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**Productivity, Employment and Human Capital
in Eastern and Western European Countries**

Enrico Marelli
Department of Economics
University of Brescia
(emarelli@eco.unibs.it)

Marcello Signorelli
Department of Economics, Finance and Statistics
University of Perugia
(signorel@unipg.it)

Abstract

The paper analyses some features of the recent economic performances in EU-27 members, by highlighting the differences between transition and “old” EU countries. In particular, the focus has been on employment rate and productivity levels and dynamics (for the period 1990-2006), on the trade-off between employment growth and productivity growth; and, lastly, on the main determinants of the productivity differences between EU countries, with a special consideration for human capital.

After a partial review of the theoretical and empirical literature, a preliminary “descriptive” analysis allowed to detect different “models” of economic growth (extensive, intensive, virtuous or stagnant) during the post-1989 period. In the econometric investigations (cross section and panel analyses), we have tried to explain the differences between countries in the levels of labour productivity (especially for the post-2000 period), by considering differences in the human capital level as well as in some other explanatory variables (R&D, competitiveness, the progress in transition, some structural indicators and synthetic indices of specialisation, the extent of the “shadow economy” and, at last, the employment rates).

The results appear rather interesting, also because similar empirical studies including jointly the two blocs of Eastern and Western European countries are not common. As to the typologies of growth, the two blocs apparently moved in opposite directions: from an “extensive” model to an “intensive” one in the Eastern countries, from “intensive” to “extensive” in many Western countries. The policy implication, on this point, strictly reminds the EU Lisbon’s goal to achieve *more and better* jobs. Finally, the robustness of the econometric results concerning the education variable places human capital as a key factor of productivity differences.

JEL Classification: J21, J24, O47, O52, P51

Keywords: Productivity, Employment, Human Capital, EU-27 Countries

1. Introduction

Many institutional, economic and policy changes occurred in Europe during the last two decades, within a world that in the meantime was rapidly “globalising” and where new competitors were making their appearance. We just recall the most important changes: (i) the fall of the Berlin wall (1989), with the subsequent complex and diversified transition processes in Eastern European countries and the recent EU membership (2004 and 2007) of most of them; (ii) the further enlargements (1986 and 1995) and the attainment of a deeper integration, with the adoption of a monetary union (since 1999) in Western European countries (and this union is now progressively being extended also to some Eastern countries); (iii) the launch of the European Employment Strategy (1997) and of the Lisbon Strategy (2000).

As well known, the Lisbon Strategy, in particular, aimed to address the difficulties of many European countries, difficulties lasting more than two decades (from early 1970s to mid-1990s) and consisting in the dominance of a “jobless growth” model (with high and persistent unemployment rates). More recently, many European countries – and especially some of them – have also shown weaknesses in terms of gdp and productivity growth. A possible economic decline, in comparison to the US and to the emerging countries in the world, was – and partly is – a worrying outcome.

In this paper we analyse the performance of 27 countries - today EU members - during the post-1989 period, by: (i) comparing the employment rate and productivity differences, both in levels and dynamics, in order to identify different “growth models”; (ii) carrying out a deeper investigation of some key determinants of productivity differences (especially focused on the post-2000 period), by paying a particular attention to the role of human capital together with other “control” variables, concerning institutional, structural and labour market (employment) features. This paper is one of the few empirical studies including the full sample of EU-27 countries, both Western and Eastern.

In particular, following a partial review of the theoretical and empirical literature (section 2), there is a descriptive analysis (section 3), centred on employment growth and its possible trade-off with productivity growth, highlighting different “models of growth” (intensive, extensive, virtuous and stagnant) in EU-27 countries and showing preliminary evidences on the relationship between human capital and productivity.

In section 4 we illustrate some econometric investigations (cross section and panel analyses) dealing with conditional convergence and, especially, the key determinants of productivity differences, starting with a proxy of human capital. In particular, in order to “test” the robustness of human capital and to achieve a more general explanation, we consider many explicative variables, classified in the following three groups: (i) *long-run determinants* of productivity (education, the global competitiveness index, the EBRD transition index and the R&D index); (ii) *structural indicators* (employment share of the three main sectors, some synthetic indices of specialisation and a “shadow economy” index); (iii) *labour market indicators* (employment rate).

The main results and some policy implications are presented in the final section.

2. A Partial Review of the Literature

A huge theoretical and empirical literature exists on the determinants of productivity (levels and dynamics). Here we just review a small part of that literature, especially focusing on the variables considered in the empirical part (sections 3 and 4).

The studies on productivity have followed two main different approaches: either a short-run “business-cycle” approach or a long-run “growth” line of attack. In the latter case, growth models – starting from the neoclassical growth model (Solow) – have focused on the main determinants of

productivity growth, both in the “steady state” equilibrium, fundamentally dependent on the rate of technical progress, and in the “transition” phase, characterized by the accumulation of physical capital. In the “conditional convergence” variant of Solow’s model (Barro, 1991¹; Mankiw, Romer and Weil, 1992), some other exogenous variables, such as human capital, are considered. These variables are even more important in the different types of “endogenous growth” models (see below).

As to the business cycle perspective, productivity growth has often been related to the growth of employment or unemployment, e.g. in the studies on the Okun’s law² (e.g. Padalino and Vivarelli, 1997; Lee, 2000). It is precisely in the short run that a *trade-off* between employment growth and productivity growth may appear (e.g. Beaudry and Collard, 2002). In particular, Pichelmann and Roeger (2008) consider this potential trade-off within the Lisbon Strategy.

Let us focus here on the empirical literature on labour market performance dynamics and, specifically, on the trade-off between productivity and employment growth (e.g. Becker and Gordon, 2008). In particular, Rutkowski (2006) highlights that low-productivity employment in the CIS is a mirror image of unemployment in the European transition countries (where a developed social safety net exists), while Belorgey *et al.* (2006) show that employment rate changes negatively affect the productivity growth rate, supporting the hypothesis of diminishing returns for the employment rate. By investigating the dynamics of both employment and productivity, Marelli (2007) identified three “models” of growth (intensive, extensive and virtuous) in some EU-25 country groups for different periods.

A key characteristic of this paper, besides considering different models of growth, is the empirical investigation of productivity differentials in EU-27 countries, by distinguishing in particular between Eastern and Western European countries. The focus is on the main determinants, human capital in the first place, but also some other variables, e.g. structural, institutional or related to labour market dynamics.

As well known, education³ is a fundamental component of human capital⁴; however, the main elements of human capital accumulation are not only education through school/university (primary, secondary, tertiary, etc.), but also out-of-job training courses, on-the-job training (generic training, specific training, learning by doing) and life-long learning. For many components, it is quite difficult to find appropriate statistical data. In addition, if we consider a wider concept of “education”, we are aware that the empirical measures generally adopted (such as years of schooling or level of school/university completed - sometimes distinguishing for the different types of schools/universities) are just a “proxy” and exclude the role played by non-school subjects - like family networks and social background - in contributing to the achievement of higher and better “education” and to the accumulation of human capital.

The role of education or human capital (stock or accumulation) for economic growth (and productivity dynamics) has been largely investigated, both theoretically and empirically, by mainstream and heterodox economists, especially in the last two decades (e. g. Lucas, 1988; Mankiw,

¹ Starting from the (unexpected) empirical results in terms of (absolute) beta-convergence between a large set of countries, Barro finds that when the initial measures of human capital are included in the regression model, the beta coefficient – linking productivity growth to the initial level of productivity – turns negative and significant (conditional beta-convergence).

² Many papers analyse the relationship or co-movement between gdp and employment (e.g. Signorelli, 2005) and obviously they obtain, at least indirectly, some evidences also for productivity (per worker gdp) dynamics.

³ As for the recent developments in the economics of education, see Hanushek and Welch (2006).

⁴ According to the definition by De La Fuente and Ciccone (2003, p. 7) “*Human capital is a broad and multifaceted concept encompassing many different types of investment in people. [...] The key aspect of human capital has to do with knowledge and skills embodied in people and accumulated through schooling, training and experience that are useful in the production of goods, services and further knowledge*”.

Romer and Weil, 1992; Johnson and Lundvall, 1994; Aghion and Howitt, 1998; Krueger and Lindhal, 2001; Benhabib and Spiegel, 1994 and 2005; Vandenbussche, Aghion and Meglir, 2006). Human capital has also been considered, as already anticipated, for analysing conditional beta-convergence between different economies (e. g. Barro, 1991).

As to the results of the studies on the role of education on economic growth (e.g. see the survey by De La Fuente and Ciccone, 2003), they are various, depending for example on the definition used (e. g. Sapir et al., 2004), on considering education in terms of stocks rather than flows (e. g. Krueger and Lindhal, 2001), or also on the different specifications of human capital as an input in the production function. In particular, following the last distinction, in a first specification close to the neoclassical growth model approach (e.g. Mankiw, Romer and Weil, 1992) human capital is an ordinary input in the production process - along with physical capital and labour - and it is human capital accumulation (e.g. increases in average educational attainment) that raises a country's productivity level with a given technology. Differently, in a second specification followed in the endogenous growth theory approach (see the recent survey by the European Commission, 2006), it is the human capital stock (e.g. average attainment of education) that determines permanent growth by fostering the ability to generate and absorb new technologies.

A second explicative variable, largely investigated in the literature as a determinant of productivity dynamics, is R&D expenditure (e. g. Sveikauskas, 2007; Zachariadis, 2004). The empirical results highlight a generally positive effect, but with different intensity and explanations. For example, some researches investigate the role of spillover effects (e.g. Engelbrecht, 1997), or the different impact of public and private R&D expenditure (e.g. Sveikauskas, 2007), or also the complex interactions between many variables (FDI, R&D and human capital), particularly in Central and Eastern European countries (e.g. Perugini, Pompei and Signorelli, 2008). As for CEECs, Radosevic (2006) notes that, during the transition period in the 1990s, neither domestic nor foreign R&D expenditures played a crucial role in supporting economic growth, but large-scale productive reallocations and provisions of new equipment were implemented to boost innovation and productivity⁵.

Concerning the other main determinants of productivity, institutions and institutional change have been largely considered - both theoretically and empirically - for explaining real economic performance, including both employment and productivity dynamics and relative performances. On one hand, as for Eastern European countries, the features (speed and shape) of the transition process have been particularly investigated (e.g. Kornai, 2006; Aghion and Blanchard, 1994; Svejnar, 2002; Raiser *et al.*, 2001; Boeri and Terrel, 2002; Popov, 2006; Brown and Earle, 2004; Gabrisch and Holscher, 2006; Marelli and Signorelli, 2008). On the other hand, in old EU-15 countries the institutions, regulations and reforms, concerning both goods and labour markets, have been especially analysed (e.g. Boeri and Garibaldi, 2007; Blanchard, 2005; Nicoletti and Scarpetta, 2002; Revenga and Bentolila, 1995; Nickell, 1999; Perugini and Signorelli, 2007). Notwithstanding ten Eastern European countries completed the institutional process necessary for entering into the EU (2004 and 2007 enlargements), economic researches have traditionally investigated distinctly the role of institutions in the two blocs of West and East EU countries.

Another important part of the literature on the determinants of productivity differences and dynamics deals with "structural change", especially considering the evolution of the main economic sectors (e.g. Kruger, 2008). In particular, many researches have highlighted the role of supply and demand factors (and their interactions) in shaping the process of structural change with remarkable effects on the dynamics of aggregate output, employment and productivity. A small selection is the

⁵ As for the more general question of the construction of a knowledge-based economy in the CEECs, see Radosevic and Piech (2006).

following: (i) Baumol (1967) and Durlauf (1993) focus on the role of the technological side; (ii) Pasinetti (1993) considers the effects of technological progress on aggregate income in a model where structural change is driven by Engel's law; (iii) Laitner (2000) presents a neoclassical multi-sector growth model; (iv) Klette and Kortum (2004) produce a multi-sector endogenous growth model; (v) Metcalfe, Foster and Ramlogan (2006) use an evolutionary model for the simultaneous consideration of demand-side factors and technological progress.

Starting from the consideration that average productivity growth is aggregated by a share-weighted sum of sectoral productivity changes⁶, a key result of some of the above researches is that aggregate productivity growth may result from structural change alone (even without productivity growth at the level of individual industries). Some comparative analysis between East and West Europe have been realised: for instance, Marelli (2007) analyzes specialization and convergence of EU-25 countries and regions within the framework of integration in the EU, focusing also on the role of structural convergence and diversification of production in affecting the dynamics of employment, output and productivity, while Stephan (2002) focuses on sectoral structure, path dependence and specialisation patterns for explaining the productivity gap.

The importance of the shadow economy⁷ in affecting productivity level and dynamics may be relevant as well; however, it has been less investigated (e.g. Bovi, 2007) in econometric models, partly due to data availability. Average productivity levels in the "informal sector" are generally lower with respect to the formal economy, also due to the relatively higher share of workers with lower-than-average educational attainments (e.g. Boeri and Garibaldi, 2006).

3. Some Key Empirical Evidences

Let us begin with a graphical analysis of the most important relations.

We initially used Maddison data⁸, which are available for a long time span and for many variables (employment, working hours, productivity per person employed, productivity per hour worked). In view of the subsequent analysis, we have selected the 1990-2007 period and all EU countries, distinguishing between the "old" European countries (the 15 countries members of EU before 2004) and the "new" European countries (the 12 new members after 2004); in addition to them, we have included for comparison purposes some non-members: Croatia, Norway, Switzerland, Japan and – particularly important as a benchmark – the United States.

Figure 1 refers to the *employment rate* – defined here as employment over total population – in the initial and in the final year, to have an idea of the rankings and differences between countries as well as of the relative evolutions over time.⁹

⁶ Industries with relatively lower rates of productivity growth tend to shrink in terms of shares and the opposite occurs to industries with relatively higher rates of productivity growth (Krueger, 2008).

⁷ Notwithstanding some difficulties of definition, the country differences in the size of the shadow economy are remarkable (e.g. Schneider and Enste, 2000), also if we consider the EU member states. Besides, countries with a higher size of the shadow economy normally experiment lower "regular" employment rates (e.g. Perugini and Signorelli, 2004). As for a focus on the informal economy in transition countries, see Belev (2003).

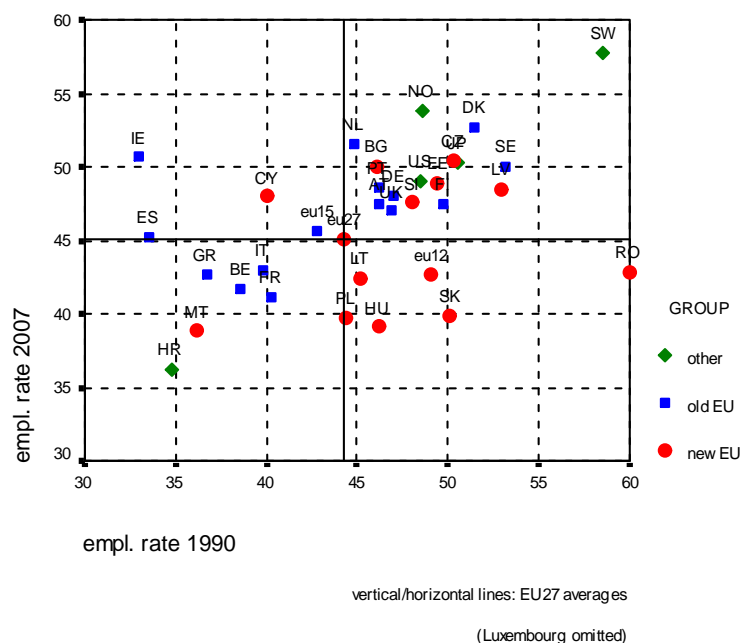
⁸ *The Conference Board and Groningen Growth and Development Centre*, Total Economy Database, January 2008.

⁹ Luxembourg, whose employment rate in 2007 is 69.2%, has been excluded to get a better "zoom" on the other countries. Moreover, we have some doubts about the productivity level of this small country, since it is probably computed with reference to employment of the resident population (while as we know there are in Luxembourg many commuters from the bordering countries).

Figure 1

Employment rate

2007 vs. 1990



The (persisting) low employment countries (in the SW quadrant¹⁰) include some Mediterranean countries, such as Greece, Italy (and Malta among the new members), besides France and Belgium¹¹. Some new members (shown in the SE quadrant) exhibit decreasing employment rates, the most evident case being Romania; the rationalisations and restructuring processes during transition have determined a general reduction in employment rates.

Most of the European countries, both old and new, are in the NE quadrant, thanks to high and (in some cases) increasing employment rates. Notice that the US values are about five points higher than the average EU-27 employment rate, both in 1990 and in 2007.

A more definite picture emerges from Figure 2, concerning *productivity*, here defined as gross domestic product per person employed; the index numbers (EU-27=100) are shown in the figure. There seems to be more persistence over time. Moreover, two distinct blocs of countries may be detected: the new members, with low productivity, and almost all the old members (excluding Portugal), with the addition of some “other” countries (US, Norway, Switzerland, Japan) with high productivity.

The lowest productivity countries (Bulgaria and Romania) have index about 60-70% lower than the EU-27 average level; but all new (EU-12) members have increased their relative productivity, thus converging toward the richest countries. On the other hand, the US have a productivity level about 40% higher (slightly increasing over time) than the EU-27 average.¹² Among the old European countries, Ireland has been more dynamic, while Italy and Spain have lagged behind.

¹⁰ The four quadrants are defined in relation to the EU-27 average values, but in the graph both the EU-15 (old members) and EU-12 (new members) averages are shown.

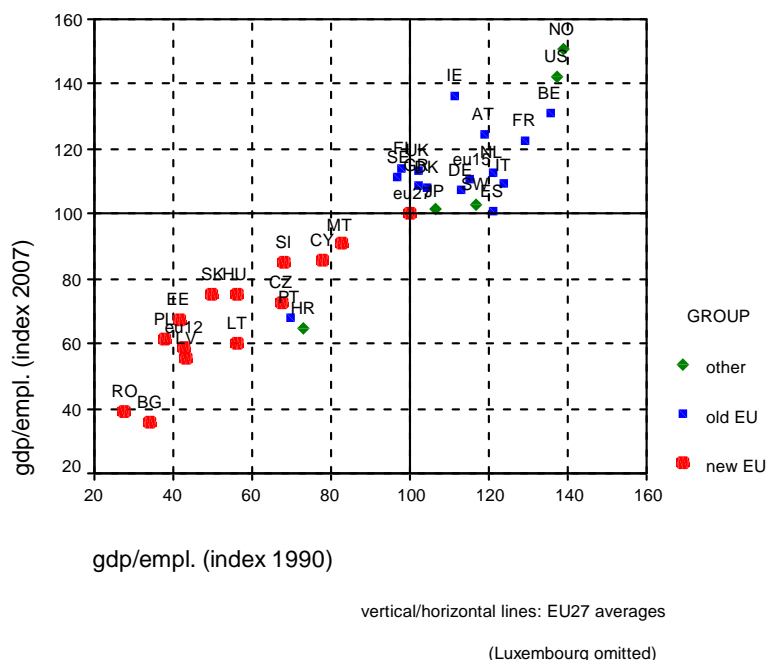
¹¹ However, all these countries partly increased their employment rates between 1990 and 2007.

¹² Luxembourg has been excluded from the graph, because its productivity's index is around 180.

Figure 2

Productivity (per person employed)

2007 vs. 1990



An equivalent graph concerning *productivity per hour* – i.e. gdp per total worked hours – shows similar tendencies (Figure A1 in Appendix, where Luxembourg and Norway have been omitted). However, the position of some countries, e.g. the US and Spain, is somewhat worse (compared to productivity per employed person), due to the higher than average amount of worked hours.

Now we are in a position to highlight – by simple graphical inspection – the different “*models of growth*” followed by the European countries, for instance by relating the *employment rate* of each country to the corresponding (relative) *productivity*. This can be done in both static and dynamic terms. A first static analysis refers to the initial year (1990). An *extensive growth model* (SE quadrant of Figure 3) is followed, in this period, by all transition countries: relatively high employment rates are accompanied by low productivity levels. This is the left over of the centrally planned phase, where situations of virtually “full employment” were the most common, but typically in low productivity state sectors or firms, thus consisting mostly in “under-employment” (see Rutkowski, 2006).

In the same period, most “old” European countries were divided into two typologies. The *intensive model* (NW quadrant) is followed by the countries (France, Belgium, Italy, Spain, Ireland) with higher-than-average productivity but relatively low employment rates. On the other hand, some European countries are characterized by a *virtuous model* (NE quadrant), with relatively high productivity *and* employment rates; also the US belong to this group.

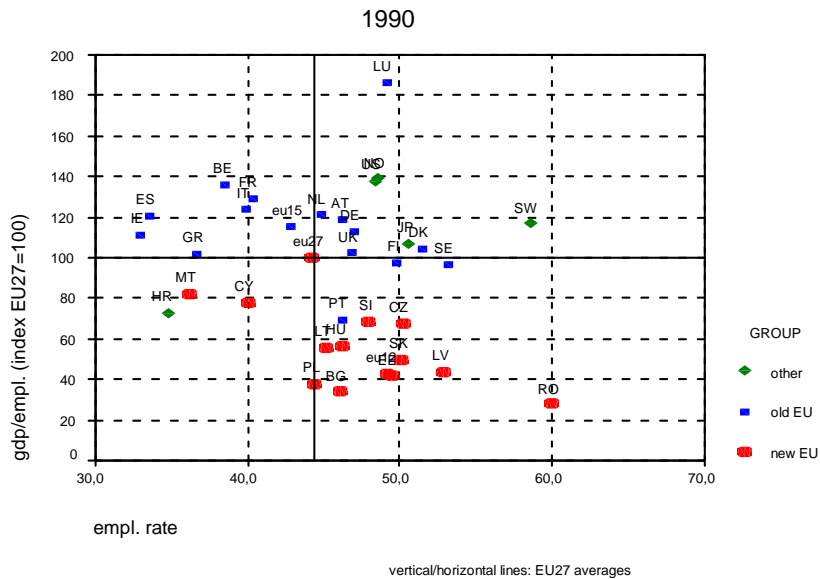
It is well known that in the last decades (from early 1970s to late 1990s) “old” Europe had mainly followed a *job-less* growth model, leading to high and persistent unemployment rates, even after the end of cyclical downturns; this in opposition to the US capacity to create millions of new

jobs¹³. However, in the last ten years, many old European countries have shifted to a more “extensive” model of growth, mainly thanks to some labour markets reforms, leading to a greater flexibility (in countries like Italy employment has frequently risen even when gdp growth was scant or nil). On the other hand, productivity has not increased as fast as in the US (despite the Lisbon’s targets), also due to the different impact of the new economy and of the *ict* revolution.

A *stagnant* model (SW quadrant of Figure 3), with low productivity and employment, has been followed in 1990 only by the two small Mediterranean countries (Cyprus and Malta), and by Croatia. During the ‘90s, the most significant changes refer to the “new” EU countries (see Figures A3 and A4 in the Appendix, concerning 1995 and 2000). Most of them shift progressively to the “stagnant” model, because of heavy reductions of employment, following the restructuring of their economies, not yet accompanied by significant improvements in the productivity levels.

Figure 3

Productivity vs. Employment rate



Finally, in the new century, the productivity levels in many transition countries begin to converge toward the European average, and in some of them a new rise in the employment rate – in comparison to the big fall of the ‘90s – can be detected (see Figure 4 below).¹⁴ On the other side, the “virtuous” character of some countries (Luxembourg, Norway, the US, and for the first time Ireland) are more apparent.

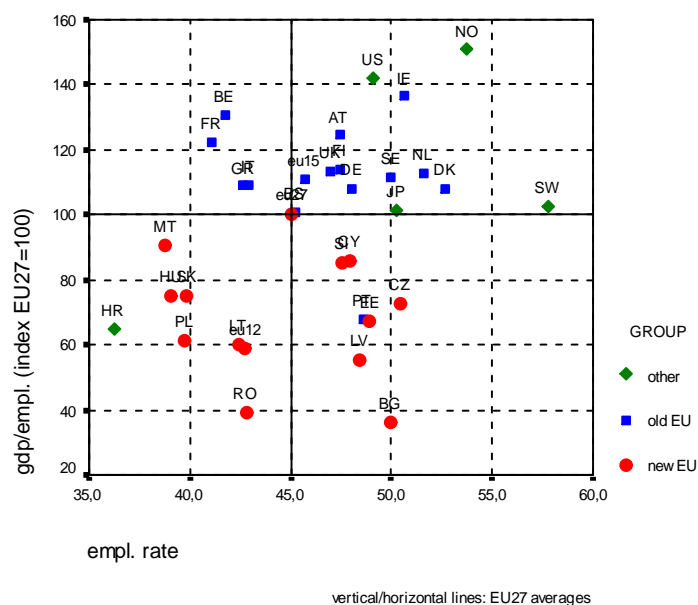
¹³ In order to appreciate some key differences in the “growth models” of “old” Europe versus US in that period, see Figure A2. A discussion on the decomposition of per capita gdp in the two main components of labour productivity (distinguishing hourly productivity and average working time per employed person) and employment rate is presented in Perugini and Signorelli (2007).

¹⁴ Luxembourg, once more excluded, exhibits an employment rate of 69.2% and a productivity index of 173.

Figure 4

Productivity vs. Employment rate

2007



A possible question is whether considering *productivity per hour*, instead of productivity per person employed, makes any difference: the answer is “no” in general. Figure A5 in Appendix shows the good correlation between the two variables (in the final year). However, the correlation is higher for the “new” group of countries; in fact, while in some countries of old Europe the performance seems better for hour productivity (Austria, Germany, the Netherlands), some others lead in terms of productivity per employee (this is the case of Ireland and the US); the reason is – to repeat – the relatively high amount of working hours in the latter countries.

The previous comparisons between 1990 and 2007 suggests the convenience of an explicit *dynamic perspective*. For this analysis, we have preferred to compare the productivity growth (per year rate) to the employment growth (per year rate).¹⁵ Thus, for the full period (1990-2007), it is quite clear (Figure 5) the *intensive* model adopted by all the “new” EU countries. Among the “old” countries, it is interesting to contrast the *extensive* model followed by Spain to the *virtuous* model of Ireland.

A similar graph (Figure 6) for the recent period (2000-2007) highlights the better performance of the new countries in terms of productivity: for the EU-12 average the growth reaches 4% per annum; it is also interesting that in some of them (the Baltic states plus Slovakia and Bulgaria) employment growth turns to be positive, thus shifting to a virtuous model of growth; on the other hand, restructuring with huge increases in productivity and still important falls in employment continues in Romania. As to the western European countries, it should be noticed the shift to the “extensive” model of countries like Spain and Italy.

We have also used different data to check these tendencies. From Eurostat, we had direct figures of the employment growth and gdp growth of all EU countries; we computed the productivity growth as the difference between the latter variables. Well, Figure A6 in Appendix shows a picture quite similar to the graph in Figure 6 above; in Figure A5 the Euro area countries are distinguished

¹⁵ Rather than the growth of the employment-to-population rate.

from the other EU-15 countries. Moreover, in the Appendix there are detailed graphs for the EU-15 group of “old” members, for the two sub-periods 1995-2000 and 2000-2006 (Figures A7 and A8).

Figure 5

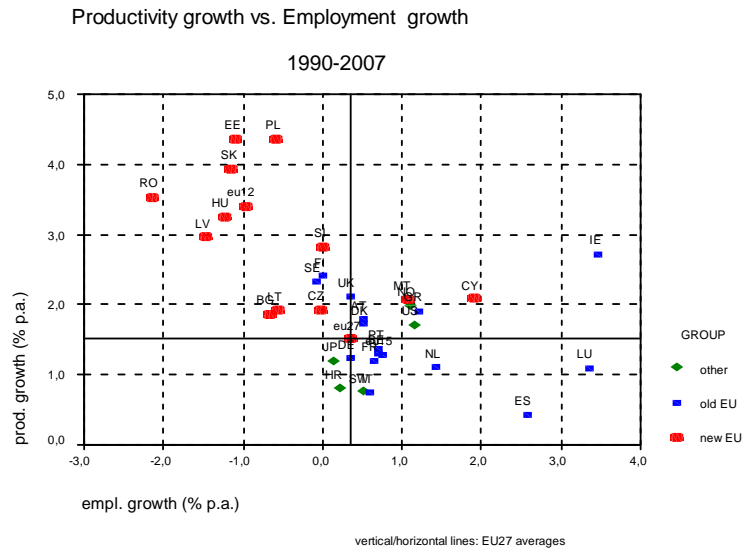
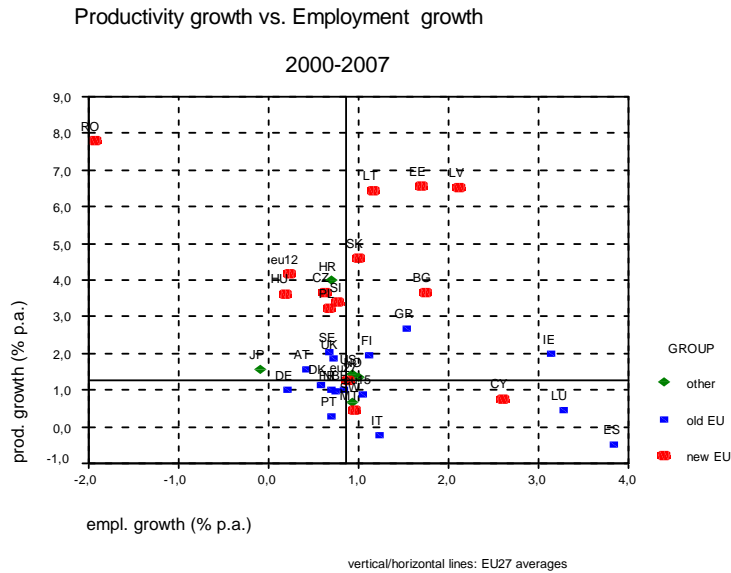


Figure 6



Before ending this section devoted to some initial empirical investigations, it is probably useful to anticipate something about the main determinants of productivity, beginning with one key factor: *human capital*. It is not simple to get adequate proxies of human capital: even limiting our attention to

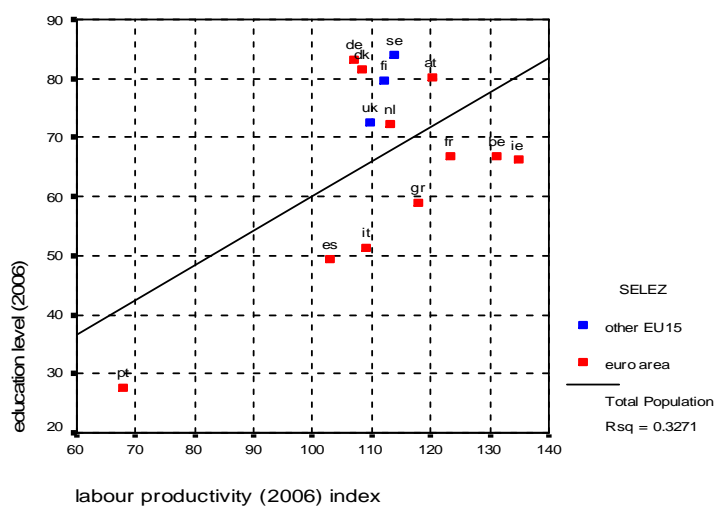
formal *education* (but the limitation of this approach are well known: see section 2), adequate and comparable data at the international level are not easy to find.

Hence we have just used, in this section, Eurostat’s “*Total population (aged 25-64) having completed at least upper secondary education*” (with the further explanations given in section 4). If we limit our attention to the EU-15 group of “old” Europe, a positive relation between this proxy and the productivity level can be found (Figure 7, where productivity is the index number and Luxembourg has been omitted). In three countries, Portugal, Spain and Italy, the education level seems particularly low, but this is in accordance with the low productivity of these countries.

Figure 7

Education vs. Productivity level

(EU15, 2006)



If we consider the dynamic relation between the increase in the education level and productivity growth, a different picture emerges. For the same group of countries (EU-15) and the same period (1995-2006), the relation is slightly positive (see Figure A9 in the Appendix).¹⁶ In fact, in this case, the outliers are more numerous: on the one hand, there are countries like Italy where the increase in education level was high (as a consequence of the initial low levels) while, for many other reasons, productivity has stagnated (with a loss greater than 20 points compared to the average European levels). On the other hand, in other countries (Germany, Denmark, Sweden) the small increase in the education level (negative in relative terms), since their initial level was already high, has been accompanied by a better performance in productivity.

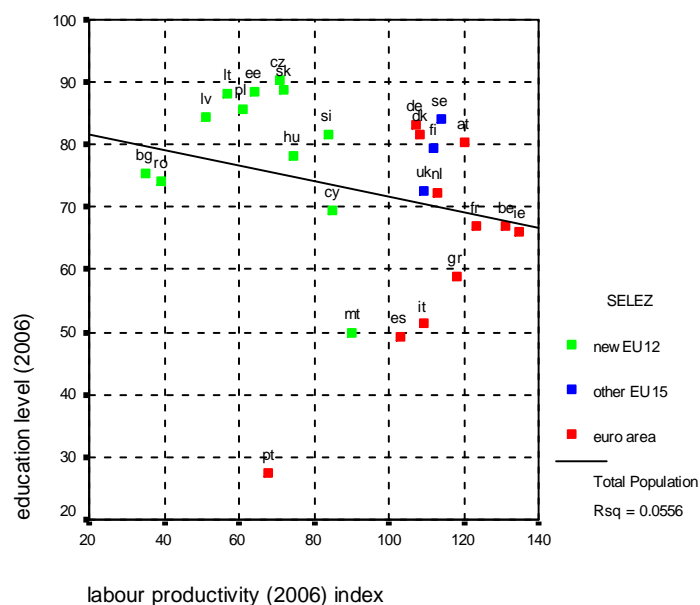
Finally, if we consider all EU-27 countries, the relation between the two variables – still for the final year (2006) – turns out to be negative (Figure 8). An easy explanation is that the group of EU-12 new members still has low productivity levels but rather high – in both absolute and relative terms – education levels (high education is one of the few good heritages of the socialist economies).

¹⁶ The productivity change is measured as the difference in the index numbers (EU-27=100) between 1995 and 2006. The education variable is in this case (because of data availability) the *youth attainment level* (for young people 20-24 years old).

Figure 8

Education vs. Productivity level

(EU27, 2006)



The latter result suggests, also in view of the following empirical analysis, to consider distinctly the two groups of countries – “old” and “new” Europe – or to introduce in the regressions some dummy variables for the CEEC countries; or also to make some estimations with fixed effects, which are able to capture the specificities of all individual countries (that cannot be explicitly taken into account by other explicative variables).

4. Econometric Results

In this section, some results of our investigations on productivity in the European countries are shown.

Empirical analysis of labour productivity growth normally highlight factors such as technical progress (especially the impact of *ict* in the most recent studies), research and development (*R&D*), education, physical capital (together with public infrastructure), besides (in some studies) organisational and institutional determinants (including the systems of industrial relations).

Our aim is to focus on the main *structural* (or long run) *determinants of productivity*: from this point of view, the *differences between countries (in recent years)* are the main object of the analysis, hence cross-sections and panel regressions seem to be adequate procedures. A second implication of our strategy is that estimation of *productivity levels* is in general quite satisfactory, though in some cases we shall try to explain productivity change.

While analysing the differences between countries, we are mainly interested in a comparison between “old” and “new” countries of the EU. For this reason, the inclusion in many regressions of a *dummy* for the *CEEC countries* (with particular reference to the ten countries that became new members of EU in 2004 and 2007) is justified. As an alternative, we include in most regressions the *fixed effects*, in order to capture the specific structural and institutional features of individual countries

which cannot be independently added (in a few cases random effects are instead included on the basis of the results of Hausman's test).

A last warning is that in our opinion human capital and *education* must be at the top of the research agenda, among all possible structural determinants (although some of them will be considered in our subsequent analysis). This emphasis has several explanations: (i) theoretically, many recent growth models consider education as a key factor in the explanation of productivity growth; (ii) empirically, we can notice that backward countries or regions suffer in general for a lack of human capital; (iii) and finally, on the policy side, EU's institutions – starting from the Lisbon's strategy – emphasize particularly knowledge and education (together with R&D and the full utilization of human resources) as the main instruments for achieving growth and competitiveness. The latter determinants are interrelated, since on one side high human capital levels stimulate technical innovations and R&D activities within firms; on the other side they sustain the process of diffusion and adoption of new technologies.

Coming now to the data sources, Eurostat publishes (also on line) the *labour productivity* (per worker) data in the form of index numbers (EU-27=100); such data are available, for all EU-27 countries, since the mid '90s. Then, we used the Cambridge Econometrics data (gross value added divided by employment), both to estimate the 1992 index numbers (whenever missing data were found for some countries) and to compute the nominal values (in constant euros).

Concerning *labour productivity per hour*, a similar procedure was followed, although the nominal values were obtained from both Cambridge Econometrics (for the total gross value added) and the Maddison/Groningen data (as to the total annual hours worked).

The most satisfactory and complete (from the point of view of countries and time coverage) proxy for human capital is probably Eurostat's "*Total population (aged 25-64) having completed at least upper secondary education*". Since for some countries and some years (especially the new members in the '90s) the data were missing, they were estimated according to the trends resulting from the Barro-Lee databank.¹⁷

The data sources for the remaining explanatory variables will be specified below.

The first investigations refer to the links between *labour productivity* and *education*. We estimate some cross sections (OLS) for the distinct years 1992, 1998, and 2006, by using the 27 EU countries as observations. The only explanatory variable is education, but we add a dummy for the CEEC countries. From Table 1 we can see that education is always positively related to productivity and is in almost all cases¹⁸ significant at 5% significance levels. This occurs in both specifications [2] and [4], where the dependent variable is *productivity per worker*, and specifications [3] and [5], where the dependent variable is *productivity per hour worked*. On the other hand, the dummy CEEC is negative and highly significant in all cases.

In fact, as already resulting from the graphical inspection (section 3), education is positively associated to productivity, but we must consider the CEEC as a separate group, because of the particularly high educational level (without the dummy CEEC we would get a negative coefficient for education in the regressions).¹⁹

¹⁷ Barro and Lee (2000), <http://www.cid.harvard.edu/ciddata/ciddata.html>.

¹⁸ The only exception is 1992, but the bad result may depend on the assumptions used to estimate the lacking data; for this reason, the even stronger assumptions made to estimate productivity per worker have suggested not reporting the results for 1992.

¹⁹ From Table A1 in the Appendix, we can see that a pool of the three years (1992, 1998, 2006), including all 27 countries, provides similar results: education is positive and significant, while the dummy CEEC is negative and significant; this is true in both "per worker" and "per hour" specifications. Moreover, if we substitute the dummy CEEC with fixed (country) effects, the overall goodness of fit improves further.

Table 1 – Productivity: cross sections (1992, 1998, 2006)

	[1]	[2]	[3]	[4]	[5]
<i>Productivity</i>	<i>per worker</i>	<i>per worker</i>	<i>per hour</i>	<i>per worker</i>	<i>per hour</i>
year	1992	1998	1998	2006	2006
n. obs.	27	27	27	27	27
Explanatory variables:					
Education	0.026	0.131**	0.158**	0.251**	0.230**
Dummy CEEC	-24.6***	-25.6***	-18.3***	-25.2***	-18.1***
Adj. R2	0.719	0.752	0.721	0.624	0.625

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

Before turning to more detailed panel estimations, with additional explanatory variables, for the recent years, we consider at this moment a dynamic aspect of productivity. This refers to the well-known issue of *convergence*: is productivity of different countries converging to a unique level? In the literature, the two fundamental approaches refer to *absolute* or *conditional beta-convergence*.

If we follow the first approach, productivity growth over time should be negatively related to the initial productivity level in order to have convergence. This is what comes out for the EU-27 countries (by focusing on productivity “per worker”), both in the 1992-2006 period and in the more recent 2000-2006 years (regressions [6] and [8] in Table 2): notice that the β coefficient is highly significant. This confirms previous empirical results dedicated to convergence in Europe, across both countries and regions (e.g. an absolute β -convergence in productivity across all European regions was found in Marelli, 2007).²⁰

If we consider, on the contrary, a *β -conditional approach*, since we are here mainly interested in the impact of *education*, if we add in the regressions this control variable, we obtain the results [7] and [9] for the two sub-periods. Not only is education positive and significant, but convergence is confirmed as well (with β coefficients slightly smaller than the ones relative to absolute convergence).

Table 2 – Absolute and conditional convergence: productivity per worker (1992-2006 and 2000-2006)

	[6]	[7]	[8]	[9]
Period	1992-2006	1992-2006	2000-2006	2000-2006
n. obs.	27	27	27	27
Explanatory variables:				
Initial productivity ⁺	-0.031***	-0.029***	-0.037***	-0.033***
Education ⁺		0.0028***		0.023***
Adj. R2	0.952	0.937	0.687	0.804

Labour productivity (per employed person): dependent variable.

+ in logs

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

²⁰ Productivity data referred to the NUTS-2 regions of the EU25 countries; convergence was detected for both the full period (1990-2005) and the recent years (1999-2005). On the other hand, the more recent paper by Marelli and Signorelli (2008), devoted to the EU8 new members (Eastern European countries that joined the EU in 2004) and on a finer regional disaggregation (NUTS-3 regions), found a significant convergence in *gdp per capita* only in the first sub-period (1990-1995), while it becomes non significant in the second one (1995-2000), and in the most recent years (2000-2006) a divergence appears. In general, we found in this paper that in the eight new EU members there has been *convergence across countries* but *divergence across regions* within the same countries.

Now we turn to the investigation of the determinants of productivity in the recent years (2000-2006). For this period, we can find more easily several explanatory variables for all EU-27 countries. We have grouped such variables into three main types:

- i. the main *long-run determinants* of productivity: education, the global competitiveness index (World Economic Forum), the EBRD transition index, the R&D index;
- ii. some *structural indicators*, e.g. the employment share of the three main sectors (agriculture, manufacturing, services) or some synthetic indices of specialisation as well as a “shadow economy” index;
- iii. *labour market indicators*, in particular the employment rates (in this case it seemed more significant in some specifications to consider the productivity changes rather than productivity levels).

We have carried out several *panel estimations*, by considering jointly the 27 countries and the 7 years (2000-2006). The results concerning the group (i) of variables are presented in Table 3. In all regressions of this group, *productivity per worker*²¹ is the dependent variable and *fixed* (or random) *effects* are added.

According to regression [10] *education*, by itself, is positive and highly significant; the overall goodness of fit is very high. Most of the fixed effects are significant too (although not shown in the table).²²

In regression [11] we have added a second explanatory variable, to capture the progress in institutional change, what is particularly relevant for the former “transition” countries, now members of the EU but for which transition has not yet been entirely completed. It is well-known that the *EBRD Transition report* provides numerical scores for a set of nine reform indicators: the score ranges from 1, which represents little or no change from a planned economy, to 4+, which represents the standard of an advanced market economy. We have computed the simple mean of the nine EBRD transition indexes and the synthetic EBRD index has been used in the regressions. Since the index is not computed for the “old” European countries, we have conventionally set its numerical value equal to 4, for all of them.

Our results show that EBRD is positively related to productivity and significant; the coefficient of education remains significant and is almost identical in its numerical value (as in the previous equation [10]).

Table 3 – Panel regressions: productivity per worker and its main determinants (2000-2006)

	[10]	[11]	[12]	[13]	[14]	[15]
n. obs.	27x7	27x7	27x7	27x7	27x7	27x7
Explanatory variables:						
Education	0.455***	0.357***	0.497***		0.359***	0.489***
EBRD index		12.65***				
GCI index			0.103***			0.101***
R&D index				4.43***	2.88**	0.69
Fixed effects (FE) or Random (RE)	FE	FE	FE	FE	RE	FE
Adj. R2	0.993	0.993	0.994	0.975	0.980	0.993

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

²¹ The results concerning *productivity per hour* are not generally different (they are available upon request).

²² An alternative to the fixed effects, as already specified, is the inclusion of a *dummy CEEC*. This is shown in the pooled regression [A5] of Table A2 in the Appendix. The education variable is still positive and significant (with a larger numerical coefficient); the goodness of the overall regression is a bit lower.

A possible alternative to the EBRD index is the *Global Competitiveness Index (GCI)* published by the World Economic Forum²³. For all years the ranks of countries²⁴ are available and since 2004 also the numerical scores are published; all data have been transformed into scores, to get a synthetic GCI index. The advantage of this index is that (differently from EBRD) is available for all countries, old and new.²⁵ The results of regression [12] reveal that also the GCI index is positive and significant, without altering the significance of the education variable.²⁶

Another important variable that could explain inter-country differences in productivity is R&D (research and development) expenditure. R&D influences not only labour productivity, but even more directly total factor productivity (whose dynamics has also been rather heterogeneous in European countries). We have used Eurostat's data on *gross domestic expenditure on R&D*, as a percentage of GDP. From regression [13] we can see that the coefficient of this variable is also positive and significant. If R&D is included in the regression together with education, both variables remain significant (equation [14])²⁷. However, if R&D is incorporated in a regression including both education and the GCI index, the coefficient of R&D is positive, but not significant anymore (equation [15]).

We can now turn to the second bloc of regressors, i.e. the *structural indicators*. The links between productivity and structural change have been investigated both theoretically and empirically.²⁸ Although the effects of structural change can be better assessed in a dynamic setting, it is likely that productivity levels differ across countries according to their sectoral mix of production.

The results about this group (ii) are in Table 4, based again on panel regressions with fixed effects and productivity per worker as the dependent variable. The “structural” explanatory variables are included by keeping the two regressors that in previous analysis turned out to be the most significant: education and the GCI index (or, in alternative specifications, the EBRD index).

A first important structural variable influencing productivity is the extent of the *shadow economy*. The data were taken from a recent paper of Schneider (2004), by using extrapolations to estimate the data for recent years (from 2004 to 2006).²⁹ The results of equation [16] show that this variable is significant and positively related to productivity; it remains significant even when included jointly with education and the GCI index. A possible explanation of the positive link is that the productivity in the “official” economy is higher where a larger share of the various and heterogeneous low-productivity activities are relegated to the “shadow” economy, instead of being (partly) emerged and formally included in national accounts (gdp, employment and productivity)³⁰.

A synthetic structural indicator is the *index of specialisation*, in particular the well-known Krugman's index (KSI):

$$KSI_j = \sum_i |s_{i,j} - s_{i,0}|$$

²³ See Sala-i-Martin and Artadi (2004).

²⁴ Almost all EU-27 countries are included in the sample: the only exceptions refer to the small countries of Luxembourg, Malta and Cyprus (for them the scores were obtained through an indirect method).

²⁵ As a matter of fact, the extremely small productivity growth in countries like Italy is commonly ascribed to the low competitiveness in the sheltered sectors, which need stronger liberalisation efforts (jointly with a reformed wage bargaining system more functional to productivity). See also European Labour Network for Economic Policy (2008).

²⁶ By substituting a dummy CEEC to the fixed effects, the corresponding result is almost as good as the one of regression [12] (see the pooled regression [A6] in Table A2).

²⁷ In this case, however, Hausman's test ($\chi^2(2) = 2.65, p > \chi^2 = 0.266$) suggests that random effects are to be preferred.

²⁸ For a recent review, see Kruger (2008).

²⁹ Ad hoc assumptions were made for the three missing countries: Luxembourg, Cyprus, Malta.

³⁰ By substituting the GCI index with the EBRD index (in equations 15 and 16), we would get similar results (see equations [A7] and [A8] in Table A2).

where $s_{i,j}$ is the share of sector i out of total employment in country j and $s_{i,0}$ is the corresponding share in the reference country, in our case the EU-27 average. Its numerical value can range from 0 (the country has the same sector structure as the European average) to 2 (the sector structure is totally different). Employment data by sector are taken from Cambridge Econometrics.

In a first specification, the KSI index has been computed considering the most detailed sectors available for each country: generally, they are 15, but Bulgaria (9 sectors are available) and Romania (5 sectors only).

Table 4 – Panel regressions: productivity per worker and structural indicators (2000-2006)

	[16]	[17]	[18]	[19]	[20]	[21]
n. obs.	27x7	27x7	27x7	27x7	27x7	27x7
Explanatory variables:						
Education	0.514***	0.506***	0.365***	0.377***	0.124**	0.450***
GCI index	0.062**	0.112***	0.095***	0.090**	0.072**	0.075**
Shadow index	0.704***					
KSI index		-34.26**				
TURB index						-46.21**
Agriculture share			-0.86***			
Industry share				-0.53***		
Services share					0.98***	
Fixed effects	FE	FE	FE	FE	FE	FE
Adj. R2	0.997	0.993	0.991	0.992	0.984	0.993

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

The result of equation [17] shows that the coefficient of the KSI index is negative and significant, while the two additional regressors (education and GCI) continue to be positive and significant.³¹ Notice that the countries with high KSI index are those countries with a rather “atypical” productive structure: a potential example is a high specialisation in agriculture, whose productivity is lower than average.

A possible alternative to the synthetic specialisation index is the inclusion of the *employment shares* of the main sectors: we have done this for the three macro-sectors: primary, secondary, and tertiary. The *agriculture* share is negatively related to productivity (equation [18]) and the same result is obtained by considering the *industry* share (equation [19]). On the other hand, the *services* share is positively related to productivity (equation [20]). In all cases, education and GCI are positive and significant.³²

Since in other papers a positive impact of an industrial specialisation on average productivity has been found, we offer our interpretation. While many rich and high-productivity countries in Western Europe are mainly specialised in the services, the industrial specialisation chiefly characterises nowadays the Eastern countries, whose productivity level is still lower than that of Western countries.

A last structural indicator can refer to the short-run labour reallocations across sectors. Reallocations of labour are connected to productivity, since job creations and destructions relate

³¹ Notice that an alternative specification of the KSI index, by considering the same number of sectors for all countries (5), provides inferior results.

³² Although the coefficient of education is lower, especially in the specification with the service share.

normally to sectors characterised by different productivity levels.³³ A structural *turbulence* indicator has been proposed (see P. Huber, 2007):

$$\text{TURB}_j = \frac{1}{2} \sum_i |s_{i,j,t} - s_{i,j,t-1}|$$

with $s_{i,j,t}$ is the share of sector i , in country j , at time t ; it varies from 0 (no change in shares) to 1 (complete change from one sector to another). Employment data are still from Cambridge Econometrics.

In regression [21], the coefficient of TURB turns out to be negative and significant.³⁴ A possible interpretation is that when labour reallocations are more intense, although they generally are from low-productivity to high-productivity sectors, the productivity can be temporarily lower in the destination sectors, because of problems of knowledge accumulation, learning by doing, etc. that might prevail in the adjustment period. The sign, numerical values and statistical significance of the two additional regressors – education and GCI – confirm their robustness.³⁵

The third group of explanatory variables refers to labour market indicators. We have focused on the *employment rate* and we have used Eurostat’s data on the “employment rate as % of population aged 15-64”. The main results are in Table 5, where the panel regressions with fixed effects still have productivity per worker as the dependent variable. However, in this group we have used variables both in levels and in differences, as specified below.

Table 5 – Panel regressions: productivity per worker and employment rate (2000-2006)

	[22]	[23]	[24]	[25]
<i>Productivity</i>	<i>level</i>	<i>level</i>	Δ	Δ
n. obs.	27x7	27x7	27x6	27x6
Explanatory variables:				
Education		0.354***		0.170***
EBRD index		12.53***		1.59
Employment rate	0.547***	0.014		
Δ Empl. rate			-0.47***	-0.56***
Fixed effects	FE	FE	FE	FE
Adj. R2	0.982	0.993	0.726	0.775

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

Regression [22] has the *employment rate* as the only explanatory variable, besides the country effects. It is positive and highly significant. (It remains positive and significant when the dependent variable is productivity *per hour*: see equation [A14] in Table A4 in the Appendix).

If we add some of the previous regressors – e.g. education and the EBRD index – these control variables have the expected sign (see regression [23]). The coefficient of the employment rate is much

³³ The empirical literature in this field is more micro-oriented, although focusing on the labour market effects of business cycles: see the pioneering work of Davies, Haltiwanger and Schuh (1996). However, according to the authors, structural change is much more intense within industries than between industries, even at a detailed level of sector disaggregation.

³⁴ A similar equation, with the lagged value of TURB as explanatory variable, confirms a negative and significant coefficient: thus the adjustment period mentioned in the text is probably longer than one year. Note that in a specification with TURB and education as the only regressors, in addition to fixed effects, both variables are highly significant (the coefficient of TURB is equal to -57.6).

³⁵ Similar regressions (equations [17] to [21]), with the EBRD index in place of the GCI index, provide generally similar results (see equations [A9] to [A13] in Table A3 in the Appendix).

lower, but it is not significant; it becomes negative and almost significant in a parallel pooled regression (equation [A15] in Table A4).³⁶ A possible explanation is that the employment rate seems to have a positive effect on productivity – when individually included as explanatory variable – because it is positively associated with education, EBRD, R&D, etc.; but if we control for these variables, its impact tends to become negative. Why? A better explanation of this outcome can be given considering some dynamic specifications, where the *change in productivity* is the dependent variable: see the last two equations of Table 5), where productivity change is negatively linked to the change in the employment rate (equation [24]). The same link holds if we add the usual regressors: education and EBRD (in levels), although the second variable is not significant (equation [25]).³⁷

This specification in differences is sometimes used to verify the “*diminishing returns for the employment rate*” hypothesis. In recent empirical works, the latter hypothesis has been proposed because «a low employment rate indicates that only the most productive workers are involved in the production process, because of their skill level or their age; as the employment level rises, less productive workers are hired» (Belorgey, Lecat and Maury, 2006).

We can also add that in many countries, like Italy and Spain, that have recently moved to an “extensive model” thanks to the reforms introducing more flexibility in labour markets, there has been a considerable increase in the employment rates (and a corresponding fall in unemployment) accompanied by a slowing down of productivity. Many new jobs, partly emerging from the shadow economy, have clustered in unskilled and low-wage occupations, in many cases stuffed by immigrant workers³⁸: this evolution seems to (partly) contradict the EU Lisbon’s strategy to create *more and better* jobs. On the opposite side, in many CEEC countries, new members of the EU, the rationalisations and restructuring of their economies have temporarily reduced the employment rates (also with an increase of the shadow economy and irregular employment), but with significant productivity gains. All these links are probably captured by equation [25].

5. Summary of the Main Results and Policy Implications

This paper - after a review of the main theoretical and empirical literature – has analysed some features of the recent economic performances of the European (EU-27) countries, by highlighting the differences between transition and “old” EU countries. The focus has been on labour market evolutions of the different countries (for the period 1990-2006), on the trade-off between employment and productivity growth, on the main determinants of the productivity differences between countries, with a special consideration for human capital.

In Section 3, we have derived – through a “descriptive” analysis – different “models” of economic growth: extensive, intensive, virtuous or stagnant. In the initial year (1990), an extensive growth model was followed by all transition countries: relatively high employment rates accompanied by low productivity levels were a typical situation for the former centrally planned countries, where “full employment” coincided with “under-employment” (normally in low-productivity state sectors or

³⁶ Here R&D is added as explanatory variable and is almost significant. If we should consider a similar specification with *productivity per hour* as the dependent variable (equation [A16] in Table A4), the coefficient of the *employment rate* would be negative as well (and significant at 5%).

³⁷ However, in a similar pooled regression (equation [A17] in Table A4), EBRD remains significant.

³⁸ Furthermore, many new jobs have been unstable and precarious: e.g. in Italy *temporary contracts*, although still modest out of total employment, represent 40% of the increase in the number of employees (about 2.8 millions) in the period 1997-2007; they are especially over-represented among young workers. As to the impact on productivity, we can observe that unstable and low-paid occupations may possibly lower workers’ effort, motivation and commitment (as maintained by efficiency wage theories) and reduce incentives to invest in human capital and on-the-job training. Finally, low wages reduce, at the firm level, the optimal capital-to-labour ratio, thus lowering labour productivity itself.

firms). In the '90s, most of these countries have shifted to a “stagnant” model, because of heavy reductions of employment³⁹, following the restructuring of their economies, not yet accompanied by significant improvements in productivity; only in the new century, have the productivity levels begun to converge toward the European average, in some countries together with a new rise in the employment rate.⁴⁰ On the other hand, many old European countries have moved in the opposite direction: they – coming from two decades of “jobless growth” – have shifted in the last ten years to an “extensive” model of growth, mainly thanks to the labour market reforms leading to a greater flexibility, while productivity growth has been weak, much lower than in the US (also due to the different impact of technical progress and the *ict* revolution): Italy and Spain are the clearest examples of this growth model.⁴¹

Among the different sources of growth, human capital emerges as a leading factor in the theoretical and empirical studies (as confirmed by the review of Section 2). Hence, by considering the old European countries (EU-15), we have tried to relate a proxy of human capital (Total population aged 25-64 having completed at least upper secondary education) with average labour productivity (Section 3): the overall relation is positive; notice that in three countries (Portugal, Spain and Italy) the education level is particularly low, in accordance with their low productivity level. However, if we consider the full sample of EU-27 countries, the relation between the two variables turns out to be negative: in fact, the new members are characterised by rather low productivity levels but relatively high education (the latter being a long-standing tradition in CEE countries).

In our more complete empirical investigations (Section 4), we have tried to explain the differences between countries in the levels of labour productivity, by considering differences in the human capital level as well as in some other explanatory variables, such as: R&D, competitiveness (e.g. measured by the global competitiveness index of the World Economic Forum), the progress in transition (EBRD transition index); some structural indicators (e.g. the employment shares of the three main sectors) or some synthetic indices of specialisation, the extent of the “shadow economy”; and, finally, the employment rates.

Both cross-sections and panel estimations have been used. Also bearing in mind the previous result (the ambiguous link between education and productivity in the full group of EU-27 countries), it seemed appropriate: (i) either to introduce in the regressions some dummy variables for the CEE countries; (ii) or to make estimations with fixed effects⁴² (which are able to capture the specificities of all individual countries). We have tried both specifications, with average labour productivity (per worker) and labour productivity per hour (although most of the presented results are with the former variable).

In the cross-sections – relative to three distinct years: 1992, 1998, 2006 – education is always positive and significant in explaining differences in productivity levels, while the dummy CEEC is always negative and significant. Now, before summarizing the results concerning the panel estimations, we just mention that in the estimations devoted to the conditional beta-convergence, the education variable is still positive and significant, while productivity's convergence across countries is established (β coefficients are negative and significant).

As to the panel estimations, since all the (above listed) explanatory variables have the expected sign (e.g. R&D, competitiveness, the transition index, the specialisation index, the services share),

³⁹ This can be detected from the direct comparisons between productivity growth and employment growth (rather than employment rates).

⁴⁰ Some transition countries (the Baltic states, Slovakia, Bulgaria) have moved to a “virtuous” model, while Romania is the only country still closely adhering to an “intensive” model.

⁴¹ Few countries (like Ireland, Luxembourg, Norway) followed a “virtuous” model, similarly to the US' typology.

⁴² In a few cases random effects were instead included (on the basis of the results of Hausman's test).

while education remains positive and significant in all cases (as are the fixed effects), we deal here with some results for which the “prior” expectations (about the sign) were ambiguous.

For example, a high industrial share seems to have a negative effect on productivity: a possible explanation is that an industrial specialisation now chiefly characterises the Eastern countries, whose productivity level is lower than that of Western countries (which are instead more specialised in service activities). The negative coefficient of the turbulence indicator can be explained as follows: although labour reallocations are from low-productivity to high-productivity sectors, productivity can temporarily be lower in the destination sectors, because of problems of knowledge accumulation, learning by doing, etc. that might prevail in the adjustment period. A possible explanation of the positive link between the shadow economy index and productivity is that the latter is higher where a larger share of low-productivity activities are relegated to the “shadow” economy, instead of being (partly) emerged and formally included in national accounts (i.e. in gdp, employment and productivity variables).

Finally, productivity growth seems negatively linked to the change in the employment rate (even when we add the usual regressors such as education and EBRD), coherently with the “diminishing returns for the employment rate” hypothesis, according to which, as the employment level rises, less productive workers are hired. As a matter of fact, while in many CEE countries (now members of the EU) the rationalisations and restructuring processes have produced significant productivity gains (although temporarily reducing employment rates), in countries that have recently followed an “extensive model” (like Italy and Spain) many new jobs have clustered in unskilled and low-wage occupations; such jobs are partly emerging from the shadow economy and in many cases are stuffed by immigrant workers.

The main policy implication calls to mind, at this point, the EU Lisbon’s strategy to create *more and better* jobs. It seems that many European countries have recently been able to create *more* jobs, also thanks to the recalled labour market reforms: this is a definite achievement, since nobody can regret the high unemployment rates of the past (and hopefully also in the new members unemployment is now decreasing). But this strategy must be completed in two ways: (i) to pay attention to the *better* jobs specification, not only to increase workers’ welfare but also to foster their effort and motivation; (ii) to focus more directly on productivity growth, for which many European countries (and especially some of them) are particularly lacking.

A special endeavour is needed to place knowledge and education, together with R&D and innovation capabilities, at the top of the policy agenda, as the main instruments for attaining growth and competitiveness. This strategy would pursue the “high way” to competitiveness in the globalised world, rather than simply searching for low-cost production methods (it would be surely ineffective for Europe to compete with China and the other emerging countries in the latter way...). A last point must be stressed: in the long run, a sustained productivity growth is beneficial also to preserve and expand employment, thus overturning the (apparent) short-run trade-offs, as the successful “virtuous” histories of some European countries clearly testify.

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APPENDIX

Countries:

Austria	AT	Czech Republic	CZ
Belgium	BE	Estonia	EE
Denmark	DK	Hungary	HU
Finland	FI	Latvia	LV
France	FR	Lithuania	LT
Germany	DE	Poland	PL
Greece	GR	Romania	RO
Ireland	IE	Slovak Republic	SK
Italy	IT	Slovenia	SI
Luxembourg	LU	EU-15	eu15
Netherlands	NL	EU-12	eu12
Portugal	PT	EU-27	eu27
Spain	ES	Norway	NO
Sweden	SE	Switzerland	SW
United Kingdom	UK	Croatia	HR
Cyprus	CY	United States	US
Malta	MT	Japan	JP
Bulgaria	BG		

Figure A1
Productivity (per hour)
2007 vs. 1990

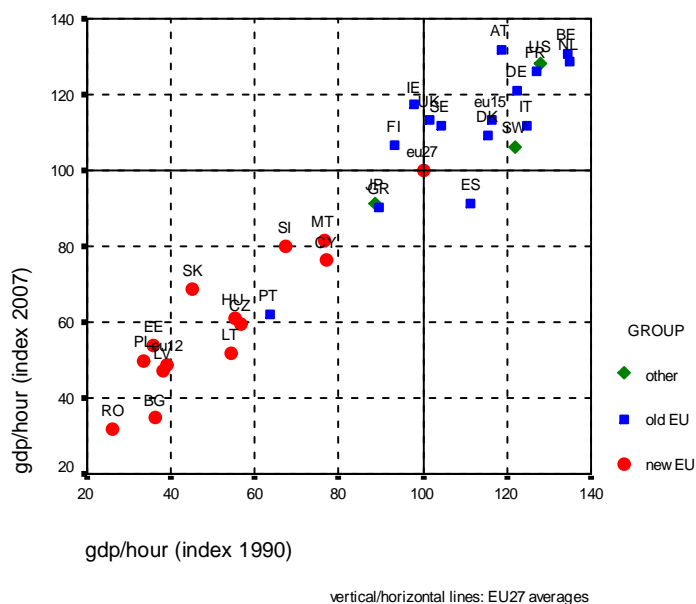
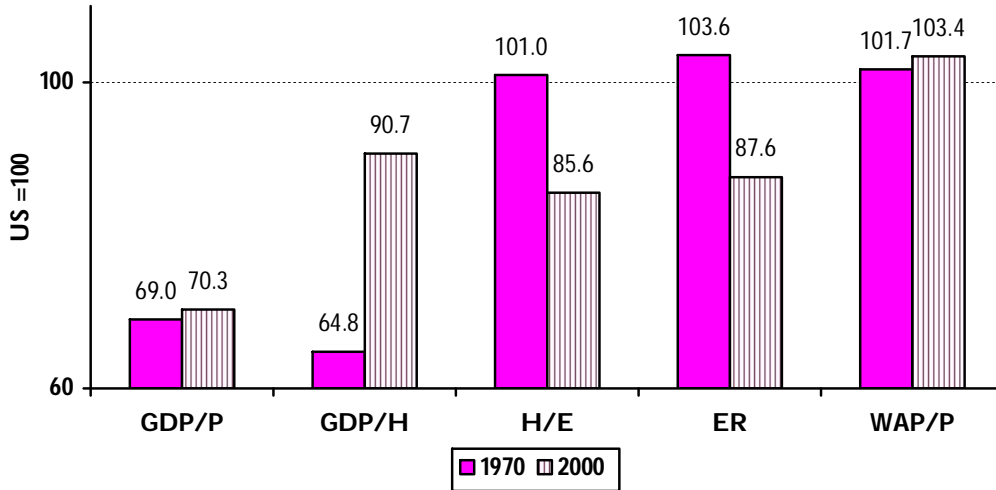


Figure A2

Compared real differences and dynamics: Europe-15 versus US (=100) (1970 and 2000)



Source: Annual Macroeconomic Database (AMECO) based on ESA 95 national accounts.

Legend: GDP/P = GDP / population = per capita GDP

GDP/H = GDP / hours worked = labour productivity per hour

H/E = hours worked / employment = annual average in working hour per employed person

ER = employment x 100 / working age population (15-64) = employment rate

WAP/P = working age population (15-64) / population

Note:
$$\frac{GDP}{P} = \frac{GDP}{H} \times \frac{H}{E} \times ER \times \frac{P_{15-64}}{P} \times \frac{1}{100}$$

Figure A3

Productivity vs. Employment rate

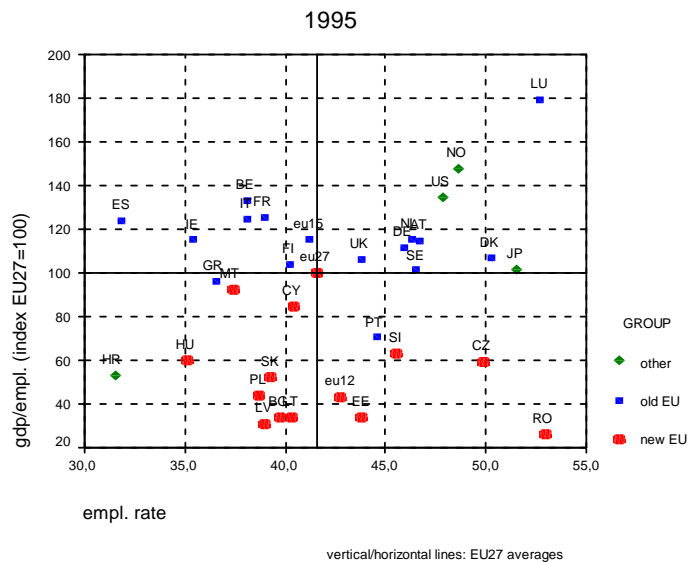


Figure A4

Productivity vs. Employment rate

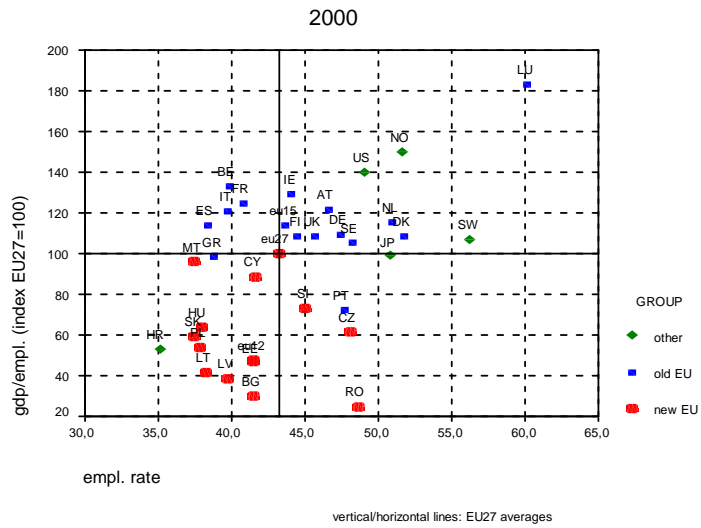


Figure A5

Productivity per hour vs. Productivity per empl.

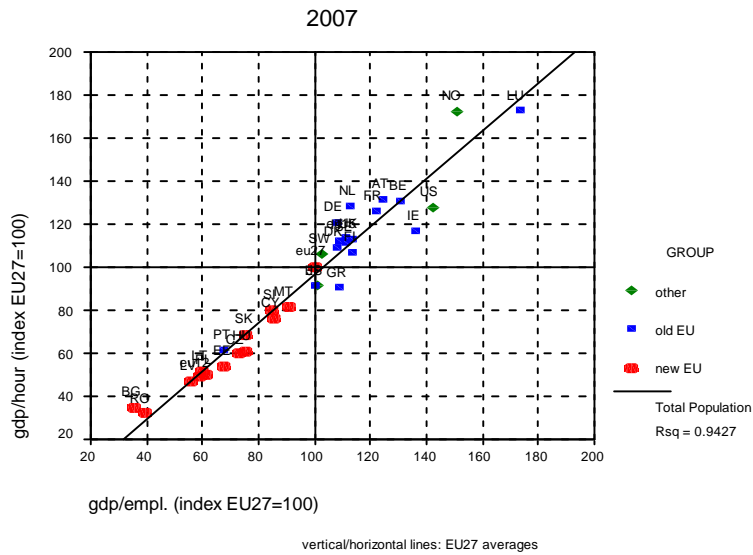


Figure A6

Productivity growth vs. Employment growth
EU27 (2000-2006)

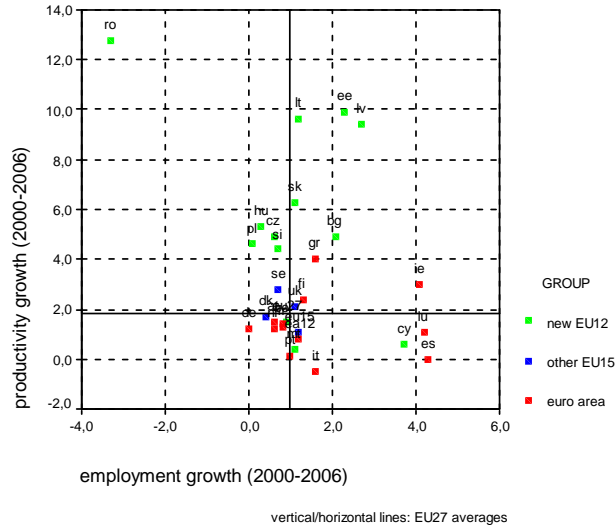


Figure A7

Productivity growth vs. Employment growth
EU15 (1995-2006)

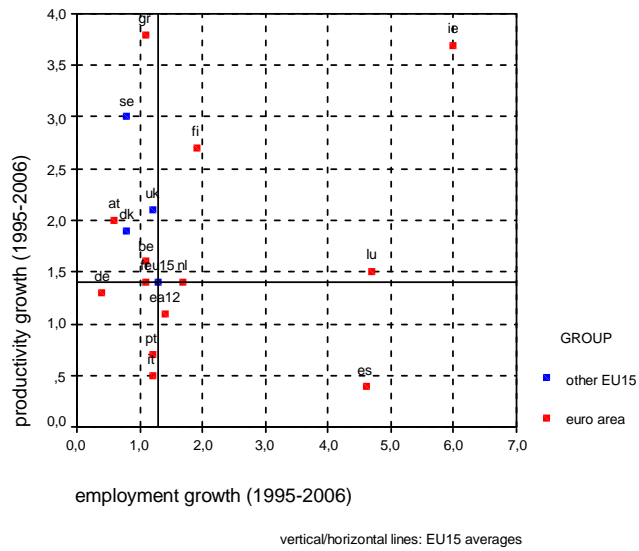


Figure A8

Productivity growth vs. Employment growth

EU15 (2000-2006)

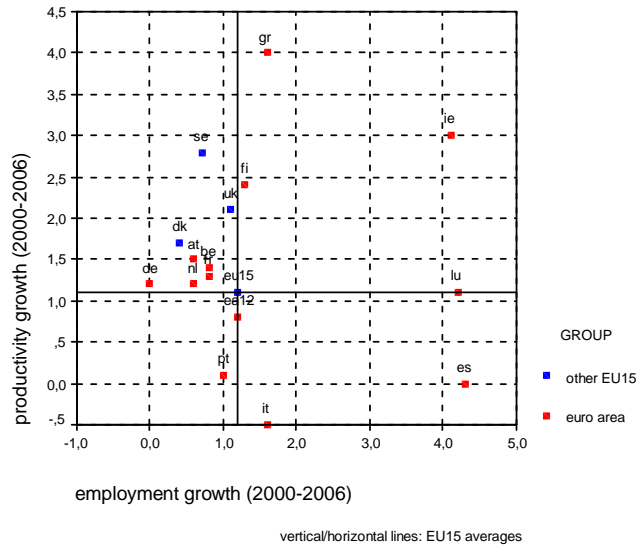


Figure A9

Education (youth attainment level)

vs. Productivity changes (EU15, 1995-2006)

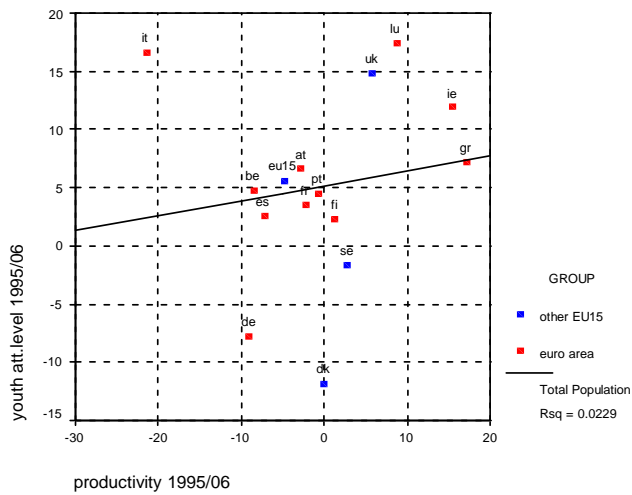


Table A1 – Productivity: pooled regressions (1992, 1998, 2006)

	[A1]	[A2]	[A3]	[A4]
<i>Productivity</i>	<i>per worker</i>	<i>per hour</i>	<i>per worker</i>	<i>per hour</i>
years	1992-1998-2006	1992-1998-2006	1992-1998-2006	1992-1998-2006
n. obs.	27x3	27x3	27x3	27x3
Explanatory variables:				
Education	0.198***	0.187***	0.167***	0.123***
Dummy CEEC or Fixed effects (FE)	-26.6***	-18.6***	FE	FE
Adj. R2	0.679	0.664	0.989	0.988

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

Table A2 – Pooled regressions: productivity and its main determinants (2000-2006)

	[A5]	[A6]	[A7]	[A8]
<i>Productivity</i>	<i>per worker</i>	<i>per worker</i>	<i>per worker</i>	<i>per worker</i>
n. obs.	27x7	27x7	27x7	27x7
Explanatory variables:				
Education	0.646***	0.198***	0.410***	0.428***
GCI index		0.356***		
EBRD index			12.39***	8.88***
R&D index			0.90	
Shadow index				0.492***
Dummy CEEC or Fixed effects (FE)	-31.16***	-20.68***	FE	FE
Adj. R2	0.889	0.917	0.997	0.997

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

Table A3 – Panel regressions: productivity per worker and structural indicators (2000-2006)

	[A9]	[A10]	[A11]	[A12]	[A13]
n. obs.	27x7	27x7	27x7	27x7	27x7
Explanatory variables:					
Education	0.361***	0.288***	0.247***	0.098**	0.348***
EBRD index	12.57***	10.76***	12.39***	9.62***	12.18***
KSI index	-25.44***				
TURB index					-15.9
Agriculture share		-0.56***			
Industry share			-0.51***		
Services share				0.77***	
Fixed effects	FE	FE	FE	FE	FE
Adj. R2	0.992	0.990	0.991	0.986	0.993

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).

Table A4 – Pooled regressions: productivity and its main determinants (2000-2006)

	[A14]	[A15]	[A16]	[A17]
<i>Productivity</i>	<i>per hour</i>	<i>per worker</i>	<i>per hour</i>	<i>per worker (Δ)</i>
n. obs.	27x7	27x7	27x7	27x6
Explanatory variables:				
Education		0.421***	0.235***	0.046***
EBRD index		12.77***	7.35***	1.14***
R&D		1.21*		
Empl. rate	0.286***	-0.08*	-0.04**	
Δ Empl. rate				-4.75***
Fixed effects	FE	FE	FE	FE
Adj. R2	0.994	0.997	0.996	0.660

Significance levels: 1%***, 5%** , 10%*; constant and fixed effects not reported (even when included).