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The Impact of Structural Funds Policy on European Regions´ Growth. A Theoretical and Empirical Approach

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Abstract

In this paper, I try to estimate the impact of Structural Funds on the growth rates of Objective 1 European regions during the two first programming periods (1989-2000). I develop a "hybrid" model of economic growth that partially endogenizes the rate of technical progress and I test its main implications following a panel data approach. The results suggest that Structural Funds have positively influenced the growth process of Objective 1 regions, although their impact has been stronger during the first programming period than the second. The same quantitative difference between the two programming periods appears in the estimated rates of β-convergence and the catching-up effect.

JEL Classification: C23, E62, H50, O47

Keywords: Growth, Convergence, Catch-up, Structural Funds

1. Introduction

The main purpose of European Cohesion policy is to decrease regional disparities within the European Union. In accordance with the treaty, the Union works to "promote harmonious Development" and aims particularly to "narrow the gap between the development levels of the various Regions". This principle implies that Objective 1 is the main priority. These regions have a GDP per capita below 75% of the Community average and share some identical economic indicators: low level of investment, a higher than average unemployment rate, lack of services for businesses and individuals and poor basic infrastructure, among others.

Thus far, Structural policies seem to have been designed on the basis of three main assumptions: (i) gaps exist between EU regions, (ii) structural policies are able to reduce those gaps, and (iii) regional growth and convergence leads to cohesion. It is therefore crucial to evaluate the impact of Structural Funds in order to help the European Commission in the pursuit and planning of future policy to maximize its impact on economic development. In this paper, I propose a theoretical model of economic growth as a framework to evaluate empirically the impact of the Structural Funds programmes on the Objective 1 European regions growth process.

To check the Cohesion Policy effects, I test the equation derived from the model that relates the rate of growth of income per capita with the initial level of income per capita, the Structural Funds, the catching-up variable and the initial level of TFP. The sample is composed of forty-one Objective 1 European regions (NUTS 2) during the two first programming periods of Structural Funds, which ran from

[1] An earlier version of the paper was presented at Latin American Meeting of the Econometric Society (Chile, 2004) and XXIX Simposio de Análisis Económico (Spain, 2004). The author would like to thank Ramón María-Dolores and two anonymous referees for helpful comments. Contact: Dpto. de Fundamentos del Análisis Económico, Facultad de Economía y Empresa, Campus de Espinardo 30100, Murcia (Spain). E-mail: mcpuig@um.es. Tel: 34 968363734. Fax: 34 968363758.

1989 to 2000. The estimation is made by OLS using a panel data approach, where the use of fixed effects emerges endogenously from the structural specification of the model.

The results of the estimation show a positive effect of Structural Funds (SF, henceforth) on the Objective 1 regions´ rates of income growth over the period considered. However, the results are slightly different when we divide the sample into the two programming periods. In that case, we observe that during the first programming period, SF have had a clearer positive effect in the regions´ growth. The biggest difference between periods emerges when trying to measure the presence of the catching-up effect and the speed of convergence between regions. Both phenomena are very significant in the first period but almost null in the second.

The rest of the paper is organized as follows. Section 2 briefly presents the European Structural Funds Policy and the theoretical approaches to evaluate the impact of SF. Section 3 develops a "hybrid" growth model that partially endogenizes the rate of technical progress. Section 4 introduces some descriptive information and describes the data. Section 5 offers the main empirical results and finally, Section 6 is devoted to conclusions.

2. Institutional setting and academic views

The European Union's SF are intended to help increase economic and social cohesion between Member States. The Funds' contributions have grown from 8 billion euros per year in 1989 to 32 billion euros per year in 1999 and more than 2/3 of the budget of the SF is allocated to helping areas which are lagging behind in their development.

The SF do not constitute a single source of finance within the European Union budget. They have their own specific thematic area. The European Regional Development Fund (ERDF) finances infrastructures, job-creation investments, local development projects and aids for small firms. The European Social Fund (ESF) aims to prevent and combat unemployment as well as to develop human resources and promote integration in the labour market. The European Agricultural Guidance and Guarantee Fund (EAGGF) supports rural development and improvement of agricultural structures. However, all of them work together to help economic activities in the regions take off by providing them with the basic infrastructure they lack, and by adapting and raising the level of human resources and encouraging investments in businesses.

For the period 2000-2006 the EU has placed a total of 195 billion euros at the disposal of SF. This figure accounts for approximately one third of the total EU budget. Some fifty Objective 1 regions, home to 27% of the European population, have received 137.80 billion euros, more than two thirds of the appropriations of the SF.

In the Second Progress Report on Economic and Social Cohesion (2003), the European Commission shows the calculations made in a previous work based on an input-output model to compute the expected economic impact of Objective 1 assistance for the period 2000-06.[2] The estimations are that the total GDP in Portugal over the period will be 3,5% higher than it would have been without

[2] The results of this work can be seen in:
http://europa.eu.int/comm/regional_policy/sources/docgener/studies/pdf/objective1/final_report.pdf

Community Support; for Greece the figure is 2,2% while in the *Mezzogiorno* it is 1,7%, in eastern Germany 1,6%, in Spain 1,1% and in Ireland is marginal. In all six areas combined, the overall impact of Objective 1 expenditure upon regional GDP averages 133%.

Later, the Third Report on Economic and Social Cohesion (February 2004) manifests that Structural interventions have boosted growth in the Cohesion countries. In Spain, GDP in 1999 is estimated to have been some 1,5% higher than it would have been without intervention, in Greece, over 2% higher, in Ireland, almost 3% higher, in Portugal over 4,5% higher and in the new German *Länder* around 4%. Structural intervention has also encouraged a growth of trade between Cohesion countries and other parts of the Union. However, the extent of convergence has varied markedly between regions, in large part reflecting their relative importance in the Member States in which they are situated. In those in the four Cohesion countries, which benefited from both substantial assistance and growth-oriented policies at national level, growth of GDP per head was much higher than in the rest of the EU. Outside the Cohesion countries, growth in Objective 1 regions has been less impressive, dragged down in part by slow national growth.

Overall, disparities have been falling across the EU since 1995. This fall has been more rapid between countries than between regions, with internal regional disparities in several Member States increasing. While growth has been generally higher in many of the least prosperous regions, it is noteworthy that the most prosperous regions have also performed well. Thus, the shares in total GDP accounted for by the least and the most prosperous regions both increased. In 2002, 10% of population living in the most prosperous regions had a GDP per head of 189% of the EU-25 average, while it was 36% in the 10% least prosperous ones.

As a result of the enlargement, disparity levels across the EU have dramatically increased. GDP levels also indicate widely differing regional situations within each objective, and there are also wide regional variations in growth rates. It is also to be noted that disparities in the EU between urban and rural areas generally increased as a result of enlargement.

The Cohesion Policy budget for the period 2007-2013 would amount to €308 billion, equivalent to 0.37% of the GNI of the EU27. The new Member States would receive 51.3% of total cohesion policy resources, which on average, represent around 3.5% of their GDP.

The new convergence objective (regions where GDP per head is less than 75% of the EU average, 2000-2002) applies to 100 regions, accounting for just over 35% of the EU 27 population. The new Regional Competitiveness and Employment objective (RCE) applies, in principle, to the rest of the Union (155 regions with 61% of the EU 27 population). The RCE regions collectively have relatively high GDP levels. However, growth remains weak in many regions and employment rates fall well short of the 70% target in most of them, which suggests that real needs persist throughout the EU.

Cohesion Policy has been recognized as a key instrument at the Community level, contributing to the implementation of the growth and jobs strategy. The Fourth Report on Economic and Social Cohesion (2007) shows preliminary estimates for the period 2000-2013 which suggest an increase in GDP compared to a baseline scenario without cohesion policy, of around 3,5% in Greece and 3,1% in Portugal and larger ones for the new Member States (2004-2013): 9,0% in the Czech

Republic and Latvia, 8,5% in Lithuania and Estonia, 6% in Bulgaria and Slovakia, and 5,5% in Poland. In addition, it is estimated that by 2015 around 2 million additional jobs will be generated due to these levels of investment.

The Commission has developed new instruments to assist Member States and the regions to improve the quality of projects. Specific initiatives have been developed to promote financial engineering for start-ups and micro-enterprises combining technical assistance and grants, with non grants instruments such as loans, equity, venture capital or guarantees: JEREMIE for the promotion of SMEs and microcredit and JESSICA for urban development. These actions will be undertaken through cooperation between the Commission and the European Investment Bank Group and other International Financial Institutions.

In September 2005, the Council adopted the new regulation on rural development with three main objectives: to improve the competitiveness of European agriculture and forestry by supporting restructuring, development and innovation; to improve the environment and the countryside by supporting land management; and to improve the quality of life in rural areas and encourage diversification of economic activity. The new rural development policy will be financed by a single fund, the European Agricultural Fund for Rural Development (EAFRD), and will no longer be part of Structural Funds, but both policies will work together to support the economic diversification of rural areas.

As part of the new governance cycle of the Growth and Jobs Strategy, the Annual Progress Report (APR) adopted in January 2006 several recommendations relevant to cohesion policy. First, it recommended that Member States ensure that Community cohesion and rural development spending is targeted toward supporting the Lisbon Strategy. Secondly, the APR highlighted the need for stronger efforts to develop coordination mechanisms between those responsible for the national reform programmes and those preparing the cohesion policy programmes. Thirdly, the APR stressed that Member States should take into account the macroeconomic impact of transfers from cohesion policy resources, and finally, recommended that the new generation of cohesion policy programmes reflect the priorities contained in the National Reform Programmes and the four priority actions: 1) investing more in knowledge and innovation; 2) unlocking the business potential, particularly of SMEs; 3) responding to globalization and ageing; 4) moving towards an efficient and integrated EU energy policy.

According to the programming documents available for the Fourth Report on Economic and Social Cohesion (May 2007), the proportion of resources that have been "earmarked" for the key investments linked to the renewed strategy for Growth and Jobs (R&D and innovation, renewable energies, energy efficiency, eco-innovations, human resources) in the EU-27 is on average, 61,2% under the Convergence Objective and 76,7% under RCE Objective. Overall, around €200 billion will be allocated to these investments (an increase of more than €50 billion with respect to the previous period).

2. 1 The growth approach: theoretical perspectives

The “growth” approach is particularly appropriate to study the impact of SF because the Funds Programs are designed to enhance the accumulation of production factors that affect the growth rate of the recipient economies. From a theoretical perspective, growth models provide different insights into the effects of public assistance and infrastructures. In the context of a neoclassical Solow growth model, regional funds would finance a greater level of physical capital, which would correspond to a higher steady state income. However, due to the decreasing marginal product of capital, the investment rate declines towards the steady state income, where the stock of capital per person is constant. Thus, a higher investment rate in poorer regions may increase the convergence speed to rich regions, but only transitionally since it does not raise the growth rate in the long run. See for example Boscá, Doménech and Taguas (1999) who obtained favourable results (they found that EU transfers have contributed decisively -mainly by increasing the public capital stock- to reducing differences in income per head in the Union). In contrast, endogenous growth theories grant public policies an important role in the determination of growth rates in the long run. For instance, Aschauer (1989) and Barro (1990) predict that if public expenditures are considered an input in the production function, then policies financing new public infrastructures should increase the marginal product of private capital, hence fostering capital accumulation and growth. An application of this approach to evaluate the impact of Structural Funds in some European Union countries is contemplated in Pereira (1999). However, there is enough evidence that an important fraction of observed productivity disparities across regions cannot be traced back to differences in factor stocks, but in total factor productivity (TFP) differentials. Henceforth, they play an important role in completing the account of growth and explain the evolution of disparities across regions (or countries). Thus, the dynamics of technical efficiency is a crucial issue that should be explored within a suitable framework.

A large part of the empirical literature related with economic growth in countries or regions concentrates on studying the issue of convergence. In the particular case of European regions, we find different results concerning the impact of SF on the speed of convergence of assisted regions. To cite an example, García-Solanes and María-Dolores (2002) find that the absolute β-convergence between the European regions receiving funds during the period 1989-96 is 2,5%, smaller than between countries during 1989-99 which is 8,6%. However, taking into account the SF they receive, the speed of convergence grows to 3,8% for the regions and 15,18% for countries.

On the side of non positive effects, Boldrin and Canova (2001) should be mentioned. These authors examined changes in the statistical distribution of several kinds of factor productivities and income per head of the EU regions during the period 1980-92, and found that economic performance of the assisted regions was not very different from the rest of the Union. For them, the important implication is that the European regional and structural policies are based on political (as opposed to economic) motivations.

In this paper, I develop as a framework to study the impact of SF a "structural hybrid" model of growth which extends the one commonly used in the literature by partially endogenizing the rate of technical progress. Indeed, similar "hybrid" models have been used previously in the literature [see Benhabib and Spiegel (1994), de la Fuente (1995), de la Fuente (2002a) among others]. In the model, I assume that technological progress in an economy evolves as a consequence of two complementary forces: (i) the exogenous mechanism of technological diffusion across countries or regions, the so-called *catch-up* effect which implies that the less developed economies can increase their technology level faster than the more advanced ones, since it is easier to copy existing technologies than to invent new ones, and (ii) an endogenous component coming from public policy. Public expenses in activities that enhance productivity can be considered as crucial determinants of the evolution of regional (or countries) TFP levels. In particular, SF can enhance the TFP on several fronts. The ERDF resources are mainly used to cofinance infrastructure and productive investments leading to the creation or maintenance of jobs. In practice, all development areas are covered: transport, communication technologies, energy, research and innovation, social infrastructure, training, etc. The ESF promotes the return of the unemployed and the incorporation of disadvantaged groups to the labour force, mainly by promoting equal opportunities in accessing the labour market, improving education and training systems, promoting a skilled workforce, boosting human potential in the field of research and development, etc. The EAGGF finances rural development measures such as investments in agricultural holdings (modernization, reduction in production costs, product quality, etc.), aids for the setting up of young farmers and vocational training, processing and marketing of agricultural products, and development of rural areas through the provision of services, encouragement for tourism, etc. All these programs work together in an attempt to provide a fertile ground for technological progress and, consequently for growth and development in European regions.

3. The model

In this section a "hybrid" model of economic growth is developed. The term hybrid is used in the sense that technological growth is happening as a consequence of both, exogenous and endogenous forces. The endogenous component focuses on the SF that the European Union allocates to the less developed European regions, since the aim of SF is to ameliorate their productive capacity. The exogenous component is the catch-up effect. The model extends the one commonly used in the literature in the way described below.

Technology is given by a Cobb-Douglas aggregate production function with constant returns to scale.

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha} = A_t L_t k_t^{\alpha}, \qquad [1]$$

where $k_t = K_t / (A_t L_t)$ is the capital/labour ratio in efficiency units of labour, L_t is the labour force that grows at an exogenous and constant rate n, and A_t is a technological index which evolves over time following the equation,

$$\dot{A}_t = S_t^{\gamma}(A_t f_0)^{1-\gamma}, \qquad [2]$$

where S represents Structural Funds which are a fixed fraction θ of the regions GDP per capita[3]

$$S_t = \vartheta \frac{Y_t}{L_t} = \vartheta A_t k_t^{\alpha}, \qquad [3]$$

and $f_0 = A_{0l}/A_{0i}$ is the catch-up factor, which measures the initial technological distance between one region i and the leader l.

[3] Note that the European authority fixes the fraction θ following its own criteria. For example, larger values of θ for poorer regions.

Substituting (3) in (2) we get the rate of technological progress as a function of θ, f_0 and k,

$$g_t = \frac{\dot{A}_t}{A_t} = \vartheta^{\gamma} k_t^{\alpha\gamma} f_0^{1-\gamma}, \qquad [4]$$

The household sector is the usual one in these models. The representative individual solves the following problem,

$$\max \int_0^{\infty} \frac{C^{1-\sigma}}{1-\sigma} L_t e^{-\rho t} dt$$

$$s.t. \dot{K} = Y - LC - \delta K$$

where C is consumption per capita, L is population or the size of dynasty and σ is the inverse of the intertemporal substitution elasticity.

Solving this problem in the standard way, we obtain the dynamic system of the model from which we derive the steady state values of capital (k^*) and the growth rate (g^*),[4]

$$k^* = \left[\frac{\alpha}{\rho + \delta + g\sigma}\right]^{\frac{1}{1-\alpha}},$$

$$g^* = \vartheta^{\gamma} f^{1-\gamma} \left[\frac{\alpha}{\rho + \delta + g\sigma}\right]^{\frac{\alpha\gamma}{1-\alpha}}.$$

To explore the transitional dynamics we will use the saddle path solution of the log-linearized system, which is given by,

$$\hat{k}_t - \hat{k}_0 = \left(1 - e^{-\beta t}\right)\left(\hat{k}^* - \hat{k}_0\right). \qquad [5]$$

where $\hat{k} = ln\, k$.

Taking into account that $\hat{y} = ln\, y = a\hat{k}$, from equation (5) we can derive an expression for the rate of growth of income per capita,

$$\frac{1}{t} \ln \frac{Y_t / L_t}{Y_0 / L_0} = g + \frac{1 - e^{-\beta t}}{t}\left(\hat{y}^* - \hat{y}_0\right). \qquad [6]$$

Replacing $\hat{y}_0 = ln(Y_0/L_0) - lnA_0$ and inserting region sub-indexes, this expression becomes,

$$\frac{1}{t} \ln \frac{Y_{it} / L_{it}}{Y_{i0} / L_{i0}} = g_i + \frac{1 - e^{-\beta_i t}}{t} \hat{y}_i^* + \frac{1 - e^{-\beta_i t}}{t} \ln A_{i0} - \frac{1 - e^{-\beta_i t}}{t} \ln \frac{Y_{i0}}{L_{i0}}. \qquad [7]$$

To make use of a panel data approach in the estimation, equation (7) must be rewritten as,

$$\frac{1}{s} \ln \frac{Y_{it+s} / L_{it+s}}{Y_{it} / L_{it}} = g_i + \frac{1 - e^{-\beta_i s}}{s} \hat{y}_i^* + \frac{1 - e^{-\beta_i s}}{s} \ln A_{it} - \frac{1 - e^{-\beta_i s}}{s} \ln \frac{Y_{it}}{L_{it}}. \qquad [8]$$

[4] The details of the derivation of the model can be followed up in the Appendix A.

where $ln\ A_{it}=ln\ A_{i0}+g_i\ t$ and s is a fixed number of years. Note that sub-index t refers to the initial value of each subperiod.[5]

Substituting $ln\ A_{it}$, we have:

$$\frac{1}{s}\ln\frac{Y_{it+s}/L_{it+s}}{Y_{it}/L_{it}}=\left[g_i+\frac{1-e^{-\beta_i s}}{s}\hat{y}_i^{\ *}\right]+\frac{1-e^{-\beta_i s}}{s}g_i t+\frac{1-e^{-\beta_i s}}{s}\ln A_{i0}-\frac{1-e^{-\beta_i s}}{s}\ln\frac{Y_{it}}{L_{it}}. \quad [9]$$

Using Taylor's Theorem and doing some algebra, $\hat{y}_i^*$ and g_i may also be expressed as linear functions of θ_i and f_i.[6]

Finally, assuming the same β for all regions, we obtain the following linear equation which is ready to estimate,

$$\frac{1}{s}\ln\frac{Y_{it+s}/L_{it+s}}{Y_{it}/L_{it}}=c+\varphi_1\left(\frac{\vartheta_i}{\vartheta_l}-1\right)+\varphi_2\left(f_i-1\right)+\varphi_3 t+\varphi_4\left(\frac{\vartheta_i}{\vartheta_l}-1\right)t+\varphi_5\left(f_i-1\right)+$$

$$+\varphi_6\ln A_{i0}-\varphi_6\ln\frac{Y_{it}}{L_{it}}, \quad [10]$$

where

$$c=g_l+\frac{1-e^{-\beta s}}{s}\hat{y}_l^{\ *},$$

$$\varphi_1=\gamma g_l\left(1-\alpha B_\vartheta\right)-\frac{1-e^{-\beta s}}{s}B_\vartheta,$$

$$\varphi_2=g_l\left(1-\gamma-\gamma\alpha B_f\right)-\frac{1-e^{-\beta s}}{s}\alpha B_f,$$

$$\varphi_3=\frac{1-e^{-\beta s}}{s}g_l,$$

$$\varphi_4=\frac{1-e^{-\beta s}}{s}\gamma g_l\left(1-\alpha B_\vartheta\right),$$

$$\varphi_5=\frac{1-e^{-\beta s}}{s}g_l\left(1-\gamma-\gamma\alpha B_f\right),$$

$$\varphi_6=\frac{1-e^{-\beta s}}{s},\ \text{and}$$

u_{it} is an error term.

This equation is an expression that relates the rate of growth of income per capita of each region with the received Structural Funds and the catch-up variable, as well as the initial values of income per capita and the TFP, A_{i0}.

The data and the estimation results are described in the following sections.

[5] This panel data formulation is obtained by moving from a single cross-section spanning the entire period to cross-sections for the several shorter periods that constitute it. We may note that equation (7) was based on approximation around the steady state and was supposed to capture the dynamics towards the steady state. It is, therefore, valid for shorter periods as well.

[6] See Appendix A, for the corresponding expressions.

4. Data and descriptive analysis

4. 1 Data sources and variables

The sample is composed of regional data in EU15 including those regions chosen as Objective 1 during the two first programming periods of European Structural Funds (1989-93 and 1994-99). I consider a total of forty-one European Regions.[7]

I focus the analysis on Objective 1 regions for three main reasons: First, because Objective 1 is the main Objective of the European Cohesion Policy, not only during the two programmes considered in this study but also during the subsequent ones. Secondly, because Objective 1 regions receive the majority of funds: more than 2/3 of the SF budget. Thirdly, because the conclusions derived from the empirical analysis including the poorest regions which also are the largest receptors of European Funds, should offer relevant information about the impact of SF policies to use in the elaboration of the subsequent programmes. This is an issue of increasing importance following the enlargement of EU, since almost the totality of population in the new Member States live in regions where GDP per inhabitant is below 75% of EU average, and they will receive an increasing proportion of the European Cohesion Policy funds.

I took the data of GDP per inhabitant in PPP units from the Eurostat New Cronos Regio database. The amount of SF is taken from the European Commission (1999) *Sixth Periodic Report on the Social and Economic situation of the regions of the Community*. I use annual rates of growth of GDP per capita from 1989 to 2000 and I build the catch-up variable as the ratio between the GDP per capita of the European Union and each region at the beginning of each sub-period. I choose the EU as the leader economy since the reference used by the European Commission to measure gaps and convergence across regions and/or countries always is the EU average.

To measure the role of SF on economic growth I consider three different variables:

1. The total annual amount of SF divided by GDP per capita
2. The percentage of Funds received by each region with respect to the Funds received by all Objective 1 regions
3. The total annual amount of Funds

All of these are measured at the beginning of each sub-period. Moreover, I also take the Funds split in ESF, ERDF, and EAGGF.

The main reason to test the model with three different measures of SF is to improve the robustness of the results. I use two "relative" measures: the ratio Funds/GDPpc, which measures the weight of Funds with respect to the regions' wealth, and the proportion of the total Objective 1 Funds received by each region, which measures the weight of the region in the SF budget. I also use the "absolute"

[7] The sample is composed of the following NUTS2 regions. For Belgium: Hainaut. For Germany: Bradenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhaltz. For Spain: Galicia, Asturias, Cantabria, Castilla León, Castilla La Mancha, Extremadura, Comunidad Valenciana, Andalucía, Murcia, Ceuta y Melilla, Canarias. For France: Corse, Goudaloupe, Martinique, French Guiana, Reunion. For Italy: Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna. For Netherland: Flevoland. For Portugal: Norte, Centro, Lisboa e Vale do Tejo, Alentejo, Algarve, Açores, Madeira. For United Kingdom: Northern Ireland. For Greece and Ireland the entire county are considered as regions because their Structural Funds are not dissagregated by NUTS2 level.

value of Funds since it could capture a scale effect of the Funds. The amount of funds could be relevant in itself, since we may think that probably, the investments with the strongest impact on growth are largely costly, independently of the size of the region[8].

Furthermore, I introduce some other variables in the different regressions, measuring the national expenditure related to the SF because part of the investments are cofinanced by public or private national resources. The variables considered at regional level are: the public national expenditure, the private national expenditure and the sum of both, measured in absolute terms and as a proportion of the regional GDP. The notation used is described in the box below.

Growth	annual growth rate of GDP per capita in PPP units
y_0	initial value of GDP per capita in PPP units
catch	catch-up variable
ESFgdp	ratio of annualized ESF/GDP per capita
ERDFgdp	ratio of annualized ERDF/GDP per capita
EAGFFgdp	ratio of annualized EAGGF/GDP per capita
FUNDSgdp	ratio of the sum of the three Funds/GDP per capita
ESFEU	% of the annualized ESF over the ESF received by all Obj. 1 regions
ERDFEU	% of the annualized ERDF over the ERDF received by all Obj. 1 regions
EAGGFEU	% of the annualized EAGGF over the EAGGF received by all Obj. 1 regions
FUNDSEU	% of the sum of Funds over the sum of Funds received by all Obj. 1 regions
totalESF	total annualized amount of ESF
totalERDF	total annualized amount of ERDF
totalEAGGF	total annualized amount of EAGGF
totalFUNDS	the sum of the three previous Funds
TNE	total public national expenditure by region
PF	total private national financing by region
NF	national financing by region =TNE+PF
TNEGDP	TNE/GDP
PFGDP	PF/GDP
NFGDP	NF/GDP
X.t	Variable X multiplied by the tendency

I performed the exercise over three different sub-samples corresponding to three different periods. The first one takes the period 1989-2000. The second and third consider the two programming periods separately. I made this distinction for one main reason: if the programmes are different in the total amount of resources, their allocation among regions, and in the period of time they are executed then, their effects could also be different. So, it is useful to check whether this expected difference appears in the data.

4. 2 Descriptive analysis

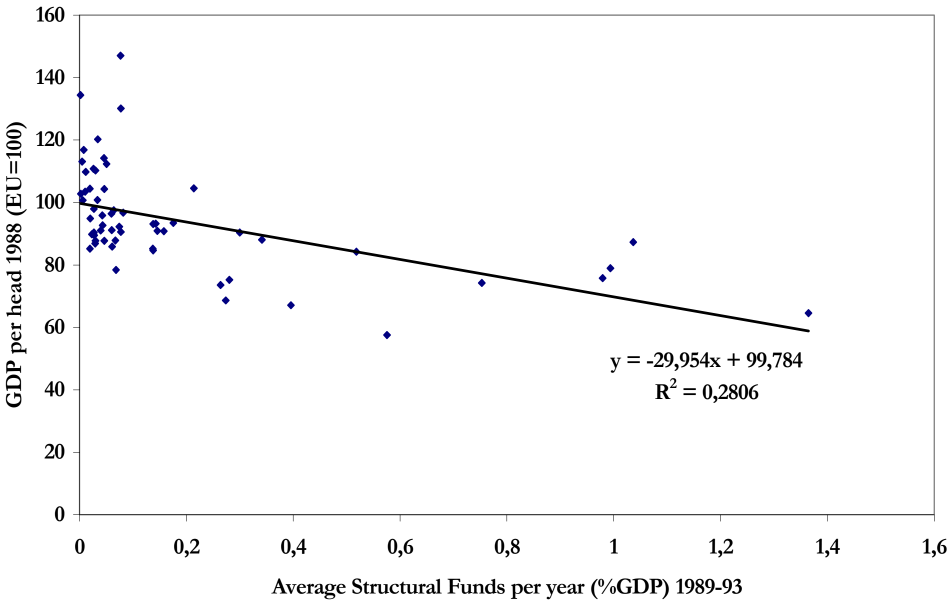
A preliminary view of the data shows that the allocation of SF among European regions is inversely correlated with their starting GDP per capita levels as we can see in Figures 1 and 2. According to the Cohesion Policy aim of helping the more backward regions, this is what we should expect. However, there is scarce

[8] I have considered the ratio Funds/GDP per capita, since this variable could be closer to the aim of the SF allocation in favour of backward regions according to their GDP per capita levels. I have also considered the ratio Funds/GDP (which is more standard in the literature) but the empirical results are very similar to that obtained using the variable Funds/GDPpc, so to save space, I do not report them.

evidence of a nearly proportionate relationship. Some backward regions have received amounts of SF per GDP similar to less depressed regions.

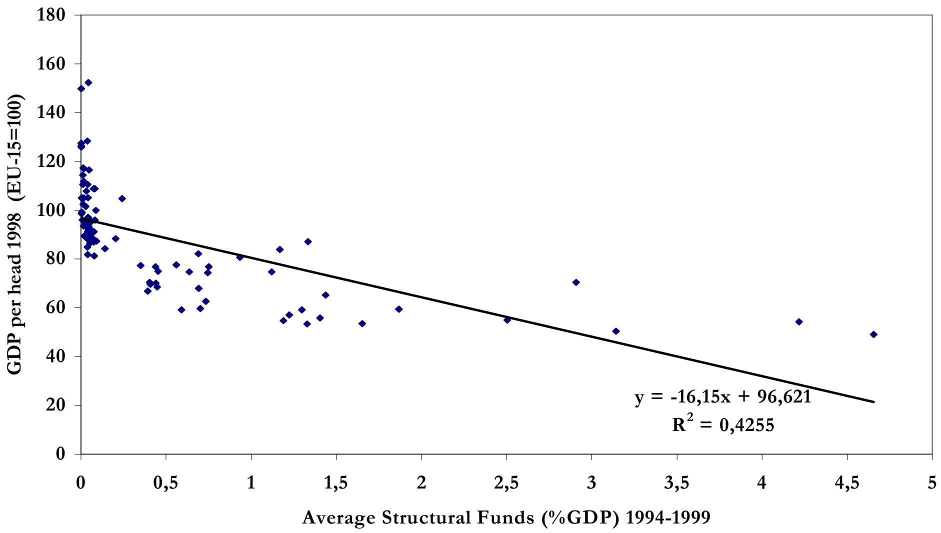
The regression line slopes make it evident that in the first programme of SF the redistribution is smaller than in the second. Although the financial redistribution through the SF has increased, it still remains very imperfect.[9]

Figure 1



Relationship between the regional GDP per capita in 1988 and the Structural Funds received by European regions in the First programming period

Figure 2

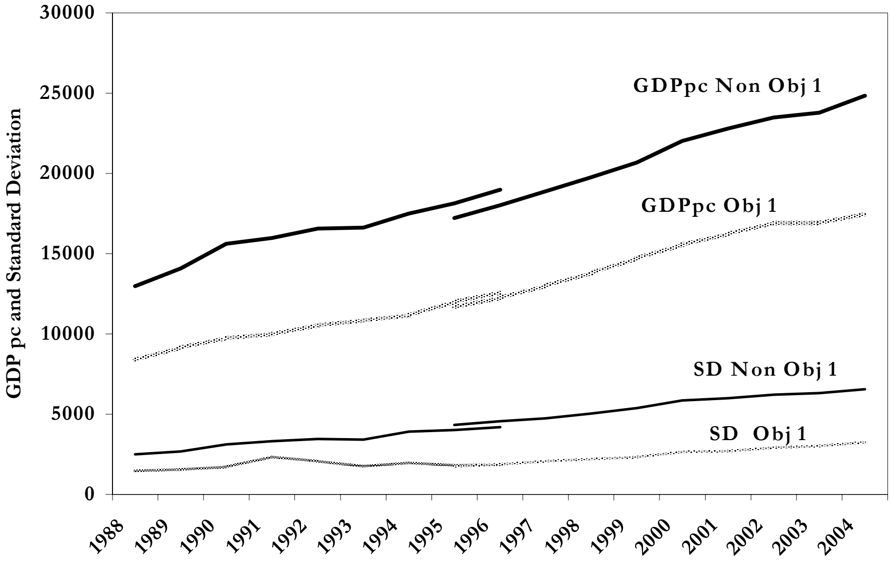


Relationship between the regional GDP per capita in 1993 and the Structural Funds received in the Second programming period

[9] The redistribution is larger among Objective 1 regions. The equation line regression is y= -5,9551x + 74,801 (R^2=0,3307).

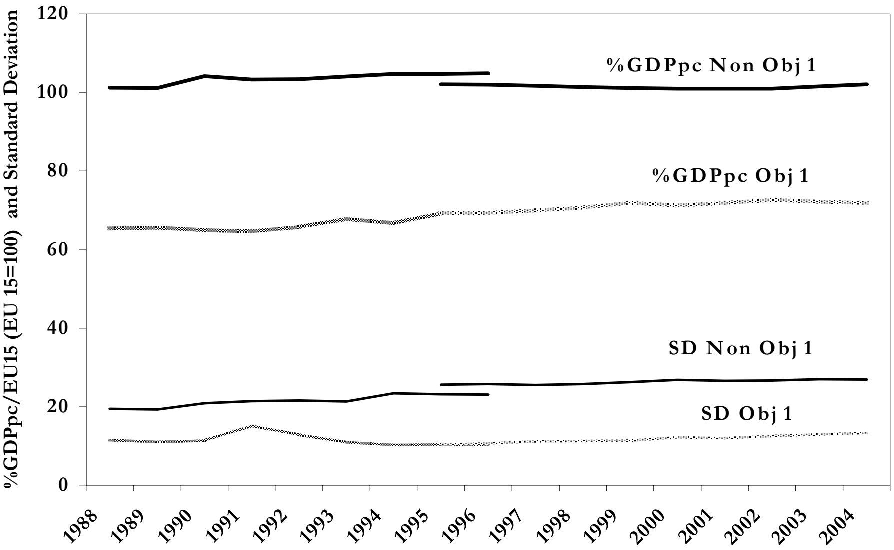
Furthermore, Figure 3 shows the evolution of the average GDP per capita for Objective 1 and non Objective 1 European regions (EU 15) and their respective standard deviations, and Figure 4 shows the evolution of the proportion of regional GDP per capita with respect to the EU15 (EU 15=100).[10]

Figure 3



Evolution of GDP pc and its standard deviation of Objective 1 and Non Objective 1 regions (EU 15)

Figure 4



Evolution of %GDP pc/EU15 and its standard deviation of Objective 1 and Non Objective 1 regions (EU 15)

[10] To facilitate the comparisons to the reader, I overlap the years 1995 and 1996 calculated with both the data offered by Eurostat using the previous and the current methodology (available since 1995).

There are significant differences between subperiods and groups of regions. Firstly, we observe that during the First programming period (89-94), the annual growth rate of the average GDP per capita of Objective 1 regions was smaller (3,96%) than for the other regions (4,34%) but the growth rate of the standard deviation of GDP pc was also smaller (4,94% vs 7,54%). The same difference appears for the annual rate of growth of the ratio GDP per capita/EU 15 (0,33% vs. 0,70%) but the standard deviation decreases in Objective 1 regions (-1,52%) and increases among the remaining regions (3,91%). However, during the Second programming period (95-00) the average Objective 1 GDP pc grows faster (5,73%) than the average non Objective 1 (4.93%), but its standard deviation grows even more (8,4% vs. 6,03%). Moreover, the annual rate of growth of the ratio GDP pc/EU is 0,58% for Objective 1 and -0,22% for the rest of regions, but the growth rate of the standard deviation in Objective 1 is 3,25% and 0,88% for the others. Therefore, we observe that during the first programming period, the standard deviation of the Objective 1 distribution goes down from 1990, but during the second programming period it begins to go up. However, the remaining regions exhibit almost the opposite behaviour.

5. Estimation results

To analyze the effect of the European Union Structural Funds on the growth rates of Objective 1 regions, I estimate equation (10) by OLS following a panel data approach where the use of fixed effects emerges endogenously to capture the value of A_{i0}, which is not observable but is fixed along the period and particular for each region.

Before going through the effects of SF, in Table 1, I present the results of a simple exercise to estimate the speed of convergence of Objective 1 regions during the period 1989-2000. In the above section of Table 1, only one constant term is introduced as a common element and no other variable that distinguishes between different steady states, so the estimation of β can be interpreted as an approximation to the speed of *absolute convergence*. However, in the section below the regressions include fixed effects by region. In this case, the estimated β values could be interpreted as an approximation of the speed of *conditional convergence* since fixed effects could be capturing differences in the regions´ steady states.[11] The results indicate that *absolute convergence* exists during the period (7.03%) and, as we should expect, it is smaller than *conditional convergence* (9.67%).[12]

To separate the effect on growth of convergence due to decreasing returns on capital from the catching up phenomenon, it is also necessary to consider the catch up variable.[13] However, by construction, the variables y_0 and *catch* are highly

[11] The concept of *conditional β-convergence* provides a measure of the speed at which each region approaches its position in a stationary distribution characterized by regional inequality. Note that if economies have very different steady states, this concept is compatible with a persistent high degree of inequality among economies. However, *absolute β-convergence* can be interpreted as a summary indicator of the strength of the tendency towards the reduction of inequalities.

[12] The previous convergence literature always predicts that the speed of convergence estimated with fixed effects is larger than without them.

[13] The concept of *β-convergence* is linked to the neoclassical growth model, which predicts that the growth rate of a region is positively related to the distance that separates it from its steady state.

correlated, so it makes no sense to introduce both in the same regression (see columns 2, 3 and 4 in Table 1). In the light of the model, however, to measure the catch up effect we have to look at coefficient φ_5, catch-up multiplied by the tendency (*catch.t*), because it measures the catching up effect during the transition to the steady state, when the catching up process is more relevant.[14] In the estimation with the constant term the variable *catch.t* is not significant, but on considering the fixed effects, not only the catch-up becomes very significant but the speed of conditional convergence grows to 24.07% (see column 4 in Table 1). The difference comes from the fact that the absence of fixed effects in the estimations, leads to a problem of omission of relevant variables which biases the estimation of the initial income and the catch-up coefficients. Note that, by definition, the catch-up variable is related to the state of each region, A_{i0} which is also correlated with the initial value of income per capita, so, in the estimation, the absence of A_{i0} means that the coefficient of the initial income becomes less negative and the coefficient of the catch-up less positive.

Table 1

Sample period: 1989-2000. Dependent variable: *Growth*					
Estimation by OLS					
c	0.6920 3.55	-0.0446 -1.78	-0.2406 -0.99	0.7676 3.62	-0.0376 -1.59
y_0	-0.0679 -3.27		0.0189 0.83	-0.0771 -3.37	
catch		0.0674 3.88	0.0806 3.24		0.0676 3.89
catch.t				0.0011 1.62	-0.0008 -1.28
$\hat{\beta}$	7.03%			8.02%	
$\overline{R}^2$	0.1270	0.1956	0.1947	0.1332	0.1986
Estimation by OLS with fixed effects by region					
y_0	-0.0921 -4.44		0.0363 2.19	-0.2139 -6.72	
catch		0.1374 7.36	0.1676 8.16		0.1457 8.22
catch.t				0.0065 6.26	0.0009 1.90
$\hat{\beta}$	9.67%			24.07%	
$\overline{R}^2$	0.2528	0.4403	0.4476	0.3926	0.4460
t-statistics are White Heteroskedasticity-consistent					
Mean dependent variable: 0.0589			S.D. dependent variable: 0.0502		

[14] Note that the coefficient φ_2 captures the effect of the catch-up factor on the steady state values of y and g since it corresponds to the term between brackets in equation 9 (φ_2 is the sum of two opposite components so its sign is not defined). However, the coefficient φ_5 corresponds to the term $g_i t$ which captures the transition to the steady state.

García-Solanes and María-Dolores (2002) estimate the *absolute* and *conditional β- convergence* rate for the EU12 countries over the period 1989-99 and the EU12 regions over the period 1989-96, also using a panel data approach with annual growth rates. They obtain that *absolute β-convergence* is 8.6% between countries and 2.5% between regions.[15] But, *conditional convergence* rates grow to 16.91% for countries and 17.9% for regions. On remaking the exercise of convergence for Objective 1 regions along the period 1989-1996, the rates of *absolute* and *conditional convergence* obtained are 12.5% and 19.98% respectively. So, during this period, Objective 1 regions converge much faster than the overall set of EU12 regions do.

These preliminary results show that the exogenous component of growth that the model proposes is active in Objective 1 regions in the period 1989-2000. On the other hand, to test the effects of SF, the sign of the coefficient φ_4 (corresponding to the term $g_i.t$ in equation 9) will tell us if their impact on growth is positive or negative, since the theoretical model clearly predicts its sign. It includes the funds variable multiplied by the tendency.[16]

Tables 2 to 4 show the results of the regressions for the period 1989-2000.[17] [18] In Table 2 we observe that when national financing (NF) is introduced into the regression the *FUNDSgdp* variable is positive and significant.[19] [20] In the same way, we see in Table 3 that the variable *FUNDSEU* is also positive and significant.[21] Finally, in Table 4, the coefficient of the variable of *totalFUNDS* is positive and significant in all regressions.[22] The absence of significance of the funds variable observed in some regressions of Tables 2 and 3 could be caused by the high correlation between the initial income and the "relative" measures of funds, which biases their estimates.[23] However the total amount of funds is much less correlated with the initial income so, as we see in Table 4, its coefficient is more efficiently estimated.

[15] Dall´rba and Le Gallo (2003) obtain a rate of *absolute β-convergence* of 1.98% for a sample of 145 European regions during the period 1989-99 using a cross-section approach.

[16] φ_4 captures the effect of SF in the transition to the steady state, while the coefficient φ_3, corresponding to the term between brackets in equation (9), captures the long run effect.

[17] Appendix B gives the regressions including each fund (ESF, ERDF, EAGGF) separately.

[18] For the sake of space I only report the results with the variables *NF* and *NFGDP*. The regressions with the national public and private expenditures variables (*TNE* and *PF*) are available upon request.

[19] Note that, by construction, the variable *NF* is less correlated with the variables of funds/GDP per capita than *NFGDP*, so the estimation of the coefficient of the fund variable is more efficient.

[20] Table B1 (Appendix B) shows that when *NF* is included, ERDF and EAGGF are also significant and ESF is positive but not significant.

[21] Table B2 (Appendix B), shows that when *NF* is included, ESF, ERDF and EAGGF are also significant.

[22] Table B3 (Appendix B) shows that ESF, ERDF and EAGGF are also significant in all regressions.

[23] Note that as we saw above in Figures 1 and 2, the allocation of Funds (%GDP) among regions is inversely related to the initial value of their GDP per capita.

Table 2

Sample period: 1989-2000. Dependent variable: *Growth*			
y_0	-0.2202 -7.13	-0.2071 -6.57	-0.1888 -4.67
FUNDSgdp	-1.4614 -4.80	-1.1629 -3.43	-1.1676 -2.18
NFGDP		-0.0837 -0.14	
NF			-4.1E-06 -0.11
FUNDSgdp.t	0.0169 1.02	0.0139 1.03	0.1265 3.16
NFGDP.t		-0.1318 -1.99	
NF.t			-6.2E-06 -1.59
catch.t	0.0086 7.83	0.0093 11.96	0.0076 5.52
$\hat{\beta}$	24.87%	23.20%	20.92%
$\overline{R}^2$	0.4457	0.6190	0.4605
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table 3

Sample period: 1989-2000. Dependent variable: *Growth*			
y_0	-0.2113 -6.75	-0.2077 -6.54	-0.1785 -4.80
FUNDSEU	-0.0084 -4.01	-0.0049 -2.39	-0.0086 -4.13
NFGDP		-0.5069 -0.88	
NF			2.2E-05 0.93
FUNDSEU.t	-7E-06 -0.04	4.1E-05 0.28	0.0013 4.33
NFGDP.t		-0.1066 -1.61	
NF.t			-1.1E-05 -3.17
catch.t	0.0079 7.34	0.0087 11.67	0.0073 6.27
$\hat{\beta}$	23.74%	23.28%	219.66%
$\overline{R}^2$	0.4416	0.6098	0.4826
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table 4

Sample period: 1989-2000. Dependent variable: *Growth*			
y_0	-0.2061 -6.66	-0.1959 -6.18	-0.1728 -4.69
totalFUNDS	-0.0002 -5.14	-0.0001 -3.46	-0.0002 -3.35
NFGDP		-0.0558 -0.09	
NF			7E-05 1.96
totalFUNDS.t	9.5E-06 4.50	6.8E-06 3.43	2.2E-05 6.29
NFGDP.t		-0.1327 -2.01	
NF.t			-1.4E-05 -3.46
catch.t	0.0082 7.71	0.0088 12.08	0.0073 6.06
$\hat{\beta}$	23.08%	21.81%	18.98%
$\overline{R}^2$	0.4596	0.6213	0.4853
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

On the other hand, we see that the *catch.t* variable is positive and significant in all regressions and its coefficient is larger than in the previous estimation without the SF variables. Moreover, the initial income variable appears as negative and significant in all regressions. The reported estimations of the speed of convergence range from 20% to 25%, not far from the 24.07% obtained in Table 1. So, the conditional convergence process of Objective 1 regions does not seem to be greatly affected by the impact of SF.[24] Whereas, the SF could have more influence in the catching-up process.

In the light of the results, the effect of SF as an engine of growth has been positive along the period 1989-2000. However, due to the importance of SF it is necessary to try to get a more accurate result and to discern whether their impact on growth is equally important over the two programming periods. Thus, I divide the whole sample period into two sub-samples, corresponding to both programming periods.

I start with the results of the convergence and catch-up exercise. Table 5 shows that during the first programming period, the *absolute β-convergence* rate is around 15%, and the *conditional β-convergence* rate increases to 28.42%, and 46.13% when the *catch.t* variable is introduced into the regression. These values indicate that the speed of convergence, both absolute and conditional, during the first programming period is the double that during the whole period.

In Table 6 we observe other important differences. On the one hand, the adjusted R-squared is larger, reaching values between 0.7 and 0.9 versus the previous ones around 0.5. On the other hand, and more importantly, all measures of SF are positive and significant and the size of their coefficients is larger than in the previous

[24] This weak impact of Structural Funds on the convergence rate of European regions is also obtained by Dall'erba and Le Gallo (2003) using a spatial econometric analysis.

estimations.[25] This means that the first Structural Funds Program (1989-1993) had a stronger and clearer impact on the growth rates of Objective 1 Regions.

Table 5

First Programming period. Dependent variable: *Growth*					
Estimation by OLS					
c	1.3625 4.39	-0.0793 -2.69	-0.2784 -0.33	1.3451 4.29	-0.0770 -2.66
y_0	-0.1416 -4.23		0.0197 0.23	-0.14 -4.17	
catch		0.0896 4.49	0.1009 1.84		0.0945 4.27
catch.t				0.0013 0.61	-0.0021 -0.89
β	15.27%			15.08%	
R^2	0.2653	0.2965	0.2908	0.2619	0.2975
Estimation by OLS with fixed effects by region					
y_0	-0.2474 -6.6		-0.1184 -2.74	-0.3695 -7.21	
catch		0.1943 6.36	0.1186 3.29		0.1849 6.30
catch.t				0.0074 3.86	-0.0017 -1.28
$\hat{\beta}$	28.42%			46.13%	
$\overline{R}^2$	0.632	0.6454	0.6599	0.6392	0.6461
t-statistics are White Heteroskedasticity-consistent					
Mean dependent variable: 0.0662			S.D. dependent variable: 0.0657		

Table 6

First Programming period. Dependent variable: *Growth*		
y_0	-0.3774 -7.45	-0.2940 -4.28
FUNDSEU	0.1232 0	0.0943 0
NFGDP		0.0034 0.09
FUNDSEU.t	0.0013 3.67	0.0006 4.08
NFGDP.t		0.0052 1.53
catch.t	0.0078 3.44	0.0064 2.99
$\hat{\beta}$	47.39%	34.81%
$\overline{R}^2$	0.7094	0.9058
Estimation by OLS with fixed effects by region		
Temporal dummies are included in all regressions		
t-statistics are White Heteroskedasticity-consistent		

[25] Note that the estimation with the variables of %Funds/UE and Total Funds are equal because %Funds/UE are a linear transformation of the Total Funds variables. I report the results corresponding to the %Funds/UE variables, except for EAGGF since in that case the matrix is singular (see Table B4 in Appendix B).

Lastly, Tables 7 and 8 show the results corresponding to the second programming period (1994-2000), which differs from the former in several ways. Firstly, in Table 7 we observe that the exogenous forces of growth seem to be much less active or even inexistent.[26] Absolute convergence is inexistent and conditional convergence as well as the catching-up are not significant.

Table 7

Second Programming period. Dependent variable: *Growth*					
Estimation by OLS					
c	-0.1679 -1.25	0.0691 3.58	-0.4757 -1.26	-0.1875 -1.46	0.0675 3.37
y_0	0.0232 1.65		0.0517 1.47	0.0246 1.81	
catch		-0.0117 -0.85	0.0258 0.78		-0.0204 -1.51
catch.t				0.0005 0.41	0.0011 0.89
$\hat{\beta}$					
$\overline{R}^2$	0.0147	0.0007	0.0150	0.0091	0.0018
Estimation by OLS with fixed effects by region					
y_0	0.0241 1.28		0.0794 2.83	-0.0640 -0.97	
catch		0.0644 0.94	0.1857 2.07		0.1062 1.43
catch.t				0.0040 1.49	0.0023 2.42
$\hat{\beta}$				6.62%	
$\overline{R}^2$	0.0	0.0493	0.0996	0.0996	0.0868
t-statistics are White Heteroskedasticity-consistent					
Mean dependent variable: 0.0520			S.D. dependent variable: 0.0268		

In Table 8, we see that the adjusted R-squared are very low, between 0.03 and 0.05. This means that the independent variables have a very small explanatory power of the growth rate of Objective 1 regions during this second period. However, the *FUNDSEU* variable (when taking into account the national financing) is the only variable that remains significant. Moreover, the coefficients of the y_0 and the *catch.t* variables preserve the correct sign and their estimated coefficients are slightly larger, but in neither regression are significant.[27]

The comparison of results between the two programming periods shows that the positive impact of SF on the growth rates of Objective 1 European regions appears in both, in the former it even seems to be stronger. However, there is a large difference in terms of convergence and catch-up, because both phenomena are null in the second period but very important in the first. This last result is in agreement with the slow down in the convergence process of Objective 1 regions that we saw above in Figures 3 and 4 when looking at the evolution of the standard deviation of GDP per inhabitant.

[26] Note that the variable y_0 only becomes negative in the estimation with fixed effects when the variable *catch.t* is introduced into the regression, but neither is significant.

[27] Table B5 (Appendix B) shows the results with ESF, ERDF and EAGGF.

Table 8

Second Programming period. Dependent variable: *Growth*		
y_0	-0.0736 -1.05	-0.1063 -1.40
FUNDSEU	0.0221 0	0.0276 0
NF		-0.0027 0
FUNDSEU.t	0.0002 0.86	0.0014 3.13
NF.t		-9.7E-06 -2.79
catch.t	0.0031 1.10	0.0048 1.51
$\hat{\beta}$	7.64%	11.23%
$\overline{R}^2$	0.0342	0.048
Estimation by OLS with fixed effects by region		
Temporal dummies are included in all regressions		
t-statistics are White Heteroskedasticity-consistent		

To finish the section devoted to the results derived from the estimation of equation 10, it is important to remark that the coefficient φ_1 including the variable of funds (without multiply by t) captures the long run impact on growth of SF since it corresponds to the term between brackets in equation (9).[28] This coefficient is the sum of two opposite sign components: the positive contribution comes from the expression of g_i^* and the negative from $\hat{y}_i^*$, so the theoretical model does not predict its sign. We see that in most estimations, the estimated values are negative, which in terms of the model implies that the impact of Funds on the long run level of income, $\hat{y}_i^*$ is larger than on the long run growth rate, g_i^*.

6. Conclusions and the future cohesion policy

The European Union's Structural Funds are intended to help increase economic and social cohesion between Member States, and constitute an important instrument for reducing regional imbalances and differences in economic development.

Since the resources devoted to SF constitute a very important part of the EU budget, and Objective 1 regions are the main priority of the European Union's Cohesion policy, it is necessary to closely follow the impact of SF on the trajectory of growth and convergence processes of these regions during the subsequent programming periods. This is even more important after the enlargement of the EU, since 90% of population in the new Member States live in regions with GDP per head below 75% of the EU average and over two-thirds live in regions where it is under half the average.

It is equally important to make the analysis under the adequate theoretical framework. While far from being the only one, in this paper I have proposed a reasonable "hybrid" model of economic growth, which allows us to interpret the

[28] Note that the coefficient φ_4 captures the impact of SF in the transition to the steady state. In the light of the model, a positive sign means that the SF contribute positively to growth.

estimated coefficients and then to analyze the effects on growth of the SF, as well as to distinguish between the trend to converge (which is called *β-convergence*) and the catching-up effect that also influence the growth rates of the regions.

In the light of my results, the SF have had a significant impact on the rates of growth of the Objective 1 regions during the first programming period. However, during the second program, the evolution of these regions is worse in terms of convergence, even if the impact on growth of the SF still remains significant.

Furthermore, what we observe when looking at Figures 3 and 4 for the period 2000-2004 (latest available data) is an increase in the different performances exhibited by Objective 1 and non Objective 1 regions in the EU15. The period is characterized by a slowing down in the annual growth rate of the average GDP per capita in both groups of regions (2,93% and 2,99% respectively compared to 5,73% and 4,93% during 1995-2000). However, the annual growth rate of the standard deviation of regional GDP per capita sensibly differs: in Objective 1 regions it is almost the double that in Non Objective 1 (5% vs 2,82%). This difference between groups of regions is stronger when comparing the average percentage of income per head with respect to EU15. In Non Objective 1 regions, the average GDP per capita grew at an annual rate of 0,26% while in the period 1995-2000 the rate was negative (-0,005%) and in Objective 1 the rate is 0,21% but in the previous period was 0,58. On the other hand, the standard deviation has grown at an annual rate of 0,09% in Non Objective 1 and at 2,28% in Objective 1 regions.

These data point to a very different evolution in Objective 1 regions, which were major recipients of support under cohesion policy, especially during the last decade. Therefore, to look for the origins of these different performances it becomes necessary to improve the design of European cohesion policies and the allocation of resources to achieve better effectiveness in all regions.

Furthermore, after enlargement, disparities within the EU have dramatically increased, likewise increasing the need for funds to combat them. Population of the Union has grown from 380 to 454 million (EU 25) or 485 million (EU27). In convergence objective it rises from 84 million to 123 million. As a result, GDP per head has dropped by -12,5% in EU25 and -18% in EU27, and disparity levels have risen (as an example, in 2003 GDP per head in Latvia was 41% of the EU average while in Luxembourg it was 215%).

However, it is among the new Member States where fastest growth and most rapid catching up are visible. The GDP of the three Baltic States has almost doubled over the decade 1995 to 2005. Poland, Hungary and Slovakia have also performed well with growth rates of more than double the EU average. But due to very low starting points for GDP per capita, and assuming the current growth rates, it seems likely that it will take more than 15 years before Poland and, especially, Bulgaria and Romania will reach a GDP per head of 75% of the EU 27 average.

In any case, the experience from the two former programmes of Structural Funds within the EU15 regions suggests that, without taking into consideration the differences between countries and regions and the international context, placing high expectations on the ability of SF to reduce gaps between regions quickly, could be misplaced.

The reform of cohesion policy in 2006 for the period 2007-2013 maintains as its main aim the reduction of disparities between the Member States and regions through the concentration of resources on the less developed areas. The bulk will be concentrated on the poorest regions and countries: whereas in 1989, 56% of available resources where allocated to the lowest income regions, at the end of the new programming period, the proportion will be 85%. The new Member States will receive just over 52% of the total over the period. However, in line with the new growth and jobs agenda and in the context of globalization, cohesion policy is putting increasing emphasis on improving the competitive position of regions in the world economy. Thus, resources are focused on all the regions coping with structural adjustments and on investment with a particular emphasis on the cluster of activities around research, innovation, the information society and business development. Cohesion policy will pursue the same growth and jobs agenda everywhere, but with the intensity of support from the Union reflecting the needs and available resources of Member States and regions.

This reform of objectives is accompanied by a better regulation based on simplification (number of financial instruments, stages of programming, financial management and control).

New challenges that Europe as a whole should confront are particularly relevant to cohesion policy since they have an uneven impact on Europe's territory and may widen social and economic disparities. To face the challenge of globalization, virtually all regions are confronted with the need to restructure, modernise and facilitate continuous knowledge-based innovation. Many regions both, in the more prosperous and in the new Member States have a high share of employment in traditional sectors where competition from the emerging Asian economies is high. In these regions competition based on cost factors is not a viable option, they need to modernise and diversify their economic structure into high-added value sectors by creating the conditions for business to adopt innovative processes, to cooperate with other enterprises and research institutes, to access risk capital and to internationalise their activities.

Many regions throughout Europe will be increasingly confronted with the asymmetric impact of climatic change. Challenges to agriculture, fisheries and the tourism industry in particular, may have disproportionate effects on disadvantaged groups, which might lack the means to adapt to them. Increased energy prices will also affect EU regions in different ways depending on their energy mix, economic structure and the energy efficiency of their firms. Increased transport costs tend to hit the geographically peripheral regions where key sectors, such as tourism could be vulnerable. Expanding renewable energies and investment in energy efficiency as well as the fight against climatic change provide major opportunities for most regions with new economic incentives through eco-innovation and the growth of environmentally friendly industries with a high local job potential.

Furthermore, demographic change and population decline put future employment growth at risk. In parallel, regions will have to cope with a number of social challenges posed by skill mismatches: labour market segmentation between high skills/high salaries and low skills/low salaries and increased immigration, against an environment where traditional security institutions are eroding since national policies face increasing difficulties in keeping up with the rapid pace of change imposed by these trends.

In this context, the goal of cohesion policy in the coming years should be to adapt to the new challenges European regions will face. On the one hand, how cohesion policy can better promote harmonious, balanced and sustainable development taking into account the diversity of EU territories. On the other hand, how cohesion policy can become more effective in supporting public policies in Member States and regions, and given the need for efficient management of cohesion policy programmes, look for the optimum allocation of responsibility between the Community, national and regional levels within a multi-level governance system.

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Appendix A

I present below the algebraic derivation of the model.
The household sector solves the following problem:

$$\max \int_0^\infty \frac{C^{1-\sigma}}{1-\sigma} L_t e^{-\rho t} dt$$

$$s.t. \dot{K} = Y - LC - \delta K$$

The present value Hamiltonian for this problem is then,

$$H = \frac{C^{1-\sigma}}{1-\sigma} L_t e^{-\rho t} + \lambda \left(K^\alpha (AL)^{1-\alpha} - LC - \delta K \right)$$

Solving the corresponding FOC, we obtain the standard equation for the evolution of consumption over time.

$$\frac{\dot{C}}{C} = \frac{1}{\sigma} \left(\alpha k_t^{\alpha-1} - \rho - \delta \right).$$

To explore the system's transitional dynamics, we begin by log-linearizing it. Defining $\hat{c}=ln\ c$, and $\hat{k}=ln\ k$, the system can be rewritten as

$$\dot{\hat{c}} = \frac{1}{\sigma} \left(\alpha k_t^{\alpha-1} - \rho - \delta \right) - \vartheta^\gamma f_0^{1-\gamma} e^{\hat{k}\alpha\gamma} \equiv F(\hat{c}, \hat{k}, \vartheta, f_0) \qquad [1]$$

$$\dot{\hat{k}} = e^{\hat{k}(\alpha-1)} - e^{\hat{c}-\hat{k}} - (\delta + n) - \vartheta^\gamma f_0^{1-\gamma} e^{\hat{k}\alpha\gamma} \equiv G(\hat{c}, \hat{k}, \vartheta, f_0) \qquad [2]$$

Equalling both equations to zero and solving the system, we observe that the steady state is a saddle point and the stable root corresponds to the negative eigenvalue. Since the equilibrium trajectory of the model corresponds to the saddle path of the system, the speed of convergence toward the steady state will be determined by this negative eigenvalue. Let us denote by β the *convergence coefficient*. We will use the saddle path solution of the log-linearized system as an approximation to the equilibrium trajectory of the original system. Thus, the equilibrium path of $\hat{k}$ is given by

$$\hat{k}_t - \hat{k}_0 = \left(1 - e^{-\beta t}\right)\left(\hat{k}^* - \hat{k}_0\right). \qquad [3]$$

Defining $\hat{y}=ln\ y$, we have that $\hat{y}=a\hat{k}$ and (3) becomes

$$\hat{y}_t - \hat{y}_0 = \left(1 - e^{-\beta t}\right)\left(\hat{y}^* - \hat{y}_0\right).$$

In terms of income per capita and dividing by *t* we have

$$\frac{1}{t}\ln\frac{Y_t/L_t}{Y_0/L_0}=g+\frac{1-e^{-\beta t}}{t}\left(\hat{y}^*-\hat{y}_0\right). \qquad [4]$$

Replacing y_0 by $\ln\frac{Y_0}{L_0}-\ln A_0$, and inserting regions sub-indexes, equation (4) transforms into an equation that can be estimated,

$$\frac{1}{t}\ln\frac{Y_{it}/L_{it}}{Y_{i0}/L_{i0}}=g_i+\frac{1-e^{-\beta_i t}}{t}\hat{y}_i^*+\frac{1-e^{-\beta_i t}}{t}\ln A_{i0}-\frac{1-e^{-\beta_i t}}{t}\ln\frac{Y_{i0}}{L_{i0}}. \qquad [5]$$

Note that, in principle, initial technology levels, technical progress rates, convergence coefficients and steady state $\hat{y}$ levels could differ across regions. To specify these differences across regions let us go back to the model.

We start by writing equations (1) and (2) in a more compact way,

$$\dot{w}=\Phi(w,\xi),\ \text{where}\ w=(\hat{c},\hat{k})\ \text{and}\ \xi=(\vartheta,f_0).$$

Using the Taylor's Theorem, we approximate $\Phi(w,\xi)$ around the point (w_l,ξ_l), where ξ_l corresponds to the parameter vector of the leader and w_l is its steady state value of $(\hat{c},\hat{k})$,

$$\dot{w}=\Phi(w,\xi)\cong\dot{w}=\Phi(w_l,\xi_l)+\Phi_w(w_l,\xi_l)(w-w_l)+\Phi_\xi(w_l,\xi_l)(\xi-\xi_l), \qquad [6]$$

where $\Phi(w_l,\xi_l)=0$, $\Phi_w(w_l,\xi_l)$ is the Jacobian matrix and $\Phi_\xi(w_l,\xi_l)$ is the matrix of partial derivatives with respect to the policy parameters, both evaluated at the leader.

Setting $\Phi(w_l,\xi_l)=0$ in (6), we can obtain an approximation of the steady state value for a given ξ, $w^*(\xi)$. Then,

$$\dot{w}=0\Rightarrow\Phi_w(w_l,\xi_l)(w^*-w_l)+\Phi_\xi(w_l,\xi_l)(\xi-\xi_l)=0,$$

$$\text{that is}\quad w^*\cong w_l-\left[\Phi_w(w_l,\xi_l)\right]^{-1}\Phi_\xi(w_l,\xi_l)(\xi-\xi_l),$$

where $$\left[\Phi_w(w_l,\xi_l)\right]^{-1}\Phi_\xi(w_l,\xi_l)=\begin{bmatrix}F_{\hat{c}} & F_{\hat{k}}\\ G_{\hat{c}} & G_{\hat{k}}\end{bmatrix}^{-1}\begin{bmatrix}F_\vartheta & F_f\\ G_\vartheta & G_f\end{bmatrix}=-\begin{bmatrix} - & - \\ -\frac{F_\vartheta}{F_{\hat{k}}} & \frac{F_f}{F_{\hat{k}}}\end{bmatrix}.$$

Hence, $$w^*=\begin{bmatrix}\hat{c}^*\\ \hat{k}^*\end{bmatrix}=\begin{bmatrix}\hat{c}_l\\ \hat{k}_l\end{bmatrix}+\begin{bmatrix} - & - \\ -\frac{F_\vartheta}{F_{\hat{k}}} & \frac{F_f}{F_{\hat{k}}}\end{bmatrix}\begin{bmatrix}\vartheta-\vartheta_l\\ f-f_l\end{bmatrix}.$$

Isolating $\hat{k}^*$, it can be expressed as $\hat{k}^*=\hat{k}_l-B_\vartheta\left(\frac{\vartheta}{\vartheta_l}-1\right)-B_f(f-1)$, where $f_l=1$ and B_θ, $B_f >0$.[29] Therefore,

$$\hat{y}_i^* = \alpha \hat{k}_i^* \approx \hat{y}_l - \alpha B_\vartheta \left(\frac{\vartheta_i}{\vartheta_l} - 1 \right) - \alpha B_f (f_i - 1). \qquad [7]$$

Once $\hat{y}_i^*$ differs across regions depending on policy parameters, we turn back to (6) and rewrite it in terms of deviations of w from its own steady state,

$$\begin{aligned}(w - w^*) &\cong \Phi_w(w_l, \xi_l)(w - w^* + w^* - w_l) + \Phi_\xi(w_l, \xi_l)(\xi - \xi_l) \\ &\approx \Phi_w(w_l, \xi_l)(w - w^*) + 0.\end{aligned}$$

Note that this system has the same coefficient matrix $\Phi_w(w_l, \xi_l)$ for all regions and therefore the same eigenvalues. Hence, as a first approximation, we can take the same value of β for all regions.

Finally, we can also rewrite the long run growth rate, g, as a function of the policy parameters in deviations to the leader, taking logarithms in equation (4) of the main text and using a linear approximation around $g_l= g(\theta_l, f_l)$,

$$g_i^* = g_l + g_\vartheta(\vartheta_l, f_l)(\vartheta_i - \vartheta_l) + g_f(\vartheta_l, f_l)(f_i - 1), \qquad [8]$$

where,[30]

$$g_\vartheta = \frac{\gamma g_l}{\vartheta_l}(1 - \alpha B_\vartheta),$$

$$g_f = g_l(1 - \gamma - \gamma \alpha B_f).$$

Now, we can rewrite the growth rate of income per capita in terms of policy variables and the catch-up factor, simply by substituting expressions (7) and (8) in equation (5).

---

[29] The expressions B_θ, and B_f are given by,

$$-\frac{F_\vartheta}{F_{\hat{k}}} = \frac{-(\gamma g_l)/\vartheta_l}{\frac{1-\alpha}{\sigma}(g_l\sigma + \rho + \delta) + \alpha g_l} = -\frac{B_\vartheta}{\vartheta_l}$$

$$-\frac{F_f}{F_{\hat{k}}} = \frac{-g_l(1-\gamma)}{\frac{1-\alpha}{\sigma}(g_l\sigma + \rho + \delta) + \alpha g_l} = -B_f$$

[30] Taking logarithms in equation (4), we have that:

$$\ln g^* = \gamma \ln \vartheta + (1-\gamma)\ln f_0 + \alpha\gamma \ln \hat{k}^* = \gamma \ln \vartheta + (1-\gamma)\ln f_0 + \gamma \ln \hat{y}^* =$$

$$= \gamma \ln \vartheta + (1-\gamma)\ln f_0 + \gamma\left(\hat{y}_l - \alpha B_\vartheta \left(\frac{\vartheta_i}{\vartheta_l} - 1 \right) - \alpha B_f (f_i - 1) \right)$$

Taking derivatives in this expression, we obtain the values of g_θ and g_f.

Appendix B

Table B1

Sample period: 1989-2000. Dependent variable: *Growth*			
y_0	-0.1987 -5.59	-0.1832 -4.31	-0.1937 -5.19
ESFgdp	-7.2447 -3.98		
ERDFgdp		-1.5049 -1.86	
EAGGFgdp			-5.2154 -3.36
NF	2.2E-05 0.73	-2.4E-05 -0.63	-2.5E-05 -0.90
ESFgdp.t	0.2428 1.14		
ERDFgdp.t		0.2216 3.71	
EAGGFgdp.t			0.5218 2.25
NF.t	-5.9E-06 -1.72	-5.1E-06 -1.26	-3.7E-06 -1.13
catch.t	0.0083 7.13	0.0073 5.40	0.0078 6.43
$\hat{\beta}$	22.15%	20.24%	21.53%
$\overline{R}^2$	0.4678	0.4586	0.4547
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table B2

Sample period: 1989-2000. Dependent variable: *Growth*			
Y_0	-0.1887 -5.39	-0.1746 -4.46	-0.1874 -5.05
ESFEU	-0.0099 -4.82		
ERDFEU		-0.0084 -3.84	
EAGGFEU			-0.0078 -6.06
NF	4E-05 1.67	9.5E-06 0.38	-3.6E-07 -0.02
ESFEU.t	0.0011 4.55		
ERDFEU.t		0.0012 4.28	
EAGGFEU.t			0.0011 4.03
NF.t	-1E-05 -3.53	-9.5E-06 -2.75	-7.6E-06 -2.80
catch.t	0.0076 7.23	0.0072 5.97	0.0075 6.88
$\hat{\beta}$	20.91%	19.19%	20.75%
$\overline{R}^2$	0.4816	0.4804	0.4717
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table B3

Sample period: 1989-2000. Dependent variable: *Growth*			
y_0	-0.1743 -5.13	-0.1722 -4.36	-0.1817 -4.77
*total*ESF	-0.0011 -4.87		
*total*ERDF		-0.0003 -2.77	
*total*EAGGF			-0.0008 -4.38
NF	7.4E-05 2.91	3.6E-05 1.00	2.2E-07 0.90
*total*ESF.*t*	7.5E-05 8.35		
*total*ERDF.*t*		3.3E-05 5.05	
*total*EAGGF.*t*			9.5E-05 6.61
NF.*t*	-1.2E-05 -3.93	-1.1E-06 -2.80	-9.9E-06 -3.34
catch.t	0.0077 7.39	0.0070 5.62	0.0074 6.64
$\hat{\beta}$	19.15%	18.90%	20.06%
$\overline{R}^2$	0.4935	0.4760	0.4733
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table B4

First Programming period. Dependent variable: *Growth*			
Y_0	-0.2871 -4.15	-0.2977 -4.35	-0.2909 -4.24
ESFEU	-0.0923 0		
ERDFEU		-0.0080 0	
*total*EAGGF			-0.1937 0
NFGDP	0.0079 0.21	0.0008 0.02	0.0057 0.15
ESFEU.*t*	0.0006 3.81		
ERDFEU.*t*		0.0005 4.03	
*total*EAGGF.*t*			5.1E-05 4.22
NFGDP.*t*	0.0049 1.44	0.0053 1.57	0.0054 1.61
catch.t	0.0065 3.07	0.0063 2.97	0.0064 3.00
$\hat{\beta}$	33.85%	35.34%	34.37%
$\overline{R}^2$	0.9053	0.9055	0.9062
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			

Table B5

Second Programming period. Dependent variable: *Growth*			
y_0	-0.1292 -1.43	-0.0923 -1.28	-0.0902 -1.09
ESFEU	0.0566 0		
ERDFEU		0.0287 0	
EAGGFEU			-0.1102 0
NF	-0.0034 0	-0.0023 0	-0.0029 0
ESFEU.t	0.0014 2.46		
ERDFEU.t		0.0011 3.55	
EAGGFEU.t			0.0009 1.05
NF.t	-9.3E-06 -2.42	-8.8E-06 -2.86	-5.4E-06 -1.34
catch.t	0.0058 1.59	0.0044 1.42	0.0040 1.28
$\hat{\beta}$	13.84%	9.69%	9.46%
$\overline{R}^2$	0.04810	0.0476	0.0165
Estimation by OLS with fixed effects by region			
Temporal dummies are included in all regressions			
t-statistics are White Heteroskedasticity-consistent			