Education, migration, and job satisfaction: The regional returns of human capital in the EU[*]

by

Andrés Rodríguez-Pose[§]

and

Montserrat Vilalta-Bufí[¶]

[§] Department of Geography and Environment
London School of Economics
Houghton St
London WC2A 2AE
e-mail: a.rodriguez-pose@lse.ac.uk

[¶] Department of Economics and Economic History
Universitat Autònoma de Barcelona
Edifici B – Campus de la UAB
08193 Bellaterra (Barcelona)
e-mail: mvilalta@idea.uab.es

Education, migration, and job satisfaction: The regional returns of human capital in the EU

Abstract: The paper looks at the link between human capital and regional economic performance in the EU. Using indicators of educational stock, the matching of educational supply and labour demand, and migration extracted from the European Community Household Panel (ECHP), it identifies that the economic performance of European regions over the last few years is generally associated with differences in human capital endowment. However, and in contrast to previous studies, the results highlight that factors such as the matching of educational supply and local labour needs, job satisfaction, and migration may have a stronger connection to economic performance than the traditional measures of educational stock.

Keywords: Human capital, education, educational supply, labour demand, job satisfaction, migration, regions, EU.
JEL Codes: O18, O40, O52, R10

1. Introduction

Human capital has traditionally been regarded as one of the key factors behind economic growth. Societies with a better endowment of human capital are considered to have a greater development potential than societies with scarce or inadequate human resources. Europe is no exception. Disparities in human capital endowment across nations, but especially across regions, are considerable and likely to affect the potential for convergence of those regions of the periphery of the European Union (EU) where the greatest shortages in human capital endowment are found.

Despite the wide scholarly agreement on the fact that human capital is an important determinant of economic growth, there is little consensus on the exact contribution of different measures and indicators of human capital to economic development and on how the passage from human capital endowment to economic growth is achieved. Pioneering studies on the link between human capital and economic performance (Barro, 1991; Mankiw, Romer, and Weil, 1992; Levine and Renelt, 1992) resorted to – perhaps as a result of the relative paucity of data on educational issues – basic indicators of educational stock, such as school enrolment rates, as proxies for the stock of human capital. Subsequent papers, while sticking to educational stock variables, started to introduce attainment measures in their models (Barro and Lee, 1994; Islam, 1995; Barro, 1997). The results of analyses using educational stock are, in addition, far from uncontroversial. Different models reach contradictory results, which, moreover, tend to be often sensitive to small changes in the specification of the model (Levine and Renelt, 1992) or to changes in the sample of countries and regions.

Educational stock, as a measurement of the quantity, availability, and even quality of an area's human resources is, however, only one of the possible ways of assessing the impact of human capital on economic growth and recent work has raised the question of the need to look for alternative measures of human capital in economic analyses (Benhabib and Spiegel, 1994; Krueger and Lindahl, 1998). The number or percentage of primary, high school, or university graduates, different measurements of the educational attainment of the population, or even indicators of the quality of the education provided – while extremely informative about the quantity and quality of human resources – give precious little information about the use a society is making of its educational stock. A decent educational stock may have little impact on local economic performance and regional disparities, if those human resources are left idle or not used to the best of their capacity in the workplace. Shortages or deficiencies in educational stock can also be tackled by the attraction of highly qualified or skilled labour from other areas of the country or other countries.

From this perspective, indicators of the adjustment between educational supply and labour demand, of the degree of employment of the best-qualified individuals, and of the level of migration are as important indicators of a society's capacity to transform human capital into economic growth, as is its educational stock. Yet the use of such indicators in growth models is far rarer. While migration is progressively becoming more frequent in certain models (e.g.: Haque and Kim, 1994; Beine, Docquier, and Rapoport, 2001), measurements of the use made of human capital on productive activities are much less common. The reasons for this neglect are related to the difficulty of measuring in an accurate and homogenous way across territorial units – and especially across subnational units – issues such as migration, but especially

factors like the correspondence between the education of workers and the job they are performing or the satisfaction of employees and employers with the education provided by the educational system, just to mention a couple of the possible ways of assessing the adjustment between educational supply and labour demand.

The aim of this paper is to analyse the link between human capital endowment and the evolution of regional disparities in the EU, focusing not just on how the educational endowment of each region affects its economic performance, but also on other human capital factors that have hitherto deserved less attention. The paper will stress the significance of the degree of use of educational supply by the productive sector and the importance of migration – and especially international migration – in promoting economic development and contrast their relationship to growth with that of the more traditional educational stock indicators. In order to achieve this aim, and given the dearth of comparable educational data at a regional level across the EU, the paper resorts to a series of regionalized microeconomic indicators extracted from the European Community Household Panel (ECHP).

The paper is divided into five further sections. After a brief review of the literature in section 2, section 3 looks at the economic trajectory of EU regions and classifies them according to their economic performance over the last few years, as a preliminary step for the descriptive analysis of the human capital endowment for each group of regions, developed in Section 4. Section 5 deals with the link between educational indicators and economic growth. Finally Section 6 presents the main conclusions.

2. The link between human capital and economic performance.

Most analyses of the role of human capital on economic performance have basically relied on only one aspect of human capital endowment: educational stock. Enrolment rates at different levels of education, the percentage of population with a certain degree of formal education, the years of schooling, or literacy rates have been recurrent human capital proxies in economic growth models (Barro, 1991 and 1997; Barro and Lee, 1994; Benhabib and Spiegel, 1994; Englander and Gurney, 1994; Hall and Jones, 1999; Hanushek and Kim, 1995; Islam, 1995).

The fact that the potential returns of human capital have tried to be captured by simple measures of educational stock represents, however, a crude simplification of the way in which the education and skills of individuals are transformed into potentially growth-enhancing activities in any space (Wolf, 2002). Our capacity of establishing links between human capital and economic performance is further limited by the poor quality of the macroeconomic proxies used (Cohen and Soto, 2001; De la Fuente and Doménech, 2002) and by measurement error (Krueger and Lindahl, 2001). The combination of these factors has often resulted in the implementation of "simplistic policies with substantial deleterious effects" (Wolf, 2004: 330). Yet, the economic impact of human capital does not solely depend on the quantity, quality, and type of human resources, but also upon a myriad of factors that cover from the matching of educational supply to labour demand, to the level of job satisfaction, or the use companies and firms are making of existing training, and to the capacity of any society to attract skills from outside.

Aware of these limitations, some researchers have recently tried to explore other paths in order to better assess the impact of human capital on economic performance. The question about which human variables are relevant for growth has thus come to the fore (Wolf, 2002). Is it the type, quality, and/or quantity of the stock of human capital? The flow or the mobility of human resources? Or the matching between the stock of human capital and the needs of the local economy?

The emphasis of the majority of the studies on educational stock and accumulation indicators and the neglect of the potential effect on growth of the existent differences in the use of human capital, the adequacy of this human capital to the local environment, and the role of migration is related to the difficulty in measuring human capital, in general, and human capital mobility and the matching between educational supply and labour demand, in particular. Some studies have, however, put greater effort in order to take the type and quality of human capital, as well as the efficiency of its allocation, into account. Hanushek and Kim (1995) have introduced a measurement of the quality of human capital – the results on international test scores – into the model. Their results indicate that the quality of education thus measured has a positive and significant impact on economic growth. Murphy, Shleifer, and Vishny (1991) show that the allocation of talent to engineering (considered in their paper as akin to entrepreneurship) has a positive effect on growth, while its allocation to law (regarded by them as rent-seeking), has the opposite effect. Similarly Wößmann (2002) shows that cross-country differences in the quality of human capital are closely associated with variations in economic development. Judson (1998) proposes an estimation of the efficiency of the allocation of educational spending between primary, secondary, and tertiary education. Her results show that the allocation of

educational resources matters for economic growth, which balances the predominant idea of education as an unquestionable positive investment (Wolf, 2004). Other studies have focused on the mobility of labour. Beine, Docquier, and Rapoport (2001), for example, analyse the relationship between migration, human capital, and growth in an open developing economy. According to them, the "drain effect" of human capital can in some cases be beneficial, if opening the economy fosters a high enough investment in education ("brain effect").

Factors like the matching between educational supply and labour demand or the satisfaction of employers with the skills of their workers or of employees with their capacity to sell and use their skills in the labour market have, by contrast, received less attention (Rodríguez-Pose, 1996 and 1998). This is related to the almost complete absence of comparable quantitative information on those issues across regions and countries.

Our intention in this paper is to further the analysis on these sorts of human capital factors, with the final goal of getting new insights on how human capital and growth are related. Our hypothesis is that both the matching of educational supply and labour demand and migration are as important as – if not more important than – educational stock indicators in explaining the link between human capital endowment and economic growth. We propose to study this interaction across regions in the EU, taking the ECHP as the main source of information.

3. The recent evolution of regional disparities in the EU.

Economic wealth and development levels are not evenly distributed across the EU. Strong regional disparities in GDP per capita have been a feature of the EU since its creation, and especially since successive enlargements have, in most cases, brought poorer countries than the original member-states into the Union. Over time, regional disparities in the EU have tended to decline. Regional convergence was the norm since the end of the Second World War and until the mid-1980s (Barro and Sala-i-Martín, 1991; Armstrong, 1995; Cheshire and Carbonaro, 1995; Molle and Boeckhout, 1995; Tondl, 2001). Indeed, national disparities have continued to decline throughout the 1990s and the beginning of the 21st century. Ireland represents the most spectacular case. Rates of real growth in excess of eight per cent per annum during much of the 1990s have lifted Ireland from the group at the bottom of the EU wealth list to the rank of the second richest member-state. Other traditionally peripheral countries, such as Portugal, Spain and, more recently, Greece, have tended to perform better than the EU average and have narrowed the gap with the core.

The picture, however, becomes more complicated when the regional dimension is taken into account. In contrast to the positive trajectory of peripheral countries, the economic performance of many peripheral regions within those countries, in the Italian Mezzogiorno, and in the former East Germany has frequently been below par. The panorama over the last decade and a half has thus been one of national convergence and regional stability or even divergence, which becomes more evident when the problems of spatial dependence are taken into account in growth models (Magrini, 1999; Rodríguez-Pose, 1999; Cuadrado-Roura, 2001; Boldrin and Canova,

2001; Puga, 2002). In addition, several authors have pointed towards a growing evidence of the emergence of convergence clubs (Neven and Gouyette, 1995; Quah, 1996) resulting in increasing polarization and lower economic cohesion across Europe (López-Bazo *et al.*, 1999).

The stagnation of regional convergence in the EU is confirmed by our empirical analysis. Figure 1 classifies NUTS 1 regions in the EU according to their GDP per capita in 1994 and their economic performance during the period between 1994 and 2000. The reason for resorting to NUTS 1 regions and 1994 as starting date is related to the use of the ECHP as the main source for human capital indicators in the following section. 1994 was the first year of the ECHP and, therefore, has to be taken as the starting point in order to reduce any potential problems of endogeneity between economic growth and human capital[1]. This also implies that the member-states which have joined the EU since 1995 were not covered by the survey.

We aggregate the ECHP data for individuals at NUTS 1 level. The remaining indicators used in the analysis are collected at the same regional level. The obligation of preserving the necessary anonymity of those taking part in the survey prevents any

---

[1] Restricting the period of analysis to a mere six years – a factor conditioned by the first ECHP taking place in 1994 – represents a serious handicap for the analysis. In such a short period of time regional growth trajectories may be strongly influenced by factors such a short-term cyclical effects, rather than reflect long-term growth paths. One-off events in any given region (such as a bumper harvest in an agricultural region) may also acquire greater importance than if a longer time period was considered. And there are also greater implications for the cut-off dates. However, the alternative of elongating the period of analysis by bringing back the initial date for GDP per capita would have implied serious risks of endogeneity and simultaneous causation, given that all human capital variables reflect the situation in 1994. After carefully pondering both options, we decided that the former option was the lesser of two evils.

analysis at finer regional scales and for relatively small countries such as Denmark, Ireland, and Luxembourg.

In order to minimize problems of spatial autocorrelation, all data is standardized nationally (cf. Armstrong, 1995; Rodríguez-Pose, 1999; Magrini, 1999). Thus, regional data is measured in deviations from the national mean[2]. These caveats leave us with a sample of 60 regions in eight countries of the EU[3].

Taking the national average of GDP per capita in 1994 and its growth between 1994 and 2000 as the dividing criteria, four groups of regions can be distinguished:

- Catching-up regions: regions with a low starting level of GDP per capita with respect to their national average, but with a higher than average economic performance.

- Winning regions: regions with both higher than national average initial GDP per capita and economic growth rate.

- Losing regions: regions with both lower than national average initial GDP per capita level and economic growth rate.

- Falling behind regions: regions with a higher than national average initial level of GDP per capita, but with below average economic performance.

---

[2] In this way, all the variables used in the paper indicate how well a region is doing relative to the national average. Any value above 1 indicates that a region is performing better than average, while values below 1 denote a worse than average performance.

[3] Regions of the former German Democratic Republic are excluded from the analysis.

The first two groups can be jointly defined as dynamic, while losing and falling behind categories can be defined as less dynamic.
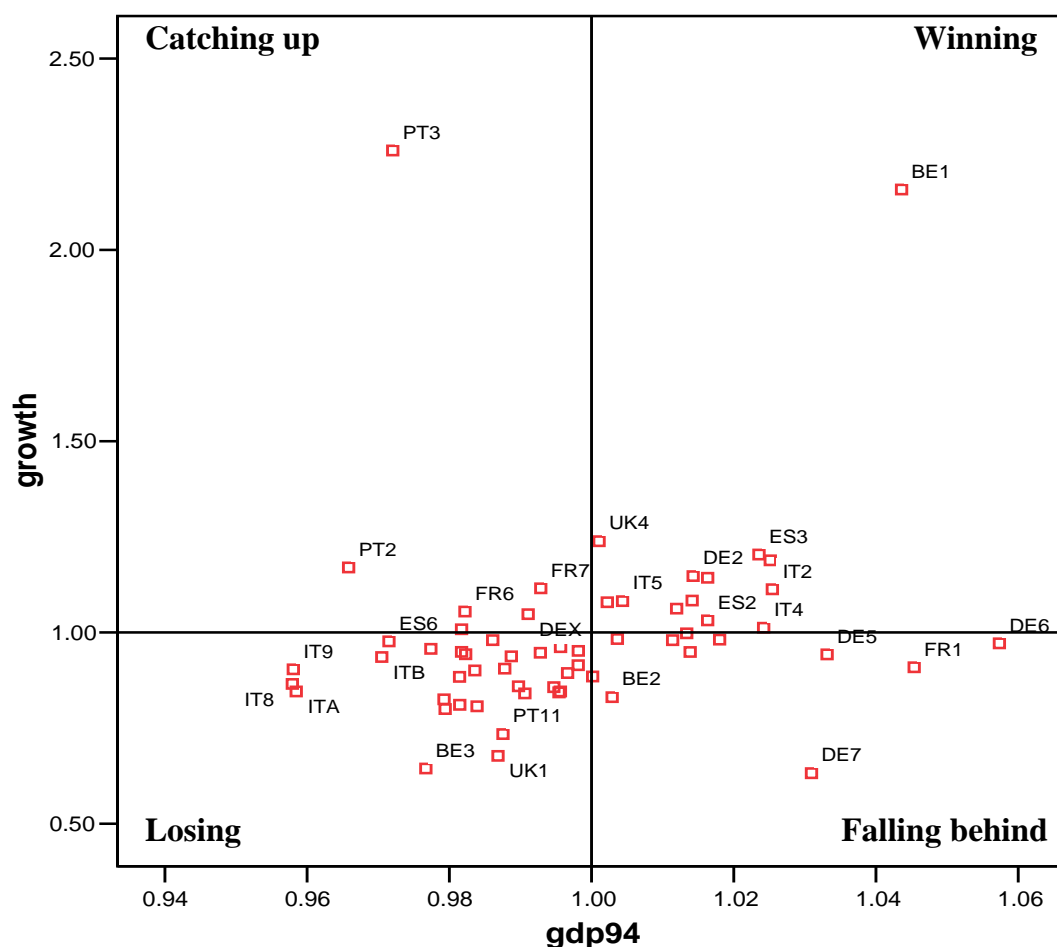
Figure 1. Growth performance of EU regions (variables nationally standardized)[4].

The results plotted in Figure 1 confirm that, when regional GDP and economic performance are considered as deviations from the national mean, there is little evidence of convergence[5]. Most regions tend to fall either in the winning or losing

---

[4] See appendices 1 and 2 for the regional codes and individual country graphs respectively.

[5] Given the short time span available, the membership of certain regions to each of the defined categories may reflect in some cases, as already indicated in footnote 1, short-term cyclical effects more than long-term trajectories, as would have been more

category, a factor that is in agreement with the findings of those authors that have identified greater polarization across regions in the EU and the presence of convergence clubs. In contrast, a limited number of regions are falling behind, and only a handful seems to be catching up.

Among the winning regions, we find many of the capital regions, such as Brussels, the South East of England, Madrid, Athens, or Lisbon, as well as regions home to some of the most important urban agglomerations, such as Milan, Munich, or the Ruhr. The catching-up regions include the Portuguese archipelagos and several regions in western France.

Losing regions form the largest group. It consists of a series of industrial declining regions, such as the North, the North West, and Yorkshire and Humberside in England, Wallonia in Belgium, or Nord-Pas de Calais in France, and many peripheral regions, such as Calabria, Campania, and Sicily in Italy, the South, Centre, and Northwest of Spain, or the North and Centre of Portugal. Only a limited number of regions belong to the falling behind category and all of them, with the exception of Hessen (Germany), are just below the average growth rate.

4. Human capital endowment in dynamic and less dynamic regions

The question that emerges at this point is whether there is a link between the economic performance of different groups of regions and their human capital

---

desirable. This may explain the presence of regions, such as Île de France or Hessen in the falling behind category, despite having enjoyed fairly dynamic growth trajectories over the last two decades.

endowment. Perhaps the main problem researchers and policy makers face when addressing these issues is the scarcity of reliable comparable regional data on human capital across a series of countries. Whereas educational data at the national level tend to be available and reliable, descending to the regional dimension implies a significant reduction of information. In spite of the improvements made in this respect over the last few years, the number of regional educational indicators included in Eurostat's Regio database is still basically limited to counts of students in full time education (i.e.: number of students by level of education, orientation, and sex or number of students by modern language studied). There is little additional information on the stock of education and on migration (which is often confined to national borders) and none on the matching of educational supply and labour demand. Moreover, national data on educational attainment is hardly comparable, given the significant national differences in education structures and traditions.

As a way to circumvent these problems and to get a broader and more accurate picture of the quantity, quality, use, and mobility of human capital across regions of the EU, this section relies on alternative sources of information. As mentioned earlier, the ECHP has proven to be an extremely valuable source for many human capital indicators. Many of the questions contained in the survey give a clear picture not only of the level of education attained by respondents, but also of their degree of satisfaction (and that of their employers) with their knowledge and skills in order to perform their work and of their mobility. Once regionalized, the whole set of indicators presents a comprehensive picture of all dimensions of human capital across NUTS 1 regions in Europe. The ECHP is thus used to construct variables relating to the educational stock, the current state of education (the number of current students),

the actual use of educational stock on the productive activities, and migration across regions in the EU[6]. Table 1 summarises the variables extracted from this source.

Table 1. Human capital variables

STOCK OF HUMAN CAPITAL	
*Ageduco**	Nat. logarithm of average age when the highest education level was completed
Hcsecon	% of respondents with secondary education completed
Hctert	% of respondents with tertiary education level completed
Agefjob	Natural logarithm of the average age at which individuals began their first job
High-skill	% of individuals working in high skilled jobs
Proftec	% of professionals and technicians among employed people
STATE OF EDUCATION	
Edutra	% of respondents who have been in education/training since January last year
Secondary	% of respondents currently in the second stage of secondary education
Tertiary	% of respondents currently in tertiary studies (not including vocational training)
MATCHING EDUCATION-LABOUR MARKET	
Training	% of workers that have had formal training related to present job skills
Provided[Δ]	% of workers with education or training provided by the employer
*Postrain**[Δ]	% of workers who took training and who think that it was at least fairly useful
Yunemp	Youth unemployment on total unemployment (from Eurostat's Regio database)
*Satisf**	% of respondents satisfied with work or main activity
*Infraskill**[Δ]	% of workers who think they could do a more demanding job with their skills
MIGRATION	
Hcmigra	% of newcomers with high education
Jobmigr	% of respondents who moved recently for job-related reasons
*Migra**	% of people who are now residents in a region but come from a foreign country

(*) data for Germany not available; (^{Δ}) data for UK not available.

---

[6] The ECHP 1994 covers on average 2,000 respondents per region, for a total of more than 130,000 individuals. Only three regions are below the threshold of 500 respondents (Bremen, Hamburg, and Schleswig-Holstein), while the number of interviewees exceeds 5,000 in the regions of Attica and Northern Greece, with several Belgian and Spanish regions not far behind. A complete list of the ECHP 1994 sample size by region is provided in Appendix 3.

Once again all variables have been standardized nationally in order to minimize problems of spatial autocorrelation. This is particularly relevant when referring to educational variables because the guidelines for national educational systems are, as a general rule, set nationally – with, in some cases, regions having powers over a devolved system of education, but still having to comply with national guidelines and curricula – and differences across European countries are so important that any cross-country comparison could make the analysis futile. "Countries that start with very different structures [in the education and training systems], even though they respond to common pressures, will often remain very different" (European Commission, 1999: 42).

Using the categories described in Table 1, the next set of four figures presents the human capital endowment for the types of winning, losing, catching-up, and falling behind regions identified in section 3, in order to unveil any possible link between educational endowment and economic performance. Each Figure presents the deviation in percentage terms from the overall mean for each variable. The overall mean is given a value of 0.

The deviations from the national average of the six different variables that measure the stock of education of a region are reported in Figure 2. These include the percentage of respondents with tertiary education (*hctert*) and secondary education (*hcsecon*), *ageduco*, and *agefjob*, which indicate the average age at which education was completed and the age at which individuals secured their first job respectively. They provide a fairly good proxy for human capital stock. Finally, the percentage of people working as professionals or technicians in the working population (*proftec*)

and the percentage of high skilled jobs (*highskill*) are also taken into consideration. These last two variables represent a broader measure of human capital, as they are not merely based on the educational attainment of the population, but on the current job performed by individuals, which will be the result of combining formal education, on-the-job training, and experience factors.
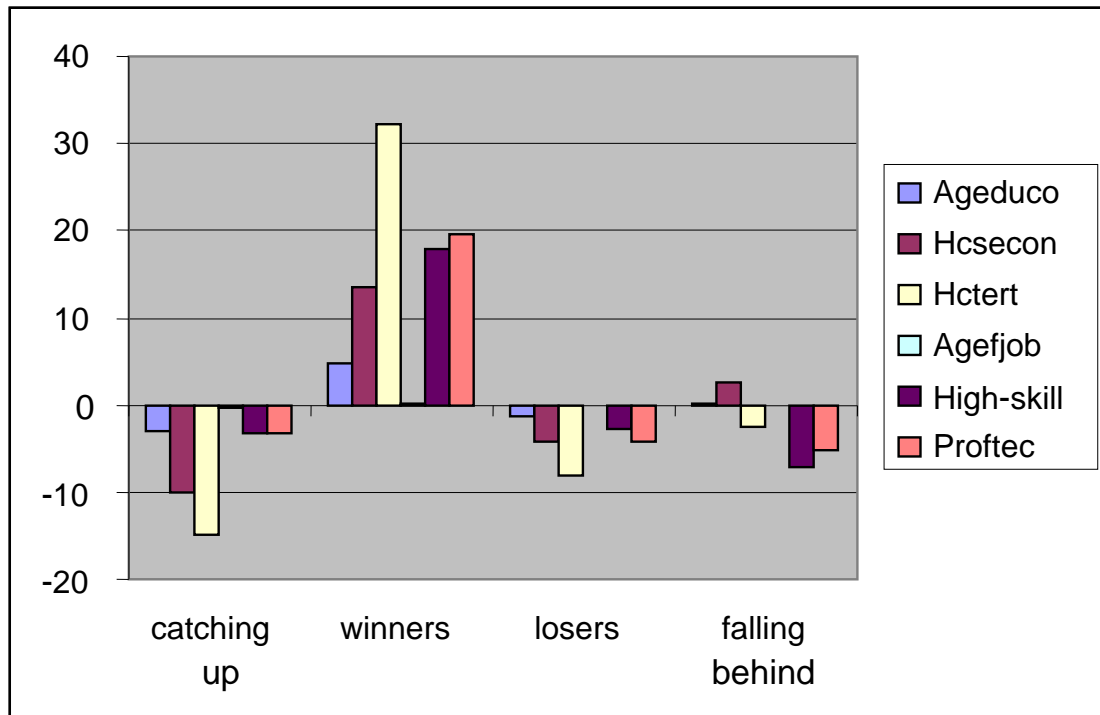

Figure 2. The stock of education across European regions[7].

The results in Figure 2 show that winning regions have a much better stock of education than regions in the other three categories. All stock variables in this group are above average and the deviation with respect to the mean is particularly important in the higher education category.

---

[7] A description of the variables included in Figures 2, 3, 4, and 5 can be found in Table 1.

The remaining three groups are clearly behind winning regions in terms of their educational stock. This is chiefly the case in losing and catching up regions, whose lower educational endowment may be a consequence of their historically lower levels of GDP per capita. The greatest relative shortage between these regions and the winning regions category is in the realms of higher education and, to a lesser extent, in secondary education.

The falling behind group has above average secondary education stock. However, the graphic reveals a shortage of individuals with higher education, a lower percentage of high-skill jobs, and a low presence of professionals and technicians. These differences in the economy of falling behind regions with respect to winning regions may be contributing to the long-term economic decline of a series of regions that started from similar levels of GDP.

The state of education variables refers to the current group of population taking part in some sort of education in the region. These three variables represent different indicators of the stock of people in education. *Edutra* is the percentage of respondents who have been in education or training in the last year; *secondary* refers to the percentage of students in the second stage of secondary level of education; and *tertiary* to those in higher education, excluding vocational training[8].

---

[8] This category of variables is the less reliable since the 1994 ECHP database does not have a good coverage of students in the sample.
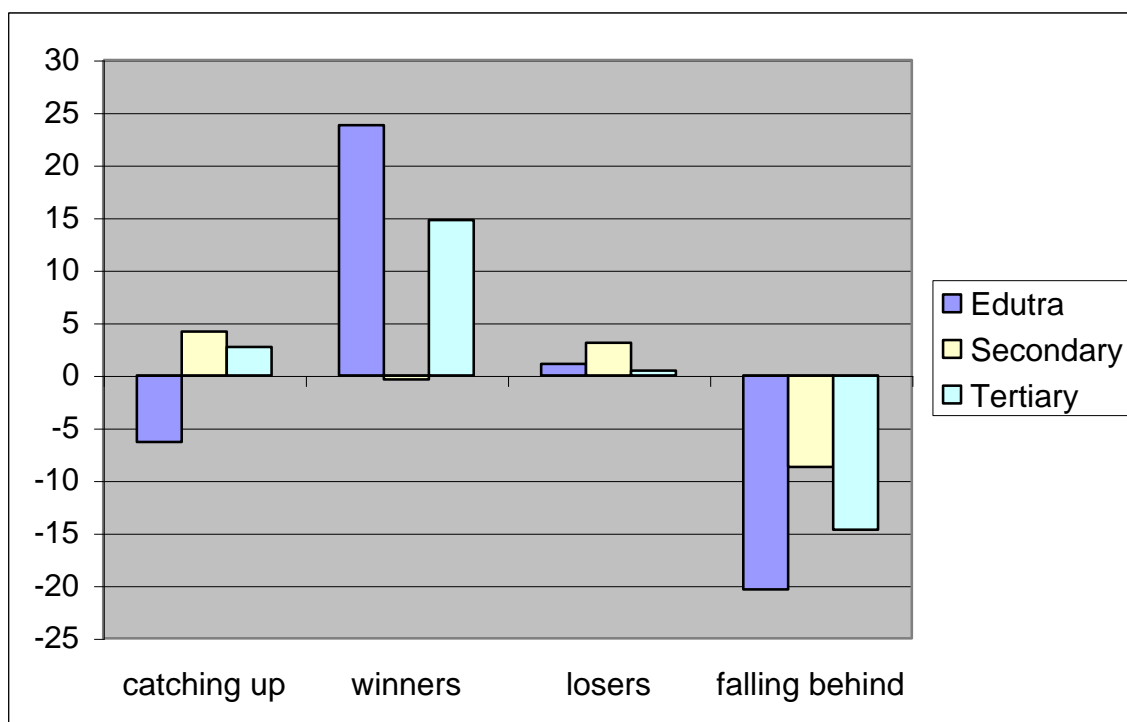
Figure 3. The state of education across European regions.

The more remarkable result from figure 3 is the gap in state of education between the winning and falling-behind regions. While in winning regions the percentage of respondents who have been in education or training in the last year is close to 25 per cent above the average, in falling-behind regions it gets to 20 per cent below it. This difference can be partly explained by the 30 percentage-points gap in students of tertiary level of education between these two types of regions. Figure 3 also reveals that falling behind regions present the lowest percentage of students in all categories, while all other regions have above average students in formal education.

Having adequate skills for the job being implemented and being satisfied at work are indicators that depict the matching of educational skills to labour demand and impinge on workers' productivity and, therefore, on the aggregate economic performance of a

region. The ECHP provides a series of questions from which variables about the matching of educational skills to labour demand can be derived. These include *training*, which is calculated based on the replies to the question of whether the individual has "*had any formal training or education that has given [him/her] skills needed for [his/her] present type of work?*". *Postrain* is a qualitative and subjective measure on the adequacy of training, derived from the responses to the question of whether the individual's training has contributed to his or her present work. We expect these two variables to have a positive effect on growth, since they indicate that workers have adequate skills for their job. *Provided* is an indicator of whether the employers pay or provide training and education for their workers, reflecting whether employers consider that there is a mismatch between the human capital available in the market and the skills they are demanding. However, *provided* will also give the employees the adequate skills for their job, possibly enhancing economic growth. Thus, the effect of this variable on economic performance is unclear. *Infraskill* represents the percentage of workers who think they could do a more demanding job. This last variable reflects a possible infra-utilisation of the stock of human capital, which we expect will have a negative effect on economic development. In addition, a more traditional (and, perhaps, objective) measure of human capital mismatch included in the analysis is the level of youth unemployment. The capacity of markets to absorb young and, on average, better trained people than earlier generations is likely to have a significant impact on the economic dynamism of a region. Finally, *satisf* captures the overall level of satisfaction at work, a factor which will impinge on productivity. It is worth noting that some of the variables included in this part of the analysis – and especially *infraskill* and *satisf* – are of a subjective nature, as they

relate to respondents' opinions, rather than to more objective measures of participation and stocks. As such they reflect the aspirations of respondents.
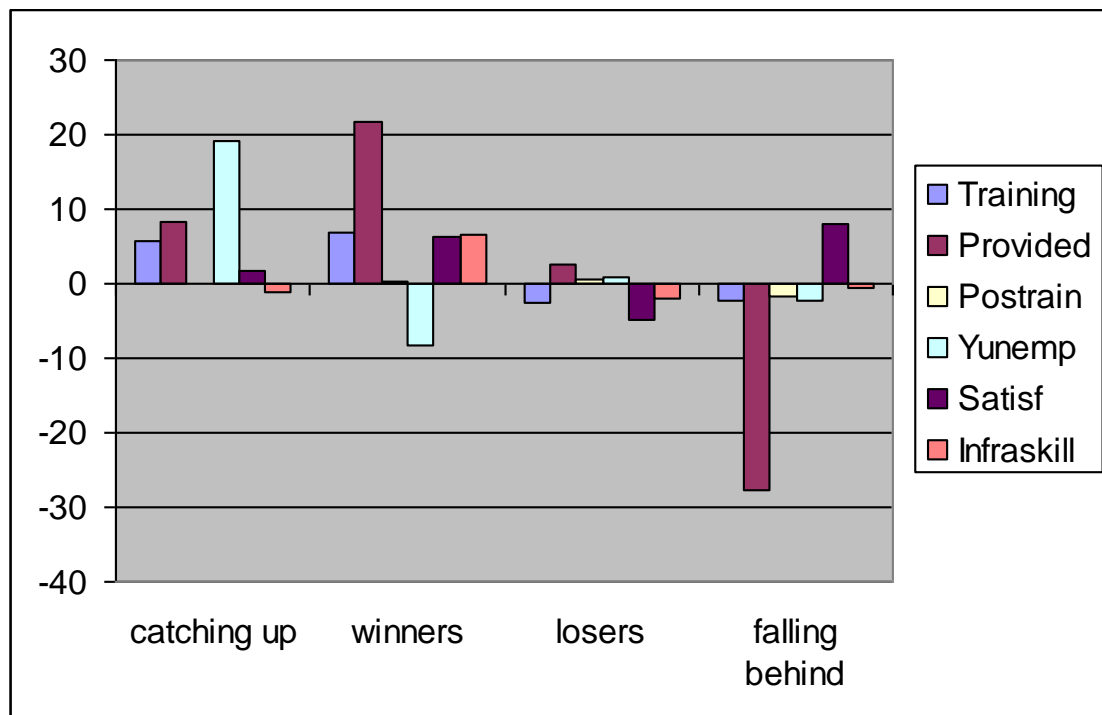

Figure 4. The matching between educational supply and labour demand across European regions.

The matching of educational supply and the skills needed by regional economies and the level of satisfaction of workers are also correlated to economic performance (Figure 4). Winning and catching-up regions generally enjoy a better match between educational supply and labour demand and have a greater proportion of satisfied workers. The high levels of variables such as *training* and *provided* in dynamic regions suggest that having studies related to the job performed is germane to changes in productivity and growth. Yet the correlation is far from perfect. While the level of satisfaction at work is above average in winning and catching-up regions, the highest level accrues to falling behind regions. Only in losing regions is the level of satisfaction at work below average, which may highlight a general feeling of being

trapped in a bad economic situation. These results highlight the fact that job satisfaction is highly subjective and affected by a myriad of factors beyond the type of job being carried out or the level of skills of each individual.

Whereas winning and falling behind regions have below average youth unemployment, the catching-up group presents the highest level. Having a large percentage of unemployed and young population, although a sign of educational mismatch in the economy, may have helped these regions to fill in any new job opportunity with the adequate worker.

The relationship between the training provided by employers and economic performance is positive (Figure 4). Employers tend to provide more training for their employees in winning and catching-up regions than in losing and, above all, falling behind regions. This measure reflects a willingness by companies to make a better use of the skills of the labour force and, hence, to insure greater competitiveness.
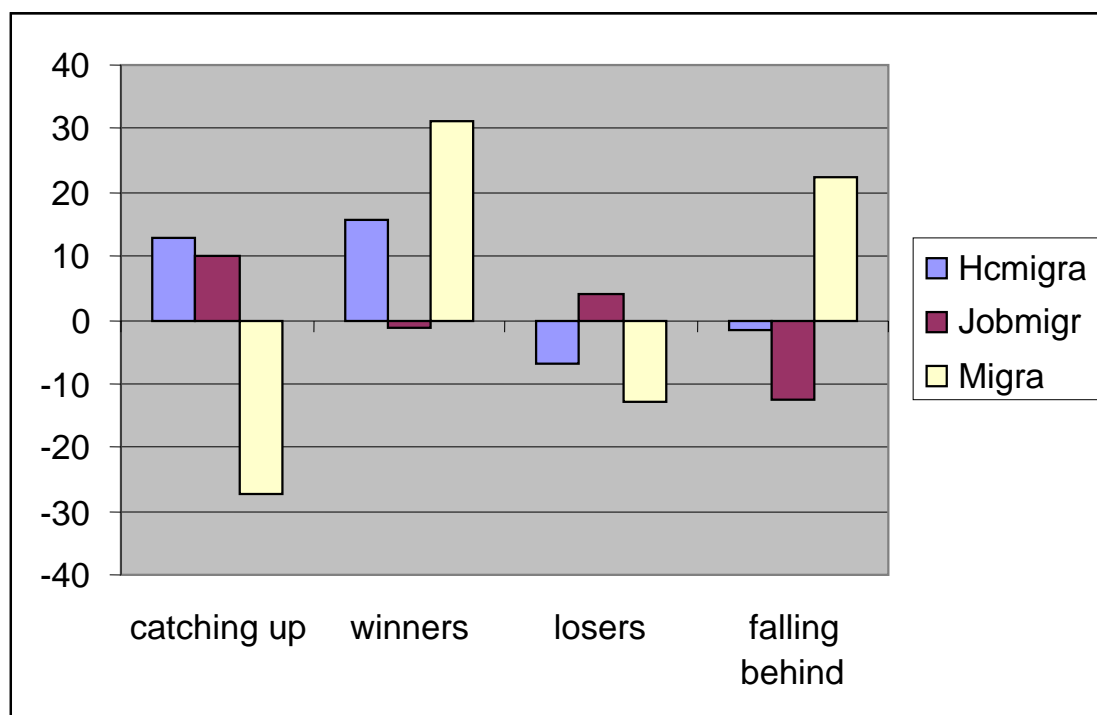
Figure 5. Migration across European regions.

The final vector in the human capital equation is migration. Here again the paper uses ECHP data, focusing exclusively on immigrants. The questions in this realm relate to whether individuals have always lived in the same region or have come from other countries for job-related or other reasons. Migration variables considered in the analysis comprise *hcmigra*, which measures the percentage of migrants from any other region with university degrees (for movements in the last two years only); *jobmigr*, which captures movements in search for jobs (again in the last two years only); and *migra*, which depicts all international migration (people who came from another country at any time), regardless of the motives behind it.

Figure 5 shows clearly that regions with higher initial GDP (winning and falling behind groups) have the highest percentage of international migration, while poorer regions have had a lower inflow of people. Since this measure accounts for

accumulated migration over time, it is likely that regions with a better past performance enjoy higher values of international migration. However, the type of and motives for recent migration differ across the four categories of regions. Winning regions manage to attract highly qualified workers. Also the catching-up group, although with below average international migration, attracts skilled labour and has strong job-related migration. This is possibly related to the presence of better job opportunities in such regions in the period prior to the analysis. On the contrary, falling-behind regions get below average skilled labour and little job-related migration. Losing regions score best in non-highly qualified job-related migration.

4. Econometric analysis

The previous descriptive analysis characterizes the four categories of regions according to their stock of education, their current number of students, their educational matching with labour market demand, and their migration patterns. In this section we extend the analysis with a regression model. Taking into account our hypothesis that indicators of the adjustment between educational supply and labour demand and migration are likely to have as strong an association with economic growth as educational stock variables, we test which human capital measures have a higher impact in economic development. OLS regressions of economic growth between 1994 and 2000 are conducted on the GDP level in 1994 and the human capital variables for 49 NUTS1 European regions[9], extracted from the ECHP. The model adopts the following form:

---

[9] German regions are excluded from this part of the analysis, as some indicators were not included in the German panel. BE1 (Brussels) and PT3 (Madeira) are also excluded as they represent significant outliers, causing huge distortions in the results.

$$\Delta GDP_{t-0} = \alpha + \beta_1 GDP_0 + \beta_2 stock_0 + \beta_3 state_0 + \beta_4 match_0 + \beta_5 migrat_0 + \varepsilon \qquad (1)$$

where:

GDP denotes the nationally standardised GDP per capita (in logs);

stock represents a series of indicators of the available stock of human capital;

state includes a series of indicators of the current state of education;

match denotes a series of indicators covering the matching between educational

   supply and labour demand in a given territory; and,

migrat represents indicators of migration trends.

0 and t represent the beginning (1994) and the end (2000) of the period of analysis

respectively, ε is the error term, and β are the coefficients, which estimate the effect

of the independent variables on the dependent variable. Specific variables in the

analysis reproduce those included in Table 1.

As in the previous section, all data is nationally standardised in order to minimize

spatial autocorrelation problems. Thus, our variables are indices of how well a region

is doing with respect to its national average or how much of a factor a region has in

relation to the country average. Results will tell us what factors are making regions

more successful or unsuccessful (as measured relative to the country average success).

Standard VIF multicollinearity tests were conducted and no violations of assumptions

were found. Endogeneity problems are reduced by resorting to explanatory variables

depicting the human capital situation in the initial year of analysis (1994).

Table 2 summarises the results. In equations 1 to 9 we regress initial GDP per capita

and each human capital variable individually on growth. Equations 10-13 introduce

series of human capital variables for each category included in the model: the

percentage of adults with secondary (*hcsecon*) and university (*hctert*) education, for the stock of education; the percentage of workers with formal training related to their present job (*training*) and the percentage of people satisfied with their current job or main activity (*satisf*), for the matching between educational supply and labour demand; and the percentage of residents from a foreign country (*migra*) and the percentage of immigrants with a university degree (*hcmigra*), for migration.

Several indications can be extracted from equations 1 to 9 (Table 2). First of all, the coefficient of the GDP per capita indicator is always positive and significant, signalling the process of regional divergence already highlighted in Figure 1, even when controlling for human capital indicators. As variables are standardised nationally, we cannot say anything about existence of convergence or divergence at the country level.

The introduction of the most commonly used educational stock variables in Regressions (2) and (3), the percentage of people with secondary education and with higher education, does not reveal the existence of a connection with economic performance. Although both coefficients are positive, they are not significant. A similar result is achieved when introducing the most common indicator of the state of education, the percentage of secondary level students (Regression 4). Although the percentage of students in the highest level of education comes out positive and significant, it is only at the 10% confidence level (Regression 5).

When including variables of the matching between educational supply and labour market demand – both from a more objective and more subjective perspective – the

results become positive and significant (Regressions 6 and 7). Whether it is the percentage of workers that have had formal education related to their job (*training*) – as a more objective measure – or the level of job satisfaction – as a more subjective one – there seems to be a positive and robust association between these indicators and growth. These results highlight that, whether it is through a more adequate use of the human resources available or through a potential adjustment – upwards or downwards – of productivity strategies by employers in order to make a better use of the skills of the regional labour supply, the matching between labour demand and educational skills matters for growth. Similarly the highly subjective measure of the level of satisfaction of the workforce – which may be fully or partially linked (or even wholly unconnected) to work related factors – impinges on the economic performance of each region.

The last category of human capital variables included in the equation is migration indicators. We argue that the ability of a region to attract skilled labour from abroad can be as important as a good educational endowment. When the percentage of foreigners is taken as a proxy for migration, as in regression (8), the results do not support our hypothesis. However, regression (9) reports a positive and significant coefficient, when including the percentage of highly educated. Those regions better able to attract highly skilled labour perform, in general, better. And, as seen in the descriptive analysis (Figure 6), it is the more dynamic regions and those with a stronger foothold in the knowledge economy, rather than the richer regions that seem to have the greatest capacity to attract this kind of workers.

When stock, matching, and migration variables are included together in the model, as in regressions (10) to (13) (Table 2), the results reveal that, for European regions and the second half of the 1990s, the matching of educational supply and labour demand, job satisfaction, and the ability to attract skilled workers matters more for regional economic growth than the available stock of education, which represents the preferred indicator of most human capital analyses. These results are robust to the inclusion of variables on the state of education.

In regressions (10) and (12), *training* and *satisf* are included together with GDP94, *hcsecon*, and *migra*. Only GDP94 and the two variables denoting the matching of educational supply and labour demand turn out to be significant[10]. The explanatory capacity of the regression improves when the percentage of skilled migrants is used, instead of international migration (regressions 11 and 13). Equation (11) shows a positive and significant coefficient for all variables, but the stock of education. Hence, having previous education related to the present job and the capacity to attract qualified labour force from abroad are important for economic performance. The strength of the association between these two variables and GDP, on the one hand, and regional growth, on the other, is similar, as indicated by the dimension of their standardized coefficients (0.262, 0.275, and 0.243 respectively).

Finally, when *satisf* is introduced instead of *training*, (equation 13) similar results are obtained. Only GDP94 loses significance, while *satisf* and *hcmigra* keep a positive and significant connection with growth. The standardized coefficients for these variables remain close to previous values (0.260 for *satisf* and 0.245 for *hcmigra*),

---

[10] Although GDP per capita loses its significance in regression 12.

giving again a similar weight to the variables for matching of education and labour market and skilled migration.

In conclusion, the regression analysis strengthens our hypothesis that the frequently used variable stock of education should, if possible, be combined with indicators of the use, level of satisfaction, and appropriability of this stock of education, as well as with variables of the ability to obtain human capital from abroad.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Constant	**-1.721****	-1.348	-1.280	**-1.824****	**-1.645***	-1.226	-1.217	**-1.670***	-1.238	-1.150	-0.934	-0.413	-0.555
	(0.830)	(0.887)	(0.902)	(0.844)	(0.823)	(0.819)	(0.846)	(0.904)	(0.810)	(0.912)	(0.841)	(0.982)	(0.887)
GDP94	**2.698*****	**2.185****	**2.184****	**2.743*****	**2.457*****	**1.890****	**1.965****	**2.641*****	**2.068****	**1.787***	**1.541***	0.899	1.083
	(0.835)	(0.942)	(0.942)	(0.841)	(0.843)	(0.866)	(0.892)	(0.923)	(0.830)	(0.982)	(0.909)	(1.099)	(0.989)
HCSecon		0.136								0.049	-0.004	0.178	0.123
		(0.117)								(0.125)	(0.119)	(0.117)	(0.118)
HCTert			0.071										
			(0.058)										
Secondary				0.058									
				(0.072)									
Tertiary					0.164								
					(0.114)								
Training						**0.310****				**0.290****	**0.249***		
						(0.130)				(0.142)	(0.138)		
Satisf							**0.221***					**0.278****	**0.207***
							(0.112)					(0.118)	(0.114)
Migra								0.006		-0.003		0.022	
								(0.039)		(0.039)		(0.040)	
HCMigra									**0.143****		**0.119****		**0.106***
									(0.057)		(0.058)		(0.060)
R-sq.	18.2%	20.5%	20.7%	19.3%	21.7%	27.1%	24.5%	18.2%	28.1%	27.4%	33.6%	29.4%	33.6%
Adj. R-sq.	16.4%	17.0%	17.3%	15.8%	18.3%	23.9%	21.2%	14.6%	25.0%	20.8%	27.5%	23.0%	27.6%

Table 2. Results of the regression analysis

Dependent variable is Growth. Standard Errors in parenthesis. (***) 1% significance level, (**) 5% significance level, (*) 10% significance level.

5. Conclusions

Although the limited time frame and the nature of the analysis implies that any conclusions should be considered with caution, the study has identified that there seems to be a significant correlation between the endowment of human capital of European regions and their economic performance over the last few years, both from a descriptive and an analytical perspective. From a descriptive perspective, the relationship between human capital and economic growth tends to be clearer for winning and losing regions, than for those catching up and falling behind. Winning regions feature a better-educated stock of population, have a larger percentage of their population in full time education, and attract highly qualified inward migration (although, curiously, not particularly job-related). Losing regions are characterised by a weaker stock of human capital, some evidence of mismatch between educational supply and labour demand, and lower than average inward migration, specially as regards to skilled labour. Catching up regions tend to attract educated workers from other areas and present a pretty high percentage of workers with job-related education, but still have a deficient stock of human capital and a high level of youth unemployment. Finally, the falling behind regions, although having an average stock of education, lack high-skilled jobs and have a relative shortage of people in full-time education. Moreover, they only manage to attract non-qualified migrants across all categories. Despite these drawbacks, they enjoy the highest level of job satisfaction.

The econometric analysis reveals that, in the case of European regions, factors such as the degree of job satisfaction, the balance between the skills on offer and those demanded, and the capacity to attract highly skilled migrants seem to have a higher

sway over economic performance than the measures of human capital stock, traditionally used as proxies for human capital in most growth analyses. Our results indicate that stock variables are more likely to be associated with wealth, whereas job satisfaction, matching indicators, and migration are more closely related to economic performance.

Overall, we can say that the link between regional economic performance and the endowment of human capital brought to light in this study is in tune with recent studies (i.e. Duranton and Monastiriotis, 2002; Overman and Puga, 2002), which have highlighted the importance of the education and experience in the economic potential of a region or with those that have pointed out that the economic returns to Structural Fund investment in education in peripheral regions tend to be higher and more significant than those in alternative investment axes, such as infrastructure or business support (Rodríguez-Pose and Fratesi, 2004). The use of microeconomic data in this paper in order to construct human capital indicators represents a step forward with respect to the traditional use of a limited number macroeconomic indicators. However, this does not imply that there is not significant room for improvement. Only major progress in the availability and quality of data, in order to obtain proxies that better reflect the full dimension of human capital and its use in the labour market, and further research using a raft of alternative methods would allow us to gain a greater understanding of the complex relationship between different aspects of human capital and the evolution of regional disparities across regions in Europe.

References

Armstrong, H. W. (1995) An Appraisal of the Evidence from Cross-Sectional Analysis of the Regional Growth Process within the European Union, in Vickerman, R. W., Armstrong, H. W. (Eds.), Convergence and Divergence Among European Regions, Pion Limited, London, pp. 40-65.

Barro, R. (1991) Economic growth in a cross-section of countries, *Quarterly Journal of Economics* 106: 407-443.

Barro, R. (1997) Determinants of economic growth: a cross-country empirical study, Cambridge, MA: MIT Press.

Barro, R. and Lee, J. W. (1994) Sources of economic growth, Carnegie-Rochester Conference Series on Public Policy 40: 1-46.

Beine M., Docquier, F. and Rapoport, H. (2001) Brain drain and economic growth: theory and evidence, *Journal of Development Economics* 64: 275-289.

Benhabib, J. and Spiegel, M. (1994) The role of human capital in economic development: evidence from aggregate cross-country data, *Journal of Monetary Economics* 34: 143-173.

Boldrin, M. and Canova, F. (2001) Inequality and convergence in Europe's regions: reconsidering European regional policies. *Economic Policy* 16: 207-253.

Cohen, D. and Soto, M. (2001) Growth and human capital: good data, good results. CEPR DP 3025, CEPR: London.

Cheshire, P. C. and Carbonaro, G. (1995) Urban economic growth in Europe: Testing theory and policy prescriptions. *Urban Studies* 33: 1111-1128.

Cuadrado-Roura, J. R. (2001) Regional convergence in the European Union: From hypothesis to the actual trends. *Annals of Regional* Science 35: 333-356.

De la Fuente, A. and Doménech, R. (2002) Human capital in growth regression: how much difference does quality of data make? An update and further results. CEPR DP 3587, CEPR: London.

Duranton, G. and Monastiriotis, V. (2002) Mind the Gaps: The Evolution of Regional Inequalities in the U.K. 1982-1997. *Journal of Regional Science* 42: 219-256.

Englander, A. S. and Gurney, A. (1994) Medium-term determinants of OECD productivity, *OECD Economic Studies* 22: 49-109.
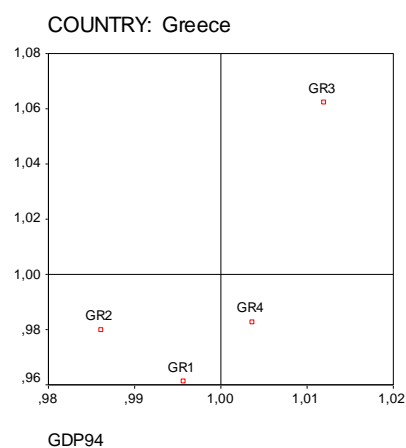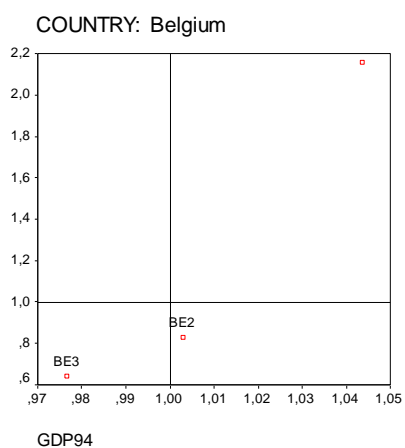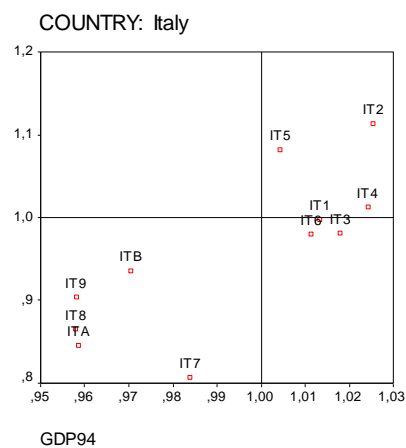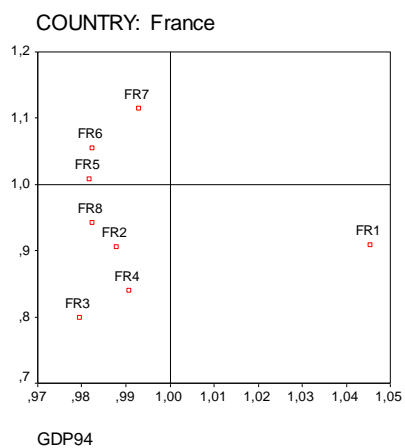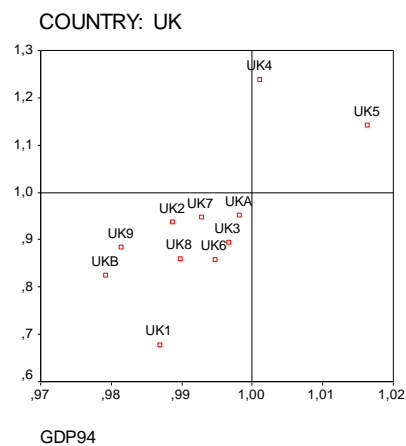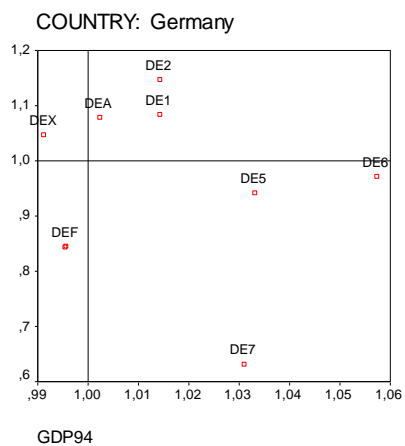
European Commission (1999) *Convergences and divergences in European education and training systems*. Brussels-Luxembourg: OPOCE.

European Commission (2003) *Second progress report on economic and social cohesion.* Brussels-Luxembourg: OPOCE.

Hall R. and Jones, C. (1999) Why do some countries produce so much more output per worker than others?*, Quarterly Journal of Economics* 114: 83-116

Hanushek, E. A. and Kim, D. (1995) Schooling, labor force quality and economic growth*, National Bureau of Economic Research,* Working Paper: 5399

Haque, N. and Kim, S. J. (1995) Human capital flight- impact of immigration on income and growth. *International Monetary Fund Staff Papers* 42: 577-607.

Islam, N. (1995) Growth empirics: a panel data approach. *Quarterly Journal of Economics,* 110: 1127-1170.

Judson, R. (1998) Economic growth and investment in education: how allocation matters*, Journal of Economic Growth* 3: 337-360.

Krueger, A. B. And Lindahl, M. (2001) Education for growth: why and for whom?. *Journal of Economic Literature* 39: 1101-1136.

López-Bazo, E., Vayá, E., Mora A. J., and Suriñach, J. (1999) Regional economic dynamics and convergence in the European Union. *Annals of Regional Science* 33: 343-370.

Levine, R. and D. Renelt, A. (1992) sensitivity analysis of cross-country growth regressions, *American Economic Review* 82: 942-963.

Magrini, S. (1999) The evolution of income disparities among the regions of the European Union. *Regional Science and Urban Economics* 29: 257-281.

Mankiw G., Romer, D. and Weil, D. (1992) A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107: 407-437.

Molle, W. and Boeckhout, S. (1995) Economic disparity under conditions of integration - A long term view of the European case. *Papers in Regional Science* 74: 105-123.

Murphy, K.M., Shleifer, A. and Vishny, R. (1991) Allocation of talent: implications for growth, *Quarterly Journal of Economics* 106: 503-530.

Neven, D. and Gouyette, C. (1995) Regional convergence in the European Community. *Journal of Common Market Studies* 33: 47-65.

Overman, H. G. and Puga, D. (2002) Unemployment clusters across Europe's regions and countries. *Economic Policy*, 17: 115-147.
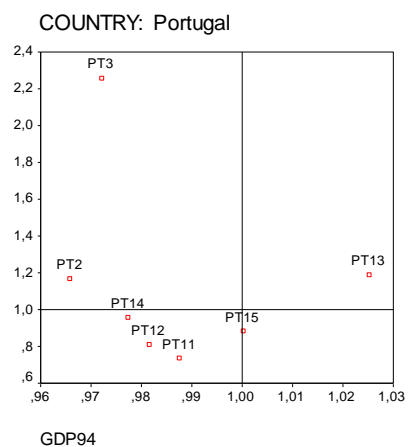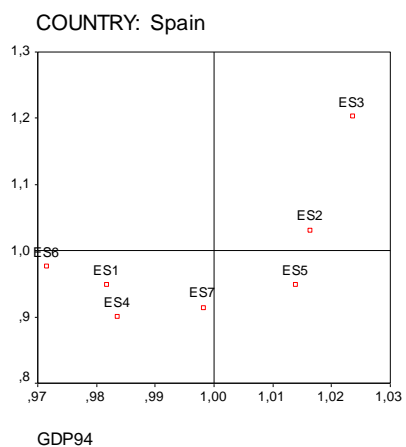
Puga, D. (2002) European regional policy in light of recent location theories. *Journal of Economic Geography* 2: 373-406.

Quah, D. (1996) Regional Convergence Clusters across Europe. *European Economic Review* 40, 951-958.

Rodríguez-Pose, A. (1996) Educación superior, mercado de trabajo y crecimiento económico en una España dispar. *Estudios Económicos* 3, 45-79.

Rodríguez-Pose, A. (1998) *The dynamics of regional growth in Europe: Social and political factors*. Oxford: Clarendon Press and New York: Oxford University Press.

Rodríguez-Pose, A. (1999) Convergence or divergence? Types of Regional Responses to Socioeconomic Change. *Tijdschrift voor Economische en Sociale Geografie* 90: 363-378.

Rodríguez-Pose, A. and Fratesi, U. (2004) Between development and social policies: the impact of European Structural Funds in Objective 1 regions. *Regional Studies*, 38: 97-113.

Tondl, G. (2001) *Convergence after divergence?: Regional growth in Europe*. Berlin: Springer.

Wolf, A. (2002) *Does education matter? Myths about education and economic growth*, London: Penguin Books.

Wolf, A. (2004) Education and economic performance: Simplistic theories and their policy consequences. *Oxford Review of Economic Policy* 20: 315-333.

Wößmann, L. (2002) *Schooling and the Quality of Human Capital*. Berlin: Springer.

Appendix 1. Classification of regions included in section 3

Catching up regions			Winning regions	
DEX	Rheinland-Pfalz + Saarland (Germany)		BE1	Région Bruxelles-capitale/Brussels hoofdstad gewest (Belgium)
FR5	Ouest (France)		DE1	Baden-Württemberg (Germany)
FR6	Sud-Ouest (France)		DE2	Bayern (Germany)
FR7	Centre-Est (France)		DEA	Nordrhein-Westfalen (Germany)
PT2	Açores (Portugal)		ES2	Noreste (Spain)
PT3	Madeira (Portugal)		ES3	Comunidad de Madrid (Spain)
			GR3	Attiki (Greece)
			IT2	Lombardia (Italy)
			IT4	Emilia-Romagna (Italy)
			IT5	Centro (Italy)
			PT13	Lisboa e Vale do Tejo (Portugal)
			UK4	East Anglia (UK)
			UK5	South East (UK)

Losing regions					Regions falling behind	
BE3	Région Wallonne (Belgium)	IT9	Sud (Italy)		BE2	Vlaams Gewest (Belgium)
DE9	Niedersachsen (Germany)	ITA	Sicilia (Italy)		DE5	Bremen (Germany)
DEF	Schleswig-Holstein (Germany)	ITB	Sardegna (Italy)		DE6	Hamburg (Germany)
ES1	Noroeste (Spain)	PT11	Norte (Portugal)		DE7	Hessen (Germany)
ES4	Centro (Spain)	PT12	Centro (Portugal)		ES5	Este (Spain)
ES6	Sur (Spain)	PT14	Alentejo (Portugal)		FR1	Île de France (France)
ES7	Canarias (Spain)	UK1	North (UK)		GR4	Nisia Aigaiou, Kriti (Greece)
FR2	Bassin Parisien (France)	UK2	Yorkshire and Humberside (UK)		IT1	Nord Ovest (Italy)
FR3	Nord- Pas-de-Calais (France)	UK3	East Midlands (UK)		IT3	Nord Est (Italy)
FR4	Est (France)	UK6	South West (UK)		IT6	Lazio (Italy)
FR8	Méditerranée (France)	UK7	West Midlands (UK)		PT15	Algarve (Portugal)
GR1	Voreia Ellada (Greece)	UK8	North West (UK)			
GR2	Kentriki Ellada (Greece)	UK9	Wales (UK)			
IT7	Abruzzo-Molise (Italy)	UKA	Scotland (UK)			
IT8	Campania (Italy)	UKB	Northern Ireland (UK)			

Appendix 2. Individual country graphs

COUNTRY: Germany

GDP94

COUNTRY: UK

GDP94

COUNTRY: France

GDP94

COUNTRY: Italy

GDP94

COUNTRY: Belgium

GDP94

COUNTRY: Greece

GDP94

COUNTRY: Spain

COUNTRY: Portugal

GDP94

GDP94

Appendix 3: ECHP sample size per region.

Code region	Region	Sample Size
BE1	Région Bruxelles-capitale/Brussels hoofdstad gewest	1.247
BE2	Vlaams Gewest	4.541
BE3	Région Wallonne	4.061
DE1	Baden-Württemberg	2.250
DE2	Bayern	2.021
DE5	Bremen	106
DE6	Hamburg	177
DE7	Essen	1.156
DE9	Niedersachsen	1.218
DEA	Nordrhein-Westfalen	3.050
DEF	Schleswig-Holstein	375
DEX	Rheinland-Pfalz + Saarland	796
ES1	Noroeste	3.396
ES2	Noreste	3.524
ES3	Comunidad de Madrid	2.176
ES4	Centro (E)	3.343
ES5	Este	4.852
ES6	Sur	4.170
ES7	Canarias (ES)	1.468
FR1	Île de France	3.163
FR2	Bassin Parisien	3.441
FR3	Nord-Pas-de-Calais	1.411
FR4	Este	1.775
FR5	Ouest	2.735
FR6	Sud-Ouest	1.977
FR7	Centre-Est	2.133
FR8	Méditerranée	2.166
GR1	Voreia Ellada	5.214
GR2	Kentriki Ellada	3.839
GR3	Attiki	5.111
GR4	Nisia Aigaiou, Kriti	1.912
IT1	Nord Ovest	2.284
IT2	Lombardia	2.690
IT3	Nord Est	3.140
IT4	Emilia-Romagna	1.182
IT5	Centro (I)	2.478
IT6	Lazio	1.800
IT7	Abruzzo-Molise	1.312
IT8	Campania	2.190
IT9	Sud	3.141
ITA	Sicilia	1.942
ITB	Sardegna	1.470

Code region	Region	Sample Size
PT11	Norte	2.514
PT12	Centro (P)	3.080
PT13	Lisboa e Vale do Tejo	1.802
PT14	Alentejo	1.493
PT15	Algarbe	1.660
PT2	Açores (PT)	2.031
PT3	Madeira (PT)	1.856
UK1	North	823
UK2	Yorkshire and Humberside	1.322
UK3	East Midlands	1.128
UK4	East Anglia	537
UK5	South East	3.931
UK6	South West	1.166
UK7	West Midlands	1.310
UK8	North West (UK)	1.382
UK9	Wales	711
UKA	Scotland	1.298
Average size		**2.211**
Total		**130.477**