EUROPEAN INTEGRATION AND INCOME CONVERGENCE

Lessons For Central And Eastern European Countries

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Foreword

The Poverty Reduction and Economic Management Unit in the World Bank's Europe and Central Asia Region has been undertaking a series of analytical works on issues pertinent to the economies in the region. These issues include transition issues; issues of economic integration pertinent for the Central and Eastern Europe countries which are candidates for accession to the European Union; poverty issues; and other economic management issues. The analytical work has been conducted by staff of the unit and other Bank staff, as well as specialists outside of the Bank.

This technical paper series was launched to promote wider dissemination of this analytical work, with the objective of generating further discussion of the issues. The studies published in the series should therefore be viewed as work in progress.

The findings, interpretations, and conclusions are the author's own and should not be attributed to the World Bank, its Executive Board of Directors, or any of its member countries.

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Abstract

The prospect of enlarging the EU to Central and Eastern European countries with income levels far below those of present members is raising questions as to how and when the candidates' aspiration to converge towards EU standards of living could possibly be fulfilled. To address this question, this paper seeks (i) to assess of the convergence experience of the four less developed EU members (i.e., Spain, Portugal, Ireland and Greece), after joining the EU, in the light of recent analytical developments; and (ii) to explore what lessons can be learned from that experience which may be useful for the CEEC candidates.

The discussion suggests that, while theoretically possible, there is little empirical reason to fear that European integration would cause economies to diverge. Rather than being spontaneous, however, real convergence would seem to depend crucially on the capacity of countries to tap international technological spillovers, particularly through foreign direct investment. Macroeconomic stability, effective competition on goods and factor markets, and a good human capital endowment are essential to harness these benefits. Nonetheless, lingering worries about the possibility that integration would lead to real divergence between countries or regions of Europe has led to the creation of large transfers under the EU's Regional Policy. Pending more conclusive evidence of their effectiveness, the candidate countries would seem wise to put greater store by those domestic policies than by EU grants to fuel their convergence.

Acknowledgements

Executive Summary

Standard international trade theory, based on neoclassical growth models, predicts that the lifting of barriers to trade and to the free movement of factors across countries not only enhances the general economic welfare of the integrating area as a whole, but would also causes income per capita to converge among its member countries (real convergence). Recent growth and geography models have cast doubts as to the general applicability of these optimistic conclusions. Rather, these models suggest that, under certain circumstances (differences in production technologies, increasing return to scale, positive agglomeration externalities and transport costs), economic integration may lead to an increasingly uneven spatial distribution of economic welfare (real divergence). Compounding these theoretical uncertainties, a debate has set in the empirical literature, as to the proper way to define and measure real convergence. When all is said and done, however, most of the theoretical and empirical literature leans in favor the proposition that some form or the other of real convergence is the most likely outcome of economic integration.

There is also widespread agreement that the integration of Europe led to substantial economic benefits for the European Union, as a whole. Lingering worries about the possibility that integration would lead to real divergence between countries or regions of Europe however constitute the main rationale for the large transfers under the EU's Regional Policy. Moreover, the prospect of enlarging the EU to Central and Eastern European countries (CEECs), with income levels far lower level of development than that of present members, is raising questions as to how and when the candidates' aspiration to converge towards EU standards of living could possibly be fulfilled.

In this context, the main purpose of this study is (i) to assess of the convergence experience of the four less developed EU members (i.e., Spain, Portugal, Ireland and Greece), after joining the EU, in the light of recent analytical developments; and (ii) to explore what conclusion could be inferred from that experiences that may be useful for the CEEC candidates.

The discussion suggests that, while theoretically possible, there is little empirical reason to fear that European integration would cause economies to diverge. Rather than being spontaneous, however, real convergence would seem to depend crucially on the capacity of countries to tap international technological spillovers, particularly through foreign direct investment. Macroeconomic stability, effective competition on goods and factor markets, and a good human capital endowment are essential to harness these benefits. Pending more conclusive evidence of their effectiveness, CEECs would be well advised to put more store by those policies, than by EU grants, to fuel their convergence.

In discussing these points, we will begin (chapter 1) by summarizing what theory tells us about convergence prospects, including what can be learned from the recent endogenous growth and new geography models. Then, in chapter 2, we will probe further measurement issues, offer a critical survey of the most common methods used in empirical research, and highlights major findings. Against this analytical background, chapter 3 explores, first, the nature and trends of real convergence of the four less developed EU members using the measures proposed before

and, second, the explanatory factors that may account for their varying performances. Special emphasis is placed on the role of different capital stocks, both physical and intangible. Chapter 4 discusses the extent to which the experience of those EU member states is useful for the design of an appropriate strategy for the candidate countries from the CEECs, taking into account not only the different catch-up experiences of the four cohesion countries, but also what we know about incipient trends among Central and Eastern European candidates. Finally, chapter 5 offers some concluding remarks.

1. Economic Integration and Real Convergence: Survey of the Theoretical Literature

Broadly speaking, economic convergence in an area formed by different countries (regions) is understood to mean the increasing alignment of the economic variables considered, due to more rapid advances in the less favored countries (regions) than in the average of the area. Two types of economic convergence are usually considered: nominal and real. *Nominal convergence* refers to the tendency towards a greater uniformity of nominal variables (those indicative of macroeconomic stability). *Real convergence* expresses the approximation of the levels of economic welfare, generally proxied by *per capita* GDP[1]. This paper focused on real convergence, and deals with nominal convergence only to the extent that it influences the latter.

Standard neoclassical growth models[2] predict that open economies (i.e., countries, regions) should converge. Assuming that technologies are identical and exogenous, the dynamics of convergence rest on decreasing returns to scale to capital: countries (regions) with low capital stocks and *per capita* income should have a higher marginal product and return to capital. Consequently, opening up the country (region) –as happens in the framework of an integration process- should trigger a convergence process, as capital should flow to capital-scarce countries (regions) to take advantage from higher returns. This should lead to more rapid capital accumulation and faster growth in poorer countries (regions) than in rich ones. Along with capital/labor ratios, labor productivity and per capita income would then converge across countries.

This line of reasoning has actually formed the basis of conventional theories of economic integration developed since the pioneering work of Viner (1950).[3] Thus, those models - sharing the assumptions of neoclassical growth theory - generate a tendency for prices, costs, and income levels to 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 (including the elimination of foreign-exchange uncertainty) associated with trade and factor movements.

These standard conclusions have however been challenged. First, a number of authors have pointed out that, the welfare effects of economic integration are more ambiguous (even in the neo-classical setting) when, as in the case that occupies us (i.e., European integration), trade opening is only partial and takes the form of preferential trading agreements (see Panagariya, 2000). Obviously, the wider the preferential trading zone (e.g., with EU enlargement), the more likely it is to approximate the effects of fully multilateral regime.

Furthermore, new models have emerged in the last fifteen years, notably under the aegis of the new growth theory, which (contrary to the neoclassical paradigm) do not predict that income convergence between rich and poor countries (regions) is the only possible outcome of

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[1] Martín and Velázquez (2001) argue that per capita GDP has some shortcomings as a proxy for economic welfare. In this sense, they propose the use of other complementary variables that can somehow capture the differences in income inequality. However they also admit that they are difficult to put into practice, due to the paucity of internationally homogenous income distribution data.

[2] As in Solow (1956) and his following versions, for example Mankiw, Romer, and Weil (1992).

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

economic integration.[4] Thus, according to one of its first contributions (Romer, 1986), returns to capital do not have to be diminishing. Once this assumption is relaxed, the impact of economic integration on convergence is not as clear as in the Solow setting. In the approach proposed in Lucas (1988), where increasing returns on human capital are the main driving force of economic growth, there is a distinct possibility that a "brain drain" from poorer to richer country could act as a vehicle of cross country divergence. Finally, some endogenous growth models that, in the same vein as Romer's (1990), emphasize the importance of commercially oriented R&D efforts as the main engine of growth, may also explain the existence of permanent, and under some circumstances, even widening, technological and income gaps between countries.

Pursuing a separate argument, the new geography literature pioneered by Krugman (1991) and reviewed in Ottaviano and Puga (1998) has put forward several reasons (notably the existence of agglomeration economies) to explain why economic integration may lead to a pattern of increased spatial income inequality.

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.[5] 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.[6]

Other channels are also considered in the literature. Studies[7] that focus on how trade spreads technology spillovers, underline the special importance of transactions in intermediate goods. They also envisage a similar role for trade in final goods, in particular in those that allow for reverse engineering by the importing country.

In this respect, some of 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 in those models for growth not only as a separate factor but also as a complement for exploiting the effects of new technologies created by either domestic or foreign innovation efforts.[8] In this context, human capital is usually considered as an essential condition for convergence.

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[4] A detail view 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).

[5] Historians have long argued that technology transfer favored by relatively cheap imitation –what Gershenkron called the "advantage of backwardness"-- is a key driving force behind economic growth.

[6] See for example Blomström and Wolff (1994), and Baldwin, Braconier and Forslid (1999) and references therein.

[7] As Nadiri (1993), Nadiri and Kim (1996), Coe and Helpman (1995), and Keller (1999).

[8] 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.

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In addition, some studies[9] underscore the importance of public capital in general, and more specifically the endowment of infrastructure, because of their significant positive externalities on productivity. Those externalities seem to be particularly large in the case of the transport and communication infrastructure.[10]

Finally, this brief overview of the recent literature on convergence and related issues would not be complete without mentioning the studies that have analyzed the relationship between nominal and real convergence. This topic has recently drawn considerable and increasing attention in view of the quite large number of countries that have experienced rapid and non-inflationary growth accompanied by a significant generation of employment in a framework of a stringent fiscal policy.[11] In a context of increasing globalization, the key factor here would be the credibility effect associated with strict stabilization policies, as it translates in a reduction of the country risk premium on interest rates.

Summing up, the literature is less than fully conclusive as to whether or not economic integration on its own generates real convergence. Indeed, when the stricter assumptions of the pure neoclassical 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 potentially result in income polarization processes. To clarify the debate, Boldrin and Canova (2000) proposes to distinguish the various available models according to whether they embody:[12]

(a) A *strong version of the convergence hypothesis* which states that due to decreasing return on capital "in the long run, a common level of economic well-being be achieved, independently of initial conditions and independently of the detail of [national] policies, as long as the diffusion and adoption of technological innovation is not seriously restrained."

(b) A *weak version* which emphasizes the determining role of initial conditions, endowments in immobile factors, and national policies in the adoption of technologies.

(c) A *strong non-convergence hypothesis* under which, due to high fixed costs, widespread increasing returns and external effects (e.g., agglomeration effects), "any increase in the degree of trade openness is likely to send the most productive

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[9] See as an example Aschauer 1989, 2000; Munnell 1990; Easterly and Rebelo, 1993 and Argimon et al. (1997)

[10] See Easterly and Rebelo 1993; Roller and Waverman, 1994. Studies have also shown how important, as for telecommunication and Internet infrastructures are for the technological upgrading of the whole productive system (Crandall, 1997 and Koski and Majumdar, 2000).

[11] See Perotti (1996) and Alesina and Perotti (1995,1996).

[12] The significance of those disagreements should however be not misunderstood. What is therefore suggested in most "non-convergence" studies, is not the advantage of autarky, but rather the need for poorer countries to enlarge and improve their endowments in those capital assets which are deemed to have a special influence on growth (be they technology, human capital and infrastructure). In addition, most of those models argue that the existence of international technological spillovers make it possible for countries to implement a strategy of growth based on imitation of foreign innovations, provided they have a good enough human capital endowment to do so.

factors flowing towards the advanced regions, where their return is higher, leaving the disadvantaged area further behind." (id.)

(d)   A *weak non-convergence hypothesis* (akin to the infant industry argument) which argues that "some minimum *absolute* level of the externalities-inducing factors must be obtained" for global convergence to set in. Absent this, such models are likely to generate "club convergence," (id.) under which countries with similar endowments in the strategic factors tend to converge into clusters.

2. Real Convergence: Measurement and Empirical Evidence

In the circumstances however, it befalls on empirical analysis to arbitrate among conflicting theoretical claims. Although not free of ambiguity itself, the current research generally would seem to lean towards associating economic integration with some version of the convergence hypothesis (be it weak or conditional). Before getting to that conclusion, however, the various authors working in the field first had to clarify what the word "convergence" meant in practice in the way that can be tested empirically.

The specialized literature has come up with a wealth of different measures and openly debated on their relative merits.[13] The simplest indicator for assessing real convergence between countries (regions) within an area is to test whether the per capita GDP of a country (region) or a set of countries is approaching 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). In contrast, *sigma*-convergence designates the reduction in the dispersion of *per capita* GDPs within a sample of countries (regions).[14]

The methodology proposed by Barro and Sala-i-Martin to test *beta*-convergence has been criticized for producing biased results. Quah (1993, 1995, and 1996) argues that this methodology largely neglects the dynamics of changing national (regional) income distributions and proposes the use of a 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.

None of the existing measurement procedures mentioned above is generally accepted as inherently superior to the others in any circumstances. Probably because of its intuitive appeal, the first approach (i.e., *beta*-convergence) remains the most commonly used. It is also the one to which we will refer in the remainder of this paper.

Although methodological debates have been fierce, they have generated little empirical evidence to support the idea that economic integration would lead to "real divergence." Subsequent research has nonetheless tempered much of Barro and Sala-i-Martin's initial optimism[15] about powerful convergence forces might be. Quah (1996) for instance suggests that the cross-country distribution of income may have a tendency to evolve towards "twin peaks" pattern, so that the world appears to polarize into distinct classes of income. In other words,

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[13] See Baumol, Nelson and Wolff (1994), Barro and Sala-i-Martin (1995), Quah (1993, 1996) and Grossman (1996) for references.

[14] See Barro and Sala-i-Martin (1995:11) for further details.

[15] Which suggested that income per capita might be converging at a rate of 2 percent per year.

countries seem to follow different growth paths and to converge to distinct steady states and cluster around different levels of *per capita* GDP.

In one of the most comprehensive study to date, Ben-David (2000) concludes that levels of *income per capita have been diverging across countries* over the period 1960-85[16] -- or at any rate, they would not have converged (if weighted by population).[17] Worse, the study finds evidence of club-convergence at the bottom end of the distribution, due not to any welfare improvement but to the downfall of countries initially better off. The study however finds convincing evidence of *convergence among those countries which have opened up to international trade*; the more so the more the latter countries actually trade among themselves.

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[16] Confirming similar findings by Pritchett (1997) over a longer timeframe.

[17] Many thanks to Peter Klenow from the Federal Reserve of Minneapolis for pointing that out.

3. Real Convergence within the Eu: The Case of the Cohesion Countries

Does this encouraging result also apply to countries joining the European Union? A quick glance at Figure 1 (showing the evolution of current GDPs *per capita* relative to the EU average) suggests so. The picture emerges more clearly when the impact of exchange rate fluctuations is netted out, as in Figure 2 -- which shows the trend of their respective *per capita* GDP in relation to the EU average, expressed in PPS (Purchasing Power Standard).[18]

Figure 1: Per Capita GDP at Current Exchange Rates, 1960-2000
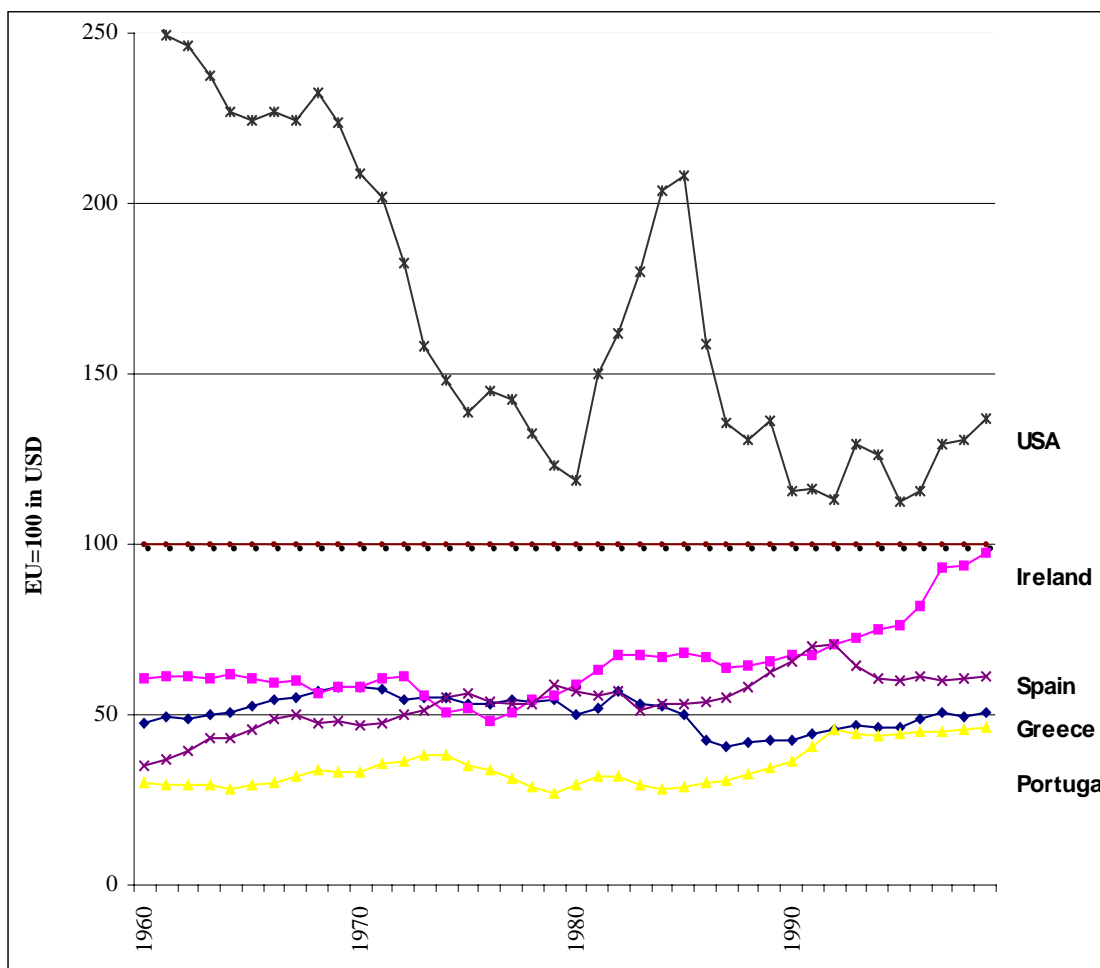
Source: World Bank data

Figure 2 illustrates essentially two things. One is that the European Union as a whole has been steadily converging towards the level of income per capita in United States (reflecting perhaps the benefit of integration for the Union as a whole). The second is that the lower income

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[18] The purchasing power standard (PPS) is defined in such a way that, for each individual aggregate, the European Union total obtained from converting the values in national currency with the purchasing power parities is equal to the European Union total for that individual aggregate in ecus/euros. In a sense, the PPS can therefore be thought of as the ecu/euro in real terms (EUROSTAT, 1999).

members of the Union (the so-called cohesion countries, to denote their eligibility for the EU's Cohesion Fund)[19] have been converging towards the EU average.

Whether, and to what extent, any of this is linked to their belonging to the European Union is a different matter. First, as the Figure shows, all cohesion countries were already converging towards EU average in the 1960s, i.e., well before their joining the Union. Similarly, Ben David (2000) shows that members of the European Free Trade Area were also converging with the EU well before the two zones formally merged -- although only after the EFTA internal trade began to be liberalized after 1967 and that with the EFTA after 1968, in the wake of the Kennedy Round). It is also notable that this convergence seems to have lost steam quickly after membership, as the effects of trade liberalization waned.[20]   Similarly, two of the cohesion countries (i.e., Ireland, and Greece) had to wait about a dozen years after joining to experience any further convergence at all. Indeed, for all cohesion cases, the process of convergence *within* the Union seems to have taken hold in earnest only after the launch first of the Single Market, then the Economic and Monetary Union, i.e., when firmly supported by other structural and macroeconomic policies.

Figure 2: Per Capita GDP at PPS; 1960-2000
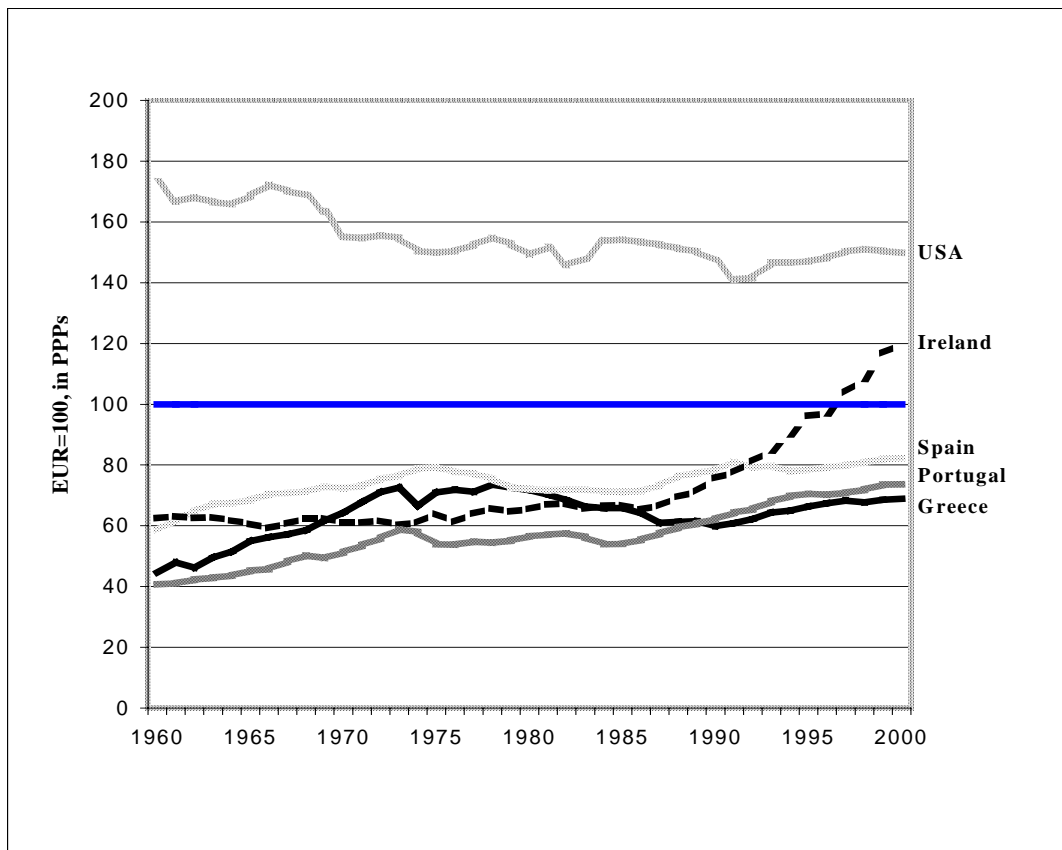
Source: European Commission

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[19] The Cohesion Fund was created in 1993 in the wake of the Maastricht Treaty to help poorer member countries cope with the demands of monetary union.

[20] See Ben David, 1993.

This actually points to a larger question: what do we actually mean by "integrating with the EU"? While adhesion can be dated with precision,[21] integration is a more diffuse notion. As would be the case later for CEECs, trade integration (for industrial goods) often started well ahead of membership under association agreements.[22] Furthermore, the Union itself has been integrating only gradually. While a common trade policy was essentially achieved by the late 1960s, one had to await the late 1980s to see a single market in goods, services and factors begin to emerge, and until the late 1990s for the monetary union to firm up. It is difficult in the circumstances to ascribe convergence to any specific policy event.

This being said, Ben-David (2000) provides convincing evidence that trade liberalization (before and after membership) was, if not a sufficient condition, at least an important contributing factor leading to convergence, and that the periods of most intense progress in the field were also associated with such convergence accelerating.[23] In contrast, in his seminal paper on the convergence experience of the founding six members of the EU (1993), the same author found no sign of convergence among a reference group of other countries with incomes per capita covering the same range as that of the founding members.

On the "real" side, as theory anticipates, income convergence appears to have been associated with a convergence of labor productivity. A decomposition of *per capita* GDP growth from 1980 onwards -- presented in Table 1 and also, in a more intuitive way, in Figure 3[24] indicates (i) that labor productivity, and more particularly hourly productivity, accounted for most of the changes in average income over the period in all cohesion countries; and (ii) that the countries where productivity grew most (Ireland being the star performer) are also those where income per capita converged more rapidly towards EU average (and vice-versa in the case of Greece, which diverged during the period under review). The fact that all four countries (with Ireland and Portugal in the lead) also managed to raise employment rates amplified welfare gains.

What would account for these productivity performances? As noted above, standard neoclassical first direct our attentions towards the role of aggregate technologies, as encapsulated in capital/labor ratios. Estimates shown in Table 2[25] suggest indeed that the stock of private capital per worker would have converged during the period towards EU levels in all countries, except in Greece – the only country, as we saw, where labor productivity also slipped further away from EU levels.

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[21] Ireland, 1973, Greece, 1981; Portugal, Spain, 1986.

[22] Effective, as regards trade, from 1968 in the case of Greece, from 1970 for Spain and from 1976 for Portugal.

[23] Ben-David (1993, 2000) shows that members of the European Economic Community had experienced greater income convergence than in the industrialized countries as a whole.

[24] For a correct interpretation one should note that those figures are not expressed in absolute but in relative terms. Specifically, they represent the contribution (in percentage) of each component to the *per capita* GDP growth in each country.

[25] The stocks of private physical capital of Spain, Portugal, Ireland, Greece, the EU and USA, are estimated on the basis of the accumulation of the respective series of private Gross Fixed Capital Formation (GFCF), conveniently deflated and depreciated, under the Perpetual Inventory Method.

Table 1: Decomposition of GDP per Capita Growth, 1980-1998, percent

	Greece	Spain	Ireland	Portugal	European Union	United States
GDP per capita	100,0	100,0	100,0	100,0	100,0	100,0
Labor productivity	75,1	86,2	85,7	71,0	96,1	67,7
Hourly productivity	60,1	114,1	86,8	88,4	108,9	67,7
Pure hourly growth effect	15,9	112,3	111,1	63,4	96,1	73,2
Structural change effect in hourly productivity growth	48,1	20,4	3,9	47,0	28,5	23,5
Residual effect	-3,9	-18,6	-28,2	-22,0	-15,7	-29,0
Working Hours	15,0	-27,9	-1,1	-17,4	12,8	0,0
Employment rate	24,9	13,8	14,3	29,0	3,9	32,3
Employment/Labor force	-38,0	-16,1	-2,9	4,2	-10,5	7,5
Activity rate	44,6	14,2	6,3	12,8	6,6	28,8
Population 15-64 years/Total population	18,3	15,7	10,9	12,0	7,8	-4,0
Memo item						
GDP per capita growth	25.2	49.6	130.3	65.0	39.4	35.1

Source: EUROSTAT and author's calculation

Figure 3: Decomposition of Per Capita GDP Growth

Breakdown of Per Capita GDP growth 1980-1998

Breakdown of Labour Productivity Growth 1980-1998

Decomposition of Employment rate growth 1980-1998

Source: EUROSTAT and authors' calculation

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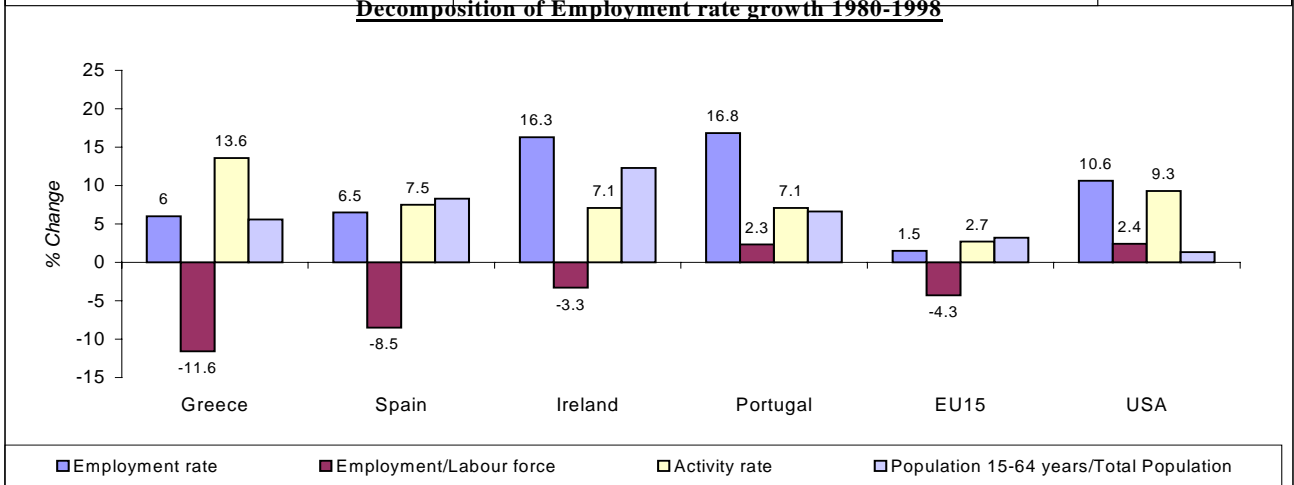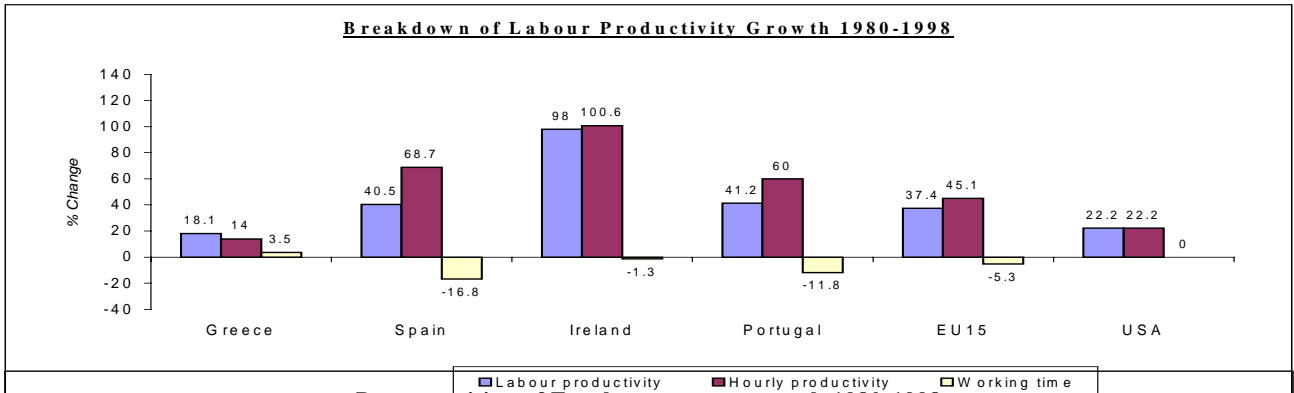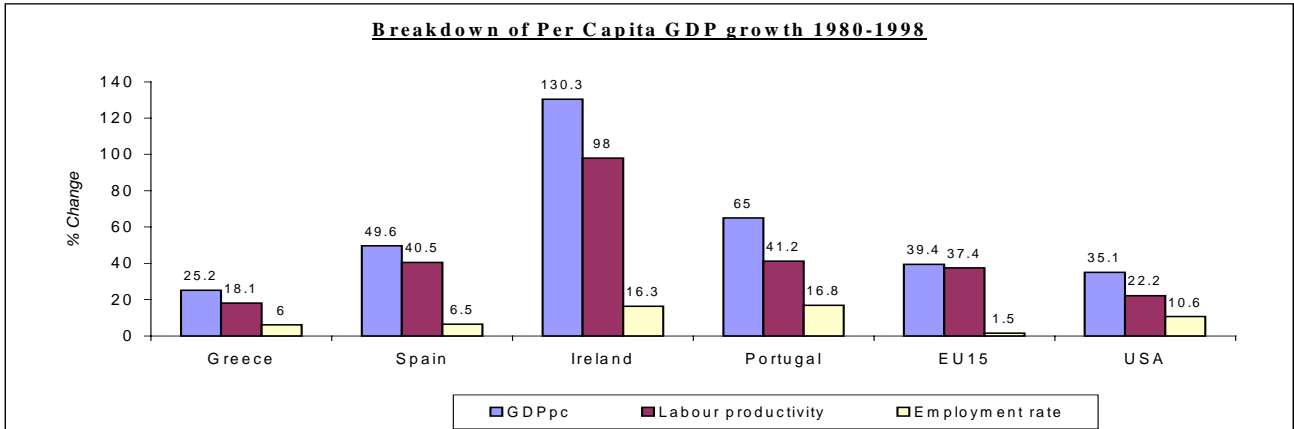
Table 2: Endowments in Various Forms of Capital

	1. Private Capital (per person employed)				2. Public Capital (per capita)				3. Transport Infrastructure (per person employed)				4. Human Capital (per capita)			5. Technological Capital (domestic) (relative to GDP)			
	% EU average		Growth	Conver-gence	% EU average		Growth	Conver-gence	% EU average		Growth	Conver-gence	% EU average		Conver-gence	% EU average		Growth	Conver-gence
	1980	1998	%	%	1980	1998	%	%	1980	1998	%	%	1980	1998	%	1980	1998	%	%
Greece	76.3	68.9	24.8	**-23.7**	47.6	62.3	67.9	**39.1**	77.6	67.5	1.9	**-30.9**	37.8	42.5	**8.1**	11.0	21.7	181.8	**13.7**
Spain	64.6	75.7	61.9	**45.7**	31.2	68.5	181.3	**118.4**	75.2	74.9	16.7	**-0.9**	58.0	70.3	**41.6**	19.0	38.5	189.5	**31.7**
Ireland	74.6	76.2	41.2	**6.8**	82.7	82.3	27.6	**-2.4**	129.0	111.6	1.3	**149.8**	61.2	69.3	**26.4**	52.0	44.1	21.2	**-14.1**
Portugal	40.0	44.5	53.8	**8.1**	28.3	50.0	126.8	**43.5**	88.1	78.7	4.6	**-44.3**	42.8	48.1	**10.2**	15.0	23.1	120.0	**10.5**
EU	100.0	100.0	38.2	**0.0**	100.0	100.0	28.2	**0.0**	100.0	100.0	17.1	**0.0**	100.0	100.0	**0.0**	100.0	100.0	43.0	**0.0**
USA	95.1	89.3	29.7	**-54.3**	80.5	79.4	26.5	**-5.3**	182.4	156.2	0.3	**46.6**	227.4	197.0	**31.3**	132.0	124.5	34.8	**30.6**

Source: EUROSTAT and authors' calculation

What about those other factors whose roles new models emphasize? Figures in Table 2 would seem to suggest that the advances countries have made in building their stock of human capital [26] could have played a role in lifting productivity (the counter-performance of Greece again confirming the rule). In contrast, there is little *prima facie* evidence that the accumulation of other forms of physical capital --public capital and infrastructure -- [27] would have generated much external effects (e.g., agglomeration effect). The country that did most in this respect, i.e., Spain, has not been rewarded with any particularly impressive growth performance (it ranks third on this score among the four cohesion countries), while the country which exhibit stellar growth performance, Ireland, did not progress towards EU levels of public capital. Furthermore, if its density of transport infrastructure did converge towards EU levels, that convergence was actually "downwards," i.e., from above average.[28]

The contribution of technological capital seems also at first ambiguous.[29] Table 2 shows little correlation between the efforts countries have made in R&D and their growth performances. The two countries which put more of their resources into expanding domestic technological capital (i.e., Spain and Greece) actually grew more slowly than the others did.

As mentioned in chapter 1, however, the 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 a variety of channels. In addition to the most conventional and direct channel, the international contracts for transfer of technology, new models have stressed two other indirect ways for international diffusion of technology through knowledge spillover effects: trade and foreign direct investment. Consequently, in these models, given a level of domestic stock of technological and human capital, the processes of opening up and trade integration will tend to raise a country's rates of growth.

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[26] The best procedure for estimating the stock of human capital is the one followed in Barro and Lee (1993 and 1996), i.e., to approach 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. This is, therefore, the method followed here. However, we will introduce an improvement trying to overcome the criticisms that the Barro and Lee (1993 and 1996) estimates have received, namely: not taking 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.

[27] The stocks of public capital have been obtained by applying the same procedure to the corresponding series of public GFCF. The transport infrastructure endowment of each country has been estimated by calculating the arithmetic mean of the availability of kilometers of "standard motorway" per square km. and per capita.

[28] In their detailed analysis of disaggregated data at the NUTS-2 level, Boldrin and Canova (2000) similarly find little correlation between accumulation of public and transport infrastructure and regional growth performance.

[29] As for the stock of technological capital, there is a wide consensus in considering that it can be reasonably approached by the accumulation of the R&D spending following the perpetual inventory method. We have, therefore, applied this method to the series of data of R&D provided by the OECD since 1973, using as a deflator that of Gross Fixed Capital Formation and assuming a depreciation rate of 10%. 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 its understatement, because it does not include the payments for imports of technology.

Available evidences seem much stronger in favor of that line of reasoning. To test this assumption, we have proceeded in the following fashion. First, we have assumed that the OECD was the relevant area of origin of all the cohesion countries' knowledge spillovers, as this where most of their imports of goods and technology as well as their direct investment inflows come from. This being posited, we have estimated the extent of technological spillovers coming from technological imports by accumulating their external technological payments under the perpetual inventory method. As for the spillovers incorporated in the direct investment inflows, we have calculated a weighted average of the stock of technological capital of each of 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 the same procedure, using as weights the share of their imports coming from each of the OECD countries.[30]

**Figure 4: Technological Spillovers
percent of GDP, 1996**
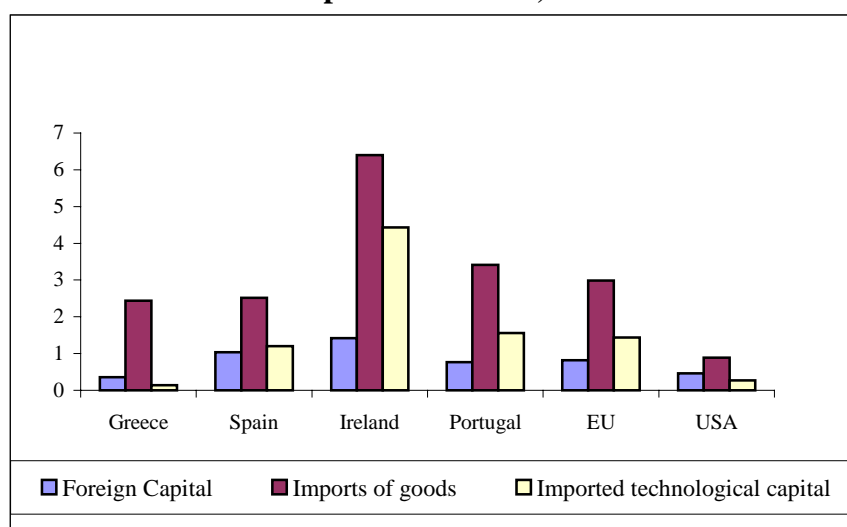
Source: OECD, IMF, EUROSTAT and author's calculation

The results obtained (see Figure 4) show (i) considerable differences in the countries' abilities to harness technological spillovers; and (ii) an extraordinary correlation between the latter and their productivity performance. Indeed, Ireland's capacity to tap such technological spillovers seems to have by far offset any disadvantages lower R&D efforts may have created. Apart from the significant role of imports in all countries, the most salient feature is, in our view[31], the extraordinary contribution of foreign direct investment in Ireland and also, although to a lesser degree, in Spain and Portugal. In contrast, the scarcity of inward investment flows in

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[30] More details about the data sources and the procedure used for the measurement of these spillovers are provided in the Methodological Appendix

[31] It should be noted that the impact of international technological spillovers on the economic growth of a country depends not only on its magnitude but also on its output elasticity. In this sense, Braconier and Sjöholm (1998) examine two potential channels for R&D spillovers -foreign direct investments and trade- for a group of OECD countries, obtaining a higher elasticity associated with the spillovers transmitted through foreign direct investments. In addition, Martín, Velázquez and Crespo (2001) evaluate the impact of the international technological spillovers channeled by imports on the economic growth of all the OECD countries and find that elasticity for such spillovers is quite low.

Greece is likely to have contributed the rather poor performance of this country as regards labor productivity.

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 majority of them come from USA and are concentrated in a rather small number of sectors, and more specifically in sectors which have exhibited particularly strong export performance.

**Figure 5: Foreign Direct Investment Inflows,
percent of GDP**
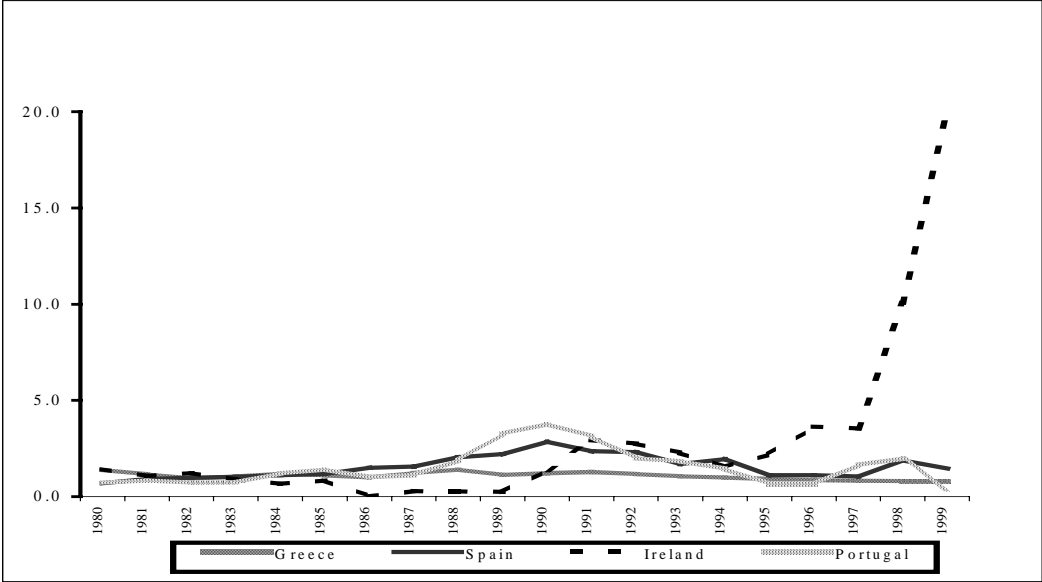
Source: EUROSTAT

Furthermore, it is worth noting that this inward direct investment boom 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. Figure 6 shows both trends, that in foreign direct investment and that in the share of technology-intensive sectors running in parallel. OECD (1999) documents in more detail how foreign direct 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.

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Figure 6: Share of Technology Intensive Sectors (*)
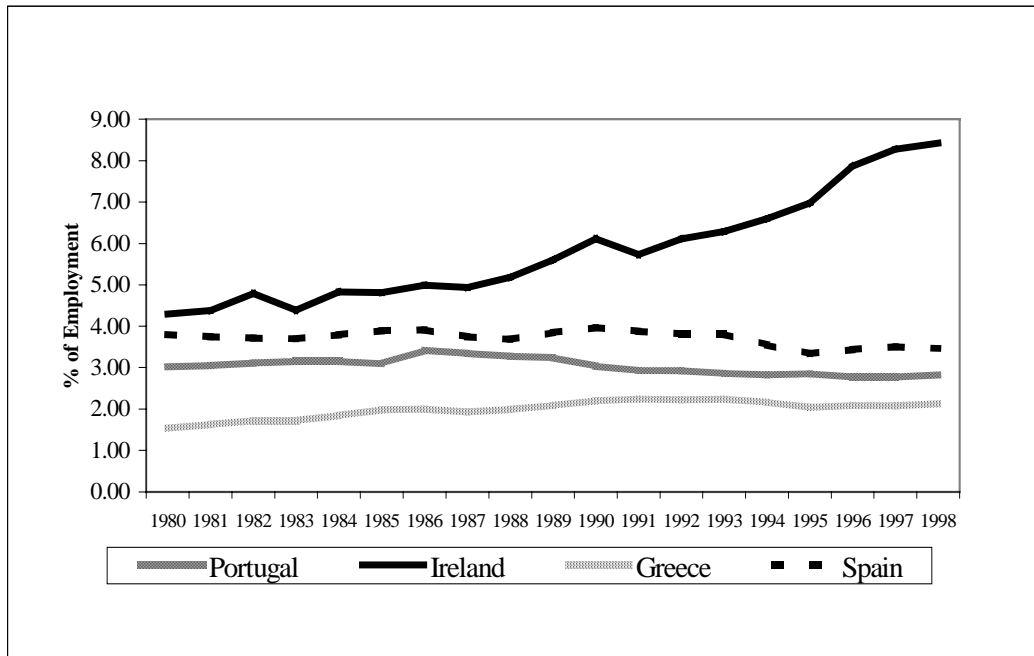
(*) Chemical products, office and data processing machines, electrical goods and communication services
Source: OECD, EUROSTAT and author's calculation.

These observation, of course, do not deny any role for public infrastructure, transport networks or domestic R&D, including in attracting foreign direct investment. It might well be that (as under a weak convergence hypothesis) a minimum *absolute level* of them is needed to be able to take advantage of technological spillovers. The fact that *absolute levels* of endowments in public capital and even more so in transport infrastructures are larger in those cohesion countries that have been more successful in raising their *per capita* GDP toward the EU average may be a sign that certain absolute threshold may need to be crossed to exploit fully technological spillovers.

Another area where such thresholds may exist is telecommunications. The set of telecommunication and Internet infrastructure indicators reported in Figure 7 would seem rather eloquent in this respect: Ireland's figures are in all cases very close to the EU average and in some of them even above. On this score again, Greece is the laggard.

Figure 7: Telecommunication and Internet Infrastructure in July 2000

Digital telephone lines
per 1000 inhabitants

USA	647
EU	522
Ireland	433
Spain	410
Portugal	418
Greece	335

Source: EUROSTAT, OECD and United Nations

Cellular mobile subscribers
per 1000 inhabitants

USA	283
EU	300
Ireland	273
Spain	272
Portugal	383
Greece	267

Source: EUROSTAT, OECD and United Nations

Deployment of fibre optic cable
Km per 1000 inhabitants

USA	136,66
EU	4,12
Ireland	16,07
Spain	1,40
Portugal	1,20
Greece	1,25

Source: OECD and United Nations

Disposable internet hosts
per 1000 inhabitants

USA	29.1
EU	7.7
Ireland	7.2
Spain	4.6
Portugal	2.5
Greece	2.3

Source: OECD, Network Wizards, Internet Society

Web servers
per 1000 inhabitants

USA	17,9
EU	1,8
Ireland	1,8
Spain	1,4
Portugal	0,3
Greece	0,2

Source: OECD, Netcraft and Internet Society

Secure web servers for electronic commerce
per 1.000.000 inhabitants

USA	181.7
EU	26.4
Ireland	46.8
Spain	16.0
Portugal	6.0
Greece	2.6

Source: OECD, Netcraft and Internet Society

Source: EUROSTAT, OECD, UN, Network Wizards, Internet Society, Netcraft and author's calculation

Additionally, as discussed in chapter 1, the increasing globalization of international markets has heightened the importance of macroeconomic stability as a condition for economic growth and consequently for real convergence (both through its impact on the efficiency of resource allocation and on the volume of investment, including from foreign sources). Table 3 reveals in concrete terms the degree of parallelism, which exist between these two dimensions.

Table 3: Cohesion Countries: Key Macroeconomic Indicators

Inflation rate		(percent)		
Greece	24.7	23.0	14.4	2.7
Spain	15.5	8.8	4.6	2.3
Ireland	18.3	3.8	1.4	1.6
Portugal	16.6	11.8	6.7	2.3
EU	*13.1*	*3.7*	*3.6*	*1.1*
USA	*13.5*	*1.9*	*3.0*	*2.1*
Long-term interest rate				
Greece	17.1	15.8	19.3	6.3
Spain	16.0	11.4	10.1	4.7
Ireland	15.4	11.1	6.7	4.7
Portugal	16.7	19.5	9.5	4.8
EU	*12.8*	*9.2*	*7.8*	*4.7*
USA	*10.8*	*8.1*	*5.8*	*6.1*
Public gross debt		(percent of GDP)		
Greece	23.9	53.6	111.6	104.4
Spain	17.5	45.1	58.8	63.5
Ireland	70.3	113.8	93.1	52.4
Portugal	32.4	68.0	63.2	56.8
EU	*38.4*	*54.5*	*65.8*	*68.1*
USA	*37.0*	*52.3*	*63.4*	*54.2*
Public budget deficit				
Greece	2.6	9.5	13.8	1.6
Spain	2.6	5.7	6.8	1.1
Ireland	12.1	10.5	2.3	(2.0)
Portugal	8.7	5.9	6.1	2.0
EU	*3.5*	*4.2*	*6.2*	*0.7*
USA	*1.7*	*3.8*	*3.9*	*(1.7)*

Source: OECD, EUROSTAT and IMF

The parallel experiences of Greece and Ireland are illuminating in this respect.[32] In both cases, EU accession was followed by a dozen-year spell of non-convergence which was only broken when the countries undertook macroeconomic stabilization. In the case of Ireland, this involved turning around a fiscal deficit of nearly 16 percent of GDP in 1981 to a surplus of 2 percent of GDP in 1998. The ensuing stabilization, combined with structural reforms, helped attract the foreign direct investment (rising from less than 1 percent of GDP in 1973 to nearly 20 percent of GDP in 1999) needed to build the foreign-dominated manufacturing sector which has been the engine of the country's subsequent rapid convergence towards EU average income. Similarly, Greece first let its fiscal deficit deteriorate to over 21 percent of GDP in 1994 before bringing it down to 2.9 percent in 2000 in a bid to join the euro-zone. Only then did Greece begin to converge. In the meantime, however, high inflation (exceeding 10 percent until 1995)

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[32] See World Bank (2000).

inhibited productivity (see Table 1), in part due to its deterrent effect on foreign direct investment (which languished at only about 1 percent of GDP per annum).

A diagnosis of the real convergence achievements in the EU cohesion countries would not be complete without discussing the contribution of the EU regional policy. While, in the first years of the European integration, regional policy was a rather insignificant issue, it has grown in importance since the first enlargement in 1973 (when Denmark, Ireland and United Kingdom joined the Union) to a point where it absorbs about one third of the EU budget (Euro 213 billion are programmed for the Structural and Cohesion Funds over the period 2000-06).

Officially, the main purpose of the European regional policy is to improve the long-term growth prospects of the Union's less prosperous regions, in an apparent fear that, should integration proceed on its own, increasing returns and agglomeration effects would naturally prevail, causing poorer regions to fall further behind (i.e., fears implicitly inspired by some version of the divergence hypothesis mentioned above). Reflecting this concern, (i) most of the grants provided under this policy have been directed towards enhancing poorer regions' human capital endowments and infrastructures; and (ii) the four cohesion countries, on which this analysis focuses, have also been the main beneficiaries of the policy (see Table 4).

Table 4: EU Budget – Net Balances with Member Countries, percent of GDP

Country	1986-88	1989-93	1994-98
Austria			-0,3
Belgium	-0,5	-0,2	-0,4
Denmark	0,4	0,3	0,1
Finland			-0,1
France	-0,1	-0,2	-0,1
Germany	-0,5	-0,6	-0,7
Greece	2,8	4,2	4,2
Ireland	4,2	5,3	3,7
Italy	0,0	-0,1	-0,2
Luxembourg	-1,0	0,7	0,0
Netherlands	0,3	-0,1	-0,7
Portugal	1,0	2,3	2,9
Spain	0,2	0,5	1,3
Sweden			-0,4
United Kingdom	-0,3	-0,3	-0,3

Sources: European Court of Auditors: Annual Report; European Commission: The Community Budget. The Facts in Figures

The European Commission (see EC, 1999 for the latest) – supported by a number of other studies (Martin, 2000: Chapter 11 and others referred there in) has long maintained that the European regional policy had had a positive effect on the narrowing the *per capita* income gaps across the Union.

This assessment however has recently been challenged. First, in a detailed statistical analysis of regional data, Boldrin and Canova (2000) find little evidence of income convergence at the regional level since the late 1970s or, more precisely, that what income convergence there has been reflects mainly, national-level convergence. The apparent interruption of regional

convergence after the late 1970s would be associated with a drying up of migration flows out of poorer regions (which had been the main engine of convergence up to then). Furthermore, these authors do not find that the availability of either EU aid or of the targeted public goods would have any statistically discernable impact on the performance of beneficiary regions. Such findings lead Boldrin and Canova (2000) to wonder whether the true purpose for the EU regional policy would not be, rather than to stimulate regional growth, to redistribute income in a bid to discourage migration.

It might also be the case, as Hervé (1999)[33] suggests, that rather than leading to an increase in the level of targeted public expenditures (e.g., on human capital and infrastructure), EU funding would instead have made it easier for countries to undertake non-targeted expenditures (the fungibility argument familiar to donor agencies). In this case, the positive impacts reported by Martin and others might be due more the relaxation of external constraints, which regional transfers make possible, than to supply-side effects. Given the amounts at stake, further empirical investigation would seem warranted on this topic.

This brief analysis of the real convergence patterns of the four less developed countries in the EU concludes therefore that, if all countries growth have benefited from trade integration with the European Union, their capacity to exploit the opportunities so created greatly depended on their own domestic policies, particularly in the areas of macroeconomic stabilization, human capital development, and openness to foreign investment.

Indeed, one cannot but be impressed by the extraordinary importance of direct investment inflows. The capacity of the Irish economy to attract capital from abroad clearly stands out even with relation to the other EU cohesion countries, Spain and Portugal, which have also been very attractive for foreign investors. At the other end of the spectrum, the meagerness of foreign direct investment in Greece probably goes a long way towards explaining that country's stagnant capital\labor ratio as well as its mediocre productivity performance. This being said, it is entirely possible that the growth strategy followed by Ireland -greatly based on developing human capital and harnessing international spillovers- would not have probably been as successful in the absence of a good endowment in domestic R&D and network infrastructures

Finally, as far as the likely implications of EU membership, we noted the positive role which seem to have played the Single Market and the European Monetary Union, as well as the debates concerning the contribution of EU regional policy.

The respective stories of the four less developed EU members, with all their commonalties as well as their striking differences, constitutes a real-life experiment of how convergence actually operates in the framework of an ambitious regional integration process. As such it presents interesting lessons for the current candidates to accession. This is the subject of the next section.

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[33] Expanding on Hervé and Holzmann, 1998.

4. The Experience of the Central and Eastern European Candidates

For the ten CEECs (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia), the process of integration with the EU began with the signing of the European Association Agreements (EAs) with the EU[34] and is continuously expanding as candidate countries endeavor to adopt the European *acquis communautaire* (as the body of European law is known) ahead of their full membership in the Union.[35]

Alongside clear differences (the process of transition being one), the experience of the new candidates presents also many similarities with that of the cohesion countries. Taken as a group, the CEECs have grown in the 1990s at a somewhat higher rate than their future EU partners. Convergence may have been slow and the remaining gap between CEEC *per capita* GDP and that of the EU often substantial, the contrast is nonetheless striking with the experience of that other group of country going through transition at the same time (see Figure 8).[36] While the average income per capita (at PPP) of CEECs lagged 20 percent behind that of the CIS at the beginning of the 1990s, it exceeded it by 50 percent as the decade drew to a close. As a result, the relative size of total GDP (at PPP) of candidate countries in Central and Eastern Europe expanded from about one to about two third of that of the CIS over that decade.

This is not to say, of course, that EU integration could, on its own, account for such different trajectories. But integration with the EU undoubtedly helped, not only because of the access the candidate have gained to EU markets made their export-led recovery possible, but also because the process of preparing for EU membership in itself has provided a framework and the impetus for countries to forge ahead with the structural reforms and stabilization, which membership embodied.

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[34] The EAs were signed on the following dates: Czechoslovakia, Hungary and Poland (December, 1991); Romania (February, 1993); Bulgaria (March, 1993); the Czech and Slovak Republic (October, 1993) Estonia, Latvia and Lithuania (June, 1995); and Slovenia (June, 1996).

[35] Under this process, CEECs have gained access to EU markets through *mutual tariff reduction for industrial goods* (for industrial goods: immediate access to EU market against gradual elimination (by January 1, 2002) of tariff duties on EU imports into CEECs, a process now expanding to agricultural goods (double-zero approach), and non-tariff barriers ("single market" agreements). Already around 80 percent of industrial imports tariffs-free by 1999. Furthermore, the EA process has spurred more general trade liberalization more generally through a web of complementary free trade agreements, CEECs have very low tariffs on industrial imports from preferential (accession and non-accession) partners. Around 85 percent of all industrial imports from these partners were duty-free in 1999. EAs have also helped CEECs attract direct investment, by with provisions on the mutual right of establishment of firms, the liberalization of capital flows, the movement of workers, and approximation of national laws with EU law (e.g., in the areas of competition, company, accounting; banking law; mergers, state aid; intellectual property)

[36] To allow comparison, this figure uses World Bank data at Purchasing Power Parity (for which series exist for the CIS), instead of Eurostat ones at Purchasing Power Standard as in the rest of the paper.

Figure 8: CEEC and CIS Per Capita GDP at PPP: 1991-99
percent of EU average
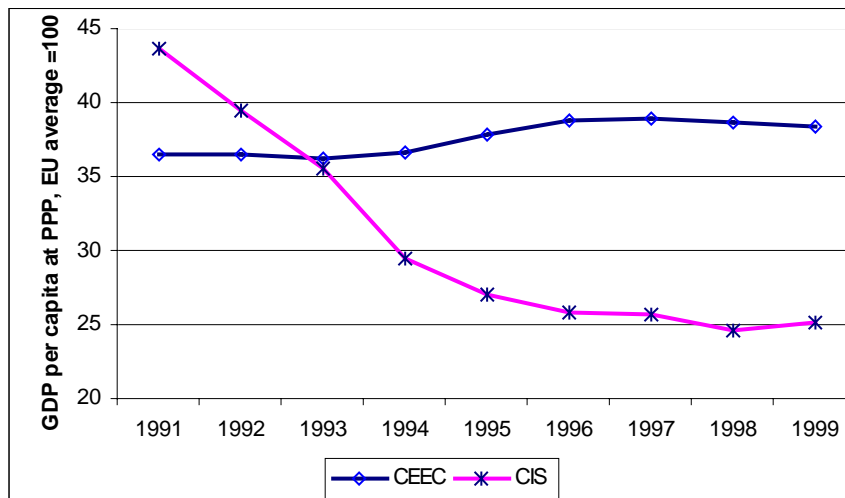
Source: World Bank calculations.

Looking beyond regional averages reveals indeed a wide variety of country experiences (see Figure 9), and directs attention towards, one, the different dynamics of productivity, and, two, the role of domestic policies in stimulating it. As in cohesion countries, the successful instances of growth recovery among CEECs have largely been driven by improvements in labor productivity (see Table 5).

**Table 5: CEECs: Labor Productivity in Industry,**
base year = 100

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bulgaria	100.0	91.4	86.6	83.9	81.5	91.8	98.5	101.8	98.0	n.a.
Czech Republic	100.0	99.6	78.7	76.6	75.2	78.9	87.6	96.0	106.7	112.7
Hungary	100.0	100.4	82.4	91.2	107.9	115.8	128.4	140.0	160.0	181.3
Poland	100.0	78.9	69.5	81.3	92.1	105.0	112.3	123.5	138.5	147.2
Romania	100.0	75.9	59.4	53.1	58.7	64.7	77.6	87.0	87.9	101.9
Slovak Republic	100.0	99.0	81.0	78.9	81.8	89.4	94.1	96.5	100.4	112.0
Estonia	n.a.	n.a.	n.a.	100.0	101.1	107.9	108.3	112.3	141.9	145.1
Latvia	n.a.	n.a.	n.a.	100.0	77.4	84.8	83.9	91.1	116.6	118.9
Lithuania	n.a.	n.a.	n.a.	100.0	77.6	68.2	76.4	82.9	89.2	99.0
Slovenia	n.a.	n.a.	n.a.	n.a.	100.0	111.8	121.2	129.3	135.1	142.4

n.a.: Not applicable
Note: The indices have different base years because of differences in data availability for the different countries.
Source: World Bank calculations based on data from EBRD *Transition Report*, various issues.

**Figure 9: CEECs: Per Capita GDP at PPS: 1990-2000,
compared to EU average**
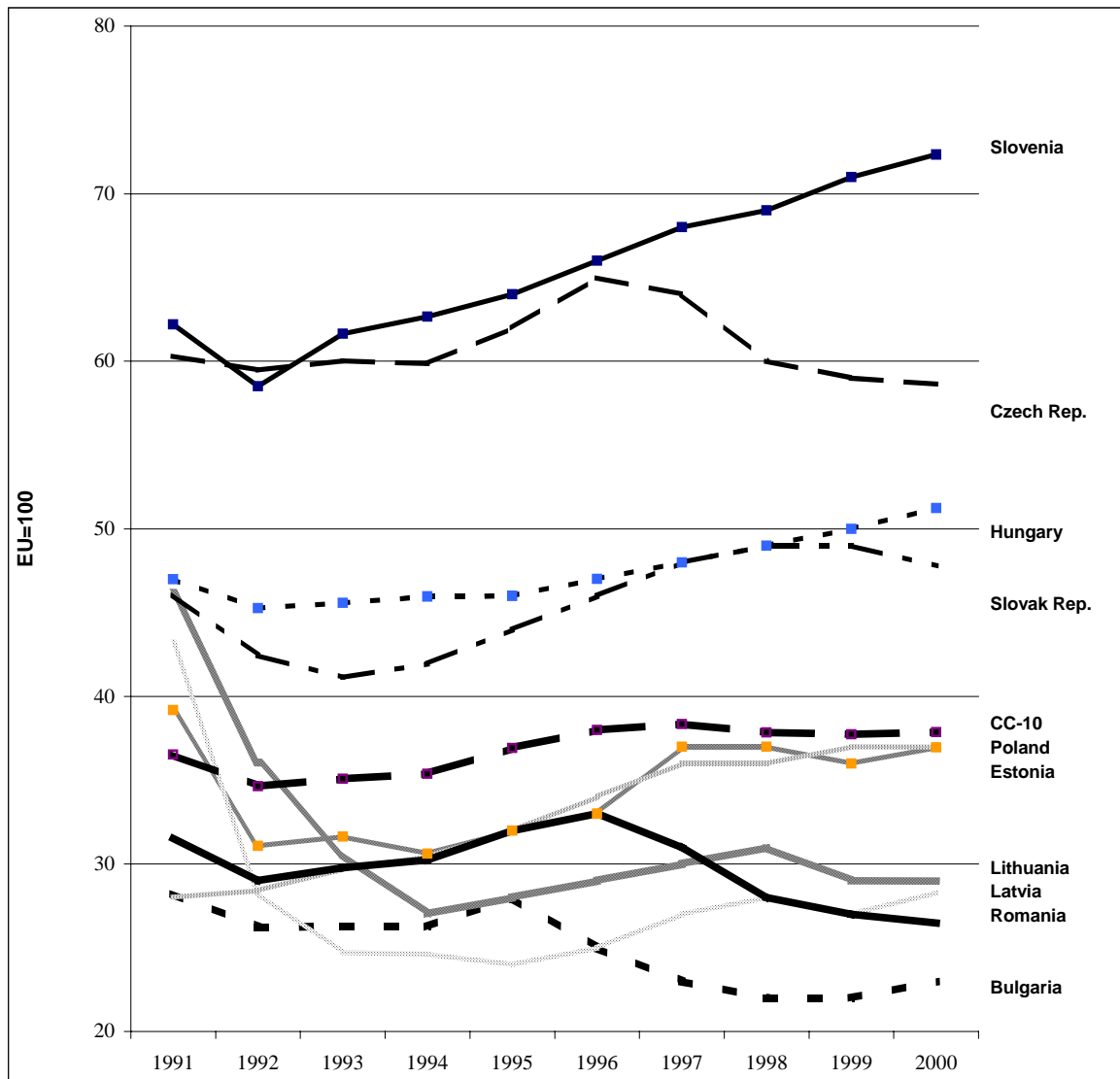
Source: EUROSTAT; Figures for 1990-94, and for 2000 are extrapolated based on constant price data in local currency.

    While the transition to the market system undoubtedly played a part, open trade together with considerable amounts of foreign direct investments (FDI) have been also been key factors in lifting labor productivity. Not only have trade and FDI contributed to a redirection of exports from the CMEA to the EU markets, they have been the main driving forces of the changes in the patterns of industrial specialization of the CEECs (particularly Hungary and Estonia) away from unskilled labor-intensive goods toward high-skilled, labor-intensive and technology-based products (see World Bank, 2000 and references therein). Among the sources of technological spillovers identified above, trade in goods and services has experienced such rapid growth over

the last decade that many CEECs are now more open to trade than the EU is, and are already more integrated in the EU than some of its current members. Similarly, in some of the most advanced candidate countries, cumulative FDI inflows have been comparatively higher than in the EU (see Table 6).

Table 6: CEECs: Sources of Technological Spillovers

	Exports of Goods and Services		Imports of Goods and Services		Cumulative Inward Foreign Direct
	% of GDP (1999)	Annual growth 1989-1999 (current US$)	% GDP (1999)	Annual growth 1989-1999 (current US$)	Investment 1991-1999 (% of GDP)
Bulgaria	44.1	-6.4	51.9	-9.6	18.5
Czech Rep.	62.7	9.0	63.9	12.6	29.4
Estonia	76.9	9.8	82.6	11.3	33.2
Hungary	52.6	6.4	55.0	8.4	37.5
Latvia	46.7	0.6	57.6	1.6	35.2
Lithuania	39.8	-	50.1	-	19.6
Poland	28.4	11.6	33.6	17.7	12.8
Romania	30.1	4.6	34.6	4.4	15.9
Slovak Republic	64.8	11.3	69.9	8.3	10.2
Slovenia	55.7	0.6	58.4	4.5	6.3
European Union	34.6	6.7	33.2	6.1	15.2

Sources: World Bank (for the CEECs), EUROSTAT and UN (for the EU) and author's calculation

EU integration has provided a critical impetus to these inflows of FDI into the CEECs (EBRD, 1999, World Bank, 2000). Indeed, beyond providing the countries preferential access to EU markets, several aspects of the Europe Agreements (EAs) have facilitated the relocation of European multinationals into the CEECs and their integration into the latter's global production cycles, including the right of establishment for EU firms, the approximation of EU economic legislation and the adoption of the European *acquis communautaire* by the CEECs, and the capacity given to the CEECs to use a duty drawback scheme (that is, refund to exporters to the EU for duties paid on imported inputs) to attract foreign investors from outside the EU.

This European factor did not operate in isolation, though. The case of Hungary – the country that up to now has received the highest FDI inflows in both GDP and *per capita* terms- illustrates the role of domestic policies in transforming the opportunity it offered into reality. Kaminski and Riboud (2000) for instance underline that the emphasis that Hungary placed on foreign investors during its privatization process, the significant progress in macroeconomic stabilization, structural reforms and institutional developments have proved essential factors for explaining the country's outstanding performance in attracting FDI. On the other hand, the poor experiences in macroeconomic stabilization and structural reforms exhibited by Bulgaria and Romania -- the countries that have received the smallest FDI inflows in *per capita* terms and suffered the worst economic performance- somehow support the same diagnosis.

Conversely, if endowments in transport infrastructure or domestic technological capital has had a role in explaining differences in growth performance across the ten CEECs, a clear pattern does not emerge from the data (see Table 7). What is clearer is that education levels in

CEECs generally approach EU standards,[37] and that if any threshold effect exist in that area (as a necessary condition for convergence), candidate countries should be well position to pass it. The experience of cohesion countries suggested that continued efforts in building human capital is an essential for *sustaining* growth and real convergence.

Table 7: CEECs: Factors Conducive to Real Convergence

	Expenditure for R&D in 1996 (% GDP) (1)	Mean school years in 1998 of the population 15-64 years (3)	Internet connections per 1000 inhabitants in 1999 (2)	Km of motorways in 1999 (2)	
				Per 1000 km2 of surface	Per 10000 inhabitants
Bulgaria	0.57	8.4	3.2	2.92	3.95
Czech Republic	1.11	10.0	19.4	6.31	4.84
Estonia	0.57	9.0	18.3	1.91	6.01
Hungary	0.68	10.6	13.6	4.45	4.82
Latvia	0.48	9.1	3.4	-	-
Lithuania	0.70	8.9	-	6.39	11.27
Poland	0.77	11.0	2.6	0.86	0.69
Romania	0.72	9.1	0.6	0.48	0.50
Slovak Republic	1.05	7.7	7.2	6.02	5.47
Slovenia	1.46	9.9	9.9	19.68	20.09
European Union	1.80	9.1	44.0	15.36	13.22

Source: (1) OECD, (2) European Commission, (3) Author's calculation on the basis of UNESCO, OECD and EUROSTAT data

Indeed, while some of the CEECs have not yet fully taken advantage of the opportunities trade integration with the EU is offering them, the main issue for the most advanced ones is more how to sustain the incipient convergence towards EU levels of income. As noted above, the experience of earlier entrants seem to indicate that trade integration may provide only a temporary boost to the countries' growth rate, after which the latter would settle back towards the regional average rate, with little further gain in terms of convergence. Taking the CEECs as a whole, Figures 8 and 9 show indeed little convergence of late. Whether and to what extent, this is a reflection of the acceleration of growth within the EU itself during the period, and/or to a drying out of the initial trade liberalization effect, it is probably too early to tell. What the precedent of the cohesion countries suggests however is that, over the medium term, the candidates may need to depend, more than anything, on Single Market and Economic and Monetary Union policies to give a second wind to their initial advances towards the higher standard of living of the EU. Similarly, when it comes to reducing internal regional disparities, the candidates may be wise to put greater store by removing obstacles to labor mobility (e.g., uniform minimum wages, rigidities in housing markets), than by EU subsidies.

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[37] It should be noted, however, that such an indicator of human capital endowments does not take into consideration the significant differences that seem to exist in the quality of education systems between the CEECs and the current EU members.

5. Concluding Remarks

The theoretical and empirical discussions above seem therefore to yield a few general lessons which current candidates may want to incorporate in their accession strategies. Here are some of the main ones:

(a) Although theory envisages this possibility, there seems to be little reason to fear that trade integration, per se, would cause economies to diverge. As predicted by standard models, a main effect of European economic integration has been to facilitate a diffusion of technologies, as encapsulated by converging capital/labor ratios, which in turn has fueled real convergence;

(b) Real convergence is not a foregone conclusion however. Whether it happens or not depends crucially on a number of other factors. In particular, the experience of the cohesion countries supports the emphasis placed in the recent growth literature on the crucial role of human capital for achieving real convergence.

(c) Similarly, the experiences of Greece and Ireland provide real-life confirmation that little can compensate for the lack of a stable, growth-promoting environment. In that sense, other common European policies, such as the Single Market and the Economic and Monetary Union, might be just as important as trade in sustaining income convergence over the long haul.

(d) It is possible for integrating countries to take advantage of international technological spillovers to overcome "technological backwardness" (in the words of Gershenkron), foreign direct investment being one of the main channel of diffusion. Macroeconomic stability and a good human capital endowment are essential to harness these benefits.

(e) Pending further empirical analysis, candidate countries may be ill advised to put excessive store by EU regional to fuel their convergence. The fact that the top beneficiary of EU funds, Ireland, also has the most outstanding convergence, should not conceal that Greece, the number two recipient had, until recently, much less to show for it. At a minimum, what this suggests, is that other factors (macroeconomic and institutional framework, competition, labor mobility) will be essential in determining the outcomes (of EU transfers).

In brief, while EU integration can be propitious for income convergence, it is not a substitute for the domestic policies necessary to achieve the latter.

Methodological Appendix

Decomposition of GDP Growth

In this respect, on the basis of a simple arithmetic exercise, it is possible break down the *per capita* GDP growth of every country into its components. Thus, it is shown that a country's *per capita* GDP growth hinges on an increase in labor productivity -which in turn can be broken down into variations in working time and in hourly productivity- and on employment rate growth.

<u>Decomposition of the per capita GDP (*GDPpc*):</u>

$$GDPpc = \frac{GDP}{Pop} = \frac{GDP}{L} \frac{L}{Pop} = Lp * Er$$

where,

GDP: Gross Domestic Product
Pop: Population
L: Employment
Lp: Labor productivity
Er: Employment rate

<u>Decomposition of Labor productivity (*Lp*):</u>

$$Lp = \frac{GDP}{L} = \frac{GDP}{L * h} h = Hp * h$$

where,

h: Working time (in yearly hours per person)
Hp: Hourly productivity

<u>Decomposition of the Employment rate (*Er*)</u>

$$Er = \frac{L}{Pop} = \frac{L}{Lf} \frac{Lf}{Eap} \frac{Eap}{Pop}$$

where,

Lf: Labor force
Eap: Economically active population

Measurement of the International Technological Spillovers by Channels

Foreign Capital (*TSfc*):

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

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. The data of each country was estimated on the basis of the accumulation of R&D expenditure 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.

Phk: Physical capital. The data of each country was estimated on the basis of the accumulation of investment flows 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*):

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

where,

M: Imports of country i from country j. The 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):

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

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*

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