HAS HUMAN CAPITAL ACCOUNTED FOR REGIONAL ECONOMIC GROWTH IN ITALY? A PANEL ANALYSIS ON THE 1980-2001 PERIOD

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Since Solow's (1957) contribution, human capital has a central role in the debate on economic growth as a leading long period development factor. If from a theoretical point of view the role of human capital on economic growth both directly and throughout its use in R&D activities is fully accepted, from an empirical perspective the results are much more controversial, strictly depending on the quality of data. A recent analysis by Aghion and Cohen (2004) put in evidence that high-level human capital has a positive effect on economic performance only if a country is close to the technological frontier: countries that are far from this frontier, specialised in traditional sectors, can growth, almost in the short run, even exploiting medium-level human capital. This analysis lead to consider the link between human capital and growth with a greater detail, trying to disclose the effect of different human capitals in a country, such as Italy, traditionally oriented toward a low/medium technology production. Using, beyond the usual proxies of human capital, some measures of its quality and of its interrelation with R&D sector, we would like to give a new contribution to the analysis of regional growth in Italy in the period 1980-2001. The panel approach, here adopted, allows us to take account of the temporal variability and to check for omitted variable specific for regions and persistent over time.

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1. Introduction

Human capital can be defined as a set of individual characteristics - such as level and quality of education, natural capabilities, talents and experiences - which are, at least partly, the consequence of an individual investment and relevant to the economic activity.

Whether it acts directly in favouring growth – because of a better educated and therefore more productive labour force - or whether its effect is indirect or limited to its use in activities which generate technical progress, for the past twenty years human capital has undoubtedly played a primary role in growth analysis, with sometimes controversial results.

The aim of this work is to analyse the impact of human capital on Italian regional growth. The interest for a regional prospective derives from the fact that it allows to better exploit both the ample variability of the growth factors throughout the different areas and the comparability of available information on human capital, which is poorer in a by country analysis. Through the use of usual human capital proxies, as well as some other measurements that should be able to get to the heart of the quality of human capital and its interrelation with R&D sector, the work is a new contribution which helps to explain regional growth between the years 1980 and 2001. In particular, throughout this analysis we will pay attention to the interpretation of some shared evidences about the existence, especially in the Southern Italy, of an "unproductive" human capital and of a sort of mismatch between the demand and the supply of professional competences and skills. Since the effect of human capital strictly depends on the production structure in which it is employed, we will also take into account the characteristics and the evolution of regional productive "specialisations" even if, because of limited information at a regional level, we will only consider macro-sectors.

The work is structured as follows. Paragraph 2 highlights the major methodological problems deriving from the relationship between human capital and economic growth. Paragraph 3 contains a review of the most relevant results of empiric literature on this subject. Paragraph 4 contains a brief descriptive statistics of the data that will be used. After a description of the methodology (par. 5), paragraph 6 presents the main results obtained from the econometric evaluations.

2. Theoretical and empirical issues

The relationship between human capital and economic growth presents several methodological problems both from a theoretical and an empirical point of view.

Human capital concept implicitly enters into the Solow's (1957) production function as one of the factors affecting (together with resources used in the R&D activity) the “technological

progress" (or "knowledge" or "labour effectiveness"), which represents the only long term growth factor. The explicit introduction of human capital in the production function, which is at the base of the extension brought to Solow's model by Mankiw, Romer and Weil (1992), allows to consider the role of the knowledge "incorporated" in the employed labour force. Nonetheless, human capital continues to exercise a positive effect on growth (just like the physical capital) only during transitional phases, while long term growth is determined by exogenous not explained factors.

The theoretical inadequacy of the results deriving from Solow's basic model and its extension - which, in fact, attribute growth to non-observable extra-economic factors - and the controversial empirical results with regard to convergence (a direct consequence of the decreasing factors returns hypothesis), have represented a strong impulse for a deeper analysis of the growth phenomenon. The so called "theories of endogenous growth", which began to develop in the second half of the Eighties, thus abandoning the hypothesis of decreasing factors returns and of constant returns to scale, pointed how economic growth depends on the positive interaction between knowledge, capabilities and innovative ability. Thanks to positive externalities and to the related increasing returns (Lucas, 1988), or rather thanks to the positive interaction with innovative ability and technological progress (Romer 1986, 1990 and 1994), human capital, becomes a long-term growth factor. However, while Lucas's approach emphasizes the role of continuous investment in human capital as the engine for growth, in Romer's theory it is the stock of human capital that positively influences the economic development since the most important role is always played by technological progress. Moreover, while in Lucas's approach the notion of human capital seems to generically represent education or diffused knowledge, for Romer the only human capital which has a positive impact on growth is that used in the R&D activity: it therefore seems that Romer's theory goes beyond the "labour quality" concept, generally represented by the human capital, to introduce the "human capital quality" concept, strictly connected to the use of the available human capital.

Also as concerns the empirical estimation of the relationship between human capital and growth it is possible to synthesize the most relevant methodological issues.

In the so called "growth regressions"[1] the dependent variable is represented by the growth rate or by the variation of GDP - either pro capita or per labour unit - during a certain period of time and the explicative variables are represented by those emphasized by the different theoretical approaches (population growth rate, physical capital and human capital) as well as

[1] The other empirical exercise, which directly derives from the Solow model, is represented by the so-called "growth accounting" in which the objective is to measure the "weight" of the single production factors in the aggregate production function.

by the initial value of the dependent variable. Then, other control variables are generally added to capture the effect of the public sector, the foreign trade, the financial structure, etc. Therefore, it is important to observe that, if from a theoretical point of view the so-called "endogenous growth theories" greatly contributed to better understand growth phenomena, from an empirical point of view a "control" of these theories is very difficult, especially because of the difficulties in testing the hypothesis relative to the presence of externalities (Pack, 1994). Even if in the empirical estimates some explanatory variables are often introduced in the aim of measuring the impact of the R&D activity, the assumptions of the endogenous theories have not been directly tested and generally the choice between the two approaches is based on the analysis of the convergence process[2].

The difficulty in testing the "superiority" of one or the other approach can be easily understood especially if one considers the following:

- in the short term, it is difficult to distinguish between a path of either exogenous or endogenous growth[3];
- in the long term, the two paths are distinguishable, but the well-known question is: can the long term be reached?

This difficulty explains why, generally, growth regressions are base based on the Mankiw, Romer e Weil (1992) equation.

A further methodological question, strictly connected to the use of human capital in analysing growth, has to do with the choice of the correct way to measure human capital (Wößmann, 2003; Temple, 2001). It is first of all necessary to clear up if it is the initial level of human capital or the growth of human capital that influences economic growth. The former case is founded on the assumption that a high level of human capital may prompt both a process of application/imitation of foreign technologies and a process of innovation, if other hypotheses do exist. Nonetheless, as observed by Temple (2001), the micro-economic approach, which establishes a correlation between the individual level of education and the individual level of productivity, suggests that it would be useful to analyse the relationship between the variation of the overall human capital level and the overall productivity level thus introducing a whole new set of problems relative to endogeneity. A second question that emerges has to do with

[2] Generally, the initial level of the endogenous variable is introduced among the explicative variables of regressions. If the estimated coefficient for this variable is positive, then it can be concluded that the initially less developed countries (or regions) will not reach the more developed ones. This confirms the hypothesis of non decreasing returns of the production factors. If, instead, the coefficient is negative, then it can be concluded that a process of convergence is under way, as expected by neoclassical theories.

[3] In theory, if a process of exogenous growth is under way, a one-off increase of the human capital level has an effect on growth rate only in the short term, while in the long term the effect is only on the level. If, on the other hand, an endogenous growth process is under way, the effect on growth rate is permanent. If the analysis is carried out on the short term, the results are practically identical.

the choice of the variables regarding human capital *stock* and human capital *investment*. Generally, the first studies used investment variables represented by the rate of enrolment in higher education institutions in a certain year[4]. Such proxy**,** however, obviously causes some problems. First of all, it is not necessarily true that all those enrolled in higher education institutions do complete their studies and then become part of the labour force; secondly, it is necessary to pay particular attention to the time spell needed for these students to be effectively used in the production process. The human capital stock measurements, generally represented by the average number of years of education of the labour force, present less methodological problems especially when it is correctly attributed to additional years of education different effects in terms of productivity[5].

Finally, another methodological question has to do with the "quality" of human capital from two different points of view. On one hand, it is useful to notice that in comparing the growth paths of countries that are very different in institutional terms and, particularly, in terms of the characteristics of the educational system, it is possible to make great evaluation mistakes by attributing the same outcome to one year of education. This problem is obviously greatly reduced when examining homogenous countries, or, as for this particular work, when adopting a regional perspective. On the other hand, as previously recalled discussing the Romer approach, if the economic growth only depends on the human capital used in R&D activities (a "productive" human capital), then it is necessary to consider the educational choices of the labour force and the outcomes of such choices in terms, for example, of those employed in the R&D activity.

3. Main results of the empirical literature

3.1 Cross-country analyses

Dowrick (2003) suggests a useful method to organize the main results of the wide cross-countries empirical literature regarding the relationship between human capital and growth. It consists in identifying three different analysis "currents"**,** which correspond to three different time phases.

The first group of studies is represented by the pioneer works by Barro (1991), Eglander and Gurney (1994) up to Barro and Sala-i-Martin (1995) where the analysis of the effect of the initial level of human capital (together with other control variables) on productivity or on *per capita* income growth rate are based on a single cross-section (Barro 1991) or on a pool of cross-sections (the others). In these works, human capital is represented by the rate of

[4] Generally a year before the one for which the analysis is carried out so as to avoid endogeneity problems.

[5] For example, it is possible to make a distinction between the average number of years of primary secondary and university education.

enrolment in higher education institutions during the base year (in the first two studies) and by education expenditures in relation to the GDP (in the third study). The results of these works are in line with the evaluations of neoclassical literature and highlight both a convergence process and the strong effect of human capital on growth.

The second group is characterized by a panel approach (Islam, 1995, Caselli et al. 1996, Barro and Lee 1997), which takes into account the individual effects reflecting technological and institutional differences between countries, and the endogeneity of certain explicative variables. In these approaches, by synthesizing the results, the effect of human capital (measured as a stock) on growth greatly decreases, as if the introduction of a time dimension could reduce the effect of the variability among countries.

In the aim of giving an explanation to the previous controversial results, the third group of studies improve the analysis through the estimation of models characterized either by non-linear relationships (Krueger e Lindahl, 2001) or by the introduction of institutional variables, or by the application of more sophisticated estimation methods on more homogenous sample countries (Pritchett, 2001; Bassanini e Scarpetta, 2001a). Anyway, the smaller impact of human capital on growth with respect to the first studies of the early 1990's is still strengthened.

Putting aside these sometimes contradictory results, some guidelines for future analysis of the relationship between human capital and growth do clearly emerge.

First of all, if it is true that a certain variability among the analysed units is necessary, an excessive variability, observed when confronting quite different institutional contexts, can lead to an overestimation of the effect of human capital. Then, it is evident how a panel approach, which allows to exploit both the variability among the study units and the time variability and, therefore, to investigate for specific effects constant through time, appears to be definitely better than the use of simple cross-sections. By exploiting longer time series, it seems fundamental to dedicate particular attention to the correct specification of the model, keeping into consideration the time lag structure.

3.2 Growth and convergence in the Italian regions

The most contributions concerning the analysis of growth processes in the Italian regions is devoted to the issue of convergence. Generally, the aim of this body of literature is to "test" the hypothesis of a progressive homogenisation of economic conditions of the different regional economies against the alternative hypothesis of the existence of “convergence clubs”

that is to say areas characterized by autonomous growth[6]. The role of human capital thus remained partially overshadowed: its introduction in growth regressions was in fact finalized to test the hypothesis of conditional convergence with respect to absolute convergence, rather than measuring its impact on economic growth. It is probably for this reason that the most studies regarding Italian regions have not kept in great consideration issues regarding the correct way to measure human capital. Human capital has been generally introduced only in terms of the rate of secondary school enrolment in the year before that of the study (Cellini e Scorcu 1997a e 1997b; Mauro e Podrecca, 1994; Paci e Pigliaru, 1995) with the two fold consequence of not considering the problems connected to this type of proxy[7] and not exploiting time variability. A contribution that concentrated on the role of human capital in the growth of Italian regions is that by Di Liberto and Symons (1998), which uses a proxy of regional human capital stock whose time variability is exploited by using it as a time-varying regressor in a panel analysis. Nonetheless, since this work is based on an evaluation of the human capital stock of the active population resulting from censual data, which is gathered every ten years, it runs into the problems deriving from the use of evaluated data instead of actual data. Even the GLS estimation method that was used causes considerable problems when dealing with not so broad panels[8].

4. The data

The analysis concentrates on the last two decades of the past century. Generally, studies on convergence of Italian regions have been concentrated on longer time spans, which include the periods of strong development and of partial decline respectively represented by the 1960's and the 1970's. Nonetheless, since the aim of this work is to develop an analysis of the impact of human capital on growth rather than a study of convergence, we focus on the last period as only from 1980 information relative to educational attainments of the labour force has been collected and published by region[9].

4.1 *The growth of Italian regions in the period from 1980 to 2001*

Italian regional GDP has increased by a yearly average of 2% between 1980 and 2001 (Table 1). This performance is the result of an average yearly growth rate of 2.3% in the 1980's and of 1.6% in the 1990's. The average growth rate of North Eastern regions is somewhat higher than the national average throughout the entire period under exam, especially in the 1990's. In

[6] See Aiello and Scoppa (1999) for a brief but complete review of empirical literature on convergence of Italian regions.
[7] See par.2.
[8] See Beck and Katz (1995).
[9] The information relative to regional upper secondary schooling is instead available for a wider time period.

the other areas, the dynamics are not so clear, since some regions show a higher performance than the average of their corresponding area, such as Lombardia (North West) and Abruzzo (South) in the 1980's, Marche (Center) and Basilicata (South) in the 1990's and Calabria (South) during the entire period. The sharp decrease of the GDP growth rate during the last decade of the past century only partly reflects on productivity trend, measured as GDP per labour unit, which increases to average 1.66% in the 1980's and to 1.46% in the 1990's. However, the almost uniform productivity growth registered at a overall level in the two examined decades is actually the result of different regional and by area dynamics, which lead to a modification of the position of single regions that could indicate a slight recovery of the convergence process. The productivity growth rate of Central Italy is lower than the national average, even if the trend seems to indicate a progressive improvement beginning at the onset of the 1990's. North Eastern regions show the same upward trend, and in the 1990's their production growth rate was definitely higher than the national average and particularly than that of North Western regions, which instead show a clear critical performance. Lastly, the productivity growth rate of the Southern regions, except the two islands, is higher than average in the examined period with two exceptional peaks for Molise and Basilicata, which show an even higher growth rate than that of North Eastern regions.

4.2 Human Capital

The composition of the labour force between 1980 and 2001 has radically changed (figure 1 a and b) throughout the whole country. The illiterate or those holding a primary-school certificate who, at the beginning of the period, were about 50% of the labour force, dropped to a little more than 12%, while those with a school degree beyond compulsory education went from 20 to 50% of the labour force. Naturally, this massive increase of the level of education is mainly ascribable to the progressive retirement, due to age limits, of people with little education who had entered the labour force after the war, as well as to the introduction in the 1970's of the so called "compulsory schooling". Northern regions, which in 1980 had the lowest percentage of labour force with a university degree, are aligned in 2001 with the rest the country, while the regions of Central Italy still hold their record for the intensity of college graduates (particularly Lazio where more than 15% of the labour force has a college degree). The labour force of Southern regions is more "polarised" than the Italian average, with a share of college graduates (11,4%) in line with the national average but whose labour force without a compulsory schooling degree is considerably higher than the national average (14.7%). The share of those who hold a education degree beyond compulsory schooling in this area has grown considerably less than in other Italian areas.

Starting from these figures, the yearly average of human capital stock has been calculated by multiplying the number of persons, comprising the labour force, with a certain education certificate (primary-school, intermediate school, secondary school certificate, college diploma, college degree) by the number of years generally necessary to obtain such certificate (five years for primary-school, eight for intermediate school, thirteen for secondary school and seventeen for the college degree). Such an overall "education stock" has then been divided by the number of labour force members in order to calculate the average number of years of education of the labour force.

Since the situation within the various geographical areas - which, for more clarity, we have identified as North West, North East, Center, South and Islands – differs greatly, table 2 shows a classification of the single regions based on the number of years of education of the labour force in 1980 and in 2001 respectively. Among the five regions with the lesser human capital stock, in 1980 three were Southern regions (Puglia, Basilicata and Molise), one was a Central region (Marche) and one was a Northeastern region (Veneto). Twenty-one years after, precisely in 2001, it can be notice how the five regions with the lesser human capital stock are Southern or Insular areas except for Valle D'Aosta, while Molise and especially Marche has improved its position. In 1980 two of the regions with a higher human capital stock were in the Northwestern area (Lombardy and Liguria), one in the Northeastern area (Friuli Venezia Giulia), one in the South (Calabria) and one in the Center (Latium). In 2001, however, no Southern regions is among the ones with the highest human capital stock. The same loss of position of Southern regions can be noticed in the regional classification with regard to "upper human capital stock"[10] (table 3), still showing the figures for 1980 and 2001. The generalized increase of the labour force's level of education is also evidenced by the considerable increase in the rate of enrolment in secondary school (figure 2), which has gone from an yearly average of a little more than 50% in 1980 to an yearly average between 80 and 90% with a few significant differences among the various geographical areas.

However human capital stock alone cannot be representative of labour productivity: given the same number of years of education of the labour force, the educational course that is chosen leads to employment in fields typified by a lesser or greater productivity. Generally, it is thought that higher education degrees (college degrees) in humanistic/social/legal subjects - which generally lead to low productivity jobs - give a lesser contribution to the growth of systems than degrees in technical-scientific subjects. An index based on the definition adopted by ISTAT (National Statistical Institute) for technical-scientific degrees – which

[10] We define "upper human capital stock" the average number of years of non compulsory schooling of the labour force obtained dividing the total amount of upper (non compulsory) education years by the total labour force.

includes Engineering, Mathematics, Physics, Chemistry, Medicine, Veterinary Medicine and Agricultural Sciences – has been created to compare the number of people holding degrees in this fields matters to the total number of collage graduates in each region. Naturally, given the mobility of college students, it is not necessarily true that those who graduated in a certain region will use their human capital in that specific region. It is however plausible to assume that a student who moves to another region in order to continue his educational course is motivated also by the belief that he will have greater chances of employment precisely in that area. Figure 4, which shows the historical data from 1980 to 2001 of the percentage of graduates in technical-scientific fields on the total of college graduates per geographical area, shows a considerable decrease and a progressive uniformity among areas: the increase of college graduates recorded for the same period is evidently largely determined by graduates in humanistic/social/legal subjects. This particular dynamic could be a problem for the development of Italian regions when such educational courses will actually correspond to a lesser productivity.

5. Methodology

As known, even if cross section evaluations - especially used in the first works on growth and convergence – give first analysis indications, they do not allow to consider the temporal dimension of the sample and the latent individual heterogeneity. Having the possibility of relying on a sample with yearly regional data and in order to increase the effectiveness of the evaluations, it is useful to adopt a panel specification, which takes into account the dynamic relationship between variables.

Correct estimates on panel data however need a detailed analysis of the characteristics of the single time-series, so as to exclude the identification of spurious correlations.

Equation (1) represents the known steady state growth equation by Mankiw, Romer and Weil where the productivity in a generic year depends on a constant (c) representing the level of technological progress, on the investments in physical capital (IPK), on the human capital in terms of stock or flow (HK) according to the chosen specification and on the sum of the growth rates of employment and technology and of the physical capital depreciation rate (n, g and δ respectively). A set of context variables (IST) have been added to the variables of the original equation, in line with the empirical literature on the subject. All the variables are expressed in logarithmic terms.

$$\ln(PROD) = c + \alpha_1 \ln(IPK) + \alpha_2 \ln(HK) + \alpha_3 \ln(n + g + \delta) + \alpha_4 \ln(IST) \qquad (1)$$

A type (1) equation however cannot be evaluated directly with the Ordinary Least Square method (simply OLS from now on) because of the presence of non-stationary variables (productivity, human capital stock, etc.): the existence of a common trend between the dependent variable and the covariates could in fact lead to a spurious correlation which would make the results of a OLS evaluation not significant. However, if two variables have the same trend, that is if they are cointegrated, it is possible that they are actually correlated: it is therefore necessary to first verify the dynamic structure of the single variables.

A method used to deal with this type of question is the introduction of an Error Correction Mechanism (ECM from here on) in which the variation of the dependent variable (productivity) is regressed on covariates inserted in the levels and in the first differences in order to capture both long and short term dynamics. With a first order ECM it is possible to hypothesize that (1) is the equilibrium equation (cointegration relationship) of an autoregressive distributed lags model of order one:

$$y_t = c + \alpha y_{t-1} + \sum_{j=1}^{k} \beta_j x_{j,t} + \sum_{j=1}^{k} \eta_j x_{j,t-1} + \varepsilon_t \qquad (2)$$

where y represents productivity and the x_j are the covariates of the steady state growth equation.

With a series of simple algebraic modifications it is possible to express formula (2) in terms of productivity variation:

$$\Delta y_t = c + (\alpha - 1) y_{t-1} + \sum_{j=1}^{k} (\beta_j + \eta_j) x_{j,t-1} + \sum_{j=1}^{k} \beta_j \Delta x_{j,t} + \varepsilon_t \qquad (3)$$

In (3) both members result stationary, by construction.

The use of an ECM is appropriate, as stated above, in the event that the variables are integrated and also cointegrated among themselves: only in this case their introduction in the first differences and in the levels allows for the errors to be stationary. With regard to the first issue, as appears evident from table 4 which reports the results of the Im, Pesaran e Shin (2003) test on the hypothesis of non-stationarity of all the panel's series, the majority of the covariates[11] turn out to be integrated of order one[12]. The only stationary covariates are the growth rate of the labour units (LG1LABUN), the ratio between gross fixed investments and the GDP (LRINV), the percentage of the work force with a secondary school certificate

[11] See the appendix B for the meaning of the variables.

[12] In the aim of verifying the order of integration, the test was applied to the first differences of the non stationary variables. In any case, as often happens with macro-economic variables, they turned out to be stationary in the prime differences.

(LRLOWLF) and the share of added value produced by agriculture (LRAV_AGR). These variables are introduced in the level evaluations for year t[13].

Then, in order to verify if the integrated variables of order one are also cointegrated with the dependent variable (productivity), the stationarity of the residuals deriving from an OLS static evaluation of (1) only limited to the covariates I(1) was also tested. The Im, Pesaran and Shin test leads to refuse the hypothesis of non-stationarity of the residuals and therefore to accept the hypothesis of series cointegration.

In light of the dynamic characteristics of the series being considered, the ECM equation subject of the evaluation is the following:

$$D1LPROD_{it} = \alpha + \beta LPROD_{it-1} + \gamma_1 LREDY_{it-1} + \gamma_2 LRTEC_{it-1} + \gamma_3 LRCOCO_{it-1} + \phi_1 d\_IND_{it-1} + \phi_2 d\_SER_{it-1} + \eta_1 D1LREDY_{it} + \eta_2 D1LRTEC_{it} + \eta_3 D1LRCOCO_{it} + \phi_3 dev\_IND_{it} + \phi_4 dev\_SER_{it} + \delta_1 LG1LABUN_{it} + \delta_2 LRINV_{it} + \phi_5 FIRSTDEC + \varepsilon_{it} \quad (4a)$$

where i=1,…., 20 is the number of regions, t=1,…21 is the number of years being considered and ε_{it} are the residuals. The variation between t and t-1 of productivity (D1LPROD) is regressed on the initial value of productivity (LPROD), on the human capital stock (LREDY), on the share of technical-scientific college degree over the overall college degree (LRTEC) and on the pro capita collective consumption (LRCOCO) as a proxy for the public sector dimension. The covariates I(1), expressed in the levels, allow for the evaluation of long term relationships. The first differences - inserted on the basis of an ECM specification – allow instead measuring the effects of short-term variations[14]. Two stationary variables (LG1LABUN e LRINV), measured in year t, and a set of dummies whose objective is to capture the productive structure of each region in the starting year besides its possible evolution were then added to the evaluation. In particular, the dummies d_IND and d_SER are constructed in such a way as to be equal to 1 when the share of regional added value produced by industrial and by the tertiary sectors exceed the average value at the national level, thus indicating the region's higher "specialization" in the sector. The dummies DEV_IND and DEV_SER, instead are constructed in such a way as to be equal to 1 when the region acquires a specialization either in the industrial or in the service sector, that is to say when the dummies d_IND and d_SER go from 0 to 1. The introduction of sector dummies should allow for the capture of those situations in which a region's development is due not so much to the increase of human capital but to a modification to the regional productive "vocation". Lastly, a dummy to identify the 1980's (FIRSTDEC) was also added.

[13] See Greene (2000), page 793.

[14] The prefix D1 indicates that the variable has been introduced in the first differences. The prefix L followed by a number N (e.g.L5) means that the variable has been introduced with a lag of N years (e.g. five years).

Since the implicit hypothesis at the base of the (4a) specification is that performance of a year of education is identical to any education level (elementary, middle and upper schooling, university degree) seems rather dubious, an alternative specification (4b) distinguishes the labour force by educational degree so as to verify which level of human capital can most influence economic growth.

$$D1LPROD_{it} = \alpha + \beta LPROD_{it-1} + \gamma_1 LRLOWLF_{it} + \gamma_2 LRUPLF_{it-1} + \gamma_4 LRUNILF_{it-1} + \gamma_5 LRCOCO_{it-1} + \phi_1 d\_IND_{it-1} + \phi_2 d\_SER_{it-1} + \eta_1 D1LRUPLF_{it} + \eta_2 D1LRUNILF_{it} + \eta_3 D1LRCOCO_{it} + \phi_3 DEV\_IND_{it} + \phi_4 DEV\_SER_{it} + \delta_1 LG1LABUN_{it} + \delta_2 LRINV_{it} + \phi_5 FIRSTDEC + \varepsilon_{it} \quad (4b)$$

Finally, in order to test the hypothesis (according to the Mankiw, Romer and Weil model) that even the investment in human capital and not only in physical capital favours economic growth, a further specification is also evaluated where the investment in human capital is represented by the percentage of people enrolled in higher schools (figure 2) and by the percentage of participants to vocational training programmes[15] (figure 3). These human capital variables were not introduced in the specification in the levels of year t. In fact, with regard to the percentage of youths enrolled in high school, it is necessary to consider that they will be entering the labour force in a later period, which is hard to quantify since these youths are differently aged (between 14 and 19 years of age). Moreover, these youths might also decide to continue to study thereafter with the consequence of postponing their entry in the labour market. It was therefore decided to introduce the variable LRENR with a lag of five years[16] (L5LRENR). With regard to the number of participants to vocational training programmes (on the labour force) it was decided to consider five- year averages (MLRTRAIN) because of the strong data variability, probably due to the availability or unavailability of funds to set up such courses and to the lack of information for a certain time span for a few regions.

$$D1LPROD_{it} = \alpha + \beta LPROD_{it-1} + \gamma_1 L5LRENR_{it-5} + \gamma_2 MLRTRAIN_i + \gamma_3 LRCOCO_{it-1} + \phi_1 d\_IND_{it-1} + \phi_2 d\_SER_{it-1} + \eta_1 D1L5LRENR_{it} + \eta_2 D1LRCOCO_{it} + \phi_3 DEV\_IND_{it} + \phi_4 DEV\_SER_{it} + \delta_1 LG1LABUN_{it} + \delta_2 LRINV_{it} + \phi_5 FIRSTDEC + \varepsilon_{it} \quad (4c)$$

Since in all the adopted specifications both the right hand and the left hand member of the equation are stationary, it is possible to proceed with a simple pooled OLS evaluation). To keep into consideration the non-independence of the observations for the same region, it is necessary to use an estimator robust to the clusters represented by the single regions (column I in tables 5, 6 and 7.

[15] Here we are referring to public provided training courses often financed, almost in the 1990's, by specific UE programs. These courses are generally managed at a regional level.

[16] The reported results are robust to sensitivity analysis.

As it is known, however, a pooled OLS evaluation is not appropriate when hypothesizing that the error term is structured as follows:

$$\varepsilon_{it} = \alpha_i + u_{it}$$

namely when the error is represented by an individual-specific term constant over time, α_i, and a term variable per region and through time, u_{it}. In this case it is appropriate to use fixed effects estimates (FE from here on) or random effects estimates (RE from here on), depending on the presence (or not) of a correlation between individual-specific error term α_i and the regressors. A FE approach seems most appropriate for these data, since it puts no restrictions on the correlation between the covariates and the errors[17]. The Hausman test confirms that the FE estimates are consistent, even if not efficient. The column II shows the results of FE estimates obtained by introducing regional dummies[18]. Since the hypothesis of absence of residuals autocorrelation, checked with the Wooldridge test (Wooldrige, 2000) implemented by Drukker (2003), is refused, column III show FE estimations obtained by evaluating the differences from the average when residuals are first-order autoregressive.

6. Results

Tables 5, 6 and 7 show the results of the estimates of (4a), (4b) and (4c).

First of all, it seems evident that during the period under consideration a conditional convergence process is underway among Italian regions from the labour productivity point of view. The coefficient of the initial productivity level (LPROD) is always negative and is statistically significant at 1% to indicate how the regions with a higher productivity have lower growth rates, just like the simple descriptive analysis had already partially highlighted. Still in line with the evaluations of the MRW model, the growth rate of labour[19] (LG1LABUN) has a negative, and therefore statistically significant, effect on the growth of productivity.

With regard to human capital, a result which clearly emerges, is the important and positive effect that human capital stock has on the growth of productivity in the Italian regions both as a whole and if split by educational attainments. The coefficient of the average number of years of education of the labour force (LREDY), in particular, turns out to be higher than all

[17] A fixed effect model gives, as it is well-known, consistent estimates both in the presence and in the absence of a correlation between regression elements and the latent individual effect.

[18] The regional dummy that has been excluded is that for Abruzzo, since its average productivity growth rate in the period between 1980 and 2001 is the most similar to the national average.

[19] In calculating this logarithm, a value equal to 0.08 for all regions and constant through time was added to the growth rate of labour units. The function of this value is to represent the sum of depreciation and of the growth rate of technological progress (δ e g in (1)), and to obtain always positive growth rates of the labour units as to have the corresponding logarithms. The results are anyway robust to different LG1UNLAV definitions.

the other coefficients evaluated in the FE evaluations (table 5, col. II and III). Even splitting for different educational degree, the results remain considerable (table 6). By excluding from the estimate the variable that represents the share of labour force without any educational qualification or only with a primary school certificate (LRPRIMLF), it is possible to notice how the increase of the percentage of the labour force with a diploma of any kind (lower secondary school, high school or college) has a positive effect on economic growth. If we observe the coefficients of the various educational levels, it emerges how particularly relevant is the effect of the increase in number of high school graduates (LRUPLF). Even in the short term, it is only the variation of the number of high school graduates (D1LRUPLF) that has a statistically significant effect on the productivity increase, while the variation of the percentage of the labour force with a college degree has not statistically significant effect.

Remaining within the proxies relative to human capital, no statistically significant effect emerges with regard to the percentage of college graduates in technical-scientific fields with respect to the total number of college graduates (LRTEC). This result, definitely contradictory with growth theories which emphasize the role of a specific human capital in favouring a productivity increase, could be explained in two ways. First of all this could simply be due to the use of a variable with an uncertain meaning, as observed in par. 4.2. Nonetheless, if this result is read together with the fact that also the coefficient of the variation of the percentage of college graduates (D1LRUNILF) is never statistically significant, it would be possible to conclude that the accumulation of generic human capital, particularly acquired by those who have had a high school education, has played the most significant role in the increase of productivity of Italian regions. Besides, this interpretation finds confirmation in the results of Aghion and Cohen (2004) who observed how in countries not technologically advanced and scarcely prone to R&D activities - because of a specialization in highly traditional sectors - a medium level human capital, able of apprehending and reproducing imported techniques and technologies but not so able of introducing new ones, plays a particular role in favouring economic growth. More generally, such a result seems in line with the theories that emphasize the complementariness between qualified human capital and propensity to R&D, particularly low in Italy.

The positive role played by high school education in the growth of Italian regions seems to be confirmed by the coefficients of the variables of "investment in human capital" both at the levels (L5LRENR) and at the first differences (L5D1LRENR), while participation to training programmes by the labour force has no statistically significant effect on evaluations with fixed effects (table 7). This last result could be interpreted by keeping into account that the

ultimate scope of these courses is to qualify (or to retrain in case of unemployment) the participants, as to increase their employment probabilities.

In order to keep into consideration how macro-sector "specialization" of one particular region, and, above all, its development (in the sense of the loss of an agricultural specialization in favour of an industrial or tertiary specialization) have influenced economic growth, it is necessary to observe the coefficients of sector dummies. While the dummies referring to the industrial sector are always negative, even if they are never statistically significant, those relative to the service sector are positive and statistically significant at 1% in all FE estimates: the regions that have (d_SER=1) or acquire (DEV_SER=1) a specialization in the tertiary sector have effectively increase their overall productivity, thanks to the higher productivity of the sector itself.

From the point of view of short-term effects, a robust result is represented by the negative effect of the increase of pro capita collective consumption (D1LRCOCO) on the productivity variation. This result could emphasize a sort of crowding-out effect played by the public sector which, by subtracting resources from the economic system and assigning them to not very productive purposes, would reduce their growth. This interpretation, however, is not quite convincing if we notice how, in first place, the long term effect of collective consumption appears to be positive and always statistically significant and, in second place, that the resources theoretically employed for productive purposes (gross fixed investments as a share of GDP) would actually have a negative effect on growth (LRINV), even if it is not statistically significant. This last result, in contrast with the growth function represented in (1), could be explained by hypothesizing, either a scarce far-sightedness in foreseeing the subsequent phase of the economic cycle by those who make investments or, more likely, a propensity to make not very productive investments.

7. Conclusions

This paper analyses the impact of human capital on the growth of productivity in the Italian regions during the past two decades on the basis of an "augmented" standard growth function. Starting from the contradictory results of the theoretical literature, and mainly, of the empirical literature, particular attention has been dedicated both to the definition of the concept of human capital and to the most appropriate panel estimation techniques in the presence of time-series with trends.

During the period under consideration, the labour force of Italian regions has shown a radical transformation thanks to the entrance of new elements with higher education degrees. Even if the differences among the various areas of the country have decreased, the Southern regions

seem to be subjected to a slow yet progressive impoverishment, with respect to other areas, of the more qualified labour force. A worrying evidence, at least with respect to growth theories that point out the importance of an education aimed at research activities, is also represented by the reduction, in all the areas, of the number of college graduates in technical-scientific subjects against the total number of college graduates.

The estimated specification is a standard error correction model where the covariates are expressed in the levels and in the first differences to capture both long and short-term dynamics.

The results emphasize a progressive conditional convergence process among the levels of labour productivity of Italian regions. A primary role in obtaining such result is played by the human capital of a medium/high level. A not as strong result seems to emerge from the more qualified human capital or the human capital more geared toward the technological-scientific sectors. Lastly, a regional disposition toward the service sector or an evolution in this sense both seem to strongly contribute to the productivity rise.

In light of these results, it appears that the growth of Italian regions, in the last years, has been driven by the development of sectors that need a human capital capable of adapting to existing production techniques rather than able of implementing new ones. The development of a tertiary sector and the greater availability of a labour force with lower and upper secondary school diplomas seem to have allowed certain regions to reach good performances. This development model, however, presents the evident limit of being short of breath. The fact that the growth of productivity was higher in the 1980's than in the 1990's points out how it is probably necessary to modify the development strategies in order to move Italian regions as close as possible to an hypothetical technological frontier.

Since it is apparently not sufficient to have a qualified human capital in order to favour technological innovation, it is necessary to stimulate the R&D activity, so as to be able to more profitably use the human capital that is already available.

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APPENDIX A
TABLES AND FIGURES

Figure 1 *Labour force composition by educational qualifications in 1980 and 2001*

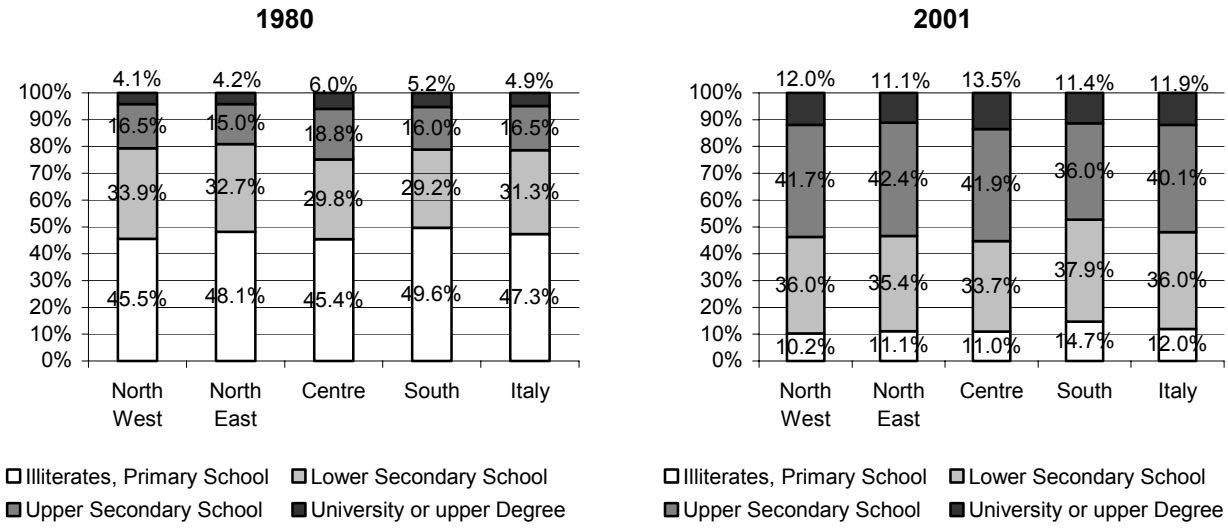

Figure 2 *High school enrolment rates (calculated over the 15-19 years old population)*
Figure 3 *Labour force participation rates to vocational training programmes (every 1000 belonging to labour force)*

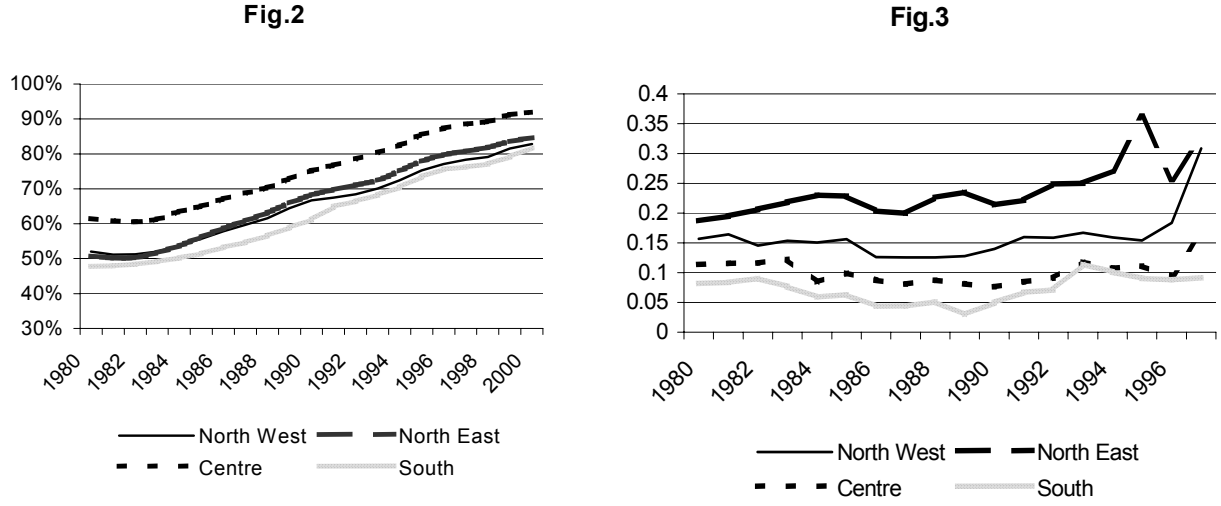

Figure 4 *Share of graduates in technical-scientific subjects*

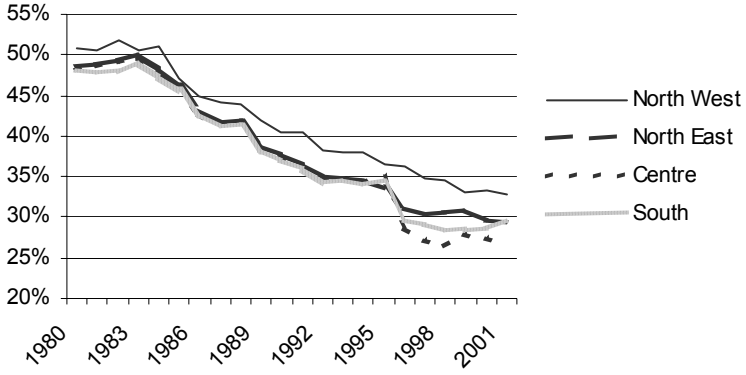

Table 1 *Yearly average growth rates of the GDP and of productivity by regions and areas (%).*

	GDP			GDP/Labour units		
	1980-1990	1990-2001	1980-2001	1980-1990	1990-2001	1980-2001
Piemonte	1.79	1.23	1.50	2.07	1.30	1.61
Valle d'Aosta	2.09	0.88	1.45	1.34	1.01	1.25
Liguria	1.21	1.11	1.16	1.41	1.85	1.49
Lombardia	2.94	1.50	2.19	1.95	1.35	1.62
NORTH WEST	*2.43*	*1.39*	*1.88*	*1.93*	*1.31*	*1.60*
Veneto	2.67	2.25	2.45	1.50	1.89	1.62
Trentino Alto Adige	2.19	1.75	1.96	0.94	1.54	1.19
Friuli Venezia Giulia	2.28	1.94	2.10	2.28	1.98	2.05
Emilia Romagna	1.76	2.14	1.96	1.19	1.82	1.49
NORTH EAST	*2.21*	*2.13*	*2.17*	*1.40*	*1.70*	*1.56*
Toscana	1.79	1.94	1.87	1.41	1.68	1.47
Umbria	1.75	1.92	1.84	1.29	1.61	1.41
Marche	1.76	2.49	2.14	1.56	2.54	1.96
Lazio	2.91	1.46	2.15	1.29	1.21	1.23
CENTER	*2.31*	*1.77*	*2.03*	*1.41*	*1.43*	*1.42*
Abruzzo	2.72	1.49	2.08	1.76	1.40	1.59
Molise	1.90	1.58	1.73	2.40	1.71	2.09
Campania	2.18	1.27	1.71	2.14	1.28	1.71
Puglia	2.21	1.52	1.85	1.82	1.67	1.72
Basilicata	1.68	2.41	2.06	2.07	3.05	2.43
Calabria	2.32	1.87	2.09	1.63	2.03	1.81
Sicilia	1.88	1.02	1.43	1.62	1.16	1.34
Sardegna	1.69	1.63	1.66	0.23	1.75	0.99
SOUTH	*2.09*	*1.39*	*1.72*	*1.70*	*1.47*	*1.58*
ITALY	*2.27*	*1.63*	*1.93*	*1.66*	*1.46*	*1.56*

Table 2 *Average years of education of the labour force by regions*

Regio	Year 1980	Regio	Year 2001
MAR	7.37	BAS	10.10
PUG	7.43	SAR	10.19
BAS	7.49	PUG	10.23
MOL	7.53	SIC	10.40
VEN	7.54	VDA	10.43
TTA	7.57	CAL	10.44
PIE	7.63	CAM	10.47
CAM	7.72	TOS	10.56
UMB	7.73	MOL	10.56
EMR	7.74	PIE	10.61
SAR	7.77	MAR	10.64
VDA	7.77	ABR	10.66
ABR	7.78	VEN	10.68
TOS	7.79	TTA	10.77
SIC	7.80	EMR	10.81
LOM	7.85	LOM	10.96
CAL	7.90	LIG	10.97
FVG	8.06	FVG	11.06
LIG	8.30	UMB	11.23
LAZ	8.71	LAZ	11.33

Table 3 *Average years of non compulsory education of the labour force by regions*

Regio	Year 1980	Regio	Year 2001
TTA	0.92	BAS	2.60
VEN	0.99	SAR	2.61
MAR	1.06	PUG	2.71
PIE	1.10	VDA	2.77
PUG	1.13	SIC	2.86
LOM	1.19	CAM	2.87
SAR	1.20	CAL	2.94
VDA	1.21	PIE	2.94
BAS	1.21	TOS	2.95
EMR	1.25	MOL	2.97
CAM	1.27	VEN	3.01
UMB	1.27	ABR	3.01
MOL	1.27	MAR	3.05
TOS	1.29	TTA	3.06
FVG	1.30	EMR	3.19
ABR	1.36	LOM	3.26
SIC	1.39	LIG	3.27
CAL	1.48	FVG	3.31
LIG	1.55	UMB	3.53
LAZ	1.82	LAZ	3.59

Table 4 *Results of the Im, Pesaran and Shin test for the existence of unit roots in panel data and cointegration relations.*

Variables	W[t-bar]	Integration order	Cointegration with the dependent variable
Dependent			
LPROD	0.251	I(1)	
Covariates			
LG1LABUN	-10.340	I(0)	
LRENR	1.489	I(1)	C(1,1)
LREDY	0.297	I(1)	C(1,1)
LRSUPY	0.038	I(1)	C(1,1)
LRTEC	-0.924	I(1)	C(1,1)
LRPRIMLF	1.585	I(1)	C(1,1)
LRLOWLF	-2.091	I(0)	
LRUPLF	-1.451	I(1)	C(1,1)
LRUNILF	-0.033	I(1)	C(1.1)
LRENR	1.267	I(1)	C(1,1)
LRINV	-0.912	I(0)	C(1,1)
LRCOCO	2.903	I(1)	C(1,1)

W[t-bar] has a standard normal distribution under the null hypothesis of non stationarity

Table 5 *Estimation results with overall human capital stock*

I: Pooled OLS estimates with regional clusters
II: Fixed Effect estimates with regional dummies
III: Fixed Effect estimated with autocorrelated residuals

	I	II	III
LRPROD	-.054 (.0108)***	-.209 (.0304)***	-.234 (.0321)***
LREDY	.096 (.0192)***	.245 (.0364)***	.265 (.0412)***
LRTEC	.002 (.0035)	-.003 (.0077)	-.005 (.0071)
LRCOCO	.011 (.0102)	.042 (.0163)**	.044 (.0179)**
D_IND	.005 (.0021)**	-.0001 (.0040)	-.0009 (.0042)
D_SER	.006 (.0028)**	.0082 (.0032)**	.0096 (.0033)***
D1LREDY	.135 (.0896)	.2 (.0878)**	.211 (.0877)**
D1LRTEC	-.0151 (.0116)	-.011 (.0084)	-.012 (.0073)
D1LRCOCO	-.194 (.0481)***	-.197 (.0481)***	-.203 (.0495)***
DEV_IND	-.0019 (.0035)	-.006 (.0058)	-.006 (.0059)
DEV_SER	.0165 (.0027)***	.015 (.0039)***	.015 (.0044)***
LG1LABUN	-.028 (.0036)***	-.022 (.0037)***	-.02 (.0036)***
LRINV	-.005 (.0045)	-.0137 (.0081)*	-.016 (.0086)*
FIRSTDEC	.013 (.0019)***	.014 (.0029)***	.014 (.0032)***
COST.	.168 (.0714)**	1.14 (.319)***	1.328 (.3221)***
OBSERVATIONS§	368	368	350

1st row: coefficients; 2nd row: standard errors

Regions	Regional FE
PIE	**.0344**
VDA§	---------
LIG	.0097
LOM	**.038**
VEN	**.0227**
TTA	.0143
FVG	.0047
ERO	**.0156**
TOS	.0104
UMB	**-.0115**
MAR	-.0016
LAZ	-.0008
MOL§	---------
CAM	-.0064
PUG	-.0087
BAS	.0138
CAL	**-.0237**
SIC	.0057
SAR	-.0011

***: Significant at 1% level
**: Significant al 5% level
*: Significant at 10% level

In bold coefficients significant at the 5% level

§ Valle d'Aosta (VDA) is not included in the sample because the region has not a University in its territory in the period.
Molise (MOL) is not included in the sample because the low number of faculties established in the region's Universities could distort the estimates.

Table 6 *Estimation results with human capital differenced by educational levels*

	I	II	III
LPROD	-.059 (.0107)***	-.163 (.0279)***	-.187 (.0284)***
LRLOWLF	.0261 (.0057)***	.028 (.0134)**	.028 (.0142)**
LRUPLF	.038 (.0062)***	.042 (.0121)***	.045 (.0128)***
LRUNILF	-.004 (.0048)	.024 (.0104)**	.029 (.0107)***
LRCOCO	.0065 (.0052)	.026 (.0214)	.024 (.0232)
D_IND	.006 (.0016)*	.0015 (.0039)	.0004 (.004)
D_SER	.004 (.0031)	.008 (.0035)**	.0105 (.0036)***
D1LRUPLF	.042 (.0187)**	.043 (.0192)**	.051 (.0183)***
D1LRUNILF	-.004 (.0128)	.009 (.015)	.007 (.0135)
D1LRCOCO	-.176 (.051)***	-.188 (.0488)***	-.186 (.0488)***
DEV_IND	-.004 (.0035)	-.003 (.0051)	-.004 (.0059)
DEV_SER	.014 (.0025)***	.017 (.0035)***	.017 (.0046)***
LG1LABUN	-.027 (.0038)***	-.024 (.0037)***	-.023 (.0032)***
LRINV	-.006 (.0042)***	-.009 (.0093)	-.01 (.0091)
FIRSTDEC	.014 (.0016)***	.013 (.0029)***	.011 (.0033)***
COST.	.548 (.0932)***	1.519 (.3964)***	1.659 (.416)***
OBSERVATIONS	420	420	400

Regions	Regional FE
PIE	**.0247**
VDA	.0276
LIG	.0062
LOM	**.0276**
VEN	**.0178**
TTA	.016
FVG	.0058
ERO	.0101
TOS	.0063
UMB	-.0089
MAR	-.0005
LAZ	-.00007
MOL	.0012
CAM	-.0074
PUG	-.007
BAS	.0016
CAL	**-.0178**

Table 7 *Estimation results with human capital as a flow*

	I	II	III
LPROD	-.039 (.0096)***	-.178 (.030)***	-.226 (.0325)***
L5LRENR	.015 (.004)***	.095 (.0185)***	.124 (.02)***
MLRTRAIN	.003 (.001)**	-.0004 (.0022)	-.0003 (.0024)
LRCOCOA	-.003 (.0049)	.002 (.0296)	-.065 (.0353)*
D_IND	.0009 (.0012)	-.001 (.0059)	-.001 (.0052)
D_SER	.0035 (.0028)	.0115 (.0042)***	.014 (.00458)***
L5D1LRENR	.114 (.0535)**	.163 (.0592)***	.161 (.0653)**
D1LRCOCO	-.147 (.0439)***	-.195 (.0519)***	-.236 (.0516)***
DEV_IND	-.009 (.0038)**	-.009 (.0052)*	-.0065 (.0069)
DEV_SER	.014 (.0033)***	.019 (.0052)***	.019 (.0053)***
LG1LABUN	-.028 (.0045)***	-.024 (.0044)***	-.024 (.0035)***
LRINV	-.006 (.0039)	-.006 (.0092)	.007 (.01)
FIRSTDEC	.010 (.0018)***	.0104 (.0029)***	.008 (.0035)**
COST.	.369 (.0724)***	1.807 (.4718)***	2.785 (.531)***
OBSERVATIONS§	320	320	300

Regions	Regional FE
PIE	**.0361**
VDA	**.0534**
LIG	**.0162**
LOM	**.0487**
VEN	**.0291**
TTA	**.0516**
FVG	**.0178**
ERO	**.0211**
TOS	.0110
UMB	-.0053
MAR	-.0004
LAZ	**.0228**
MOL	.0066
CAM	.0070
PUG	.0066
BAS	.0020

§ The number of observations is lower because one of the covariates is introduced with a delay of five years (L5LRENR)

APPENDIX B
VARIABLES AND DATA SOURCES

$$\text{LPROD} = \ln\left(\frac{GDP95}{Labunit}\right)$$

$$\text{LG1LABUN} = \ln\left(\frac{Labunit_{t+1} - Labunit_t}{Labunit_t} + 0.08\right)$$

g+δ is hypotheses equal to 0.08 for every region and year as to have all the logarithm of the sum n +g + δ

$$\text{LREDY} = \ln\left(\frac{EdYears}{LF}\right)$$

$$\text{LRSUPY} = \ln\left(\frac{SupYears}{LF}\right)$$

$$\text{LRPRIMLF} = \ln\left(\frac{PRIM + ILL}{LF}\right)$$

$$\text{LRLOWLF} = \ln\left(\frac{LOW\_S}{LF}\right)$$

$$\text{LRUPLF} = \ln\left(\frac{UP\_S}{LF}\right)$$

$$\text{LRUNIFL} = \ln\left(\frac{UNI}{LF}\right)$$

$$\text{LRTEC} = \ln\left(\frac{TEC}{GRAD}\right)$$

$$\text{LRENR} = \ln\left(\frac{UPSE}{POP1519}\right)$$

$$\text{MLRTRAIN} = \frac{\sum_{i=1}^{5} \ln(TRAIN_{t-i})}{5}$$

$$\text{LRINV} = \ln\left(\frac{FGI}{GDP}\right)$$

$$\text{LRCOCO} = \ln\left(\frac{COCO}{POPTOT}\right)$$

$$\text{LRAV\_AGR} = \ln\left(\frac{AV_{AGR}}{AV}\right)$$

$$\text{LRAV\_IND} = \ln\left(\frac{AV_{IND}}{AV}\right)$$

$$\text{LRAV\_SER} = \ln\left(\frac{AV_{SER}}{AV}\right)$$

Variable	Meaning	Source	Publications	Period
GDP95	GDP at 1995 prices	ISTAT	Conti Economici Regionali	1980-2001
Labunit	Labour units	ISTAT	Conti Economici Regionali	1980-2001
LF	Labour force	ISTAT	Rilevazione trimestrale delle forze di lavoro	1980-2001
EdYears	Total education years amount of the labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro	1980-2001
SupYears	Superior education years amount of the labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro	1980-2001
PRIM+ILL	Illiterate or primary school labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro	1980-2001
LOW_S	Lower secondary school labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro	1980-2001
UP_S	Upper secondary school labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro	1980-2001
UNI	University or upper degree labour force	ISTAT	Elaborazione su Rilevazione trimestrale delle forze di lavoro lavoro	1980-2001
TEC	Graduates in technological-scientific subjects	ISTAT	Annuario/Statistiche dell'Istruzione	1980-2001
GRAD	Overall graduates amount	ISTAT	Annuario/Statistiche dell'Istruzione	1980-2001
UPSE	Students enrolled in the upper secondary school	ISTAT	Annuario/Statistiche dell'Istruzione	1980-2001
TRAIN	Enrolled in vocational training programmes	ISTAT	Annuario Statistico Italiano	1980-1997
FGI	Fixed Gross Investments	ISTAT	Conti Economici Regionali	1980-2001
COCO	Collective Consumptions	ISTAT	Conti Economici Regionali	1980-2001
POP1519	Population between 15 and 19 years old (potential population enrolled in the upper secondary school)	ISTAT	Statistiche sulla popolazione	1980-2001
POPTOT	Total Population	ISTAT	Conti Economici Regionali	1980-2001
AV_{AGR}, AV_{IND}, AV_{SER}	Added value of tje agricultural (AGR), industrial (IND) and tertiary (SER) sectors	ISTAT	Conti Economici Regionali	1980-2001
VA	Total added value	ISTAT	Conti Economici Regionali	1980-2001