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Real Convergence and European Integration: The Experience of the Less Developed EU Members

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Abstract

This study aims at providing an assessment about real convergence across countries and regions in the EU, focusing more specifically on the four cohesion EU members (Spain, Portugal, Ireland and Greece), since they seem to be more appropriate to draw lessons for the Central and Eastern European countries (CEECs). The results obtained when making an assessment of real convergence in the EU, both at country and regional level, show that in the course of the last few years a process of convergence has taken place between the per capita income levels of the EU regions and also, to a larger extent, of the Member States. Nevertheless, also marked differences could be identified: Ireland is undoubtedly the most successful of the four, while Greece showed the least satisfactory performance.

In this respect, the differences that may be observed between these countries suggest that advances in real convergence are far from being a spontaneous outcome of the accession to the EU, but largely determined by the growth strategy implemented by the countries themselves. Lastly, our study suggests that the Community's regional policy has played a significant role in favor of real convergence between the Member States of the EU. However, the experience of Greece indicates that the impact of EU's financial assistance on the beneficiary countries depends not only on its amount, but also on the efficiency with which its allocation is carried out.

One important lesson to be drawn is that the accession is likely to contribute significantly to improving the possibilities of the current CEECs candidates in aligning their per capita income levels with those of the more advanced current EU members. However, we have also learnt that the prospects of growth and income convergence towards EU levels in the current candidates will depend crucially on the measures taken by each country, and particularly on their capacity to invest more and more efficiently.

Foreword

by János Gács

This paper is one of the results of a broad, multi-year research project of the Economic Transition and Integration Project of IIASA entitled "Catching Up and EU Accession – Prospects for First and Second Wave Countries". The research was particularly encouraged by IIASA's Swedish and Hungarian national member organizations, while financial support was provided by the (then) Swedish national member organization, the Swedish Council for Planning and Coordination of Research (FRN). Preparations for the project started in 1999. In addition to other forms of communication two workshops, one in Budapest in January 2000, and one in Stockholm in May 2001, helped to elaborate the research agenda, coordinate collaborative work and discuss results. Publication of the studies prepared in the framework of this projects started in September 2001.

The main ideas of the research project can be summarized as follows.

The accession of the Central and East European countries (CEECs) to the EU is likely to lead to conflicts between these countries and the incumbent members unless there is a rapid narrowing of the gap in per capita incomes between them. The CEECs are much poorer and have proportionately much larger agricultural sectors than the average EU country, and their combined populations make up between one-fourth and one-third of that of the current EU. Due to these characteristics there is concern in EU member states about a mass migration from the East following accession, about social and environmental "dumping" from CEECs, and about an increased demand by the CEECs on the EU's Structural and Cohesion Funds, as well as on the funds provided under the Common Agricultural Policy.

These concerns, however, are counterbalanced to a large degree by a "catching up" predicted by both theory and experience: poorer countries, unless their development is impeded by institutional barriers, usually develop faster than richer ones, and there is a tendency toward convergence in levels of GDP per capita. In recent years, this catching up process seems to have started. In addition, trends in capital inflows and stock market developments suggest that the expected return on capital in the region is sufficiently high to support the buildup of stronger production capacities.

The research project on catching up studied the pattern according to which preparations for membership can trigger changes that will affect the growth process before and after membership. Special attention was paid to CEECs in different positions: those that started negotiations in 1998 and may reach membership first, and those that started negotiations in 2000. The effects on the sources of growth in both the pre-accession and post-accession periods were studied.

The following specific topics were investigated by the contributors of the project: the relevance of the export led East Asian development experience for CEECs; the forces of convergence and divergence that worked in the less developed EU member states (Spain, Portugal, Ireland and Greece) following their accession; the mixed experience of East Germany in catching up in a growth theoretic perspective; the role of domestic savings and savings behavior in the catch-up process; the likely pattern of the so-called Balassa-Samuelson process (real appreciation associated with the expected rapid productivity growth) in the course of the convergence; evaluation of the possible effects of EU structural aid on the candidate countries' development based on the experience of the cohesion countries of the EU; financial convergence of the candidate countries to the EU and the growth process; the role of institutions in the process of transition and catching up; and the relationship between the growth process and human development (health, education, standard of living, including inequality) in the context of EU accession.

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Real Convergence and European Integration: The Experience of the Less Developed EU Members

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1. Introduction

The issue of real convergence - the reduction of economic inequality between countries (regions) - has been capturing the attention of policy-makers and researchers in recent years. This issue is specially important in the European Union (EU), where the goal of economic and social cohesion aimed at reducing disparities between member countries and regions is included in the Maastricht Treaty. It is not only of major importance for the present Member States, but will also become crucial in the context of the eastern enlargement of the union. Thus, testing the existence of real convergence is a key task of economic research that has implications for national and EU policies, in particular the EU regional policy channeled mainly through the Cohesion and Structural Funds.

Although our understanding of the question of real convergence has grown since the mid 1980s, neither economic theory nor empirical evidence available provide an unambiguous proof for the existence of real convergence. Indeed, apart form the ambiguity of theoretical predictions there are difficulties involved in the measuring of real convergence.

In this context, this study aims at providing an assessment about real convergence across countries and regions in the EU, focusing more specifically on the four cohesion EU members (Spain, Portugal, Ireland and Greece), since they seem to be more appropriate to draw lessons for the Central and Eastern European countries (CEECs), that have already started accession negotiations.

Section 2 briefly summarizes the soundest hypotheses in growth literature regarding the convergence *versus* divergence debate. Then, section 3 discusses the possible ways for measuring real convergence and, on this basis, it provides an assessment of real convergence patterns in the EU. In this respect, it offers first an overall view of the fifteen EU members, at both national and regional levels, and secondly it focuses on the four cohesion countries. Section 4 analyzes the likely explanatory factors that may account for the differences in these catch-up experiences. Here, we begin by taking into account the peculiarities of the growth strategies of the cohesion countries concerning the domestic efforts to improve their technological capability and capital endowments. Then, we explore the likely contribution of international technological spillovers. And, finally, we examine the role played by the EU's regional policy. Section 5 concludes and offers some final remarks regarding the

extent to which the experiences of the four Cohesion EU members can be useful for the Central and Eastern European candidates.

2. Economic growth theories and the convergence *versus* divergence debate

Broadly speaking, real convergence in an area formed by different countries (regions) is understood to mean the approximation of the levels of economic welfare - generally proxied by per capita GDP - across those countries (regions). So, the question of real convergence has to do with the study of economic growth, which in turn has traditionally been approached through an aggregate production function. Using this approach, two main groups of models - the neo-classical and the new endogenous growth models - arrive at very different predictions of real convergence.

The neo-classical growth models - as in Solow (1956) and his following versions, for example Mankiw, Romer and Weil (1992) - imply convergence between poor and rich countries (regions). In these models, output per worker can rise only if the ratio of capital per worker increases or if technology (i.e. total factor productivity) improves. Then, assuming that technologies are identical and exogenous, the mechanism behind convergence rest on the diminishing returns to capital: countries (regions) with low capital stocks and per capita income should have a higher marginal product and return to capital. This should therefore lead to more capital accumulation and faster growth in poor countries (regions) than in rich ones.

Consequently, opening up the country (region) - as happens in the framework of an integration process - would only accelerate the convergence process, as capital should flow to capital-scarce countries (regions) to benefit from higher returns. This is, in fact, the line of reasoning that is in the conventional theory of economic integration developed since the pioneering work of Viner (1950)[1]. Thus, those models - sharing the assumptions of neo-classical growth theory - predict a tendency that in the member countries, prices, costs and income levels converge, with trade and international factor mobility acting as the convergence mechanisms. This process of real convergence is further stimulated in the case of monetary union by the reduction of transaction costs and the elimination of foreign-exchange uncertainty.

However, the new more sophisticated growth models developed in the 1980s do not predict that income convergence between rich and poor countries (regions) is the only possible outcome[2]. Thus, according to one of its first contributions, Romer (1986), returns to capital do not have to be diminishing. From this it follows, therefore, that the impact of economic integration on convergence is not so clear as in the Solow setting. In the approach proposed in Lucas (1988), where human capital with increasing returns is the main driving force of economic growth, the possibility of the brain drain acting as a vehicle of cross country growth divergence is considered. Finally, in some versions of

[1] Hine (1994) and Baldwin and Venables (1995) offer revisions of the theory and summarize the results of the main empirical studies.

[2] A detailed overview of endogenous growth models developed since the early 1980s can be found in Barro and Sala-i-Martin (1995); Grossman (1996) and Aghion and Howitt (1998), and a recent survey of the empirical evidence is presented in Temple (1999).

endogenous growth models, in the same vein as Romer's (1990), the importance of commercially oriented R&D efforts has been emphasized as the main engine of growth, thus also explaining the existence of permanent, and under some circumstances, even widening, technological and income gaps between countries.

In addition, the new economic geography literature pioneered by Krugman (1991) and reviewed in Ottaviano and Puga (1998) pose several reasons, in particular the existence of agglomeration economies, to explain why economic integration may lead to a pattern of increased spatial income inequality.

Since the neo-classical and endogenous models have different views on the mechanisms and processes generating growth and convergence (divergence), they have different implications for public policy.

In the neo-classical model, policy does not have an impact on the long run rate of growth, given that it predicts that poorer economies will grow faster than rich ones and converge to the same long-run equilibrium level of income.

In the endogenous models, however, income convergence need not occur. Government policy can, therefore, positively affect the long-run growth rate through economic incentives for the accumulation of various forms of capital and through the promotion of technological innovations. Thus, pro-active regional policy may play a significant role in achieving convergence.

Nevertheless, some recent versions of endogenous growth models point to more optimistic prospects for international (and interregional) convergence. A characteristic feature of these models is that they assume the existence of knowledge spillover effects of an international scope. Thus, by considering that imitation is cheaper than innovation, these models imply that convergence through technological diffusion is a likely outcome[3]. Apart from taking into account contracts for transfer of technology, they emphasize the role of trade and foreign direct investment as channels for technology spillovers.

Studies that - such as Nadiri (1993), Nadiri and Kim (1996), Coe and Helpman (1995), and Keller (1999) - are focused on technology spillovers spread by trade underline the special importance of transactions in intermediate goods. Yet they also admit this role for trade in final goods, in particular in those ones that allow for reverse engineering practices by the importing country. As for the technology spillover effects through foreign direct investments, there are a great number of studies – see for example Blomström and Wolff (1994), and Baldwin, Braconier and Forslid (1999) and the references therein - which agree on the importance of these effects for growth in the host countries.

In this respect, the most elaborated and realistic formulations of innovation-driven growth models also stress the complementarity between both domestic R&D and foreign R&D spillovers and human capital investments. Thus, both the level (stock) and rate of investment in human capital prove crucial for growth not only as a separate factor, but also as a complement to exploiting the effects of new technologies created by

[3] Note here that historians have always argued that technology transfer favored by relatively cheap imitation –what Gerschenkron called the “advantage of backwardness” is a key driving force behind economic growth.

either domestic or foreign innovation efforts[4]. In this sense, human capital is usually considered as an essential condition for convergence.

In addition, some studies – see as an example Aschauer (1989, 2000), Munnell (1990), Easterly and Rebelo (1993), and Argimon et al. (1997) - underscore the importance of public capital in general, and more specifically the endowment of infrastructure, because of their significant positive externalities on the productivity of companies. Those externalities seem to be particularly big in the case of the transport and communication infrastructure (Easterly and Rebelo, 1993; Roller and Waverman, 1994). Moreover, as for telecommunication and the internet infrastructure, it has been put forward how important they are for the technological upgrading of the whole productive system (Crandall, 1997; and Koski and Majumdar, 2000).

Interestingly, some authors argue that at the present time those infrastructures associated with telecommunications and the internet are a key determining factor of growth given their crucial role in the diffusion of the radical innovations that have been taking place in the last few years. In this respect, the term *general purpose technologies* has been introduced (Bresnahan and Trajtenberg, 1995) to refer to a certain type of drastic innovation, that has the potential for pervasive use in a wide range of sectors in ways that radically change their modes of operation. In fact, we already have a significant number of insightful studies, which illustrate the nature of general purpose technologies, the Internet in particular, and their far-reaching and enduring implications for economic growth and welfare (see Helpman, 1998 and references therein).

What is more, for some of the supporters of this view those radical and pervasive innovations in the area of information and communication technologies imply the birth of the so called "new economy". What is meant under this concept is a revolutionary change in the modes of production and in the behavior of both economic agents and institutions, which is making our inherited economic knowledge obsolete. Without going so far, one cannot but admit the paramount importance of those new technologies as determinants of both the level and the "quality" of economic growth.

Summing up, the literature reviewed above leaves one with rather inconclusive predictions as to the question of whether or not economic integration is able to produce real convergence between country members of an economic union by itself.

Thus, when the rather rigid assumptions of the pure neo-classical growth model are relaxed, particularly that production technologies are identical and exogenous across countries, opening up to trade and factor mobility may become a source of divergence. Indeed, in some versions of endogenous growth models integration, although still leading to aggregate welfare gains, may be conducive to income polarization processes.

Nevertheless, the majority of evidence available suggests that a trend towards real convergence is the most likely outcome, although it is generally considered that this will

[4] Indeed, as argued in Cannon (2000), there is a tendency to integrate the two existing approaches to analyzing the relationship between education and growth. The first, initiated by Lucas (1988) is based on the idea that growth is primarily driven by the rate of accumulation of human capital. The second, which has its origin in the contribution by Nelson and Phelps (1966), describes growth as being driven by the stock of human capital, which in turn affects a country's ability to generate and imitate technical progress.

be a kind of conditioned convergence. More specifically, what is suggested that laggard member countries need to boost efficient investments to enlarge and improve their endowments in all those kinds of capital assets with special influence on growth, namely: technology, human capital and infrastructure. In addition, most of those models argue that the existence of international technological spillovers make it possible to implement a strategy of growth based on a less costly way of imitation of foreign innovations, provided that the country has a good enough human capital endowment. Here it is also underlined how important it is for any strategy of growth to have the provision of good telecommunication infrastructures. In addition, the need for keeping a climate of macroeconomic stability that favors the investments in all those kinds of capital assets required to achieve a sustained economic growth has been pointed out as well.

3. An assessment of real convergence patterns in the EU

This section aims at arriving to a general assessment of the real convergence patterns in the EU, although focused on the case of the four less developed members. For this purpose, it first proceeds to make a brief overview of the main indicators used for measuring real convergence between countries (regions).

3.1. The measuring of real convergence

There are many ways of looking at income or real convergence. Thus a choice must first be made as to the spatial units of reference: countries or regions. Then, one needs to choose among the different concepts and indicators available for that purpose.

Indeed, what we have in the specialized literature - see Baumol, Nelson and Wolff (1994), Barro and Sala-i-Martin (1995), Quah (1993, 1996), and Boyle and McCarthy (1997, 1999) for references - is a wealth of measures and an open debate on their relative merits.

The simplest indicator for assessing real convergence between countries (regions) within an area is to test whether the relative per capita GDP of a country (region) or a set of countries has approached the average of the area.

The two most popular measures are: the *beta*-convergence and *sigma*-convergence. The former implies that the poor countries (regions) grow faster than the richer ones and it is generally tested by regressing the growth in per capita GDP on its initial level for a given cross-section of countries (regions). In turn, this *beta*-convergence covers two types of convergence: absolute and conditional (on a factor or a set of factors in addition to the initial level of per capita GDP). Under *sigma*-convergence we mean the reduction of per capita GDP dispersion within a sample of countries (regions) (see Barro and Sala-i-Martin (1995:11) for further details).

The methodology proposed by Barro and Sala-i-Martin to test *beta*- convergence has been criticized for producing biased results. In this sense, in Quah (1993 and 1996) it is argued that this measure largely neglects the dynamics of changing national (regional) income distributions. In addition, this author identifies a tendency towards "twin peaks" in the cross country distribution, so that the world appears to polarize into distinct classes of income. In other words, countries seem to follow different growth

paths and to converge to distinct steady states, so that they tend to cluster around different levels of per capita GDP. In this respect, Quah (1995) proposes the use of a very complex method based on the use of Markov chains to capture the dynamics of the entire cross-county distribution.

More recently, Boyle and McCarthy (1997 and 1999) have suggested the use of the Kendall index of rank concordance - referred to as *gamma*-convergence - in addition to *sigma*-convergence in testing for *beta*-convergence. That measure seems, therefore, more adequate to capture the possible mobility of countries (regions) within the distribution of income levels over time.

In any event, it may be claimed that none of the existing procedures is generally accepted as inherently superior to the others in any circumstances. In fact, what we find is a wide agreement about the idea that the relative merits of each of the measures may differ depending on what the purpose of the empirical analysis is. In this sense, our purpose in this paper is twofold. On the one hand, our interest is to get on overall picture of real convergence in the EU, at both national and regional levels. On the other hand, we are particularly interested in assessing the achievement in real convergence for each of the four cohesion countries within the EU.

Consequently, below we use first regressional analysis for testing absolute and conditional β convergence - complemented by the σ and γ tests - in order to achieve a global assessment of real convergence in the EU. And, secondly, we take the simplest of the above-mentioned indicators, the trend in the gap to the EU average, so that we can analyze the relative catch-up process of each of the cohesion countries.

3.2. National and regional convergence in the EU: an overall view

On the basis of the convergence indicators that were set out in section 3.1 we carry out here an assessment of the trend in real convergence in the EU. Before that, however, we calculate three indicators - rank, Gini and Theil's indexes -, generally used by the European Commission in its reports on economic and social cohesion in the EU[5]. Accordingly, beginning with rank index, the values obtained in the two reference years, 1986 and 1998[6], show that the difference between the richest and the poorest regions has diminished. Specifically, at the start of the period Hamburg - the most prosperous region - had a relative per capita income (198.5%) six times higher than that of Thüringen (33.3%), whereas by 1998 the rank was calculated to be at 185.5% for the selfsame Hamburg and at 41.8% for Ipeiros[7]. If the rank index is applied across the ten richest and ten poorest

[5] In fact, the Directorate General XVI for Regional Policy has produced a number of reports analyzing convergence and inequality across the regions and Member States: these are the First Cohesion Report (1996) and Second Cohesion Report (2001) as well as the periodic reports on the situation of the regions, the latest edition of which is the Sixth Periodic Report on the Social and Economic Situation and Development of Regions in the European Union (1999).

[6] 1986 is the year in which Spain and Portugal joined the EU, and 1998 is the last year for which data on GDP per capita are available.

[7] The EUROSTAT regional per capita income series does not have data prior to 1989 for the new Länder of Germany. It was therefore decided to assume that the relative per capita income remained stable on the eve of reunification (1986-1988).

regions, a similar conclusion is reached, as the relative per capita income of the former decreased from the 172.2% of 1986 to the 165.6% of 1998[8], whereas in the latter it increased from 37.1% to 51.4%. If the analysis is extended to 25 regions each, it may be observed that, although the per capita income of the most prosperous set of regions has remained stable at around 148.0%, that of the least prosperous set improved considerably: from 45.0% to 61.1%.

This diagnosis, however, is open to criticism because it is based on measurements that only take into account the modifications taking place at the extremes of the distribution. Therefore, a Lorenz curve is produced for 1986 and 1998 - and the relevant Gini coefficients calculated - for the purpose of offering a better picture of regional inequality in the EU. As it may be observed in Figure 1, the curve for 1998 is closer to the 45º line[9] than the one for 1986, which confirms the diagnosis that regional income distribution is more equitable in 1998 than in the earlier year. In fact, during the whole period the Gini index dropped from 0.175 to 0.151[10]. This decrease in regional inequality, however, was not uniform all the time, since it increased slightly during the 1993 recession, as is made clear by the trend in the Gini index represented in Figure 2. Note that this matches up with the results of other studies. Thus, in Martín (1999) it is pointed out that inequality tends to decrease in periods of economic expansion and to level off or slip back in times of recession. In short, the analysis carried out on the basis of the calculation of the measurements used in previous studies by the European Commission enables us to conclude that the territorial distribution of income in the EU was more equitable in 1998 than in 1986.

These indicators, however, do not allow us to ascertain the extent to which this improvement in territorial equity in the EU is attributable to the regions and/or to the Member States. We have therefore calculated Theil's index (0), which does indeed provide this information. Certainly, as may be seen in Table 1, this measurement confirms, first of all, the reduction in the spatial inequality of income in the EU, from 0.057 to 0.034[11].

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[8] It should be noted that these values do not match up exactly with those offered by the Second Cohesion Report (2001), since in the calculations for the present paper we have homogenized the series to include Sweden, Finland, Austria and the new Länder of the former German Democratic Republic from the start of the period, 1986. We did this in order to make comparable all the data we are using in the time series 1986-1998. Note that if we included these regions only since 1991, all the other regions would increase significantly their relative GDP per capita in that year, distorting our estimations. In addition to this, the Second Cohesion Report defines the top and bottom regions in terms of the population they cover instead of the number of regions as reported in the First Cohesion Report (1996) and Sixth Periodic Report on the Social and Economic Situation and Development of Regions in the European Union (1999).

[9] The Lorenz curve relates the accumulated proportion of income to that of the population, with per capita income arranged in descending order. In our case, the individuals are the 210 regions of the EU at a NUTS II level of disaggregation with an associated frequency equivalent to the proportion of their population to the total. Thus, the smaller the area between the curve and the 45º line, the more equitable the income distribution is. Due to its construction, the Lorenz curve only allows us to compare two distributions when the curves do not intersect.

[10] Note that the computation of the Gini index for the EU(12) - excluding Austria, Finland, Sweden and the regions of East Germany - provides similar results: a drop from 0.162 in 1986 to 0.150 in 1998.

[11] If we exclude East Germany, Austria, Finland and Sweden we obtain values for the Theil's index (0) of 0.045 in 1986 and 0.037 in 1998, showing again a reduction of spatial inequality, although to a lesser extent than when these regions are included.

Table 1: Regional and state member contribution to the total income disparities in the EU (1986 and 1998)

	Theil (O) index	
	1986	**1998**
Austria	0.026	0.028
Belgium	0.026	0.025
Denmark*	-	-
Finland	0.014	0.027
France	0.032	0.032
Germany	0.107	0.030
Greece	0.005	0.013
Holland	0.015	0.010
Ireland*	-	-
Italy	0.035	0.042
Luxembourg*	-	-
Portugal	0.038	0.017
Spain	0.020	0.028
Sweden	0.004	0.012
United Kingdom	0.017	0.021
Total regional inequity	0.042	0.027
State inequity	0.015	0.007
EU inequity	0.057	0.034

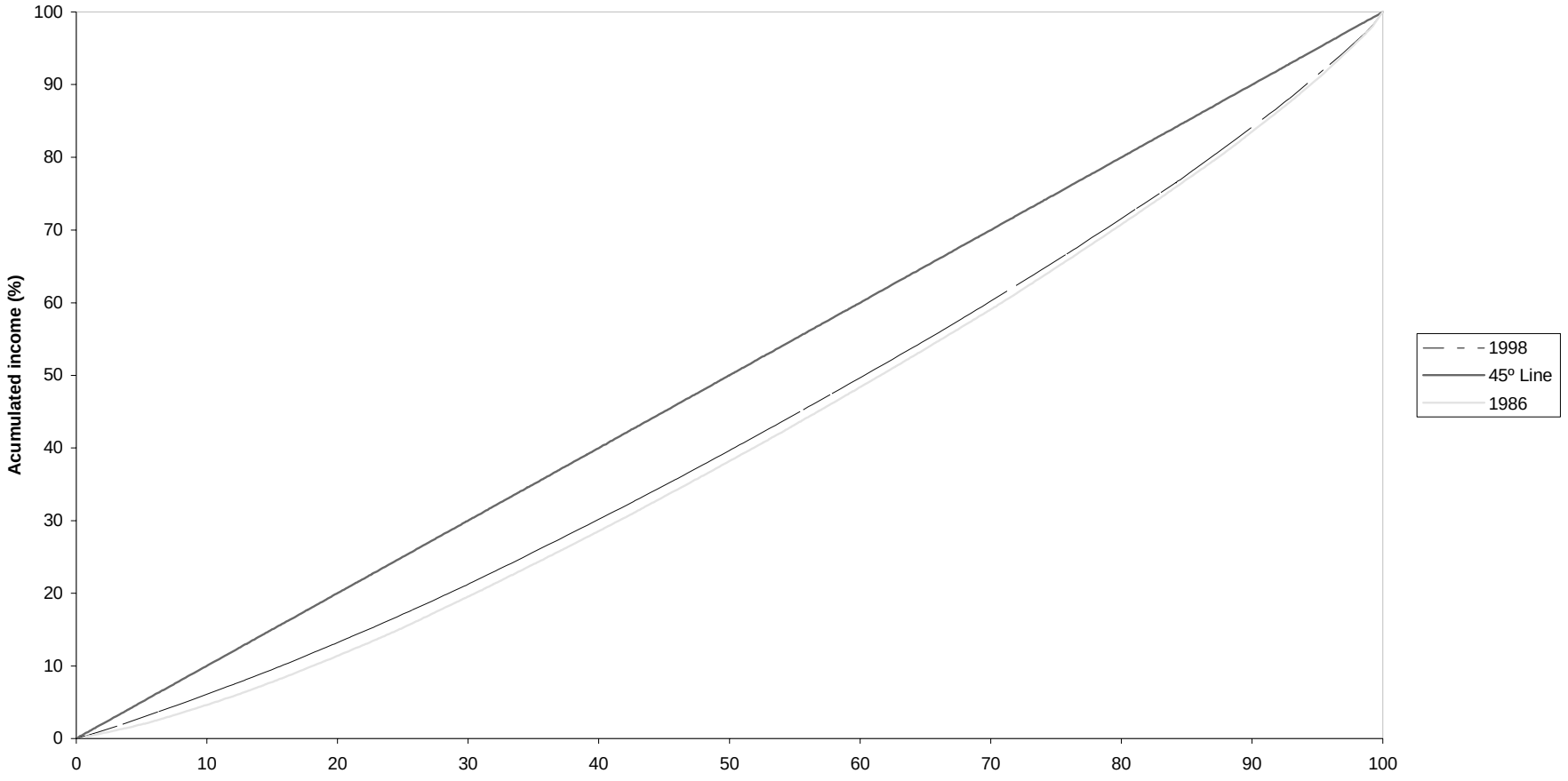
Note: Denmark and Luxembourg do not have any disaggregation area at NUTS II level. Ireland is divided into two areas only since 1997.

Source: Own elaboration starting from the REGIO Data Base of Eurostat.

Furthermore, in the second place, it offers evidence that both inter-country differences (from 0.015 to 0.007) and inter-region differences (from 0.042 to 0.027) have contributed to this decrease, although, in relative terms, the reduction was greater in the case of the Member States. Precisely, owing to the consistent breakdown provided by Theil's index (0), it may be stated that the differences in income on the national level (0.007) are only responsible for 20.6% of the inequalities recorded in the EU in 1998 (0.035). Lastly, the decrease in total regional inequality - which is obtained as the weighted sum of the regional inequity in each State - varied considerably: while the index dropped very significantly in Portugal and Germany, it increased in the majority of the Member States, above all in the Nordic countries[12].

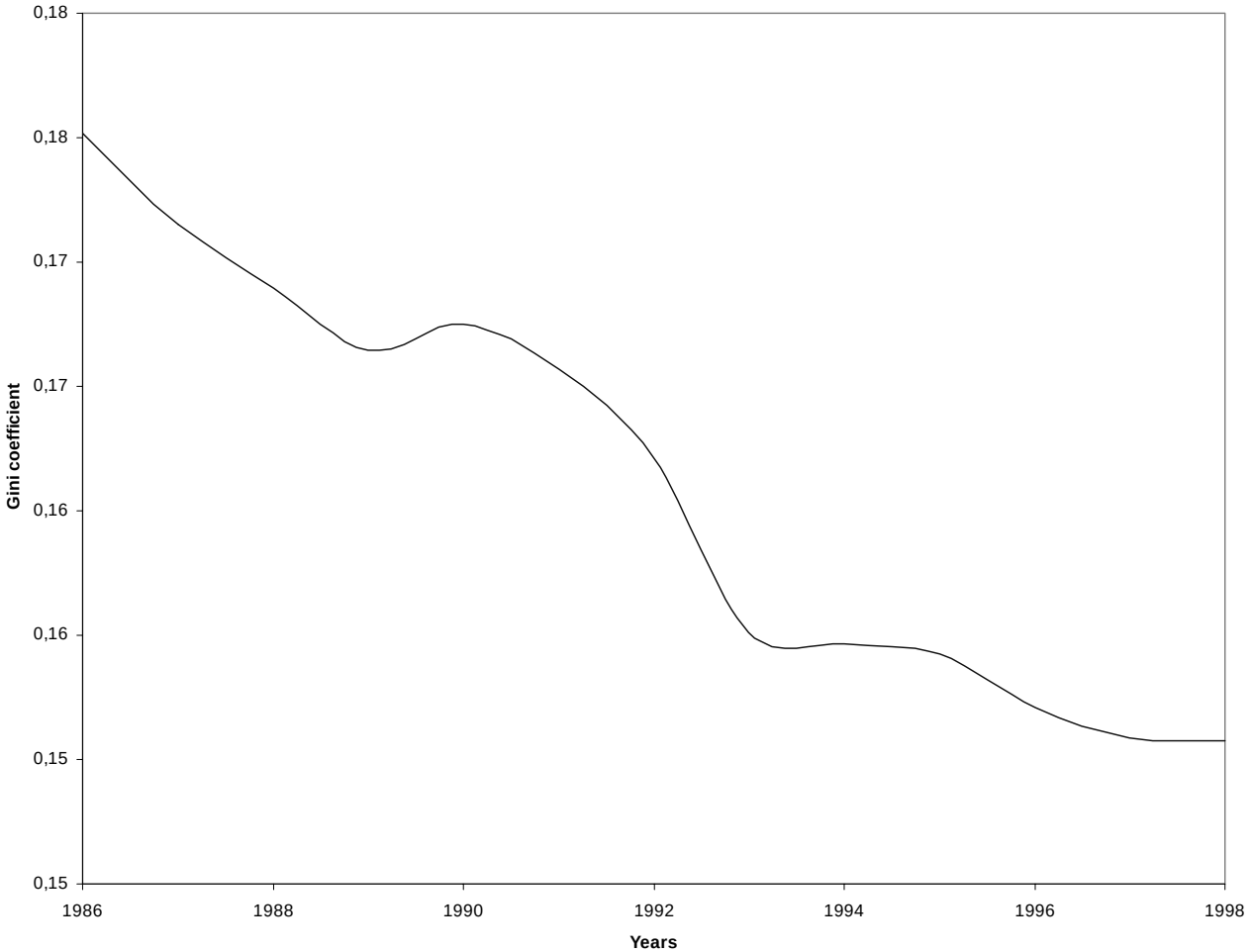
[12] The Theil's Index with $\beta=0$ is a sum of a disparity measure $\log (U/X_i)$ (where U is the average GDP per capita of the total area, and X_i the GDP per capita of each region) weighted by the share of population. Thus, Theil (0) is computed for each country using its regional data. The weighted sum of these indices measures, therefore, regional inequity. Then, the State inequity is calculated using the data of each country. Finally, using the data for the 210 regions as if all of them were part of the same area we arrive to the EU inequity, which can also be obtained as the sum of total regional and State inequity.

Figure 1: Regional income distribution in the EU (1986 and 1998): Lorenz curve



Source: Own elaboration starting from the REGIO Data Base of Eurostat

Figure 2: Gini coefficient of the regional income distribution in the EU (1986-1998)



Source: Own elaboration starting from the data of the REGIO Data-Base of Eurostat

It is of particular interest, that a wide variety is observed across the countries in the cohesion group. Thus, Portugal has improved equity of income distribution considerably due to the spectacular development of three regions which were very laggard in 1986: Centre, Alentejo and Algarve. On the other hand, Greece, which started from one of the lowest levels of inequality, with an index of 0.005 in 1986, almost tripled it (0.013) by 1998. In Spain, Catalonia and the Community of Madrid have experienced a rate of convergence that many other regions have not been able to follow. Hence, for Spain Theil's index (0) has shown an increase, albeit to a lesser extent than for Greece. As for Ireland, which in 1997 was disaggregated into two areas: the South and the East (where Dublin is located), the gap between these two is appreciable: whereas the former area enjoyed a per capita income in relation to the EU average of 118.5% in 1998, the latter's was only at 79.3%.

In short, in the cohesion group we find two different models for approaching the EU per capita income, typified by Portugal and Greece. While Portugal approached the standards of EU economic well-being and at the same time reduced its internal regional differences, Greece caught up and simultaneously increased it spatial inequality[13].

In any case, it should be pointed out that the inequality indicators applied so far do not allow us to capture the dynamics of territorial income distribution satisfactorily. It is therefore advisable to resort to the convergence indicators mentioned in section 3.1. In this respect, we begin with the simplest indicator: the absolute β-convergence index. The method used for its calculation will be the one put forward by Cuadrado, García and Raymond (1999), which only differs from the more well-known 'Barro type regression' in that the former uses the rate of growth of the regions defined in relation to the average growth of the area[14]:

$$\Delta \ln GDP_{i,t} - \Delta \ln GDP_{EU,t} = \beta \, (\ln GDP_{i,t-1} - \ln GDP_{EU,t-1}) + \varepsilon_{i,t} \qquad (1)$$

Where:

$GDP_{EU,t}$	per capita income of the EU in purchasing power standard (PPS) in year t
$GDP_{i,t}$	per capita income of the region or country i in PPS in year t
i	15 Member States for country convergence and 210 regions of the EU at the NUTS II level of disaggregation for regional convergence
t	all the years in the period 1986-1998

[13] Note that Greece would have shown the same trend as presented above if we have had considered its full EU membership period. Indeed, the Theil (0) index for 1981 is 0.006, which is pretty close to that of 0.005 corresponding to 1986.

[14] The main advantage of this methodology is that it enables conditional β-convergence to be estimated without the need to establish the variables determinant of the steady state of the regions, besides allowing us to examine both the cross-section and the time dimension.

Table 2: Estimated β-convergence in the EU (1986-1998)

Estimated equation	$\Delta ln\ GDP_{i,t} - \Delta ln\ GDP_{EU,t} = \beta\ (ln\ GDP_{i,t-1} - ln\ GDP_{EU,t-1}) + \varepsilon_{i,t}$			
Estimation	Absolute β		*Conditional β*	
	Regional	States	Regional (within)	***States*** (GLS)
β	-0.026 (-8.269)	-0.039 (-4.827)	-0.122 (-6.427)	-0.031 (-2.226)
N observations	2520	180	2520	180
Adjusted R^2	0.0596	0.0996	0.2643	0.0509
Hausman Test CHISQ(1)			230.24	1.11
Test $A=A_i$ F(209,2309)	-	-	2.22	-

In parenthesis White´s (1980) heteroscedasticity consistent t-statistics.

As it may be seen in Table 2 that we estimate two different equations. The first one by using country data of the 15 Member States and the second one by employing 210 regions of the EU at the NUTS II level. The β coefficient is negative and significant in both cases, although the rate of convergence at Member State level, 3.9%, is higher than the regional rate, which stands at 2.6%. It should be pointed out, however, that the results obtained for the case of the estimation of regional convergence may be biased by the 'country effect', i.e.: by the fact that growth is more affected by the development of the country to which regions belong than by the actual features of the region.

Consequently, we proceed in two ways to confirm that there has been regional convergence. First, equation (1) is estimated for the 210 regions including a dummy for the 15 Member States that takes value 1 if the region belongs to a particular country and 0 if otherwise. Thus, we reduce the spatial self-correlation caused by the fact of the regions belonging to the same geographical areas (Armstrong, 1995). In this way we obtain the same result for β-convergence, -0.026, as when excluding these country dummies. Second, the same equation (1) is estimated but taking the regional GDP per capita in relation to the country average to which each region belongs rather than in relation to the EU. By means of this procedure, similar to that used in Rodríguez-Pose (1996), an estimate of the rate of regional convergence of 2.3% is obtained. Hence, from both

procedures, it may be verified that, apart from the 'country effect' there is a convergent tendency specific of the regions.

It should be remembered, however, that the estimations made so far consider that all the areas have the same steady state. Therefore, and in order to be able to detect the possible existence of the different steady states for each country or region, two new estimations of the equation (1) will be performed for state and regional convergence by means of the panel data procedure. The first is the within (fixed effects) through the estimation of equation (1) including per country dummy in the case of state convergence, and per region dummy for regional convergence. This procedure allows for different steady states for each country or region. The second is the Generalized Least Squares (GLS) estimation (random effects) of the pooled data, imposing a common intercept and, therefore, assuming the same steady state for each country or region. The latter estimate is more efficient than the former but will be biased if there is correlation between unobservable effects and explanatory variables. Hence, we have carried out Hausman Test of the null hypothesis of no correlation between the unobservable effects and the explanatory variables[15].

Table 2 sets out the results obtained in this new estimation. Thus, for the case of the regions, Hausman's test indicates that the individual effects are correlated with per capita income, so a *within* estimation is performed to avoid bias[16]. In this way, an estimation for the rate of conditional convergence of 12.2% is obtained, much higher than that obtained for absolute convergence. This significant increase is due to the fact that the individual effects of each region display a positive correlation with per capita income. In fact, the F test rejects that these effects are the same for every region, which may indicate that convergence is taking place to different equilibrium income levels[17]. Hausman's test does not dismiss the hypothesis that there is no correlation between the individual effects (at country level) and per capita income. A GLS estimate was therefore undertaken in order to increase the degree of efficiency. Accordingly, a value for the conditional β of 3.1% is obtained. Note that this magnitude cannot be compared with that obtained with

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[15] If the hypothesis is rejected, we run the single unbiased estimator (within estimates). If it is not rejected, we proceed with the GLS estimates because, in addition to being unbiased, they will be the most efficient. So, there would be absolute convergence in two cases: firstly if the GLS estimator is unbiased and hence we do not include any other variable apart from the previous year's relative income per capita as an explanatory variable for the rate of change; and secondly if only the within estimator is unbiased, but we can not reject the hypothesis of country dummies being equal for all the countries (De la Fuente, 2000). In this case all the countries or regions will converge to the same steady state. On the other hand, if β is negative but the only unbiased regression is the within estimates and we reject the hypothesis of all the individual effects being the same, then there is conditional convergence. Consequently, all countries or regions will be converging to different steady states.

[16] As may be verified in Table 2, the hypothesis that individual effects are not correlated with the explicative variable is rejected at a 1% level of significance.

[17] Panel data estimation of the afore-mentioned regression enables us to observe whether there are significant individual effects, but not to explore what those factors specific of each region may be. Furthermore, the fact that the individual effects are different may indicate that, although there has been a convergence process in an integrated area, this process may not continue taking place in the future (De la Fuente, 2000).

the *within* estimation for the regions, as it is a case of different procedures. In addition, the fact that there are no time-constant individual effects justifying the differences in per capita income suggests that EU partners are converging to the same income level in the long term.

In short, the most laggard areas of the EU have grown to a greater extent than the most prosperous ones over the period 1986-1998.

However, to ascertain that a convergence process has taken place in Europe, it is necessary to calculate the σ-convergence, since, as argued in Sala-i-Martin (1995), β-convergence, both absolute and conditional, is a necessary but not a sufficient condition. Thus, on the basis of σ-convergence, it may be established that the EU has experienced a decrease in regional disparities from 0.357 in 1986 to 0.266 in 1998[18]. Convergence between Member States has been even greater, as disparities decreased from 0.033 to less than half, 0.015.

Finally, the value of γ-convergence confirms the results obtained by σ-convergence. In fact, in the regional context convergence has been minimal, as in a rank between 0 (when the ranking is modified completely) and 1 (if the ranking is not altered) the index obtained stands at 0.96[19]. Again, the convergence estimated with respect to the Member States is much higher: 0.83[20].

In conclusion, all the convergence estimations performed suggest that EU Members States converge to the same steady state, whereas the regions do so to different ones and at a slower pace.

3.3. The case of the Cohesion countries

The four countries whose per capita income was significantly below the EU average during the 1990s - Greece, Ireland, Portugal and Spain - are those referred to as "cohesion countries".

In assessing their real convergence patterns, we will look at the trend of their respective per capita GDP in relation to the EU average expressed in PPS (Purchasing Power Standard). Specifically, Figure 3 shows the evolution of this indicator for each of the four cohesion countries, over the 1960-2000 period. Compared with their starting levels in 1960, all four countries can be said to have succeeded in catching-up, at least to some extent, to the EU average. However, the experience of the four countries in this period was very different. Ireland, whose income level is now above the EU average, is the most successful of the four and Greece the least[21].

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[18] For the EU(12) regions these indices are 0.337 in 1986 and 0.290 in 1998.

[19] If the binary Kendall index, which only uses the information of 1986 and 1998, is calculated instead of the multi-annual index, which uses all the data of the period, an index of 0.93 is obtained. In both cases the test is significant at 1%, so it is rejected that there is no association between the rankings of different years. This statistic is distributed as a chi-square. For the EU(12) regions the result is 0.97.

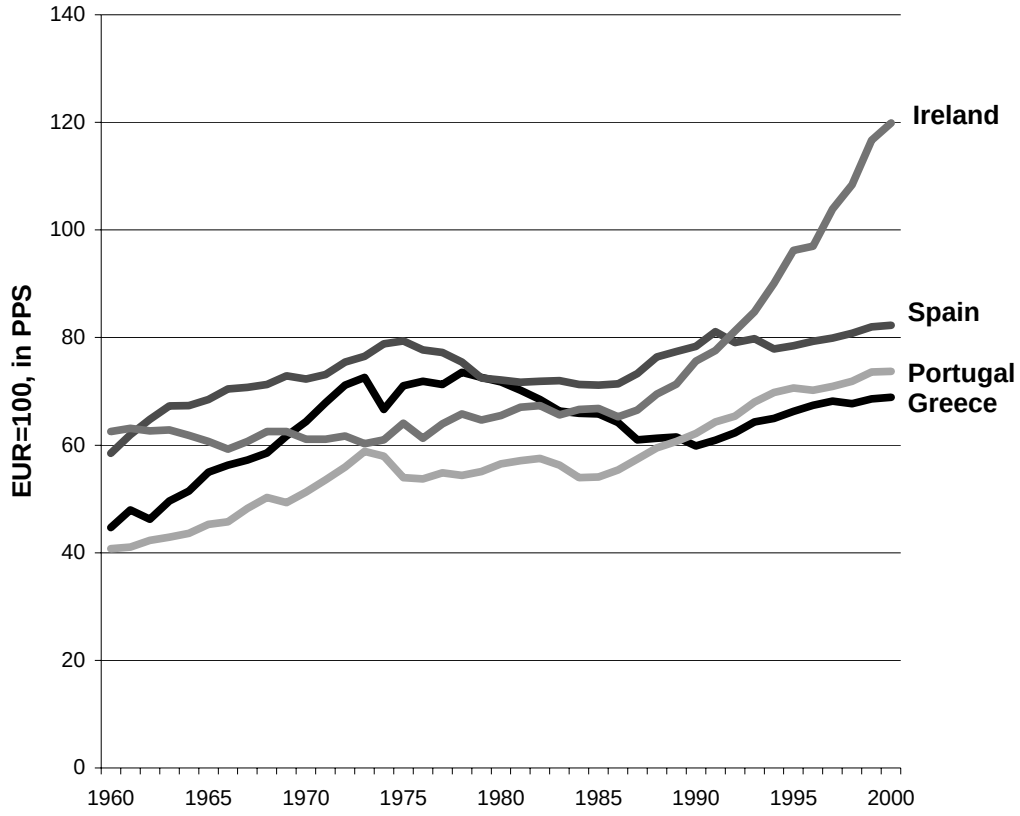
[20] The binary Kendall index is 0.82 and both are significant at 1%.

[21] It should be note that Ireland's income level is about 10 percentage points lower if measured in

The intensity of the catch-up process has varied over the time, so that, with the sole exception of Greece in the early years after its accession, the cohesion countries show a better performance after their membership. Again, the case of Ireland proves to be particularly impressive in this respect. Thus, over the 90s no other EU member has been able to match its outstanding growth performance.

Such differences across member countries suggest that, far from being spontaneous, their respective process of real convergence is largely attributable to differences in their respective growth strategies.

Figure 3. Per capita GDP in the Cohesion Countries (1960-2000)



Source: European Commission: European Economy and EUROSTAT: Statistics in Focus. Economy and Finance.

terms of GNP per capita, mainly due to the significant presence of multinational firms whose repatriated profits are not included in the GNP.

4. Main determinants of real convergence of the Cohesion countries in the EU

Proceeding with our aim of achieving an adequate diagnosis of real convergence experiences for less developed EU members, we will now first take into account the factors that, according to the soundest theoretical and empirical evidence, are the main determinants of growth in the medium and long term. That is to say, we will make and assessment of the endowments of the cohesion countries in both physical and intangible capital, as well as their investment efforts to increase them.

Secondly, we will explore the likely contribution of international technological spillovers - through trade and foreign direct investments - in the catch-up experiences of the four less developed EU members. And finally we will analyze the role played by the EU's Regional policy.

4.1. National growth policies

According to the evidence on the determining factors of economic growth – recall what was summarized in section 2 – it is reasonable to expect that the across-countries differences found in the real convergence process of the cohesion countries have to do with the differences in their respective strategies of capitalization on both kinds of capital endowments: physical and intangible.

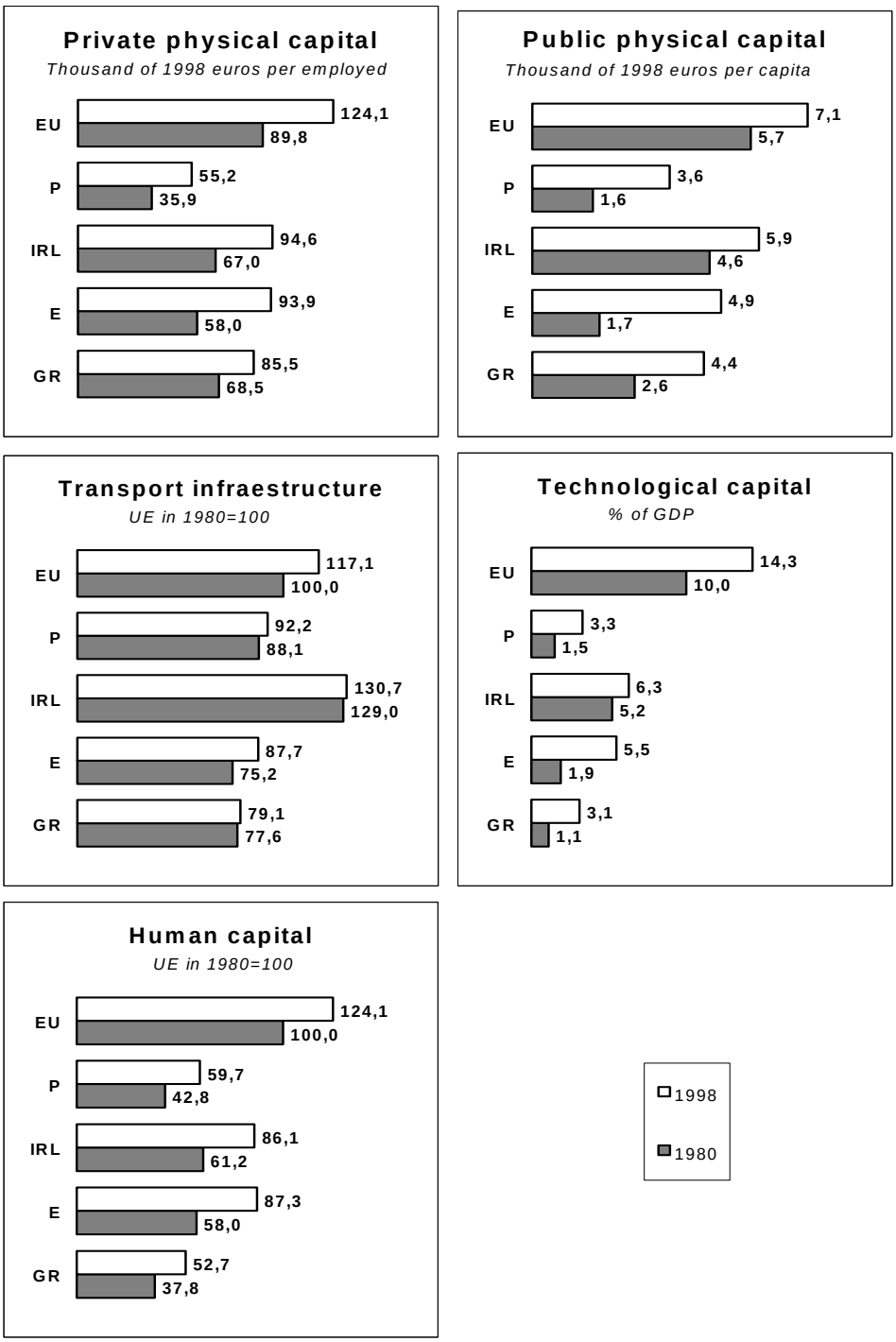
Regarding the level and trends in physical capital endowments we proceed first to estimate the stocks of private capital. Accumulation is calculated on the base of the respective series of private Gross Fixed Capital Formation (GFCF), conveniently deflated and depreciated under the Perpetual Inventory Method. Then, the stocks of public capital are to be obtained by applying the same procedure to the corresponding series of public GFCF. Finally, we attempt an assessment of the transport infrastructure endowment by calculating the arithmetic mean of the availability of a kind of standard motorway per square km and per capita (see Martín, 2000 for more details).

The values estimated for all these kinds of physical capital endowments are shown in Figure 4. The figure shows that, as expected, the various endowments are generally larger in those of the four Cohesion members that have been more successful in narrowing their *per capita* GDP to the EU average than the rest.

As for the stock of technological capital, there is a wide consensus that it can be reasonably well estimated by the accumulation of the R&D spending following the perpetual inventory method[22]. We have, therefore, applied this method to the series of data on R&D starting 1973 (provided by the OECD), using as a deflator that of the Gross Fixed Capital Formation and assuming a depreciation rate of 10%.

[22] The use of the R&D expenditures as an indicator for the technological development has received two kinds of criticism. On the one hand, it has been claimed that R&D spending is an overstated measure of the efforts in technological activities in view of the high rates of failures that are likely to occur in R&D projects. On the other hand, others have argued that it is under-estimated, because it does not include the payments for imports of technology.

Figure 4: Capital endowments in the cohesion countries and the EU



Source: OECD: *National Accounts. Main Aggregates*; OECD: *National Accounts. Detailed Tables*; OECD: *Main Science and Technology Indicators*; OECD: *Basic Science and Technology Statistics*; OECD: *Labour Force Statistics*; OECD: *Economic Outlook*; OECD: *Education at a Glance*; EUROSTAT: *National Accounts ESA. Detailed Tables by Sector*; UNESCO: *Statistics Yearbook*; UN-ECE: *Annual Bulletin of Transport Statistics for Europe and North America* and own elaboration

As regards the estimation of human capital stock, it should be pointed out that the best procedure used up to now is the one followed in Barro and Lee (1993 and 1996). This procedure approaches the human stock of a country in terms of the level of training of its working-age population according to the years of schooling at all levels of education. While we will essentially follow this method, we will introduce an improvement trying to overcome the criticisms that the Barro and Lee (1993 and 1996) estimates received, namely that they do not take into the consideration the likely differences of quality across the *education systems* of the countries. Consequently, our estimated series of human capital stock introduce a correction, based on data on the cross country differences in education expenditure per student at every level of teaching, in an attempt to get data in terms of the same quality standard. More details about the data sources and the procedure used for the measurement of these spillovers are provided in BOX 1 below.

The estimated values for these two intangible capital endowment indicators for Spain, Portugal, Ireland and Greece – all of them in relation to those of the EU average in the years 1980 and 1998 - are presented in the same Figure 4. From examining the figure on technology capital we deduce, among other things, that all the cohesion countries, with the exception of Ireland, have been far behind the EU average. The gap has, however, diminished significantly over time (except for the case of Ireland). This is explained by the stronger rate of investment in R&D in the most backward member countries during most of the period of reference and by the slowdown in R&D spending in some countries, such as Germany, which have got a bigger stock of technological capital.

As for the stock of human capital the cohesion countries also show a significant but decreasing gap in relation to the EU average (except for Greece). Among the four laggard countries we should underline the special efforts made by the Spanish economy in the given period.

Overall, the differentials found in the level and path of technological and human capital stocks across the four cohesion countries appear to confirm the hypothesis of the endogenous growth theories which stress the importance of the role of these factors in the growth and economic real convergence of countries.

4.2. International technological spillovers

Once we have found that underlying the catch-up process in per capita GDP of the laggard EU members there have been the important efforts to increase their tangible and intangible capital endowments, it seems interesting to explore the likely contribution of international technological spillovers to this process.

BOX 1. CALCULATIONS OF CAPITAL ENDOWMENTS

- **Stock of private and public physical capital:**

Data for each country was estimated on the basis of the accumulation of investment flows since 1960 under the perpetual inventory method. The series on the private and public GFCF (Gross Fixed Capital Formation) and their deflators are those which figure in OECD: National Accounts, Vol. 1, Main Aggregates. The depreciation rate is 5.4% and was obtained from EUROSTAT (1997).

- **Stock of transport infrastructure:**

Data for each country was estimated on the basis of the weighted sum of km of local, regional and national roads and motorways for each year. The series on the km of roads and motorways are those which figure in United Nations: Annual Bulletin of Transport Infrastructure for Europe and North America. See Martín (2000) for more details.

- **Stock of technological capital:**

Data for each country was estimated on the basis of the accumulation of R&D expenditure since 1973 under the perpetual inventory method (with a lag of two years) and assuming a 10% depreciation rate, based on data obtained from OECD: Main Science and Technology Indicators; Basic Science and Technology Statistics; and Research and Development Expenditure in Industry.

- **Stock of human capital:**

The human capital stock is estimated through a formulation similar to the perpetual inventory method; that is, by adding up the number of students enrolled each year since 1930 at all educational levels (primary, secondary, technical and higher education) who are of working age in the year for which the indicator is calculated, previously weighted by the ratio between expenditure per student at each level of education and in each country, and the average total cost of educating a university student in the EU. The advantage of this procedure, in addition to its easy updating, is that it allows us to take into account that the disparities in expenditure per student across different educational levels and countries indicate different quality. The original sources of data are: UNESCO: Statistical Yearbook, and OECD: Education at a Glance. See Martín (2000) for more details.

Indeed, as was mentioned in section 2, recent growth literature has not only emphasized the importance of domestic R&D and human capital investments, but also that of the international diffusion of technology through different channels. Thus, in addition to the most conventional and direct channel, the international contracts for transfer of technology, the new growth models have stressed two other indirect ways for international diffusion of technology: those due to the assumed existence of knowledge spillover effects channeled through trade and foreign direct investment. Consequently, in these models, at a given level of domestic stock of technological and human capital, the processes of opening up and integration of a country will tend to raise its rate of growth.

Following this line of reasoning, we will pursue our analysis of real convergence for the four target countries by trying to approach the relative importance of their

capability to benefit from foreign technological innovations through the three channels mentioned above.

In view of the fact that the four countries have concentrated their imports of goods and technology as well as their direct investment inflows in the OECD countries, we will consider this area as the origin of all their knowledge spillovers through each of these ways. To begin with, we have estimated the extent of technological spillovers coming from technology imports on the basis of the accumulation of the series of technology import payments under the perpetual inventory method. As for the spillovers incorporated in the direct investment inflows, we have calculated a weighted average of technology capital in the OECD member countries using as weights the stocks of foreign capital received from each of them. Finally, technological spillovers through imports of goods have been estimated by an analogous procedure but here using as weights the imports coming from each one of the OECD countries. More details about the data sources and the procedure used for the measurement of these spillovers are provided in BOX 2 below.

The results obtained in our estimation of the importance of those three channels of diffusion of foreign technologies are presented in Figure 5. As expected, in the light of their relatively lower stocks of technological capital from a domestic origin, technological change in the four less developed EU countries seems to have been based to a great extent on the diffusion of foreign innovations.

A short glance at the different channels reveals some interesting features. Apart from the leading role of imports in all countries, the most salient feature is the extraordinary importance of foreign direct investment in Ireland and also, although to a lesser degree, in Spain and Portugal. Moreover, as it has been argued in other places (see OECD, 1999 and Barry, 1999) foreign direct investment has played a crucial role not only in the technological modernization but also in the transformation of the Irish economy. The traditional scarcity of inward investment flows in Greece makes the rather poor performance of this country as regards labor productivity easier to understand.

A more descriptive analysis of the trends of direct investment inflows in each country - which have given rise to cumulative data graphically reported in Figure 5 - reflects that in the case of Ireland the bulk of these investments have taken place since the beginning of the 1990s, (see Figure 6), that is to say, since the eve of the formation of the European Single Market. The major share of those capital inflows come from USA and are concentrated in a rather small number of sectors which exhibit a salient export performance. All these facts suggest, therefore, that Ireland has been chosen by American investors as a base to supply all the EU market.

It is interesting to denote that this inward direct investment boom in Ireland seems to have been on the basis of the clear reorientation of both productive and trade structures towards skilled-labor and technology-intensive sectors observed in the 90s in the Irish economy. In this sense it is of interest to note that the trend in foreign direct investment and that corresponding to the increasing share of technology-intensive sectors have gone in parallel. In addition, in OECD (1999) it is documented in more detail that inward investment has been vital in the creation of an export-oriented, skilled-labor-intensive sector, concentrated in areas such as electronics, pharmaceuticals and corporate services.

BOX 2. MEASUREMENT OF THE INTERNATIONAL TECHNOLOGICAL SPILLOVERS BY CHANNELS

- **Foreign Capital (*TSfc*):**

$$TSfc_{it} = \sum_{j=1}^{n} \frac{Fc^{i}_{jt}}{GDP_{it}} \frac{Tk_{jt}}{Phk_{jt}}$$

where,

Fc: Stock of foreign capital in country i from country j. The values of this variable were obtained from OECD: International Direct Investment Statistics Yearbook. Given the disparities found between data for the source and host countries, the statistics had to undergo a data-editing process.

Tk: Stock of technological capital. Data for each country was estimated on the basis of the accumulation of R&D expenditure since1973 under the perpetual inventory method (with a lag of two years) and assuming a 10% depreciation rate, based on data obtained from OECD: Main Science and Technology Indicators; Basic Science andTechnology Statistics; and Research and Development Expenditure in Industry.

Phk: Physical capital. Data for each country was estimated on the basis of the accumulation of investment flows since 1960 under the perpetual inventory method. The series on the GFCF (Gross Fixed Capital Formation) and their deflators are those which figure in OECD: National Accounts, Vol. 1, Main Aggregates. The depreciation rate is 5.4% and was obtained from EUROSTAT (1997).

i and j are referred to the host and the source country of the flows of foreign capital.
n is the number of countries considered. In this case all OECD countries.

- **Good Imports (*TSm*):**

$$TSm_{it} = \sum_{j=1}^{n} \frac{M^{i}_{jt}}{GDP_{it}} \frac{Tk_{jt}}{GDP_{jt}}$$

where,

M: Imports of country i from country j. Data on bilateral trade flows were drawn from the IMF: Direction of Trade Statistics Yearbook. To overcome the problem of the lack of coincidence between the trade data from the standpoint of imports (fob) and of exports (fob), the arithmetical mean between both of them was calculated.

- **Technological imports (TStm):**

$$TStm_{it} = \frac{Mtm_{it}}{GDP_{it}} = \frac{Mtm_{it-1}(1-\delta)\frac{p_{it}}{p_{it-1}} + tm_{it}}{GDP_{it}}$$

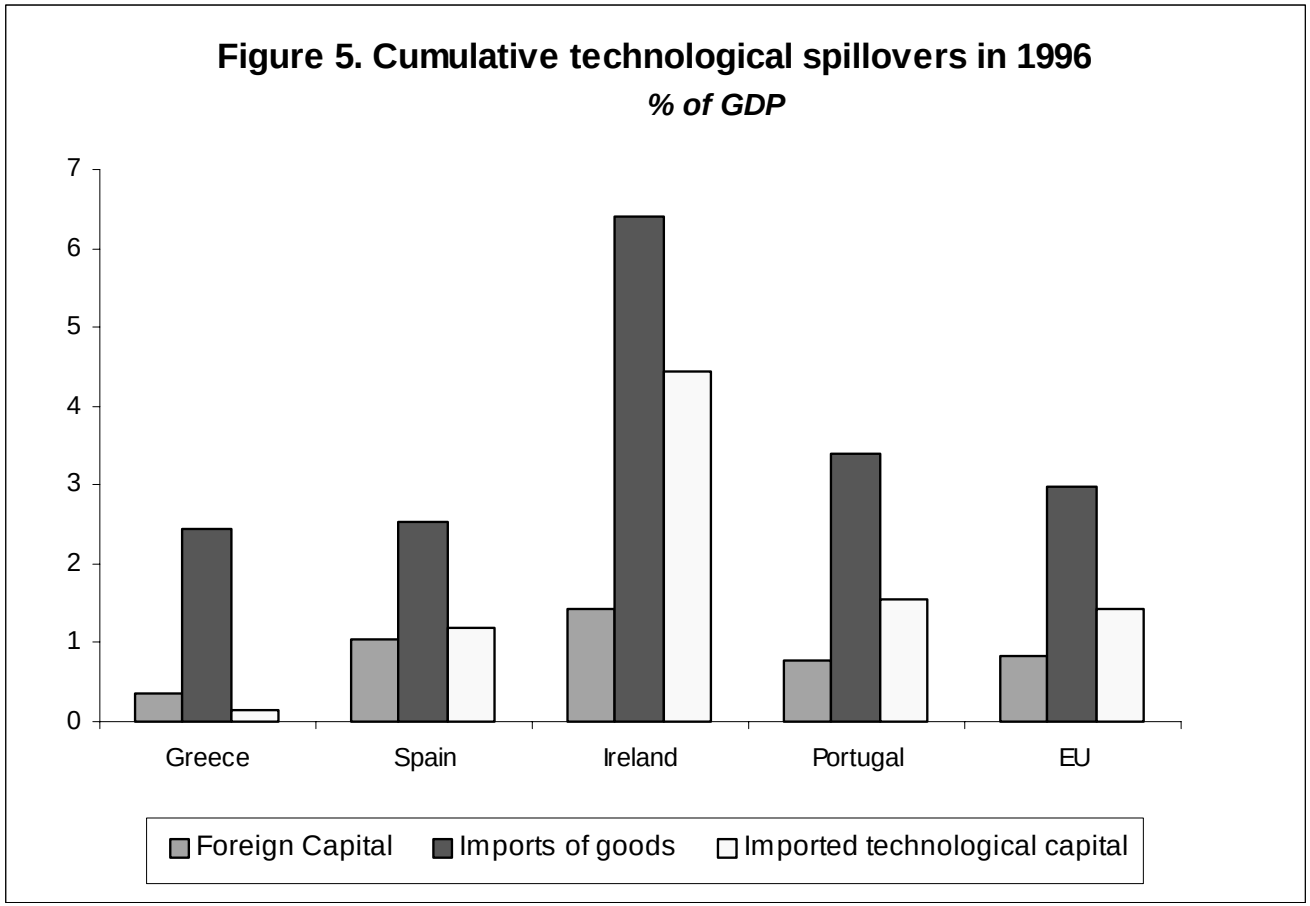
where,

Mtm: Accumulated technological imports from 1973, calculated by the perpetual inventory method.

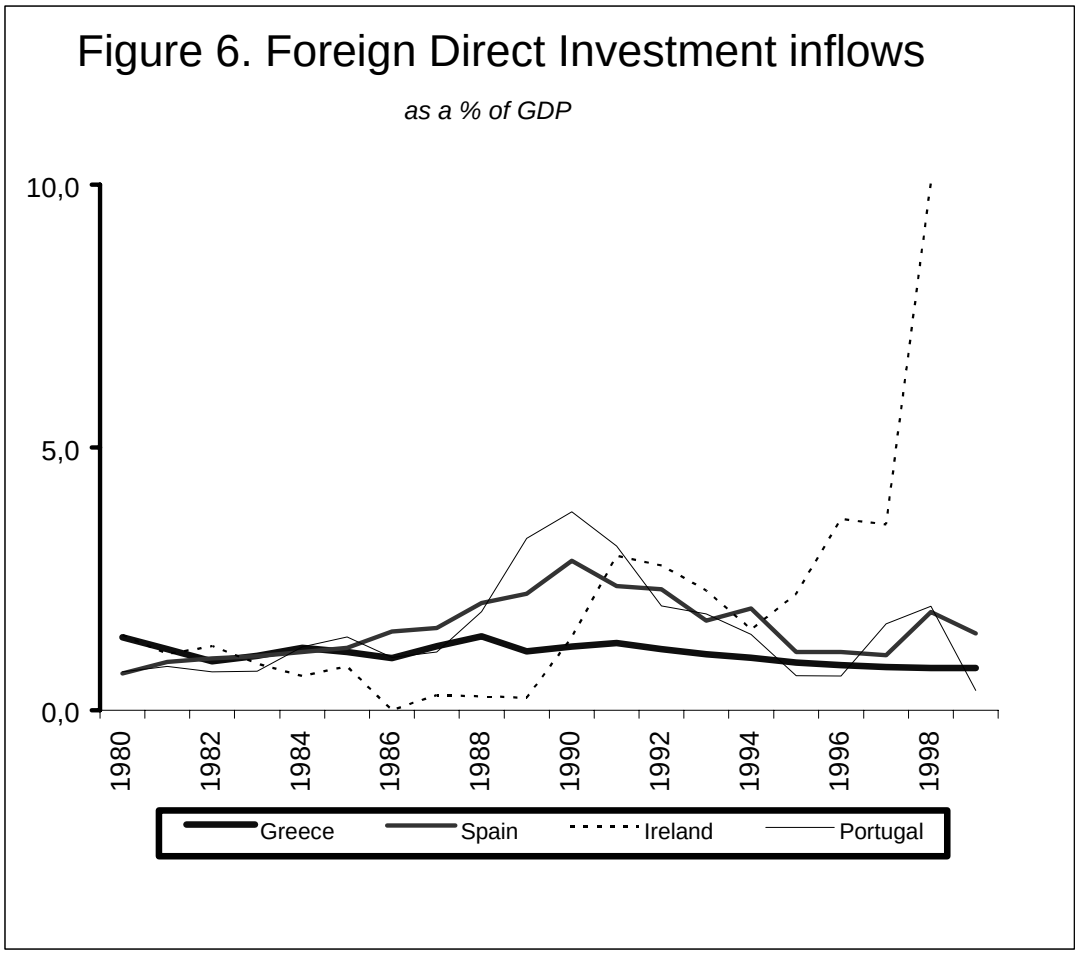
tm: technological imports per year obtained from IMF: *Balance of Payments Statistics Yearbook*, EUROSTAT: *Balance of Payments. Quarterly Statistics* and OECD: *Basic Science and Technology Statistics*.

δ: Depreciation rate. In this case the depreciation rate is 10% as in Mohnen et al. (1986) and Bernstein and Nadiri (1989).

p: Deflator of Gross Fixed Capital Formation obtained from OECD: *National Accounts. Vol. I: Main Aggregates*



Source: OECD: *National Accounts. Main Aggregates*; OECD: *Main Science and Technology Indicators*; OECD: *Basic Science and Technology Statistics*; OECD: Services. *Statistics on International Transactions*; EUROSTAT: *International Trade in Services*; EUROSTAT: *Balance of Payments*; IMF: *Balance of Payments Statistics Yearbook* and own elaboration.



Source: OECD: *International Direct Investment Statistics Yearbook*; EUROSTAT: *European Union Direct Investment Yearbook*; UN: *World Investment Report* and own elaboration.

Needless to say, the diagnosis of real convergence achievements in the EU cohesion countries would be very limited if it did not discuss the contribution of the EU regional policy. We will devote, therefore, the next section to a consideration of this important issue.

4.3. The Regional dimension in the EU Budget

In this section we will examine the role played by the Community budget, and especially by the Structural Measures, in the convergence observed in the EU. In this respect, it is advisable to start off by pointing out that the limit established for EU budgetary spending is 1.27% of the GNP of the Fifteen, whereas national public spending for the average of the Member States amounts, according to European Commission data, to 46.3%. This therefore shows that the scope of any EU budgetary-based policy is rather limited.

In the last few years, however, the Community budget has undergone major changes in its composition, particularly on the expenditure side, which may have affected the spatial distribution of income in the EU. Thus, since 1986 a substantial increase has taken place in the share of the Structural Measures in total EU expenditure: from just 15% in 1986 they have gone up to represent over 35% at the present time, while the Common Agricultural Policy (CAP) has declined in importance, but without ceasing to be the most substantial item, accounting for close to 45%.

Generally speaking, it is observed that the Member States with lower per capita income - the recipients of the Cohesion Fund - have been increasing their net balances with the EU (see Table 3). In this respect, we may single out the case of Ireland, which was receiving funds to the tune of 5% of its GDP until the mid-1990s. The second country that has most benefited from the EU regional policy is Greece, which has obtained funds of an annual amount of around 4% of its GDP. Lastly come Portugal and Spain. Note that the position regarding the receipt of budgetary funds seems to have been more associated with the seniority of the countries being members of the Union than with their relative development level. This leads us to think that the experience gained in participating in EU regional policy programs confers an advantageous position for benefiting from it[23].

Overall, the distribution of all the budgetary resources of the Fifteen may be said to have become more equitable with time. In fact, if the two Lorenz pseudo-curves produced from statistics of 1986 and 1998 are compared, in a way analogous to that used in Martín (2000)[24], it is confirmed that distribution of funds was more equitable in the latter year (see Figure 7).

[23] Furthermore, as showed by Kandogan (2000), once countries join the EU they may use their votes to modify the budgetary rules and improve the percentage of the Community funds they receive.

[24] Lorenz' pseudo-curve is an extremely useful instrument for analyzing the regional dimension of taxes and expenditure. Specifically, by comparing the accumulated income of the countries making up the EU, arranged in descending order of per capita income, with the resources received from the EU also expressed in cumulative terms, we may deduce whether expenditures have contributed to territorial equity (when the curve is situated above the 45º line) or whether they have not done so.

Table 3: Community budget: contributions, revenue and net balance of the EU countries

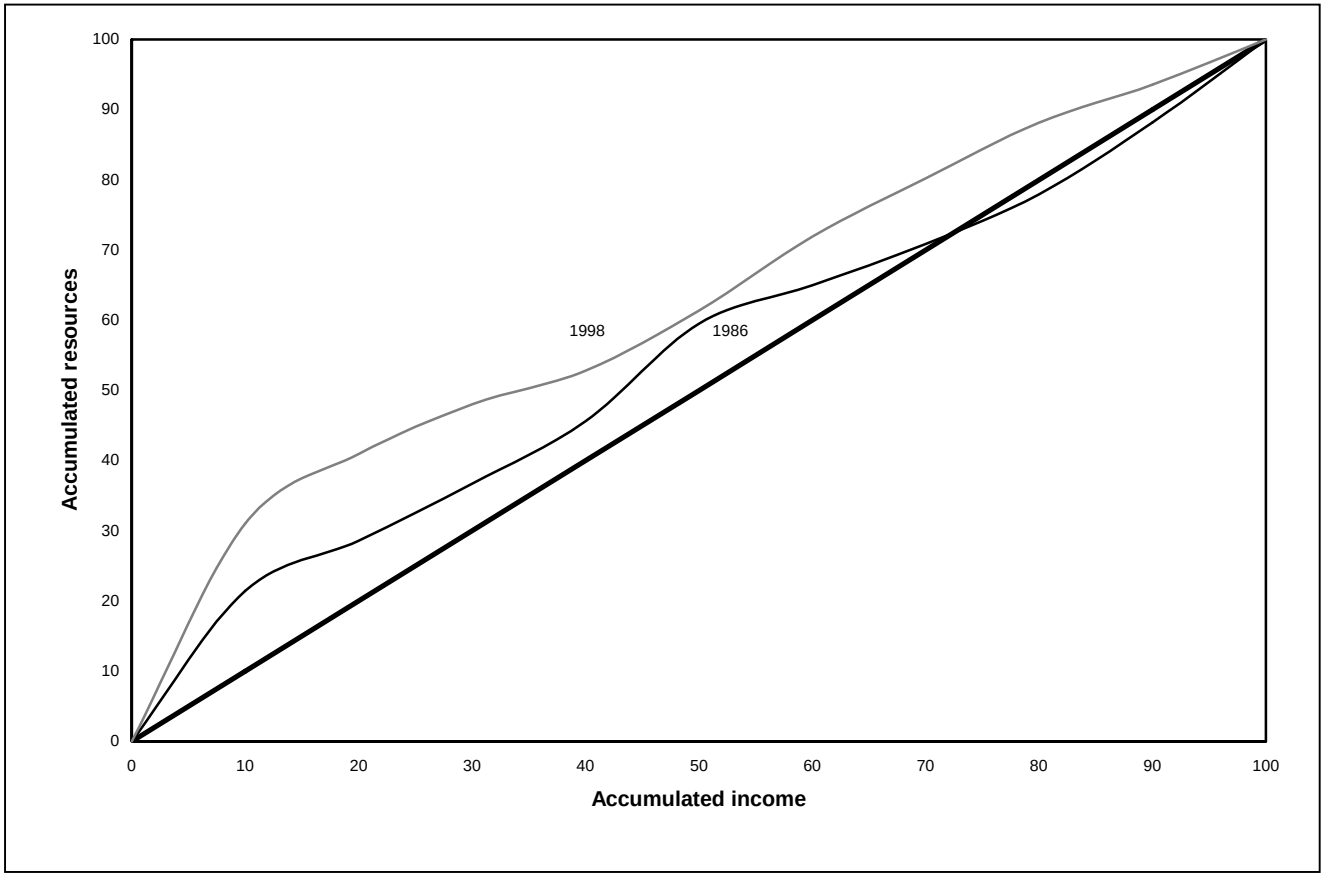
Average annual contributions to Community budget (% of GDP)			
Country	**1986-88**	**1989-93**	**1994-98**
1. Austria			0.9
2. Belgium	1.3	1.3	1.4
3. Denmark			1.0
	1.0	0.9	
4. Finland			0.8
5. France	1.0	1.0	1.1
6. Germany	0.9	1.0	1.1
7. Greece	**0.9**	**1.0**	**1.1**
8. Holland	1.3	1.4	1.5
9. Ireland	**1.2**	**1.2**	**1.3**
10. Italy	0.8	0.9	0.9
11. Luxembourg	1.2	1.2	1.3
12. Portugal	**0.9**	**1.1**	**1.2**
13. Spain	**0.9**	**1.1**	**1.1**
14. Sweden			0.9
15. United Kingdom	0.8	0.8	0.9

Average annual revenue to Community budget (% of GDP)			
Country	**1986-88**	**1989-93**	**1994-98**
1. Austria			0.6
2. Belgium	0.8	1.1	1.0
3. Denmark	1.4	1.2	1.1
4. Finland			0.7
5. France	0.9	0.8	0.9
6. Germany	0.5	0.4	0.5
7. Greece	**3.7**	**5.2**	**5.4**
8. Holland	1.6	1.3	0.7
9. Ireland	**5.4**	**6.5**	**5.0**
10. Italy	0.8	0.8	0.7
11. Luxembourg	0.2	1.9	1.3
12. Portugal	**1.9**	**3.4**	**4.1**
13. Spain	**1.1**	**1.6**	**2.3**
14. Sweden			0.4
15. United Kingdom	0.5	0.5	0.6

Average annual budget balance (% of GDP)			
Country	**1986-88**	**1989-93**	**1994-98**
1. Austria			-0.3
2. Belgium	-0.5	-0.2	-0.4
3. Denmark	0.4	0.3	0.1
4. Finland			-0.1
5. France	-0.1	-0.2	-0.1
6. Germany	-0.5	-0.6	-0.7
7. Greece	**2.8**	**4.2**	**4.2**
8. Holland	0.3	-0.1	-0.7
9. Ireland	**4.2**	**5.3**	**3.7**
10. Italy	0.0	-0.1	-0.2
11. Luxembourg	-1.0	0.7	0.0
12. Portugal	**1.0**	**2.3**	**2.9**
13. Spain	**0.2**	**0.5**	**1.3**
14. Sweden			-0.4
15. United Kingdom	-0.3	-0.3	-0.3

Source: European Court of Auditors: Annual Report; European Commission: The Community Budget: the Facts in Figures and own elaboration.

Figure 7: Concentration of Resources Received from the Community Budget by EU Countries*



* To be able to compare the curves for 1986 and 1998 they were calculated for the countries which formed part of the European Union throughout the period. Nonetheless, the curve for 1998 that includes all 15 members is very similar.

Source: European Court of Auditors: Annual Report; European Commission: The Community Budget: the Facts in Figures; OCDE: National Accounts. Volumen I: Main Aggregates and own elaboration

Having analyzed the net contribution of the individual Member States to the Community budget, it is of interest to find out what the specific incidence of each one of the actions financed by the Budget has been. One way of doing this is by calculating Gini's pseudo-indices of the distribution of the items of expenditure associated with each type of policy amongst the different Member States[25]. The values obtained - shown in Table 4 - underline the fact that expenditures under the EAGGF-Guarantee Section (the European Agriculture Guidance and Guarantee Fund) made no contribution to convergence at the start of the period[26]: the Gini's coefficient of these expenditures was negative (-0,05); later, however, these expenditures were restructured and led to a favorable effect (+0.16)[27]. Similarly, it is deduced that Structural Measures were more effective in 1998 than in 1986 in their aim of fomenting economic and social cohesion, as the index rose from 0.36 to 0.46. Lastly, insofar as funds allocated to R&D activities are concerned, it should be pointed out that the Framework Program funds have focused traditionally on a series of twelve 'innovation islands' situated in the most advanced EU countries. A few recent initiatives of the Commission, however, have helped the cohesion group to step up their participation in the Framework Program, as is underlined by the value attained by Gini's index (+0.03).

In short, the data analyzed suggests that the Community Budget has been largely benefiting the less prosperous countries of the EU, particularly through the Structural Measures.

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[25] Thus, in the case of the resources received from the EU Budget by each country, a positive index represents a equalitarian effect. In addition, the pseudo-index for the total expenditure is obtained as the weighted sum of every one of its components, so it is possible to analyze the contribution of the different policies to the improvement (or deterioration) of the equity achieved (see, Martín 2000). Martín (2000) uses this procedure for each item of income, and it turns out that only slight progress is made towards cohesion in the case of the contributions made in the form of VAT.

[26] In De la Dehesa and Krugman (1992) and the references of studies on the subject provided there, conclusive results are offered on the inequity of this policy in the eighties.

[27] A similar conclusion is reached in Zanias (1994).

Table 4: Distribution of Resources from the EU Budget to the Cohesion Countries and the Rest of Member Countries

1986

	Resources from:				
	GDP in euro (%)	**EAGGF Guarantee**	**Structural measures**	**R&D**	**Total**
Cohesion (P, GR, E and IRL)	9.4	13.1	29.3		21.0
Rest	90.6	86.9	60.7		79.0
Gini coefficient		-0.05	0.36		0.08

1998

	Resources from:				
	GDP in euro (%)	**EAGGF Guarantee**	**Structural measures**	**R&D**	**Total**
Cohesion (P, GR, E and IRL)	10.4	26.1	52.1	11.7	35.3
Rest	89.6	73.9	47.9	88.3	64.7
Gini coefficient *		0.16	0.46	0.03	0.27

** To compare the coefficients for 1986 and 1998 they were calculated by including the countries which belonged to the European Union throughout the period. Nonetheless, note that the value of the coefficient calculated for 1998 that includes the 15 members is very similar.*

Source: European Court of Auditors: Annual Report; European Commission: The Community Budget: the Facts in Figures; OECD: National Accounts. Volume I: Main Aggregates and own elaboration.

It should be pointed out, however, that the analysis carried out does not allow us to estimate the extent to which the increase in the budgetary funds received by the cohesion group has contributed to the improvement that has taken place in income convergence across the members of the EU. Various studies have shown, however, that Structural Measures have indeed made a significant contribution to the economic growth of the poorest regions and countries of the EU. Thus, Cappelen, Fagerberg and Verspagen (2000) find a significant favorable effect of Community funds on the economic growth of the EU regions in the period 1989-1993, through estimation of a production function in which they also include initial per capita income level, percentage of industrial and agricultural employment and long-term unemployment[28]. Domenech, Maudes and Varela (2000) find that the Community Budget reduced per capita income differences across EU Member States by 5% in the period 1986-1998. The Economic and Social Cohesion Laboratory (1997) has also estimated that the Cohesion Fund has had a considerable impact on the regional and national economies of Spain, Portugal, Greece and Ireland.

Lastly, another series of papers that perform macroeconomic model simulations find that the Structural Actions have stimulated economic growth by around 0.5 to 1 percentage point[29]. Thus, Beutel (1995), using an input-output model, finds a favorable effect of the Community Support Frameworks (CSFs) in the countries receiving funds from Objective 1, whereas Herce and Sosvilla (1994 and 1999), Bradley, Modesto and Sosvilla (1995), Bradley (2000) and Christodoulakis and Kalyvitis (1998) - by means of the HERMIN model - also estimate a favorable impact of the CSFs on the cohesion group countries[30]. Finally, Roeger (1998) also finds a favorable effect of the CSFs on growth, employment and investment in the cohesion group by means of the QUEST II model.

Nevertheless, there are also some studies that question the effectiveness of the Structural Measures in the reduction of territorial income disparities in the EU. Thus, Boldrin and Canova (2000) contend that the EU regional policy has been ineffective in achieving the convergence of the per capita income levels of the poorest regions towards the richest and they even claim that this convergence will only be possible if emigration is fomented from the former to the latter[31]. Martin (1998) also maintains that financing of

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[28] This estimation, however, may be biased by the high correlation between initial per capita income and the high percentage of agricultural employment with structural funds.

[29] Lolos (2000) points out that these analyses are based on an ex ante assessment, so it is being implicitly assumed that the recipient countries are capable of absorbing all the funds and implementing the programs efficiently and that the macroeconomic conditions on which the models are based do not change.

[30] Christodoulakis and Kalyvitis (2000), however, state that these favorable effects only appear when the externalities of the projects financed by the Commission are taken into consideration, as they estimate the effects on demand separately beforehand, and they find no impacts on the economic growth of Greece. Hence, they conclude that these projects have to be coordinated on a large scale if they are to be efficient.

[31] Puga (1999), however, has devised a theoretical model in which the absence of migrations from the poorest to the richest regions may halt the polarization and agglomeration process. In fact, in this model, to begin with the integration process encourages the localization of companies in areas with better infrastructure through reducing transport costs, but if emigration does not take place from the less prosperous to the richer regions after that, companies will then tend to disperse.

infrastructure in the poorest regions stimulates large-scale importing of products manufactured in the rich areas and is therefore counterproductive for convergence. In this respect, he states that a more effective policy for convergence would be support for research and development in the regions with the lowest per capita income.

In short, although the evidence is not conclusive, most of the studies conducted suggest that the EU regional policy has had a significant favorable impact on income convergence in the EU.

5. Conclusions and lessons for the Central and Eastern European candidates

This study started off by carrying out a brief survey of the convergence *versus* divergence debate, which has appeared in the most recent literature on economic growth. In this way, it has been made clear that neither the theory nor the empirical evidence are conclusive. Accordingly, it may not be affirmed that removal of the barriers to trade and to factor mobility between countries - as carried out between the fifteen members of the EU, or which will have to be carried out when the candidates join the union - will necessarily entail a convergence in their income levels. In fact, there are many models - particularly models of endogenous growth - that identify the coexistence of factors both conducive and contrary to convergence.

However, the majority of the empirical evidence suggests that convergence is the most likely outcome, although it is a convergence conditional upon investments on the part of the laggard countries (regions) in order to overcome their deficit in tangible and intangible capital endowments, which lies at the root of their lower level of economic development. In this respect, it may be claimed that governments can influence the capability of countries to converge toward the higher level of income in the more advanced countries by means of public investment, especially in the capital investments - such as infrastructure, R&D and human capital - which play a more decisive role in growth than other types of investments.

The results obtained when making an assessment of real convergence in the EU, both at country and regional level, are compatible with such hypotheses. Thus, our study confirms, by means of calculating the different indicators that are normally used in studies of this type, that in the course of the last few years a process of convergence has taken place between the per capita income levels of the EU regions and also, to a larger extent, of the Member States. More specifically, by means of estimating the *beta*- (absolute and conditional), *sigma*- and *gamma-convergence indices*, we found that the Member States appear to be converging towards the same steady state, whereas the regions are doing so towards different ones and at a slower pace.

As regards the countries that were of special interest in this study, the four cohesion countries, the advances towards convergence are noticeable in all of them. Nevertheless, also marked differences could be identified: Ireland is undoubtedly the most successful of the four, while Greece showed the least satisfactory performance. In this respect, the differences that may be observed between these countries suggest that, advances in real convergence are far from being a spontaneous outcome of the accession to the EU, but are largely determined by the growth strategy implemented by the countries themselves.

In fact, the assessment of the physical and intangible capital endowments of these countries and of the investment efforts made to enlarge them, which was undertaken in section 4, shows that both are positively related to the progress in real convergence achieved in each of the cohesion countries. Furthermore, the extent of the achievements in terms of real convergence is apparently also associated with the varying capacity to attract direct foreign investments displayed by the countries. Indeed, this appears to be one of the essential factors to explain the exceptional path of convergence recorded by Ireland.

Lastly, our study suggests that the Community's regional policy has played a significant role in favor of real convergence between the Member States of the EU. In this respect, it should be mentioned that Ireland has been precisely the country that has most benefited from Structural Actions, which represented a financial support of around 5% of its GDP. However, the experience of Greece – this was the second country most favored by Community regional policy funds, but it has recorded the worst results in terms of convergence - suggests that the impact of EU's financial assistance on the beneficiary countries depends not only on its amount, but also on the efficiency with which its allocation is carried out.

All these results regarding the experience of the Member States, and especially of the four least developed ones, provide some useful lessons for the candidate countries which, like them, are going to join the EU while having an income level considerably below the average of the EU partners.

One important lesson to be drawn from the experience of the four cohesion Member States is that the accession is likely to contribute significantly to improving the possibilities of the current Central and Eastern European candidates in aligning their per capita income levels with those of the more advanced current EU members. However, on the basis of the differentials found across the cohesion countries, we have also learnt that the prospects of growth and income convergence towards EU levels in the current candidates will depend crucially on the measures taken by each country, and particularly on their capacity to invest more and more efficiently. In this respect, there is little doubt that domestic efforts to increase human capital endowments and infrastructure are essential ingredients for taking advantage of integration in terms of real convergence.

The European regional policies can be expected to be of help to fostering the capacity of income convergence of the Central and Eastern newcomers. Nevertheless, as the evidence of the current EU members show, the efficient use of the financial assistance is not assured. Moreover, there is a risk that the EU subsidies - the structural and cohesion funds - transferred to the laggard regions may generate distortions and waste of public resources. It seems, therefore, to be clear that the efficient use of the financial assistance of the EU regional policies requires that the CEECs build up an administrative capacity that allows appropriate monitoring and evaluation of the subsidized projects.

On the basis of the catch–up experiences of the cohesion countries, the Central and Eastern candidates should also learn about the importance of macroeconomic stability as a condition for economic growth and, consequently, for real convergence. In this respect, the case of Greece, an economy that until recently exhibited large macroeconomic stabilization problems and slow catching up, is particularly illustrative.

In sum, the analysis of the convergence achievements in the EU cohesion countries suggests that the Central and Eastern candidates have to confront a huge task in order to meet what, in the end, is the ultimate goal of accession: convergence towards the higher standards of living of the future partners in the EU. But it also suggests that, in spite of the difficulty, this task is likely to be favored by integration. In addition, it should be pointed out that in the case of CEECs integration induced effects are reinforced by those stemming from the dismantling central planning.

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