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Carlos San Juan Mesonada and Carlos Sunyer Manteiga (EconPol Europe, Universidad Carlos III de Madrid)

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Carlos San Juan Mesonada[1] and Carlos Sunyer Manteiga[2]

ABSTRACT

The objective is to empirically assess the effects of the European Structural and Investment Funds (ESIF) on the regional convergence of income catching-up of the Objective 1 regions in Spain. The principal added value of the paper is that by using realized investment data, it allows comparison of the results in terms of real regional convergence of the two budgetary periods covering different phases of the business cycle and two ESIF operational programs. The panel data model's results allow recommendations to assess economic and financial adjustments in the UE and the use of the ESIF. Changes in economic cycles seem to have a significant impact on the ability of funds to contribute to the growth of the regional economy. Possible use in the Eurozone of the future Crisis Fund of the multiannual budget 2021-27. The level of indebtedness in the region has a definite adverse effect on the effectiveness of European projects. Additionally, we identify an apparent spillover effect from the funds towards other border regions on those that are formally receiving. Therefore, it is essential to be able to adapt the funds according to the phase of the business cycle. Moreover, during the downturns, to ensure their effectiveness may not be co-finance by regions.

Keywords: Public Deficit, Income Gap, Regional Convergence, European Structural and Investment Funds, Regional Debt

[1] Jean Monnet Profesor. Universidad Carlos III de Madrid.
[2] Universidad Carlos III de Madrid.

Introduction

The objective of the paper is to quantify the effects of the European Structural and Investment Funds (ESIF[3]) on the catching-up of the rural population income. Public deficit shows up as a critical variable to explain the convergence process differences during the boost and bust.

The model seeks to evaluate the effects of ESIFs before and after the financial crisis using the real investment data for the period 2000-2013. Given that the funds provided explicitly target the reduction of economic disparities among regions, we expect that in the case in which the ESIF result correctly allocated, they could improve income on lagging behind regions.

The primary added value of this research is that it allows comparing the results in terms of regional convergence of two budgetary periods covering different phases of the economic cycle and two ESIF operational programs, the current 2014-20 and the previous one.4 As explained below, our results, using data from funds spent, show that the effects on the real convergence of the Spanish regions were different after the recession that took place from 2007-13 (FEGA, 2017).

Furthermore, on a view of the future expenditures of the EU required to overpass the post-COVID19 recession, the experience about regional efficiency of the structural funds is relevant to assess the future programs. In particular, we present evidence of the role of the spillover effects and the quality of governance to enhance growth and the phase of the business cycle effects on regional convergence.

The quality of governance at the regional level result questioned in recent researches. The role of Members States in the responsibility and ownership to coordinate the cohesion programs with the Commission is revalue[5] The later drive to evaluate the relevance of the policy choices to effectively reach the targets of regional convergence and growth presenting empirical evidence of the consequences of the difference in the interactions of central and regionals governs (Crescenzi et al. 2020 p. 8).

Recently the relevance of account for the impact of the policy intervention, not only in the budgetary period but also in the following years, is claimed by Di Cataldo (2017). The evaluation of the aspects of the structural policy appears as a relevant question, especially when the empirical results present a correlation between the level of the founding programs and the results in increasing the rates of growth. The past focus on particular pillars of the structural programs seems to be less relevant for the impact on growth than the specific orientation on enhancing the competitive advantages of the certain regional sector according to with the synthetic evaluation of the UK regions experiences (Di Cataldo and Monastiriotis, 2020).

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[3] To avoid confusions about the changing names of the different ESIF they are abstract in Table 7 *Names of the ESIF according to the multiannual program*.

[4] We use the available data for the period 2000-06 and 2007-13

[5]) "If member states are punching below their weight, the entire architecture is weaker and less politically sustainable" Crescenzi, et al. 2020 p. 8).

The European programs slowly move the focus from redistribution to infrastructure investment targeting investments related to local endowments following the recommendation of Sotiriou and Tsiapa (2015). Furthermore, later on, sifting from big infrastructures to softer investment targeting specific areas of regional need like R&D+i, education and youth employment programs, proving to have long term effect on growth (Barca et al., 2012; Rodriguez-Pose and Fratesi, 2004). In particular, the research using data from different Member States regions reveal that investments targeting regional economic shortcomings use to be more productive and socially appreciate (Crescenzi et al., 2017).

Data of regional funds

The importance of data quality is fundamental (Pienkowski and Berkowitz, 2015). One of the main reasons why evaluations of the effectiveness of ESIFs present such disparate results is the quality and source of the data used. A large part of these studies has used data on budgeted expenditure (Becker et al. 2012, among others), ignoring the long lags that exist – even more than three years - between the scheduled spending date and the actual effective spending. Attempts to compensate for this lag have been made with the use of lags in the regressions (Rodriguez-Pose and Fratesi, 2003), obtaining significant results. However, the use of appropriate real investment data drives to better results.

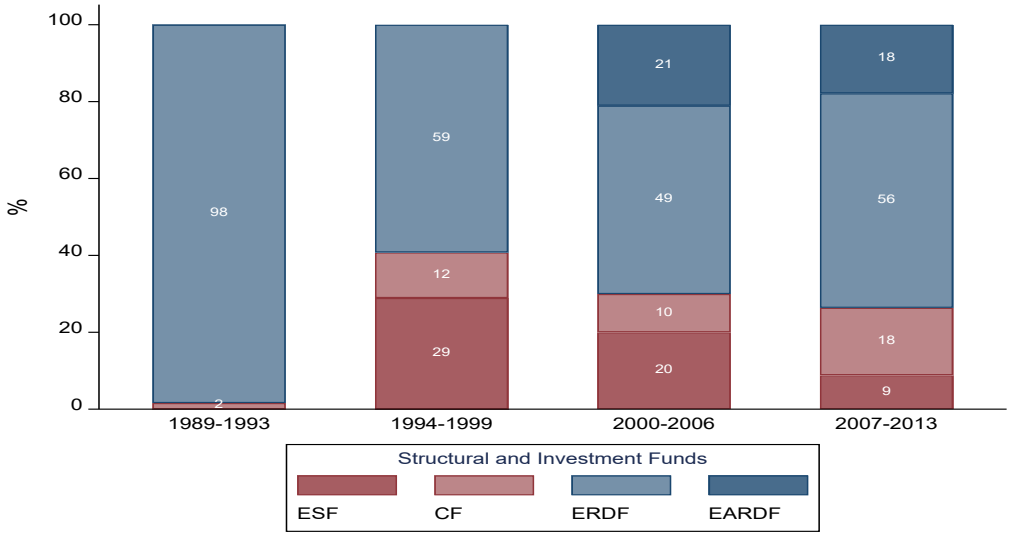
Fortunately, for this study, the Spanish General Management Sub directorate of the European Regional Development Fund (ERDF) has provided us with access to the executed ERDF and Agricultural Fund for Rural Development (EAFRD) expenditures for the operational programs 2000-2006 and 2007-2013, which together account for approximately 75% of the total amount of the ESIF. On the other hand, the program expenses for all the ESIFs comes from the operational programs of each Autonomous Community.

The aid has not arrived uniformly, and in 2004, due to the integration into the EU of the eastern countries, the average per capita gross domestic product (GDP pc) of the European Union decreased significantly with the enlargement to the east and central European countries. Only those regions whose GDP is less than 75% of the EU average receive funds Objective Convergence[6] (See Illustration 1).

Former Objective 1 regions, do not qualify after the enlargement to the east, because of their per capita income results over the average EU. This decrease in the EU average GDPpc affected the collection of funds for many Spanish regions, which saw their relative position exogenously improve, thus losing their status as less developed regions (Objective 1) and, with this, the intensity of aid. The overall available ESIF for Spain decreased significantly with the primary enlargement to the east and central European countries in 2004. Later on, the ESIF reduction continues with the "panic-driven austerity" after 2011 (De Grauwe and Ji, 2013). Data shows that the Objective 1 region suffer the liquidity trap and the fiscal austerity restrictions simultaneously.

[6] The name 'Objective 1' regions was changed into 'Convergence regions' for the 2007-2013 period and again into 'Less developed regions' for 2014-2020, moreover the rule of eligibility "Regions whose development is lagging behind" (European Commission, 2008) remain the same.

Illustration 1. The relative size of the European Structural and Investment Funds



Note: ESF: European Social Fund ESF; CF: Cohesion Fund; ERDF: European Regional Development Fund; EARDF: European Agricultural for Rural Development Fund

Source: Own elaboration

The source of data for our model estimates for the rest of the variables are the following:

- The data on real GDP (base year 2010), the GDP deflator and the population resident in Spain have come from the FEDEA regional accounts database.
- Public investment and the index of human capital (as an average of years aimed at studying of the population between the ages of 15 and 64) come from the database created by the IVIE; the employment rate data come from EUROSTAT.
- The public debt of the Autonomous Regions (NUT-2) has come from the website of the Spanish Ministry of Finance; the contribution to the GDP of agriculture comes from the INE.
- The government quality index, following Rodriguez-Pose and Garcilazo (2013), has been obtained by merging data from the database of the University of Gothenburg and the World Bank Governance Data.

Methodology and literature review

Approximately one-third of the EU funds[7] being allocated to the ESIFs, which represents the second-largest community policy, after the Common Agricultural Policy (CAP). Due to the enormous size of these budget and their macroeconomic importance, numerous studies have investigated their impact on interregional convergence in Europe (see, among others, those

[7]According the Commission data Objective 1 regions received 71.6% of the total 2000-2006 Cohesion Policy budget (213 billions euros, European Commission, 2010). For the 2007-2013 Multiannual Financial Framework the Budget to 'Convergence regions' was increased to 82% (European Commission, 2008; 2014).

of Ederveen et al., 2002, 2006; Rodríguez-Pose and Fratesi, U. 2002; 2004; Puigcerver-Peñalver, 2007; Becker et al., 2008; Becker et al., 2010, 2012; Boscá et al., 2016).

However, the empirical results on the effectiveness of the ESIF to achieve real convergence are disparate according to the period under analysis. Recent work indicates that in the long term in the period 1995-2010 there is "the existence of a regressive process in terms of regional convergence in the Eurozone, especially marked by substantial and asymmetric differences in the patterns of productive specialization" (Rodil, Vence and Sánchez, 2014 pp. 300).

These differences highlight the difficulties in achieving convergence in certain areas since the enormous challenges associated with meeting the objective of territorial cohesion are related to the productive specialization of each region and the economic cycle. In particular, "there is a slowdown in the fragile convergence that began in the second half of the nineties and has ended up leading to a process of divergence in the most recent recession" (Rodil, Vence and Sánchez, 2014 p.300).

In the Díaz and Franjo (2016) model, as in the case of Spain, the low interest in the Eurozone during the expansion before the real estate crisis hurt the growth of the economy's TFP by inefficiently allocating a disproportionate share of the investments. The concentration during the economic boom of investments in goods and services internationally not tradable (e.g., real estate) generated the subsequent massive loss of employment in the construction sector in regions lagging behind during the recession, affecting convergence in per capita GDP. The latter may have had relevant effects in the working population changes in rural areas, mainly during the building side expansion and a severe recession later on.

Models of regional convergence

In this section, we first relate the rural depopulation rate of the Objective 1 regions with the taxpayers' income-gap between rural and urban areas. We initially contrast the hypothesis that the per capita urban-rural income-gap, together with the working population and ageing, are the primary drivers of the speed of rural depopulation. Income-gap is calculated as the distance in per capita income between rural and urban municipalities. For this, our empirical analysis uses a specification as follows:

$$\mathbf{g}_{i,t} = \boldsymbol{\alpha} + \boldsymbol{\beta_1} * \boldsymbol{y}_{i,t} + \boldsymbol{\beta_2} \boldsymbol{X}_{i,t} + \boldsymbol{\varphi}_i + \boldsymbol{\tau}_t + \boldsymbol{\varepsilon}_{i,t} \qquad (1)$$

Where $\mathbf{g}_{i,t}$is the growth rate of the population calculated as $g = \left(\frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}}\right)$, were **p** means population, with **i** and **t** as municipality and time index, respectively; $\boldsymbol{y}_{i,t}$ is the variable of interest, described in the following paragraph; $\boldsymbol{X}_{i,t}$ is a matrix of municipal characteristics that include employment growth (provincial working population), foreign population, ageing index, masculinity index and Gini index; $\boldsymbol{\varphi}_i$ y $\boldsymbol{\tau}_t$are vectors of invariant municipal characteristics and dichotomous time variables that capture permanent differences in population growth rates, respectively; finally, $\boldsymbol{\varepsilon}_{i,t}$is a vector of i.i.d. residual.

The σ-convergence and the differences in the working population between regions

The speed of convergence and whether it is transitory or permanent plays an essential role in characterizing regional disparities in income. Following Barro and Sala-i-Martin (1992; 1995), we say that there is β-convergence if regions with lower levels of per capita income tend to grow faster than the income leaders. Furthermore, σ-convergence if the dispersion of their relative per capita income levels tends to decrease over time.

It follows that β-convergence is a necessary but not a sufficient condition for σ-convergence (Quah, 1993a, b). An important implication of this result is that income inequality across countries or regions may persist due to shocks (e.g., cyclical fluctuations in economic activity) that tend to increase dispersion.

What are the drivers of sigma divergence?

In our data, the σ-convergence, the dispersion of their relative regional per capita income levels, tend to decrease over time until the financial recession. Moreover, later on, the σ-convergence stops and becomes divergence. The drivers of sigma divergence start with the financial recession, σ increases from 2008, meaning an increasing dispersion of the income per capita (see Illustration 2). The bars differences illustrate the lower growth of Objective 1 regions during the post-financial recession and the increase dispersion on the income per capita (the left scale line in Illustration 2).

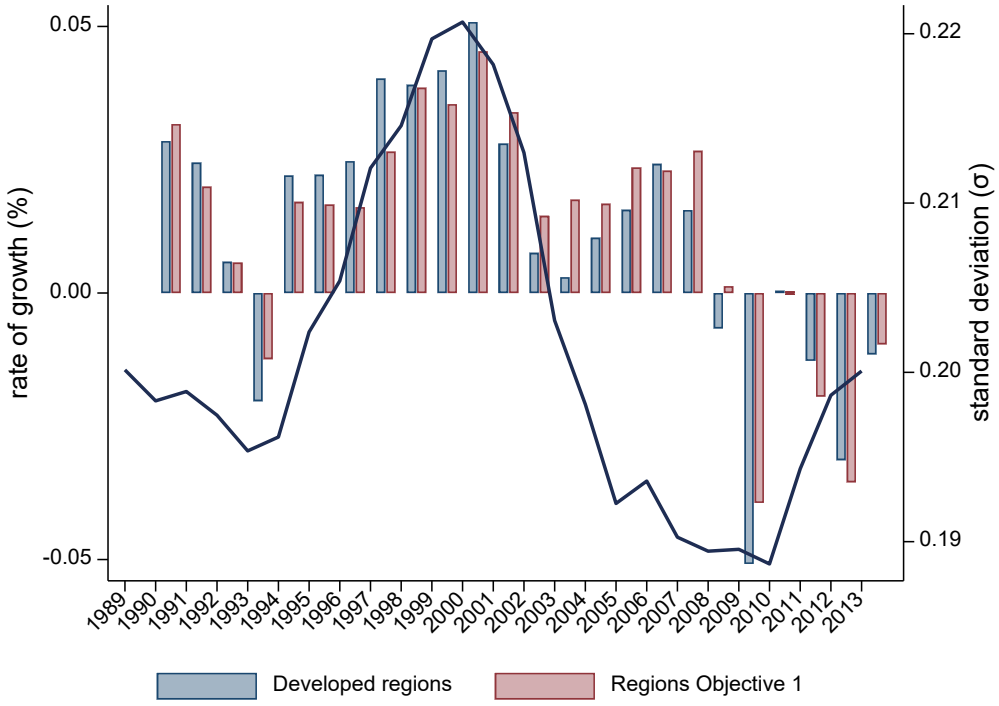
The aid has not arrived regularly. In 2004, due to the integration into the EU of the eastern and central European countries, the average per capita gross domestic product (GDP pc) of the EU decreased significantly. The statistical decrease in the average GDPpc exogenously reduces the options to collect structural funds by specific regions.

Specific Objective 1 regions lose their "less developed" status, becoming "phasing-out regions" due to the statistical effect of the downshift of the EU's average income. The intensity of aid shrinks.

The line in Illustration 2 is σ, the dispersion of the logarithm of GDP per capita. Illustartion 2 shows how since 2000, it started to go down and, from 2008, it starts to rebound. Bar graphs further reinforce the later. The more significant is the blue bar difference with the red one; the wealthiest regions grow more, so the dispersion increases.

In a more informative way, using the concept of convergence σ, in Illustration 2 Sigma convergence of the ln GDP pc by region, we observe something similar. Until 2007, the standard deviation of the logarithm of the per capita GDP between the regions was reduced, and since then, it has increased to approximately reach the 2001 levels.

Illustration 2 Sigma convergence and the rate of growth of the ln GDP pc: Objective 1 regions versus developed



Source: Own elaboration

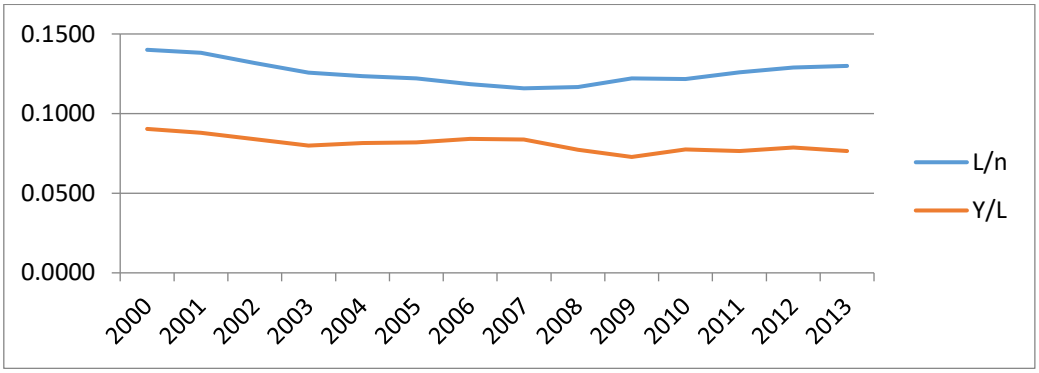
Note: In the right scale, the line is the dispersion of the logarithm of GDP per capita or sigma. The figure shows how since 2000, sigma started to go down and, from 2008, it starts to rebound. Bar graphs further reinforce the later visualising the difference in the growth by type of region, left scale.

Disaggregating per capita GDP into two components, income per worker Y/L and percentage of the working population (L/n) we observe that although the standard deviation of income per worker has remained constant throughout the period, the standard deviation of the working population increased since 2007 (Illustration 3).

$$Y/n = Y/L * L/n \qquad \text{(Equation 3)}$$

The latter suggests that the main engine of divergence for the second sub-period has been the increase in the differences in the working population between regions (Illustration 3). Employment and depopulation hold related in the rural areas, so divergence in income per capita regarding the urban areas may decrease the working population in rural regions—the later drives to study the evolution of the conditional convergence between regions in the next paragraph.

Illustration 3 Sigma convergence of the GDP pc desegregated by the working population by inhabitant (L/n) versus income per worker (Y/L)



Source: Own elaboration.

Regional absolute versus conditional β-Convergence

A second step in understanding the problem is the analysis of the β convergence. For this purpose, in Table 1, using cross-section data, the following regressions are estimated: Equation (4) tries to estimate absolute β convergence,

$$g_{it} = \alpha + \beta * \ln(y_{i,t-1}) + u_{it} \qquad \text{(Equation 4)}$$

Where g_{it} represents the average per capita GDP growth rate in the period studied, $y_{i,t-1}$ per capita GDP at the beginning of the period.

Equation (5) assumes that each region has its own stationary state,

$$g_{it} = \alpha + \beta * \ln(y_{i,t-1}) + \sigma * k_h + u_{it} \qquad \text{(Equation 5)}$$

Including human capital k_h, it is about capturing significant and exclusive characteristics of each region to find the conditional **β** convergence. A second reason to introduce the human capital is that it may be affected by the rural brain drain of advanced metropolitan regions. Table 1 shows the absolute (Equation 4) versus the conditional (Equation 5) convergence results.

While equation (4) seeks to estimate absolute **β** convergence, equation (5) assumes that each region has its stationary state. Our results confirm the hypothesis that regional convergence stopped after the financial crisis and, during the fiscal austerity period, has reverted to divergence (see Table 1).

We observe, in the period from 2000 to 2007, a conditional convergence process of up to 6.44%.

Table 1 Beta convergence and beta conditional convergence

	β convergence (absolute)			β convergence (conditional)		
	2000-2013	**2000-2007**	**2008-2013**	**2000-2013**	**2000-2007**	**2008-2013**
ln($y_{i,t-1}$)	-1.37	-2.56	0.902	-4.11	-6.44	2.08
	(0.79)	(-0.89)	(1.31)	(-3.91)	(-5.38)	(1.13)
kh				1.2	1.76	-0.41
				(3.09)	(3.83)	(0.7)
R^2	0.2	0.35	0.1	0.52	0.68	0.13

Source: Own elaboration

From 2008 to 2013, the β coefficient turns to be positive, indicating divergence; moreover, β ceased to be significant. Therefore, the conclusion is that the 2008 financial crisis hurt Spanish regional convergence (Table 1).

Empirical Results: β-convergence

In this section, we attempt to answer the following question: Do European Structural and Investment Funds have a significant impact on Spanish regional convergence in terms of per capita income?

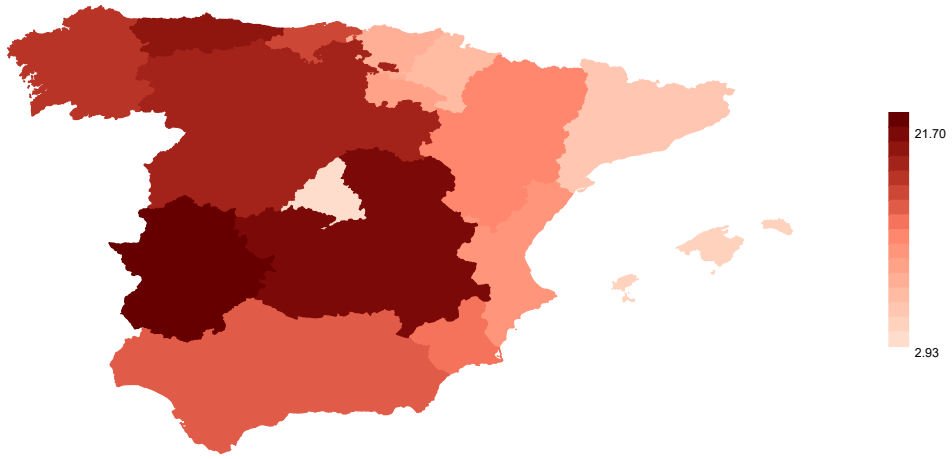
We start by examining the overall impact of ESIF funds on economic growth across Spanish regions. The convergence hypothesis means that less developed regions grow faster than the developed regions. The named 'Objective 1' regions were changed into 'Convergence regions' for the 2007-2013 period and again into 'Less developed regions' for 2014-2020; moreover, the rule of eligibility holds, defined as "Regions whose development is lagging behind" meaning that the GDP per capita remains to bellow the seventy-five per cent of the average EU (European Commission, 2008).

The results of this analysis are in Table 2a. In column (1), we present the model in its simplest form, with no further control variables. In this initial specification, we already find clear evidence of β-convergence and a positive relationship between ESIF investments and regional growth. The estimated coefficient is significant at 10% and shows a rather sizeable effect. Thus, an increase of 50% in the per capita funds received by regions (e.g., from our sample average of 35.48 to 53.22 euros per capita) would be associated, *ceteris paribus*, to a growth rate higher by 1.59%.

In the next column (2) model, we introduce the following controls:

a) The ESIF long-term elasticity, to control for the duration of the effects of the investment.
b) The per capita investments, to control by the size of the investments
c) The Employment rate, to control for the working opportunities of the region.
d) The Human Capital, to control for the brain drain in less developed regions.
e) The rural employment, to control for the villages and agricultural activities.

Map 1. Funds per capita that each region has received by average period (euros).



Note: Extremadura, which is the main European funds perceptor, during the four periods, received **86.8 euros per capita in all the four periods** (or an average of 21.70 euros per year). The minimum a region assignment is 2.93 euros per year equivalent to **11.72 € per capita** in twenty years (1989-2013).
Source: Own elaboration.

Table 2a ESIF impact in regional convergence models

Dep. Var: GDP pc growth	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
GDP pc (t-1)	**-0.090****	**-0.372*****	**-0.371*****	**-0.372*****	**-0.377*****	**-0.160*****	**-0.234*****	**-0.175****	**-0.177****
	(0.039)	(0.045)	(0.043)	(0.048)	(0.043)	(0.025)	(0.028)	(0.031)	(0.032)
ESIF pc	**0.009***	**0.003****		**0.003***	**0.004*****	**0.011*****		**0.009****	**0.011*****
	(0.005)	(0.001)		(0.001)	(0.001)	(0.001)		(0.002)	(0.000)
Objective 1			**0.008*****		**0.009*****		0.009		**0.005*****
			(0.003)		(0.003)		(0.005)		(0.001)
ESIF pc squared				0.000				-0.001	
				(0.001)				(0.001)	
(Objective 1) x (ESIF pc)					**-0.004*****				-0.003
					(0.001)				(0.002)
ESIF long-term elast. (size)		**0.008****		**0.008***	**0.009*****	**0.070*****		**0.052*****	**0.063*****
		(0.003)		(0.046)	(0.004)	(0.015)		(0.019)	(0.013)
Investment pc		**0.045*****	**0.046*****	**0.045*****	**0.045*****	**0.013****	0.017	**0.015****	**0.012***
		(0.010)	(0.010)	(0.010)	(0.010)	(0.004)	(0.013)	(0.003)	(0.005)
Employment rate		**0.235*****	**0.231*****	**0.235*****	**0.232*****	**0.092*****	**0.080*****	**0.093*****	**0.088*****
		(0.033)	(0.031)	(0.036)	(0.031)	(0.007)	(0.007)	(0.006)	(0.007)
Human Capital		**0.348*****	**0.363*****	**0.348*****	**0.364*****	0.113	**0.314****	0.134	0.154
		(0.066)	(0.062)	(0.067)	(0.065)	(0.051)	(0.074)	(0.059)	(0.068)
Rural employment		**-0.164****	**-0.157****	**-0.164****	**-0.175****	-0.027	0.052	-0.033	-0.034
		(0.072)	(0.073)	(0.077)	(0.083)	(0.041)	(0.049)	(0.038)	(0.028)
No. Of observations	408	408	408	408	408	68	68	68	68
R-squared	0.186	0.626	0.627	0.626	0.633	0.916	0.845	0.919	0.921
No. of regions	17	17	17	17	17	17	17	17	17

Note 1: See Appendix I Table I.1 Names of the ESIF according to the multiannual program.
Source: Own elaboration

The effect rises somewhat its statistical significance when including the controls in the model of column (2), but it decreases in the ESIF impact size comparing with column (1).

In column (3) model, we find a positive and statistically significant effect examining the effect of an assignment into Objective 1 region (Convergence status) making it eligible to ESIF supported projects. Our results show that regions obtaining Objective 1, on average, funds annually grew by 0.8 percentage points faster than other regions during the 1989-2013 period. This result, along with the β-convergence coefficient obtained, is in line with the work of Cataldo and Monastiriotis (2020) for the UK regions over the period 1994-2013, a fact that suggests similar convergence rates within countries. Furthermore, the inclusion of this Objective 1 dummy barely changes the obtained β-convergence coefficient in column (3). Thus, the estimated effect of EU funds expenditure cannot be seen as capturing an inverse income-selection effect, whereby lower-income regions become assigned to Objective 1 status and at the same time grow faster due to neoclassical convergence.

In column (4) we test for a non-linear effect of EU funds on economic growth since some studies (e.g. Becker et al., 2012) found evidence of decreasing returns of the Cohesion Policy expenditures in European regions. Although in our estimation, the quadratic term of EU funds[8] is not statistically significant, the negative and significant coefficient of the interaction term between the Objective 1 dummy and ESIF expenditure [-.004 in column (5)] may drive to suspect that, among the main recipients, those receiving more funds, display the slowest growth rates.

It could be argued that EU funds lose their effectiveness after a certain time. Fortunately, and due to the dynamic specification of the model, we can derive from the regressions the long-term elasticity (θ) of ESIF.

The long-term elasticity θ is derived as follows:

$$\begin{aligned}\ln(y_{i,t}) &= \beta_1 \ln(y_{i,t-1}) + \beta_2 \ln(ESIF_{i,t}) \leftrightarrow \ln(y_{i,t}) - \ln(y_{i,t-1}) \\ &= (\beta_1 - 1) \ln(y_{i,t-1}) + \beta_2 \ln(ESIF_{i,t}) \leftrightarrow \ln(y_{i,t}) - \ln(y_{i,t-1}) \\ &= \alpha \ln(y_{i,t-1}) + \beta_2 \ln(ESIF_{i,t}) \leftrightarrow \ \theta = \beta_2/-\alpha\end{aligned}$$

The coefficient obtained is large, positive, significant and rather stable across regressions (columns (2), (4), (5)). Additionally, its size is similar to the one obtained by San Juan Mesonada and Sunyer Manteiga (2020) with data for all the EU12 regions over the same period.

With the models in columns (6) to (9), we examine whether the results obtained from the annual data replicate themselves across programming periods. To do so, we aggregate our annual data to the level of the four periods and re-estimate the previous models, except for column (1). As can be seen, the new regressions produce on the whole qualitatively similar results, providing additional confidence on the growth effects estimated from the annual data

[8] This term is a measure of *concentration of effort* (the sum of the squares of these shares based on a Herfindahl index), which (Di Capalbo and Monastiriotis, 2008) had use in his empirical analysis.

and suggesting that these effects are not driven merely by year-on-year variations, which are more likely to suffer from endogeneity problems.

Table 2b. Panel data state-specific effects tests

Wald test	
$\chi 2$ -statistic	129.10
p value	0.000
Cross-section random effects	
BPLM $\chi 2$ -statistic	7.00
p value	0.004
Hausman test	
$\chi 2$ -statistic	170.31
p value	0.00
Pesaran's test	
$\chi 2$ -statistic	6.251
p value	0.00
Wooldridge test	
F-statistic	39.675

Source: Own elaboration

In Table 2b as for the data, we use in this analysis is not random, being subject to common shocks, we perform a modified Wald test for GroupWise heteroskedasticity. The results ($\chi^2(17)$=129.10, p-value ≈0.000) lead us to strongly reject the null hypothesis, and thus robust standard errors are needed. We also reject the null hypothesis with the Breusch and Pagan Lagrangian multiplier test for random effects and the Hausman test, so the model should control for unobserved heterogeneity. Finally, further evidence of cross-sectional dependence (Pesaran's test) and first-order autocorrelation (Wooldridge and Baltagi–Wu tests), lead us to adjust the standard errors and employ a consistent covariance matrix like the one proposed by Driscoll and Kraay (1998). shows the results of these tests.

Spillover and public debt effects

Next, we extend the model to observe if there are spillover effects of individual funds, in particular of the European Regional Development Fund (ERDF), from the receiving region to other border regions. In fact, in Table 3 *Estimation of the spillover model and public debt*, when interacting this variable with the ERDF variable, the result is a positive and significant coefficient, which implies that a percentage of the aid to the regions Objective 1 ends up having positive effects in other regions.

We also study whether the level of indebtedness in the region, measured as the percentage of public debt to GDP, has some impact on the ability to attract investments through projects co-financed by ESIFs in the region.

$$\frac{\partial l\ Growth}{\partial l\ ERDF} = \beta_2 + \beta_{11} * Debt \quad \text{Equation 4}$$

The coefficient turns out to be negative and significant, so we conclude that the impact of ESIFs on regional growth is no longer linear and will depend negatively on the degree of public debt held by the Regions (See Table 3 *Estimation of the model with spillover and public debt*).

Table 3 Estimation of the spillover model and public debt

Dependent Variable: ln (rate GDP pc)				
Independent Variables	Coefficient	t	Coefficient	t
GDP pc	-.473	-8.99	-.407	-7.50
FEDER[1]	.005	1.42	.007	2.65
Kh	.029	3.89	.029	3.17
Ip	.042	2.98	.049	3.47
Employ	.150	3.42	.079	1.65
n + g + δ	-.023	-1.37	-.021	-1.20
Agr	.0005	0.07	.009	1.02
Spillover	.095	1.35		
spillover*FEDER	.041	2.97		
Debt			.244	1.97
Debt *Funds			-.061	-2.39
Constant	5.97	9.60	5.07	8.20
R2 within	0.54		0.52	
F	22.94		20.73	
nº observations	237		237	
nº groups	17		17	
Average observations	13.9		13.9	

Note 1: See Appendix I Table I.1 Names of the ESIF according to the multiannual program.

Source: Own elaboration

This result is robust and matches those of previous studies (Georgescu, 2008; Varga, 2010; Varga, J. and J. In't Veld, 2011; Esposti and Bussoleti, 2008). Also, its importance increases due to the crisis, since cuts in public spending have created difficulties when absorbing ESIFs, causing a significant number of them not to be executed in the foreseen date and, therefore, limiting their ability to boost the regional economy (Marzinotto, 2011 also reach similar result).

To control for the impact of the financial crisis on growth we explicitly include an artificial variable *crisis* in the model, taking values of one for dates after 2007 and null for previous years (See Table 4).

Table 4 Estimation of the model with the artificial variable crisis included.

Independent variable: ln(rate GDP pc)				
	Coefficient	**T**	**Coefficient**	**t**
GDP pc	-.175	-3.82	-.167	-3.76
ERDF[1]	.002	0.50	.002	0.97
ERDF[1]	-.0003	-0.17	-.002	-1.13
crisis* ERDF			-.004	-2.09
crisis*program			-.003	-0.83
Program	.005	1.44	.005	1.34
k_h	.021	3.50	.021	3.61
i_p	-.001	-0.09	.005	0.49
Employment	.028	0.82	.022	0.66
$n + g + \delta$	-.038	-2.88	-.038	-2.85
Agr	-.010	-1.61	-.007	-1.15
Crisis	-.048	-11.44	-.028	-2.56
constant	1.845	3.27	5.475	3.27
R^2 within	0.72		0.72	
F	41.39		45.70	
nº observations	237		237	
nº groups	17		17	
average observations	13.9		13.9	

Note 1: See Appendix I Table I.1 Names of the ESIF according to the multiannual program.

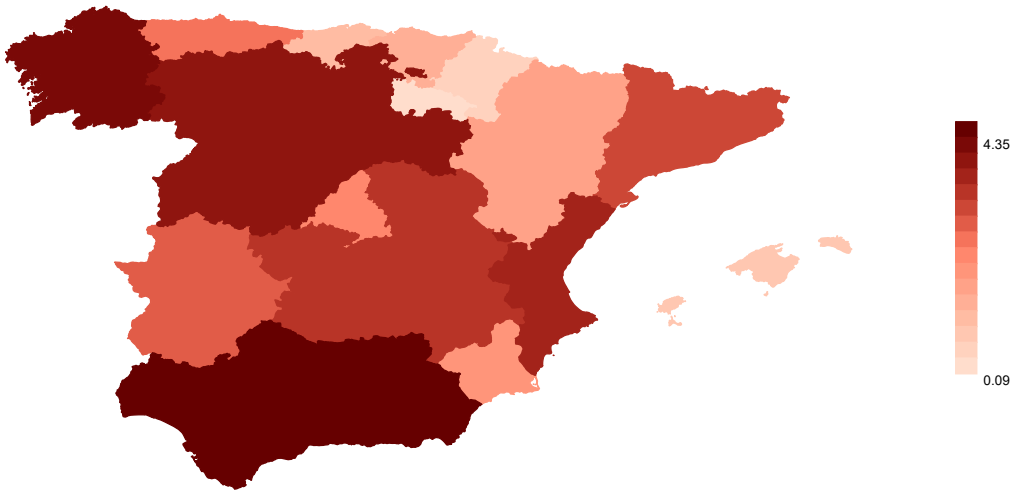
Source: Own elaboration

Effectively the estimated model goes from an R^2 of 0.54 to 0.72 increasing, in turn, the F (41.39). From this result, we infer that in the previous model, we were ignoring something fundamental like the change in the economic cycle and that now, with its inclusion, we can make more consistent estimates.

Is relevant the decrease in the rate of β-convergence, passing from a coefficient of -0.41 to another of -0.17. Besides, regarding our variables of interest, all have ceased to be significant, which would imply a total absence of impact on economic growth by European funds during the recession.

Next, we try to see if there is any change in the interaction of the crisis variable with the funds. We find in the case of programmed funds do not have effects, because they are not significant. On the other hand, the coefficient relative to the ERDF becomes slightly negative (-0.04) and significant (columns 4 and 5 in Table 4).

Map 2. The proportion of the ESIF funds that have each region received in absolute figures (1989-2013). The average region equal to 1.



Note: In Figure 2, the average of total funds received by region is 1. Andalusia, which is the one that has received the most, has received 4.36 times the average for Spain as structural funds. Figure 2 shows the greatest beneficiaries. In absolute numbers, Galicia and Andalusia (because of the beneficiary population). Moreover, in per capita terms, Castile-La-Mancha, Asturias and Extremadura are the main perceivers, see Figure 1.

Source: Own elaboration.

The later meaning a post-crisis found null contribution to growth. It seems plausible to think that since the projects are co-financed, by the principle of additionality, through European and national or regional funds, the amount of investments slowdown. The reduction of public spending, to which the Commission forced Spain to reduce the public deficit, has a relevant factor in hindering the execution of funds budgeted. The latter is coherent with the conclusion that:

"Finally, lower per capita revenues or higher per capita primary expenditures also favor the breach of regional fiscal rules. The revenue effect is greater than the expenditure one (…)." Leal y López Laborda (2015) p. 35

The delay in executing the ESIFs amounts up to 8,153 million. Meaning the delay of the 31.7 per cent of the planned expenditure of the ERDF during the post-financial crisis. Approximately 10% more than in the previous budgetary period 2000-2006 (See Table 5). In conclusion, both variables, *crisis*, and *public debt* seem significant to explain the regional convergence stagnation.

Table 5 Percentage of the ERDF budget not executed in the program period
Comparison between the periods 2000-06 and 2007-13

Percentage of the ERDF budget not executed in the program period			Difference %	Deficit in % GDP	Deficit in % GDP
Region	**2000-2006**	**2007-2013**		**2006**	**2011**
Andalusia*	30,54	45,39	-14,86	0.06	-3.46
Aragón	21,26	38,32	-17,06	0.00	-2.64
Asturias***	31,43	7,93	-23,50	0.00	-3.62
Baleares	28,47	48,71	-20,24	-0.03	-4.19
Canary Islands**	29,77	37,83	-8,06	0.00	-.1.50
Cantabria*	4,98	46,02	-41,04	-0.01	-3.56
Castile-La Mancha*	15,08	20,20	-5,13	-0.02	-7.87
Castile-León**	19,39	18,95	0,44	0.01	-2.59
Catalonia	20,14	27,66	-7,53	-0.01	-4.02
Extremadura*	24,02	30,95	-6,93	-0.05	-4.73
Galicia	20,39	41,70	-21,31	0.01	-1.63
Madrid	29,97	51,06	-21,10	0.01	-1.96
Murcia***	29,27	25,08	4,19	0.02	-4.46
Navarre	15,66	36,24	-20,58	0.04	-1.99
Basque Country	12,00	36,20	-24,19	0.07	-2.56
Rioja	13,58	-0,03	13,61	0.01	-1.45
Valencia*	25,30	26,95	-1,66	-0.01	-5.0
Average	**21,84**	**31,72**	**-9,88**		

Own elaboration with data from FEGA, 2017 and Leal & López Laborda (2015) Table 1.

NOTE: The meaning of the asterisks is:
* Regions Objective 1.
** Regions Phasing-In: "Those regions that would have ceased to belong to Objective 1 by natural effect, that is, by exceeding 75% of the EU-25 average." Mining that due to EU enlargement, the average per capita income decreases in the EU.
*** Regions Phasing-Out: "Those regions that would have been below 75% of the EU average to EU-15 and that have exceeded this percentage because the average has decreased after the entry of the 12 new countries."

In Table 6 we can see the percentage of per capita GDP that each community represents concerning the national average. The percentage changes (highlighted in red) belong to the regions that have converged in the period indicated by the head of the column. Moreover, some of the regions converge to the average from over the average per capita income, an undesirable convergence. Since the other converge from lower levels of per capita GDP, a desirable path. Although in the sub-period before the crisis, 12 of the 17 regions converged, only five regions did so in the next sub-period. Therefore, the overall balance for the period 2000-2013 is that just nine of the 17 regions managed to converge towards the national average.

However, of these nine regions, three (Balearic Islands, Catalonia, and Rioja) approached the national average from above, that is, their growth was lower than the national average in GDP per capita in 2000-2013.

In addition to the six regions that in the whole period show a tendency to reach the national average of per capita GDP from below three of them (Andalusia, Asturias and Castile-La

Mancha) lost ground after the crisis of 2008 (See Table 6. *Regional distribution of per capita GDP and growth 2000-13*).

Table 6 Regional distribution per capita of the European Regional Development Fund, ERDF (2000-06 & 2007-13) and growth 2000-13

	ERDF	
REGION	**Euros per capita**	**Index (Spain =100)**
Andalusia*	221,58	148,10
Aragón	62,06	41,48
Asturias***	272,76	182,31
Baleares	29,84	19,95
Canary Islands**	200,08	133,73
Cantabria*	87,00	58,15
Castile-León**	240,85	160,98
Castile-La Mancha*	248,33	165,98
Catalonia	44,83	29,96
Valencia**	114,83	76,75
Extremadura*	417,58	279,11
Galicia*	228,87	152,98
Madrid	20,24	13,53
Murcia***	178,72	119,46
Navarre	43,13	28,83
Basque Country	76,47	51,11
Rioja	56,24	37,59

Own elaboration with data from FEGA, 2017

NOTE: The meaning of the asterisks is:
* Regions Objective 1.
** Regions Phasing-In: "*Those regions that would have ceased to belong to Objective 1 by natural effect, that is, by exceeding 75% of the EU-25 average.*" Mining that due to EU enlargement, the average per capita income decreases in the EU.
*** Regions Phasing-Out: "Those regions that would have been below 75% of the EU average to EU-15 and that have exceeded this percentage because the average has decreased after the entry of the 12 new countries."

Conclusions

The economic recession after the 2008 financial crisis halted the income convergence between regions. That meant the end of the real income convergence process operating during the pre-recession period. The effects of the European Structural and Investment Funds may appear empirically different from the former concerning the actual program. Possibly budgetary austerity may have had a specific role in those results.

We have estimated the impact of the structural funds on the convergence in per capita GDP between autonomous communities, and we have attempted to quantify the effect of the variables that can significantly influence the current rhythm of regional convergence in Spain.

The empirical results show that the convergence process in the study period, 2000-2013, is divided symmetrically into two sub-periods: 2000-07 and 2008-13. While in the first, interregional differences decrease, in the second, during the downturn, they increase.
In the period 2000-13, without taking into account the crisis, the models using the data of both the European Regional Development Fund (ERDF) executed and that of the set of budgeted structural funds (not implemented investment) seems to detect a weak impact of these projects on growth.

When we control for the recession, the estimates change substantially. The rate of convergence and the impact of the ERDF on growth turn out to decreases, and the impact of the budgeted funds as a whole is not significant. Besides, we verify the importance of other factors generally ignored in the literature, such as regional public debt and spillovers. The level of indebtedness in the region has a definite adverse effect on the effectiveness of European projects. Additionally, we identified an apparent spillover effect from the funds towards other border regions on those that are formally receiving.

Therefore, the analysis may drive to the wrong conclusion that structural funds function works more as a redistributive policy than as a structural policy because results using a limited number of regions present a lack of significance in the long run (Boldrin and Canova, 2001). Nevertheless, including data for all the regions of the EU12, we find that the Cohesion Policy does foster regional growth (San Juan Mesonada and Sunyer Manteiga, 2020), even when controlling for endogeneity and spatial spillovers.

Both in the short and the long run, the rate of growth correlate with the ESIF investments. This effectiveness result hindered during the financial crisis, especially in the least developed regions, and partly due to lower absorptive rates. Furthermore, human capital and quality of government prove to be crucial growth determinants necessary for improving the performance of the Structural Funds (San Juan Mesonada and Sunyer Manteiga, 2020).
On the other hand, changes in economic cycles seem to have a significant impact on the ability of funds to contribute to the growth of the regional economy. Therefore, it is essential to be able to adapt the funds according to the phase of the business cycle, especially during downturns, to ensure their effectiveness. The anti-crisis fund budgeted in the draft budget perspectives for the Multi-annual EU budget 2021-27 and the exceptional measures taken for the Commission to recover from COVID19 recession could fulfil this function as long as it reaches a sufficient volume to have significant effects.

Given that the Eurozone suffered a liquidity trap that lasted three years after the financial crisis, an expansion of central government spending in the euro area equal to 1% of the Eurozone's GDP could increase GDP in the periphery by more than 1% (Blanchard et al., 2017).

Notably, in Spain, the financial crisis has asymmetrically hit the Autonomous Regions, hindering convergence. Thus, the regions with the most significant public debt problems, which are usually Objective 1, are the ones that have had the most difficulties in adjusting to the budgetary austerity program. Also, reductions in public spending have had a doubly adverse effect.

It is money budgeted but not invested since the project not applied due to the lack of available regional budget to co-finance it. The latter also implies that part of the ESIF funds remains not allocated at the critical moment of the great recession.

As a consequence, the potential effectiveness of ESIFs to boost real convergence results severely weakened. Moreover, a number of the peripheral region's problems are structural, and this should be the objective of the ESIF: solving the structural issues (Bonatti and Fracasso, 2017 pp. 35-36).

However, during the recession, the backward regions have also suffered the consequences of European austerity policies, so they could even recover lost ground in real convergence if there were a fiscal expansion in the future. An EU anti-crisis fund will be a handy countercyclical policy tool as far as it can have the proper size and can be timely applied. As it is well known, automatic countercyclical instruments use to be more efficient than those that require political agreements to start. Size matter because it should be sufficient to discourage speculative movements against areas in crisis as well as overreaction responses of the economic agents.

The latter is consistent with the position of Blanchard et al. (2013, 2017), who maintain that the multiplier of public spending grows during recessions, and who also underscore how the liquidity trap in the periphery of the Eurozone could improve the effectiveness of an external fiscal stimulus. After the COVID19 outbreak, we find increased support to act fast and whatever it takes (Baldwin and Weder di Mauro, 2020) which includes proposals like "*the time for helicopter money is now*" (Gali, 2020) or "*Keeping the Lights On: Economic Medicine for a Medical Shock"* (Baldwin 2020).

The ECB undertakes monetary policy exceptional measures to avoid deflation in the Eurozone and on March 2020 the Governing Council decided on a comprehensive package of expansive monetary policy measures adding a temporary envelope of additional net asset purchases of €120 billion. In June 2020, the envelope for the pandemic emergency purchase program (PEPP) was increased by €600 billion to a total of €1,350 billion (ECB Governing Council, 4 June 2020 https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.mp200604~a307d3429c.en.html).

The Commission also promised *to ensure that incomes and jobs are not affected disproportionately by the pandemic* (Commission, 2020 COM 112), and in the draft, Multiannual Financial Perspectives enlarged the expenditure in an unprecedented expansion. Moreover, the size and timing of the real execution of the projects in the less developed regions risk being too late and too small[9]. The present situation requires a drastic simplification of the red tape in the management of the projects and the generalization of the

[9] Presently only 13.83 % of the planned projects being implemented in Spain and only 21.68 % of the planned projects being decided, partially do to the COVID19 administrative and economic paralisation of the activity. Mining that 63244 M€ are at risk of been delayed investments. The current level of executions of he Funds is reported by the Commission at: https://cohesiondata.ec.europa.eu/countries/ES visited the 09/06/2020.

EU 2015/1839 regulations to the less developed regions allowing the EU financial support of the 100 per cent of the investment in the ESIF projects to avoid liquidity traps.

The present possibly later reaction of the EU to prevent the economic effects of the Covid-19 epidemic sanitary controls must not forget the lessons of 2008 financial crisis and the damaging consequences that generated in the EU, clearly worse than in the US[10]. The main difference has been that the fiscal and monetary policy in the US was earlier and of a bigger size[11]. The number of years with negative output make the difference: faster recovery in the US than in the EU. It was resulting in regional divergence more extended in the EU. Did we want to repeat the same mistakes?

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[10] In May 2020 the US unemployment fell to 13.3 per cent and added 2.5 million jobs. Conversely in the EU unemployment rate was 6.6 % in April 2020, up from 6.4 % in March 2020, moreover it reaches 14.5 per cent in Spain.

[11] The policies to sustain employment and demand amount around 0.3 per cent of the GDP in the EU since in the US reach 2.3 percent of the GDP (with data until March, 2020). In Spain is expected to expend 1.6 per cent of the GDP in anti-Coronavirus crisis measures, moreover the fall in the T-III 202o GDP is 9.7 per cent over the T-IV 2019.

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Appendix I Tables

Table I.1 Names of the ESIF according to the multiannual program

	ERDF	**ESF**	**EAFRD**	**EFFFM**
1989-1993	European Regional Development Fund, **ERDF**	European Social Fund (**ESF**)	European Agricultural Guidance and Guarantee Fund (EAGGF)	Included in EAGGF
1994-1999	**ERDF**	**ESF**	**EAGGF**	Financial Instrument for Fisheries Guidance (**FIFG**)
2000-2006	**ERDF**	**ESF**	**EAGGF**	Financial Instrument for Fisheries Guidance (**FIFG**)
2007-2013	**ERDF**	**ESF**	European Agricultural Fund for Rural Development (**EAFRD**)	European Fisheries Fund
2014-2020	**ERDF**	**ESF**	**EAFRD**	European Fund for Fisheries Fishing and Maritime

Note 1: The European Agricultural Guidance and Guarantee Fund (EAGGF) have been replaced by the European Agricultural Fund for Rural Development (EAFRD) and the Financial Instrument for Fisheries Guidance (FIFG) and the European Fisheries Fund are now the European Fund for Fisheries Fishing and Maritime.
Note 2: The name 'Objective 1' regions (for 1994-2006) change the label into 'Convergence regions' for the 2007-2013 period and again into 'Less developed regions' for 2014-2020, moreover the rule of eligibility holds.

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.