESIF per capita than those above that threshold. Thus, we could interpret the graph as showing that OBJ1 regions whose average GDP per capita in the period studied is equal to 17 071.2, received more funds than NOOBJ1 regions.

Figure 1



Compiled by the authors using Stata. Source: ARDECO and the European Commission.

4. ECONOMETRIC MODEL

The model used is based on the neoclassical growth model (Solow, 1956; Swan, 1956) in which we apply a spatial dependence dummy variable. The equation of the conditional convergence model (Barro and Sala-i-Martin, 1991, 1992a, 1992b) we use is described as follows:

$$ln\ (y_{i,t}) - ln\ (y_{i,t-1}) = \beta_0 + \beta_1 ln(y_{i,t-1}) + \beta_2\ ln\big(ESIF_{i,t}\big) + \beta_3 X_{i.t} + \beta_4(DEF) + \beta_5(GBYS) + \varphi_i + \tau_t + \varepsilon_{i,t} \qquad [1]$$

The variable $y_{i,t}$ represents GDP per capita, ESIF our main variable of interest indicating ESIF expenditure per capita and $X_{i,t}$ is a vector grouping control variables specific to each region, such as GFCF per capita, population and employment density, population growth, human capital (education) and spatial dependence. In addition, the variables DEF and GBYS control for the business, monetary and fiscal cycle, and quantify the policy mix. The subscripts i and t refer to region and time and the error φ_i represents the region-specific error, τ_t the error due to time and $\varepsilon_{i,t}$ is the independent and identically distributed residual term. With this model, if β_1 is negative and statistically significant we will find β-convergence. Similarly, if β_2 is positive and statistically significant, the ESIF will contribute to the economic growth of the regions and thus to convergence. On the other hand, if β_4 and β_5 are statistically significant, the policy mix will have an effect on growth. However, the sign of both coefficients will depend on the policy mix.

On the other hand, we want to assess whether ESIF are effective in the long run. Following San Juan Mesonada & Sunyer Manteiga (2020b) we introduce in some models two lags to the ESIF variable to check whether after the passage of time there is a significant impact of the funds on the set of regions and in particular on the OBJ1 regions, since we cannot expect ESIF-financed investments to have an instantaneous impact on per capita income. However, the long-run elasticity of ESIF on GDP per capita growth cannot be quantified with a single time span of two years, so we calculate it following Mohl & Hagen (2011)[4]. To identify the impact of ESIF on OBJ1 regions, we

[4] "The long-term elasticity can be interpreted as showing that a one per cent increase of ESIF payments (as per cent of GDP) raises the real GDP per capita by φ per cent. Besides, most of the

introduce in some regression the dummy variable *OBJ1* which specifies whether a variable is OBJ1 or not. We also introduce a dummy variable *EU15* which takes the value 1 if the Member State joined the EU before 2004 and 0 if it did not. With this variable we aim to reveal whether the regions in the Eastern Member States (mostly OBJ1) that have recently joined the EU have grown faster than the more established regions in the West. To this end, it is interesting to compare the speed of convergence of the Eastern regions with the Western regions and to determine whether there is a higher speed compared to other literature. Sala-i-Martin (2000) proposed the following model of the speed of convergence:

$$\hat{\beta} = \frac{\left[1 - e^{-\lambda T}\right]}{T} \qquad [2]$$

Where $\hat{\beta}$ represents the estimation coefficient of the convergence model, T is the period of duration (in our case 1 year when taking annual values) and λ is the speed of convergence. Therefore, the higher the $\hat{\beta}$ the greater the speed of convergence.

Similarly, neoclassical growth models and our β-conditional convergence model state that regions are independent and converge at the same rate to the same steady state. However, empirical evidence shows that there is regional interdependence, with the risk that one region may "spill over" some of its growth to another. For example, a higher ESIF allocation for road construction in region *i* may affect the economic growth of a bordering region *j*. By taking spatial dependence into account, we ensure that the econometric model captures these spillovers to obtain consistent results. For this reason, in our model we take into account the spatial dependence between regions by introducing a dummy variable that takes the value 1 if region OBJ1 is bordering a developed region and 0 otherwise.

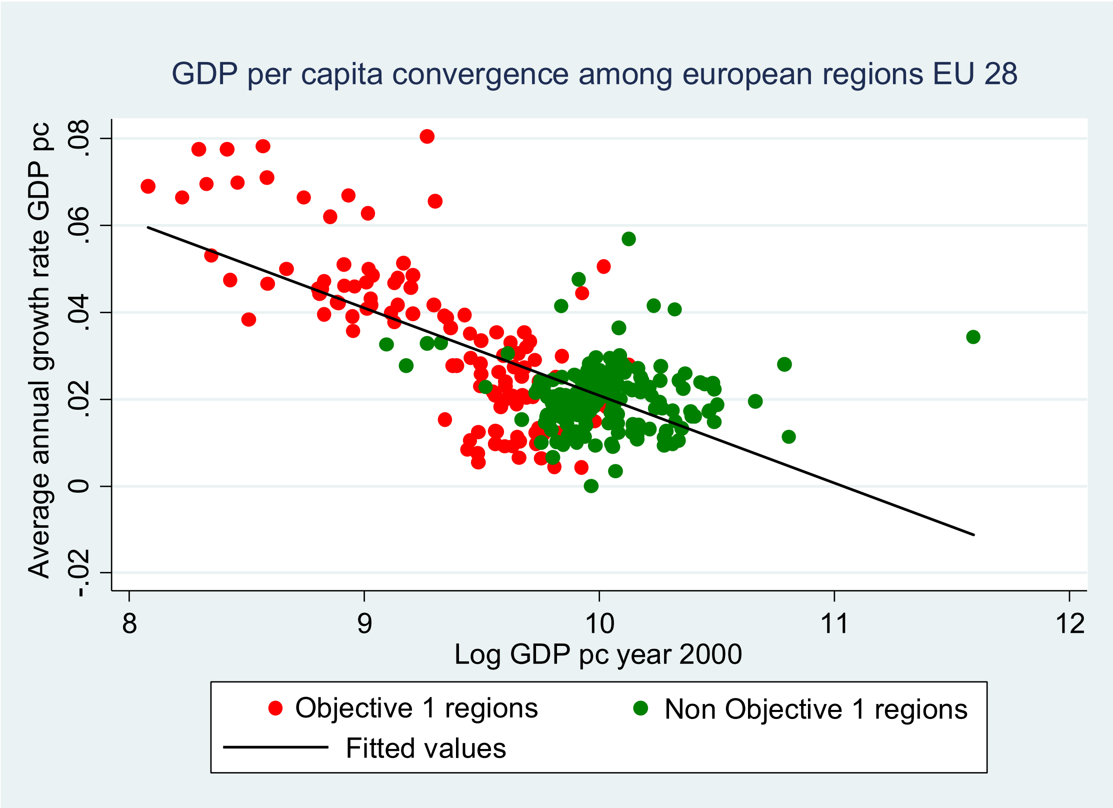
---

previous studies do not discuss the long-term quantitative impact which can simply be calculated as φ = (β2/−β1) in the case of ESIF payments." Mohl & Hagen (2011).

5. RESULTS

5.1 Descriptive data

Figure 2



Compiled by the authors using Stata. Source: ARDECO.

Following the work of Barro and Sala-i-Martin (1991, 1992a, 1992b), in **Figure 2** we take the logarithm of GDP in the base year, which in our case is 2000, and express it as a function of the average annual growth rate of GDP per capita of the 28 Member States plus Norway. We observe a negative relationship between the two variables, indicating the existence of β-convergence. We also find that the average annual growth rate is higher in OBJ1 regions than in non-OBJ1 regions. So much so that we observe that some OBJ1 regions in the period 2000-2018 have grown on average each year by around 8% and NOOBJ1 regions have grown each year by around 2%.

These results show that OBJ1 regions that started with a lower level of initial GDP per capita than other regions have grown faster than those with a higher level of initial GDP per capita.

5.2 Panel data regression with Driscoll-Kraay standard errors

To carry out our analysis we have to evaluate the structure of the data we use and thus build our six models with Driscoll-Kraay standard errors. The results of the tests are illustrated in **Table A.1** in the appendix.

The data we use for the study of the OBJ1 regions are not random, so we perform a heteroscedasticity test to check whether we need to apply robust errors in the models. First, we perform a Wald test and reject the null hypothesis in all models. Next, we make sure that our models are fixed-effect and not random, so we perform the Breusch and Pagan test and the Hausman test. Both tests tell us that the models will account for unobserved heterogeneity as we reject the null hypothesis. Finally, by also rejecting the null hypothesis of the Pesaran and Wooldrige tests we conclude that there is dependence and AR(1) first order autocorrelation in our panel structure data. These results lead us to adjust the standard errors and employ the consistent covariance matrix proposed by Driscoll and Kraay (1998).

In **Table 2** we find absolute (model 1) and conditional (all other models) β-convergence by checking the sign and significance of the coefficient of the variable L1LNGDPPC (β_1). We also observe that the coefficients of our variables of interest LNESIFPC (β_2), DEF (β_4) and GBYS (β_5) are significant and positive in almost all models.

Thus, in model 5 we observe that a 1% increase in ESIF increases the GDP per capita of the regions by about 0.02‰. In model 3, in which we introduce the dummy variable *OBJ1*, we see that the OBJ1 regions have grown by 0.069‰ more than the NOOBJ1 regions.

Tabla 2: Regressions with Driscoll-Kraay standard errors

Dep. Var: GDP PC GR	(1)	(2)	(3)	(4)	(5)	(6)
L1LNGDPPC	-0.0242***	-0.0711***	-0.0616***	-0.0724***	-0.0610***	-0.0759***
	(0.00484)	(0.0204)	(0.0167)	(0.0193)	(0.0133)	(0.0196)
LNESIFPC		0.00787*		0.000636	0.00214***	0.00287***
		(0.00445)		(0.000764)	(0.000615)	(0.000960)
LNINVPC		0.0236**	0.0189**	0.0351***	0.0142**	0.0212**
		(0.0106)	(0.00870)	(0.0113)	(0.00528)	(0.00867)
LNEMPDEN		0.0580***	0.0523***	0.0513***	0.0466***	0.0641***
		(0.0168)	(0.0133)	(0.0127)	(0.0111)	(0.0144)
LNPOPGR		-0.00301**	-0.00329**	-0.00403**	-0.00356***	-0.00277**
		(0.00133)	(0.00134)	(0.00142)	(0.000909)	(0.00131)
LNPOPDEN		-0.0549***	-0.0490***	-0.0480***	-0.0433***	-0.0611***
		(0.0166)	(0.0132)	(0.0123)	(0.0111)	(0.0139)
EDUC		-0.000351**	-0.000260*	-0.0000715	-0.0000893	-0.000259*
		(0.000151)	(0.000144)	(0.000140)	(0.0000994)	(0.000123)
L1LNESIFPC		-0.00525				
		(0.00341)				
L2LNESIFPC		-0.00170				
		(0.00198)				
SPILLOVER		-0.00273**	-0.00310*	-0.00275**	-0.00348**	-0.00319*
		(0.00112)	(0.00148)	(0.00111)	(0.00159)	(0.00157)
OBJ1			0.00648***			
			(0.00201)			
EU15				-0.0238***		
				(0.00418)		
DEF					0.00346**	
					(0.00149)	
GBYS					-0.00258***	
					(0.000729)	
OBJ1xDEF						0.00157
						(0.00124)
OBJ1xGBYS						-0.00216**
						(0.000966)
CONS	0.268***	0.575***	0.514***	0.498***	0.547***	0.643***
	(0.049)	(0.131)	(0.104)	(0.107)	(0.0987)	(0.130)
No. of observations	5184	4335	4779	4656	4604	4604
R-squared	0.065	0.154	0.138	0.170	0.218	0.146
No. of regions	288	288	288	288	288	288

* p<0.10 ** p<0.05 *** p<0.01

Compiled by the authors using Stata.

Similarly, in model 4 we can see that the per capita income of the Western countries has grown by 0.24‰ less than the per capita income of the newly incorporated Eastern countries. Thus, both the *OBJ1* and *EU15* variables reinforce the idea of the existence of convergence between the different European regions.

As can be observed, Gross Fixed Capital Formation (LNINVPC) and employment density (LNEMPDEN) are more important determinants of GDP per capita growth than ESIF. Moreover, the education figure is as expected since the models indicate that a population with higher human capital would boost the economy and grow GDP per capita. In contrast, with Driscoll-Kraay standard errors we cannot claim that ESIF are effective after a time lag of two years, as the coefficients of L1LNESIFPC and L2LNESIFPC are not significant.

5.3 Panel data regressions with two-step system GMM

In **Table 3**, following Mohl and Hagen (2010) we use the Generalised Method of Moments (*Two-step System GMM*) which allows us to remove endogeneity from the estimators, assuming that all control variables are endogenous (Blundell and Bond, 1998) and errors are adjusted to finite samples (Windmeijer, 2005).

Unlike **equation [1]** and the models estimated in **Table 2**, in **Table 3** we have included as explanatory variables three lags (Y', Y'' and Y''') of the dependent variable GDP PC GR. These lags are introduced in the models since we consider that the economic growth of previous years (*t-1*, *t-2* and *t-3* with *t* as the base year) is relevant for the determination of current growth, which allows us to be more precise in our estimates. Similarly, the inclusion of these variables in the control of the dependent variable allows us to respect the specification tests of the models. Thus, we take into account control variables that have not been used previously in the literature and the characteristics of the GMM technique. In addition, we cannot reject the null hypothesis of Hansen's test which states that the instruments are not correlated with error and, therefore, the instruments used are valid. Apart from Hansen's test, we also add the p-value of first-order autocorrelation AR(1) and second-order autocorrelation AR(2). We conclude that there is first-order serial correlation, but no second-order serial correlation, which allows the validation of the moment restriction for the autoregressive term.

The validation of the tests included in **Table 3** ensures that the interpretation of the GMM estimators is correct. However, the overfitting of instruments in the models could reduce the effectiveness of the Hansen test and generate a bias in the robust *two-step* standard errors (Windmeijer, 2005). For this reason, we include as instruments the control variables used in each model and limit the instrument lag to 1.

In **Table 3**, we observe that both the significance and the coefficients of the estimators increase, except for the population growth variable (LNPOPGR), which is no longer significant. In contrast to model 2 in **Table 2**, in model 1 in **Table 3** we find that the ESIF would indeed be effective two years after the transfer to the regions. In particular, ESIF would contribute positively to GDP per capita growth.

Table 3: Regressions with *Two-step System GMM*

Dep. Var: GDP PC GR	(1)	(2)	(3)	(4)	(5)
Y'	0.0812***	0.0548***	0.0389*	-0.0813***	0.0563***
	(4.18)	(2.83)	(1.69)	(-3.10)	(2.88)
Y''	-0.155***	-0.178***	-0.182***	-0.207***	-0.144***
	(-7.63)	(-8.77)	(-8.99)	(-7.71)	(-7.05)
Y'''	-0.0774***	-0.108***	-0.107***	-0.125***	-0.0602***
	(-4.60)	(-6.57)	(-6.61)	(-5.39)	(-3.49)
L1LNGDPPC	-0.144***	-0.148***	-0.141***	-0.135***	-0.148***
	(-15.83)	(-15.86)	(-15.77)	(-12.84)	(-15.35)
LNESIFPC	0.00705***		0.000972	0.00745***	0.00774***
	(5.09)		(0.89)	(4.95)	(5.83)
LNINVPC	0.0479***	0.0451***	0.0651***	0.0327***	0.0446***
	(8.34)	(7.11)	(8.11)	(4.81)	(7.66)
LNEMPDEN	0.124***	0.134***	0.0949***	0.0948***	0.120***
	(7.75)	(5.88)	(4.50)	(4.84)	(6.65)
LNPOPGR	0.00111	0.00184	-0.00113	0.00170	0.00165
	(0.64)	(0.85)	(-0.57)	(0.88)	(0.87)
LNPOPDEN	-0.119***	-0.126***	-0.0876***	-0.0838***	-0.114***
	(-7.50)	(-5.52)	(-4.22)	(-4.21)	(-6.33)
EDUC	-0.000717***	-0.000697***	-0.000354**	-0.000246**	-0.000705***
	(-5.36)	(-4.31)	(-2.55)	(-2.07)	(-5.63)
L1LNESIFPC	-0.00743***				
	(-6.53)				
L2LNESIFPC	0.00292***				
	(2.93)				
SPILLOVER	-0.0064	-0.00167	-0.00785*	-0.00656	-0.0102**
	(-1.54)	(-0.39)	(-1.92)	(-1.52)	(-2.37)
OBJ1		0.0141***			
		(3.63)			
EU15			-0.0405***		
			(-4.48)		
DEF				0.00615***	
				(18.15)	
GBYS				-0.00291***	
				(-3.88)	
OBJ1xDEF					0.00359***
					(6.44)
OBJ1xGBYS					-0.00170**
					(-2.49)
CONS	1.159***	1.222***	0.980***	1.141***	1.196***
	(16.7)	(14.37)	(11.29)	(13.38)	(15.08)
No. of observations	3944	4051	3955	3932	3932
AR (1) (p-value)	0.000	0.000	0.000	0.000	0.000
AR (2) (p-value)	0.137	0.305	0.308	0.439	0.337
Hansen (p-value)	1.000	0.729	0.994	1.000	1.000
No. of instruments	379	310	349	421	421
No. of regions	288	288	288	288	288
* p<0.10	** p<0.05	*** p<0.01			

Compiled by the authors using Stata.

The fact that ESIF are negative in the first year (L1LNESIFPC) shows empirically how some European regions have difficulties in absorbing and managing ESIF, so that the efficiency and quality of regional government (QoG) is key for the effect to be even greater (Charron & Lapuente, 2018). Some analyses (San Juan Mesonada & Sunyer Manteiga, 2020b) include QoG as a control variable, as it captures the capacity of institutions to improve economic growth. However, as QoG is a synthetic indicator constructed from multiple variables, it may be correlated with our control variables included in the models (EDUC, DEF, LNPOPGR). This could lead to endogeneity problems (Acemoglu et al., 2001), so we have decided not to include QoG in certain models to ensure that there are no endogeneity problems.

Another differential element of our work is that we have decided to calculate the long-term effectiveness of ESIF by means of the long-term elasticity as calculated by Mohl & Hagen (2011) $\varphi = (\beta 2/-\beta 1)$. Taking the values of $\beta 2$ and $\beta 1$ from model 1, we obtain a long-run elasticity of 0.49‰, a result that demonstrates a larger long-run impact of ESIF on GDP per capita than over two years (0.03‰). This result seems consistent with the well-known fact that the effects on GDP per capita growth of investments are often lagged.

Furthermore, we find that GDP per capita in OBJ1 regions grows 0.14‰ more than in developed regions (NOOBJ1) and that GDP per capita in Western regions grows 0.40‰ less than in Eastern regions. These results reinforce those found in **Table 2** and are in line with the work of San Juan Mesonada & Sunyer Manteiga (2020b) in their study of EU12 regions.

The above results lead us to analyse the speed of convergence among European regions. To do so, the **equation [2]** described above allows us to calculate the speed of convergence of European regions over the period 2000-2018. If we take -0.135 (model 4) as the minimum value and -0.148 (models 2 and 5) as the maximum value of $\hat{\beta}$ and assume that T is equal to 1 (annual time period), we find an annual convergence speed of between 13.5% and 16%. These results exceed those found in the existing literature: Sala-i-Martin (1996) observed a convergence speed of 1.5% and Geppert et al. (2005) one of 2.4%. Other authors such as San Juan Mesonada & Sunyer Manteiga (2020a) found a speed of convergence between 17.4% and 46% for the Spanish Autonomous Communities in the period 1989-2013. Despite the heterogeneity of the periods and regions studied by the literature, our results show the existence of β-convergence of the OBJ1 regions and a higher speed of convergence when data from the Eastern regions of the European Union are included.

On the contrary, the spatial dependence SPILLOVER variable is only significant at 10% and 5% in models 3 and 5, for which reason, for these models, the positive externalities or spillovers of the growth of region *i* on border region *j* must be taken into account. For this reason, in model 5, a 1% increase in GDP per capita in region *i* would decrease GDP per capita in border region *j* by 0.10‰.

On the other hand, models 4 and 5 collect information about the effect of the policy-mix. First, in model 4 we observe that the DEF variable is significant, which is why we argue that an improvement in the deficit ratio (a 1% decrease in the deficit) would increase GDP per capita by 0.06‰ in all regions. This result is consistent since, given the high level of debt overhang in European regions before and after the recession, a reduction in public deficit would give regions more room for manoeuvre (co-financing more programmes and obtaining more ESIF) to counteract the economic downturn. In short, marginal deleveraging of regions would have a positive effect on GDP per capita, while marginal over-indebtedness would have a negative effect on this variable.

Secondly, we find that in model 4 the variable GBYS is significant and negative. This variable controls for the business cycle a Member State is in, whether expansionary or contractionary. Thus, in a given Member State, the greater the difference between the long- and short-term interest rates, the greater the impact of the financial crisis. The model results show that a 1% increase in the interest rate differential decreases GDP per capita by about 0.03‰.

In addition to monitoring the economic cycle of the Member States, this variable can also be used to capture the effect of the implementation of a specific monetary policy. Since 2000, both the ECB and most of the central banks of the Member States have been committed to a progressive reduction in official interest rates, until they reached zero percent in 2016[5], which demonstrates that monetary policy can be categorised as uniformly expansionary for all regions in the 2000-2018 period. However, during the recession the interest rate spread on 10-year government bonds widened in those

[5] This is the case of the ECB, which announced an official interest rate of 0% on 16 March 2016.

countries whose financial solvency was in question and remained the same or decreased in those countries that were considered by financial markets to be low risk in terms of debt repayment. Consequently, the interest rate spread was wider in those Member States most affected by the recession. This reasoning and the results of model 4 regarding the GBYS variable allow us to confirm that the conventional expansionary monetary policy based on interest rates was insufficient to stimulate the European economy. It therefore empirically confirms the appropriateness of the ECB's decision to implement an unconventional monetary policy to mitigate regional liquidity traps.

Thus, the policy mix had an asymmetric impact on the convergence of the OBJ1 regions. At this point it is worth remembering that most of the OBJ1 regions are regions belonging to Eastern Member States that joined the EU from 2004 onwards[6] (see map in **Figure A.1**). In descriptive statistics **Table 1** we have found that OBJ1 regions had higher levels of debt and interest rate differentials, which is evidence that these regions were the hardest hit by the recession. In model 5 we present two cross-elasticity variables (OBJ1xDEF and OBJ1xGBYS) that explain the impact of fiscal policy in OBJ1 regions. Accordingly, we find that a 1% decrease in the percentage deficit increases GDP per capita in OBJ1 regions by an additional 0.036‰ relative to GDP per capita in NOOBJ1 regions. Similarly, an increase in the difference between short-term and long-term interest rates of 1% would decrease GDP per capita by 0.017‰ more in OBJ1 regions than in NOOBJ1 regions. These differences may seem small at the aggregate level but, in reality, they could be significant when it comes to regions in countries with high deficits where, in addition, regional governments also accumulate deficits.

The results reveal that contractionary fiscal policy, compatible with regional deleveraging, is effective for economic convergence in the OBJ1 regions. In contrast, conventional expansionary monetary policy based on declining interest rates did not contribute to the convergence of the less developed regions of the EU. The latter result indicates that the implementation of a uniform expansionary conventional monetary policy has not had the same impact in the centre as in the periphery, with the negative impact being accentuated in the peripheral regions. In addition, the less developed regions have been more vulnerable to the so-called liquidity trap, in which, despite low interest rates, financial institutions do not contribute to the dynamization of the flow of

[6] See OBJ1 regions in red in Figure A.1 in Appendix, page 32.

credit and therefore there is no significant impact of monetary policy on the real economy. However, it would be necessary to extend the analysis to the current unconventional monetary policy based on instruments such as *quantitative easing* or *forward guidance*, among others, to check its effectiveness after the economic recession of 2008 and during the current crisis caused by COVID-19.

Also, given that our estimates are constructed using annual data, it could be argued that the results may be inaccurate. Indeed, some studies (Becker *et al.,* 2018; Bouayad-Agha *et al.,* 2013) have addressed this problem using quinquennial (5-year) time indices. However, in this paper we have preferred to strengthen the asymptotic robustness of our results by using annual data and then calculating long-term elasticities.

However, both the results of model 4 and the previously analysed results of model 5 confirm that conventional monetary policy alone was not effective in stimulating aggregate demand in European regions and, in particular, failed in the OBJ1 regions. For this reason, as these are less developed regions, fiscal policy has proven to be more effective in raising GDP per capita growth. This result is consistent with the findings of Blanchard et al. (2017), who argue that fiscal expenditures are more effective in Europe's peripheral regions mired in the liquidity trap than in central European regions. It is therefore appropriate to readjust the monetary and fiscal policy mix to achieve the economic, social, and territorial integration and cohesion between regions that the European Union so ambitiously seeks.

6. CONCLUSION

This paper analyses the effect of ESIF and the fiscal and monetary policy mix on growth on 288 European regions belonging to the EU29, including Norway and the United Kingdom in the 2000-2018 period. Thus, unlike the previously available literature, it has the added value of including regions from Eastern Member States at NUTS 2 level and analysing the effects of the policy mix, elements not previously studied.

The results corroborate the economic convergence of the OBJ1 regions with the rest of the European regions and thus the positive effect of ESIF on GDP per capita growth. In the analysis we find that both employment density and gross fixed capital formation are the most important determinants of economic growth in ESIF regions. Thus, the estimated long-run elasticity of ESIF on GDP per capita of the regions is 0.5‰. A higher speed in the β-convergence process is thus observed than that previously found in the literature, presumably because the Eastern EU regions have been included. In this perspective, the improvement in the GDP per capita of the less developed regions empirically shows that the results of EU Regional and Cohesion Policy are capable of significantly counteracting some of the predictions of the theory of the new economic geography, in particular, the one that predicts a possible long-term concentration of per capita income in the more developed regions.

In turn, empirical results show that public deficit reduction can contribute to convergence in less developed regions (provided it does not slow down the investments foreseen in the budgeted ESIF), while the conventional expansionary monetary policy of lowering interest rates hampers convergence objectives. However, liquidity traps can be countered by extraordinary unconventional monetary policy measures.

It is therefore essential that policy makers adapt the policy mix to the characteristics and economic cycle of each Member State and its regions. Specifically, mechanisms that avoid lagging regions with budget deficits being excluded from European funds should be implemented to allow for adequate funding to complete European projects during recessions. However, this improvement in impact seems difficult to achieve without the EU making progress on fiscal harmonisation, so we believe that programmes financed by the EU budget could have a positive effect on those regions that are lagging behind.

Finally, this paper is simultaneous with the launch of the Recovery Plan for Europe, a temporary financial instrument tied to the regular 2021–2027 budget of the EU's Multiannual Financial Framework (1824.3 billion euros) that includes the Next Generation EU funds (806.9 billion euros), and the new ESIF programme for the period 2021-2027 with a budget of 392 billion euros. The Next Generation EU funds, following the Covid-19 crisis, aim to relaunch the European economy through investment in sustainable projects for ecological transition and digitalisation, the strengthening of education, and rural development. In addition, the new ESIF programme will continue with the objectives of integration and economic, social, and territorial cohesion of European regions. For this reason, this work may be useful for future regional studies that analyse the joint effect of the Next Generation funds and the ESIF 2021-2027 programme on economic recovery and European interregional convergence.

7. BIBLIOGRAPHY

Acemoglu, D., Johnson, S., & Robinson, J. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, 91(5), 1369- 1401.

Acceturo, A., De Blasio, G. & Ricci, L. (2014). A tale of an unwanted outcome: Transfers and local endowments of trust and cooperation. *Journal of Economic Behavior and Organization*, 102, 74-89.

Arellano, M. & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economics Studies,* 58(194), 277. https://doi.org/10.2307/2297968.

Bachtrögler, J., Fratesi, U., & Perucca, G. (2020). The influence of the local context on the implementation and impact of EU Cohesion Policy. *Regional Studies*, 54(1), 21-34.

Baltagi B.H, & Li D. (2004). Prediction in the panel data model with spatial correlation. Advances in Spatial Econometrics: *Methodology, Tools and Applications, Anselin L, Florax RJGM, Rey SJ* (eds). Springer: Berlin; 283–295.

Baltagi, B.H. (2008). Forecasting with panel data. *Journal of Forecasting,* 27(2), 153-173. https://www.jstor.org/stable/20054001.

Bayoumi, T. & Eichengreen, B. (1992). Shocking Aspects of European Monetary Unification. *National Bureau of Economic Research*, (3949). DOI: 10.3386/w3949.

Becker, Egger, & Von Ehrlich. (2010). Going NUTS: The effect of EU Structural Funds on regional performance. *Journal of Public Economics*, 94(9-10), 578-590.

Becker, S.O., Eggert, P.H., Von Ehrlich, M. (2018). Effects of EU Regional Policy: 1989-2013. *Regional Science and Urban Economics,* 69(C), 143-152. https://doi.org/10.1016/j.regsciurbeco.2017.12.001.

Blanchard, O.J., Christopher J.E., Lindé, J. (2017). Jump-Starting the Euro-Area Recovery: Would a Rise in Core Fiscal Spending Help the Periphery? *NBER Macroeconomics Annual, University of Chicago Press,* 31(1), 103-182. DOI: 10.3386/w21426.

Blundell, R. & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics,* 87(1), 115-143. https://doi.org/10.1016/S0304-4076(98)00009-8.

Boscá, J. E., Escribá, J., Ferri, J. Murgui, M. J. (2016). El Impacto de los Fondos FEDER (2014-2020) sobre el Crecimiento y el Empleo de las Regiones Españolas (No. eee2016-34). *FEDEA*.

Bouayad-Agha, S., Turpin, N., Vedrine, L. (2013). Fostering the Development of European Regions: A Spatial Dynamic Panel Data Analysis of the Impact of Cohesion Policy. *Regional Studies,* 47(9), 1573-1593. DOI: 10.1080/00343404.2011.628930.

Bourdin, S. (2019). Does the Cohesion Policy Have the Same Influence on Growth Everywhere? A Geographically Weighted Regression Approach in Central and Eastern Europe, 95:3, 256-287, DOI: 10.1080/00130095.2018.1526074.

Brunsdon, C., Fotheringham, A. S., Charlton, M. (1999). Some notes on parametric significance tests for geographically weighted regression. *Journal of regional science*, 39(3), 497-524.

Cartone, A., Postiglione, P., Hewings, G.J.D. (2021). Does economic convergence hold? A spatial quantile analysis on European regions. *Economic Modelling,* (95), 408-417. https://doi.org/10.1016/j.econmod.2020.03.008.

Cerqua, A. & Pellegrini, G. (2018). Are we spending too much to grow? The case of Structural Funds, Journal of Regional Science, 58(3), 535-563.

Cerqua, A. & Pellegrini, G. (2019). Quantitative evaluation techniques for regional policies. *Handbook of Regional Growth and Development Theories*, 2, 688.

Charron, N., & Lapuente, V. (2018). Quality of government in EU regions: spatial and temporal patterns. *QOG working paper Series*, 1(1).

Coehlo, M. (2019). Fiscal Stimulus in a Monetary Union: Evidence from Eurozone Regions. *IMF Economic Review*, 67(3), 573-617. DOI: 10.1057/s41308-019-00084-2.

Dall’erba, S. & Le Gallo, J. (2008). Regional Convergence and the impact of European structural funds over 1989-1999: A spatial econometrics analysis. *Papers in Regional Science,* 87(2), 219-244. DOI: 10.1111/j.1435-5957.2008.00184.x.

Dall'erba, S. & Fang, F. (2017). Meta-analysis of the impact of European Union Structural Funds on regional growth. *Regional Studies*, 51(6), 822-832.

De Rus, G. & Nombela, G. (2007). Is Investment in High-Speed Rail Socially Profitable? *Journal of Transport Economics and Policy,* 41(1), 3-23. https://www.jstor.org/stable/20054001.

Driscoll, J.C. & Kraay, A.C. (1998). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Review of Economics and Statistics,* 80(4), 549-560. https://www.researchgate.net/publication/311788557_Consistent_covariance_matrix_estimation_with_spatially_dependent_data.

Eggert, W., Von Ehrlich, M., Fenge, R., König, G. (2007). Konvergenz und Wachstumseffekte der europäischen Regionalpolitik in Deutschland. *Perspektiven der Wirtschaftspolitik*, 8(2), 130-146.

Esposti, R. & Bussoletti, S. (2008). Impact of Objective 1 Funds on Regional Growth Convergence in the European Union: A Panel-data Approach. *Regional Studies,* 42(2), 159-173. DOI: 10.1080/00343400601142753.

Fotheringham, A. S., & Brunsdon, C. (1999). Local forms of spatial analysis. Geographical analysis, 31(4), 340-358.

Fratesi, U. & Wishlade, F. G. (2017). The impact of European Cohesion Policy in different contexts.

Geppert, K., Happich, M., Stephan, A. (2005). Regional Disparities in the European Union: Convergence and agglomeration. *Papers in Regional Science,* 87(2). DOI: 10.1111/j.1435-5957.2007.00161.x

Hein, E., & Truger, A. (2003). European Monetary Union: nominal convergence, real divergence and slow growth? *Structural Change and Economics Dynamics,* 16(2005), 7-33. https://doi.org/10.1016/S0954-349X(03)00049-3.

Ketterer, T., Rodríguez-Pose, A. (2018). Institutions vs. 'first-nature' geography: What drives economic growth in Europe's regions? *Regional Science*, 97(1), 25-62.

Ketterer, T., Rodríguez-Pose, A. (2020). Institutional change and the development of lagging regions in Europe, *Regional Studies*, 54(7), 974-986, DOI: 10.1080/00343404.2019.1608356

Krstevska, A. (2018). Real Convergence of Western Balkan Countries to European Union in view of Macroeconomic Policy Mix. *Journal of Central Banking Theory and Practice,* 7(2), 187-202. DOI: 10.2478/jcbtp-2018-0018.

Krugman, P. (1991). Increasing Returns and Economic Geography. *Journal of Political Economy*, 99(3), 483-499. https://doi.org/10.1086/261763.

Lucas, R.E. (1988). On the mechanics of economic development. *Journal of monetary economics,* 22(1), 3-42. https://doi.org/10.1016/0304-3932(88)90168-7.

Mazzola, F. & Pizzuto, P. (2020). Great Recession and club convergence in Europe: A cross-country, cross-region panel analysis (2000-2015). *Growth and Change,* 51(2), 676-711. https://doi.org/10.1111/grow.12369.

Mohl, P. & Hagen, T. (2010). Do EU structural funds promote regional growth? New evidence from various panel data approaches. *Regional Science and Urban Economics,* 40(5), 353-365. https://doi.org/10.1016/j.regsciurbeco.2010.03.005.

Mohl, P. & Hagen, T. (2011). Do EU Structural Funds Promote Regional Employment? Evidence from Dynamic Panel Data. *ECB Working Paper Series,* (1403). http://ssrn.com/abstract_id=1963699.

Monfort, M., Cuestas, J., Ordoñez, J. (2013). Real convergence in Europe: a cluster analysis. *Economic modelling,* 33(C), 689-694. DOI: 10.1016/j.econmod.2013.05.015.

Percoco, M. (2017). Impact of European Cohesion Policy on regional growth: does local economic structure matter? *Regional Studies*, 51:6, 833-843.

Pieńkowski, J. & Berkowitz, P. (2016). Econometric assessments of Cohesion Policy growth effects: How to make them more relevant for policy makers? In EU Cohesion Policy (Open Access) pp. 55-68.

Piris, J.C. (2011). *The future of Europe: Towards a two-speed EU?* Cambridge.

Puigcerver, M. (2007). The impact of structural funds policy on European regions growth. A theoretical and empirical approach. *The European Journal of Comparative Economics,* 4(2), 179-208.

Rodríguez Pose, A. & Garcilazo, E. (2015). Quality of Government and the Returns of Investment: Examining the Impact of Cohesion Expenditure in European Regions. *Regional Studies*, 49(8), 1-17. DOI: 10.1080/00343404.2015.1007933.

Romer, P.M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy,* 94(5), 1002-1037. https://www.jstor.org/stable/1833190.

Romer, P.M. (1990). Endogenous Technological Change. *The Journal of Political Economy,* 98(5), 71-102. https://www.jstor.org/stable/2937632.

Sala-i-Martin, X. & Barro R.J. (1991). Convergence across States and Regions. *Brookings Papers on Economic Activity,* (1), 107-182. https://doi.org/10.2307/2534639.

Sala-i- Martin, X. & Barro R.J. (1992a). Convergence. *Journal of Political Economy,* 100(2), 223-251. https://www.jstor.org/stable/2138606.

Sala-i-Martin, X. & Barro R.J. (1992b). Regional Growth and Migration: A Japan-United States Comparison. *Journal of the Japanese and International Economies*, (6), 312-346. DOI: 10.3386/w4038.

Sala-i-Martin, X. (1996). The Classical Approach to Convergence Analysis. *Economic Journal*, 106(437), 1019-1036. https://doi.org/10.2307/2235375.

Sala-i-Martin, X. (2000). *Apuntes de crecimiento económico.* Antoni Bosch, segunda edición. Página 212.

San Juan Mesonada, C. & Sunyer Manteiga, C. (2020a). European Structural and Investment Funds and Regional Convergence: The Impact of Public Deficit in Beta-Convergency. *European Network for Economic and Fiscal Policy Research*, (47). https://www.econstor.eu/handle/10419/221807.

San Juan Mesonada, C. & Sunyer Manteiga, C. (2020b). Three decades of Structural Funds: Do they work? *EconPol Working Paper.*

San Juan Mesonada, C. & Sunyer Manteiga, C. (2021). European Structural Funds and Resilient and Recovery Facility Governance. *EconPol Working Paper,* 67(5).

Solow, R. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics,* 70(1), 65-94. https://doi.org/10.2307/1884513.

Swan, T. W (1956). Economic growth and capital accumulation. *Economic record,* 32(2), 334-361. https://doi.org/10.1111/j.1475-4932.1956.tb00434.x.

Treaty of the Functioning of the European Union. (2008). *The Official Journal of the European Union nº115 the 9th of May,* page 127.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1), 25-51.

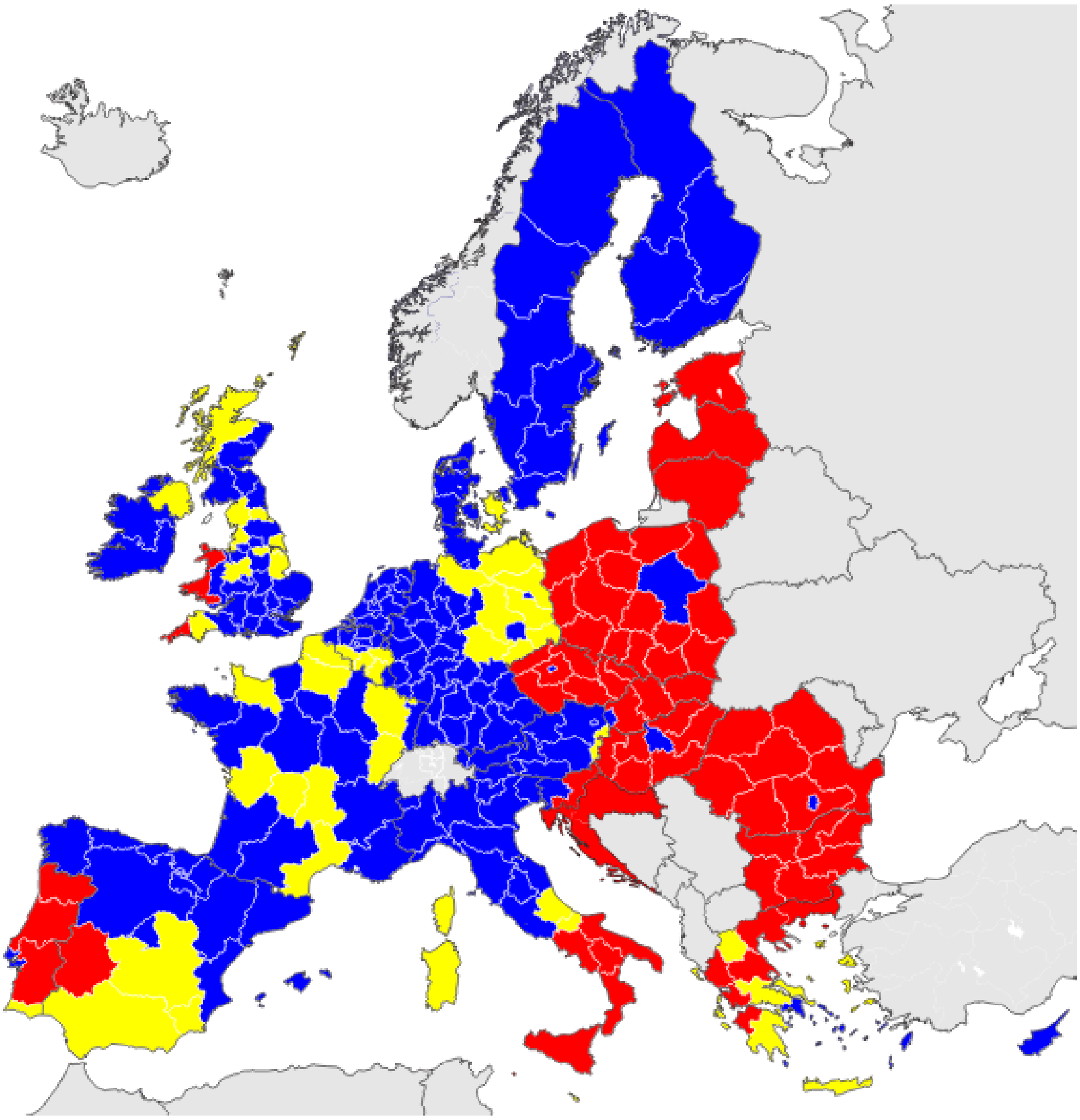
8. APPENDIX

Table A.1: Test results of panel data models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Wald test						
$\chi 2$ -statistic	1261.16	2650.08	2878.33	3322.14	2274.43	2396.36
p value	0.00	0.00	0.00	0.00	0.00	0.00
Breusch and Pagan test						
BPLM $\chi 2$ -statistic	132.63	30.97	43.75	5.73	74.64	58.99
p value	0.00	0.00	0.00	0.00	0.00	0.00
Hausman test						
$\chi 2$ -statistic	174.46	486.06	464.26	403.1	999.97	428.5
p value	0.00	0.00	0.00	0.00	0.00	0.00
Wooldrige test						
F-statistic	343.98	243.73	206.82	203.46	150.91	195.54
p value	0.00	0.00	0.00	0.00	0.00	0.00
Pesaran test						
p value						
L1	0.00	0.00	0.00	0.00	0.00	0.00
L1LNGDPPC	0.00	0.00	0.00	0.00	0.00	
LNESIFPC		0.00		0.00	0.00	0.00
LNINVPC		0.00	0.00	0.00	0.00	0.00
LNEMPDEN		0.00	0.00	0.00	0.00	0.00
LNPOPGR		0.00	0.00	0.00	0.00	0.00
LNPOPDEN		0.00	0.00	0.00	0.00	0.00
EDUC		0.00	0.00	0.00	0.00	0.00
L1LNESIFPC		0.00				
L2LNESIFPC		0.00				
OBJ1			0.00			
EU15				1.00		
DEF					0.00	
GBYS					0.00	
OBJ1xDEF						0.00
OBJ1xGBYS						0.00
SPILLOVER		0.69	0.69	0.69	0.69	0.69

Compiled by the authors using Stata.

Figure A.1: European regions eligible for the ESIF 2014-2020 programme



Source: Cranberry Products.

Legend: regions with Objective 1 status are shown in red, regions in transition in yellow and more developed regions in blue.

EconPol Europe

EconPol Europe - The European Network for Economic and Fiscal Policy Research is a unique collaboration of policy-oriented university and non-university research institutes that will contribute their scientific expertise to the discussion of the future design of the European Union. In spring 2017, the network was founded by the ifo Institute together with eight other renowned European research institutes as a new voice for research in Europe. A further five associate partners were added to the network in January 2019.

The mission of EconPol Europe is to contribute its research findings to help solve the pressing economic and fiscal policy issues facing the European Union, and thus to anchor more deeply the European idea in the member states. Its tasks consist of joint interdisciplinary research in the following areas

1) sustainable growth and 'best practice',

2) reform of EU policies and the EU budget,

3) capital markets and the regulation of the financial sector and

4) governance and macroeconomic policy in the European Monetary Union.

Its task is also to transfer its research results to the relevant target groups in government, business and research as well as to the general public.