The Contribution of Human Capital in the EU: Are There Limits to the Potential Level of Economic Development?

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Abstract

The knowledge and skills held by knowledge workers are the main competitive source for advanced economies. In Western countries, the presence of widespread programs of education and training allows an high average level of human capital, thanks to public and private funding. In various EU contexts, however, differences in the composition of the labor force still exist, and this may help to explain the different economic path and, in particular, the response to the period of prolonged recession after the global financial crisis of 2007. If the high level of education is widespread in Europe, women still have fewer opportunities to integrate in the labor force and exploit their productivity; furthermore, in different countries there are different opportunities for young workers, which would induce more innovation. The aim of the paper is to analyse the similarities/dissimilarities among EU countries in terms of economic development, human capital and female participation in job, using a Multidimensional scaling analysis.

Key Words: Human capital; education; gender inequality; economic growth

1. Introduction

The most competitive economic resource of the EU countries is the positive contribution made by a high average level of human capital, embodied in the labor force. The so-called knowledge worker incorporate the skills and abilities that allow a high level of productivity, and this is made possible by the spread of education and training programs (e.g. lifelong learning). The role of human capital is today essential in a context of growing international competition, with the advent of new competitors on traditional sectors, as well as on those based on high investment in R&D. It is well known that, despite this importance, also in Western countries there are limits that impede the smooth path of education and training for some segments of the population, ethnic and religious minorities, and in general of the feminine gender, but also a different composition of the labor force, in terms of the average age of participants. In addition, these restrictions affect strongly on the labor market, potentially preventing the participation of workers with high productivity, replacing them with others not at risk of social exclusion.

For this reason, it is necessary to perform analysis that consider many different aspects of the composition of human capital that make up the active labor force in each country, considering aspects related to productivity and innovation.

In this paper, we consider the group of EU member States and observe if there is a close relationship among the economic development, the national human capital, the full exploitation of female workers, the age (the degree of innovation of the younger and the experience of the elderly) and the qualifications of workers (and thus the potential degree of productivity at work). Such information on the human capital employed may be useful to explain significant differences in terms of economic growth in the EU countries.

The work is composed as follows: in the next section we analyse the contribution of human capital on the economic growth and development with reference to the economic literature, considering the phenomenon of gender inequality; in the third section we analyse the cross-country relationship between economic growth and the characteristics of the labor force in the EU using *World Bank* data; in the fourth section we use several variables related to economic development, human capital and female participation in labor force, applying *Multidimensional scaling analysis*, with the aim to analyse the similarities/dissimilarities among the EU countries, followed by the conclusions.

2. The Contribution of Human Capital to Economic Growth: Innovation, Productivity and Experience

The knowledge embedded in the labor force is the real engine of economic growth in the most advanced countries (Becker, 1964; Levine, 1998; Aghion and Howitt, 1998), which are based on the high quality of human capital employed in all industries, and this is possible thanks to a continuous and binding support (with public and private funds) to activities related to education, involving a wider range of population. Moreover, in the advanced economies, the knowledge workers have the ability and opportunity to use advanced technology, e.g. ICTs (see, among others, Fischer, 2000; Harun, 2002; Wild et al., 2002; Bucciarelli et al., 2010a; Mattoscio et al., 2008a), triggering virtuous circles of growth support, producing knowledge spillovers and phenomena such as *learning by doing* and *by using* (among the many contributions see Tirole, 1989; Andrews, 2004, Mattoscio et al., 2008b).
In advanced economies, the activities of education and training can have contributions from both public and private origin (Krueger and Lindahl, 2001) as well as the R&D, linked to technological innovation. In many Western countries, we find the presence of advanced training programs, which contribute to the propagation of both theoretical and applied knowledge, allowing the opportunity (such as for businesses) to focus on investments in intangible capital to be used in manufacturing and scientific research and technology activities. The new technologies and the training processes are two "resources" that must coexist to provide a competitive model for the economically advanced countries, compared with new emerging competitors, became competitive in most classical production areas.

We must consider that in the EU there are public education systems that allow the widespread education, thus also supporting any financial unavailability of the poorest population, e.g. where there is strong income inequality (see, among others, Levine, 1998; Beauchemin, 2001; Adams, 2002; Galor and Moav, 2004; Grossmann, 2008). The population coverage of public education programs allow to avoid the risk of deprivations in the early years of studies, that leads to rear barriers towards the continuation of the studies at all levels (Huston, 1991; Solley, 2005; Krugman and Wells, 2009; Narayan and Petesch, 2009; Narayan et al., 2009; Dudwick et al., 2009). Even in Western countries persist reasons for early school leaving, or non-attendance (Eckstein and Wolpin, 1999; Bucciarelli et al., 2010b), mainly for ethnic minorities (Entwisle and Alexander, 1993). At the same time, general economic conditions have a strong influence on the decisions of school attendance (see, among others, Brown and Park, 2002; Colantonio and Mattoscio, 2012), as occurred in years of prolonged economic recession that followed the crisis of financial origin, originated in the U.S. in 2007, for which not all EU countries have been able to overcome and return to a path of economic growth.

Furthermore, in these countries is evident also the female human capital contribution, starting from education to labor force training. The lack of this involvement, as it happens in countries with limits imposed by social practices or constraint, would be a brake on the potential level of economic growth (among some recent studies see Abu-Ghaida and Klasen, 2004; Klasen, 2006; Stotsky, 2006; Blackden et al., 2007). There are many conflicting theses on the relationship between gender inequality in education and the relative support to economic growth (Barro and Lee, 1994; Barro and Sala-I-Martin, 1995; Hill and King, 1995; Dollar and Gatti, 1999; Forbes, 2000; Knowles, et al., 2002; Klasen, 2002; Abu-Ghaida and Klasen, 2004). A part of the theoretical literature shows that the average amount of human capital in a society is reduced by gender inequality, as well as economic performance is negatively affected by it. Gender inequality restrained the opportunities of the highly qualified female part of the population (and replacing it with less qualified boys instead, e.g. in Dollar and Gatti, 1999). Furthermore, considering declining marginal returns to education, restricting the education of girls to lower levels while taking the education of boys to higher levels means that the marginal return to female worker more trained is higher than that of male worker and thus would increase the overall economic performance (Knowles et al., 2002). Regard the externalities of female education, it is known that the raise of female education reduces both fertility and mortality levels, as well as improves the education of the next generation.

These factors have a positive impact on economic growth, so that the positive outcomes to society of high female education are restrained by gender gaps in education (Galor and Weil, 1996; Lagerlöf, 1999; King, Klasen and Porter, 2008).

3. The European Context

The EU countries have different composition of the labor force in terms of participants' age and educational qualifications. There are many aspects that must therefore be considered to explain the differences in terms of economic growth among the different contexts.

In countries and sectors characterized by a large proportion of young workers, they should induce more easily innovative processes, and may incorporate an average level of education which differs from previous generations. In contrast, older workers embody the experience learned with the job. The differences are significant in the European area: calculating the average 2000-12 values (*World Bank* data) the percentage of the labor force consists of ages 15-24, ranging from 23-24% (Bulgaria, Croatia, Greece, Hungary, Italy, Lithuania, Poland) to just over 60% (Netherland and Denmark), whereas, for the share of labor force with tertiary education, the values ranging from less than 15% (Czech Republic, Italy, Portugal, Romania, Slovak Republic) to approximately 35% (Belgium, Cyprus, Estonia, Finland).

As mentioned in the previous section, education, also advanced, it is quite widespread in almost all EU countries, but the real contribution of the female gender in the labor force varies greatly. If we consider the contribution of female human capital to the production contexts, women who work on the total range between 30-40% (Italy and Malta) and 80% (Netherland), constituting between about 32% of the total labor force (Malta) to over 49% (Estonia, Lithuania, Latvia).

Graphs in Figure 1 show the relationship between variables related to economic growth and income level compared to employment of workers with tertiary education, young workers aged 15-24, and the female work (both in the total population and on female labor force) for 27 countries (EU excluding Luxembourg). Interpolating functions were applied to better understand the relationship.

From these graphs (Figure 1) it is highlighted a clear division in the values between the richest countries, more conscious of education and employment of women (in the upper right part of the graphs) and the poorer ones (lower part of the graphs). The following chart shows the historical evolution in the European Union (1993-2012) of the labor force (by gender) with high education, workers with 15-24 years (by gender) and the enrolment in higher grades of education.

The graph in Figure 2 shows a clear growing attention to the education of highest levels, with a strong positive trend in the total enrolment since the 90s. The same variations, in particular since 1999, are present for the share of labor force with higher education for both genders, although it does not represent a high share of the total. On the contrary, there is a clear negative situation for the working employment of younger workers, especially since the economic crisis (2007-08) caused by the bursting of the financial bubble in the U.S., with serious implications for the EU. This situation is due to the greater rigidity of the European labor market, e.g. compared to the U.S., thus limiting the intake of new labor force in many countries.

4. A Multidimensional Analysis of the EU Countries: Data, Methodology and Results

The aim of our analysis is to see whether there are significant relationships among education and efficient employment of the female gender and the economic growth and development, observing the structural differences and trying to explain growth differentials for dissimilar groups of EU countries during the period considered (2000-2012). We distinguish three groups of variables under consideration: the first group concerns the rates and levels of economic growth (*GDP*) and development (*HDI*); the second group concerns the necessary public input and expenses in education, training and R&D; the third group concerns the professional employment of women in general and considering the level of education. The selected variables are listed in table 2

We use a *Multidimensional scaling analysis* (MDS) to analyse simultaneously the distances between the EU member States and observe whether the relationships described above are relevant and whether the links are more evident for certain group of countries.

MDS is a useful tool that makes it possible to produce graphical representations of the 27 member States (with the exclusion on Luxemburg), based on the degree of similarity/dissimilarity between them.

We aim to provide a representative map that best approximates the distances observed between the member States, concerning the appropriate integration of female human capital (also qualified) with the support of public education and R&D in relation with the condition of economic development. Using this statistical method, we attempt to build a configuration of the various entities, merged in a small number of dimensions (two in our case). We do this by defining relations between States in terms of proximity/distance with respect to the considered indicators. The resulting positioning map has the property to partition the regions into homogeneous groups, so that the degree of association between two regions is maximal if they belong to the same group and minimal otherwise.

We use data from *World Bank* and *United Nations* starting in 2000 and ending in 2012. We rescale the average data between zero and one within each considered variable, in order to avoid possible distortions due to different ranges and magnitudes.

We assess the model's goodness of fit using the *RSQ* (0,942 for the considered period), that indicates the proportion of variability explained by the corresponding dissimilarity distances, and the *Stress index* (0,108 for the considered period). As a rule, we find results to be robust when the size *k* achieves a stress index value lower than 0,15. We judge a two-dimensional model acceptable according to the values of the previous indices. Further investigation provides an additional basis for choosing the two-dimensional solution - the "elbow" rule - that suggests choosing the number of dimensions in correspondence to where the diagram yields an "elbow", beyond which the broken line flattens (see Table 1 and Figure 3).

The correlations between dimensions and variables for the considered period (see Table 2) were useful for naming the axes of the graph where the 27 countries are represented and positioned as a result of the analysis. The resulting two-dimensional image is shown in Figure 4.

From graph shown in Figure 4 we can distinguish four groups of countries, clustered according to the four quadrants marked by the two axes, which represent the two dimensions of our analysis (see Table 2).

It is interesting to note that the period considered to calculate the mean values of the variables (2000-12) contains the years of the international financial crisis of 2007 and the advent of the prolonged recession, which in many countries is considered to coincide with the lack of economic recovery after 2009-10. For this reason we must consider this event of great magnitude in describing the second dimension, i.e. the vertical axis.

It can be said that the group of countries at the top right of the graph includes the most virtuous, conscious in education and R&D, which fully integrate in the labor force the female human capital and the skilled workers and, also for these reasons, enjoy good levels of economic growth. In the bottom right, instead, there are countries that, even with good average levels of human capital and public investment in education, have lower integration of women with higher education and slower economic growth, considering that they were more affected by the international economic crisis, than the group described above. As can be seen from the graph, in these groups there are countries of Central and Northern Europe, Spain and marginally Italy, albeit with a worse economic situation.

On the left side of the graph there are countries that have less invested, in the considered period, in terms of extensive education and R&D. To this group belong the countries of Eastern Europe and the Mediterranean area. The results are very different in economic terms for these countries. Some of them have continued a path of economic growth not due to the development of the fields of innovation and research, but the classic ones, such as manufacturing, less sustainable in the long run. Finally, we observe that in the bottom left quadrant we find those countries already described in paragraph 3 (Figure 1) that may have deficiencies in professional female or young workers, or minor public investment in widespread education programs and R&D.

It is therefore evident that the aforementioned aspects that form the so-called knowledge economy, assumed as a socio-economic environment technologically and culturally advanced based on research and education, are the main resources that allowed the best performing to maintain adequate levels of economic growth in the recent years, facing a severe imported financial crisis, and the "Great Recession" that followed.

5. Conclusions

In this paper we observed whether, in the context of the European countries, persist limits to the potential level of economic development, due to social and structural constraints that limit the employment of specific domestic "resources".

Considering the evolution of the countries under analysis, we believe that these resources are embedded in the so-called knowledge workers, and the most common limits are on the appropriate employment of female human capital, in particular the highly qualified one.

In the first part of the paper we have considered the specific literature on gender inequality in education, confirming the problems due to the lack of exploitation of a part of the national human capital, with the consequent use of less-skilled workers and the waste of valuable "resources". The economic literature has also confirmed that these restrictions are relevant even in the most advanced socio-economic contexts. Then we have considered the relationship in Europe between several variables related to human capital, women's work (even with high qualification) and young workers, another group at risk, in a period covering the international financial crisis of 2007. The observation of the data, prior to our main analysis, showed profound differences in the various EU countries, confirming the variables on gender inequality as a subject of investigation.

We applied then a *Multidimensional scaling analysis* considering the EU countries and three groups of variables: the efficient use of human capital of women, public spending on education and R&D, economic growth and development. From the results and the representation of groups of countries in terms of proximity/distance with respect to the considered indicators, it is evident that the virtuous countries are that of Central and Northern Europe, spending higher level of public funds in education, training and R&D, and with greater care of the female skilled human capital. They were able to cope with the imported financial crisis with significant real effects, in a sustainable manner in the long term, based on the intangible resources of the knowledge economy (the period considered in the analysis is 2000-12, then covered the bursting of the speculative bubble in the U.S.). These countries have also less affected by the lack of economic recovery, the so-called "Great Recession"

In summary, it is clear that in Europe there are still significant differences not only in terms of public spending on R&D and education, but also on the appropriate and best use of the human capital of women, especially of the most highly qualified workers. The formation of groups of countries with different structural characteristics showed that in a context of increasing international competition, the lack of exploitation of intangible assets of knowledge represent a limit to the potential level of development of the national economy, as well as to remain competitive and sustain good levels of growth.

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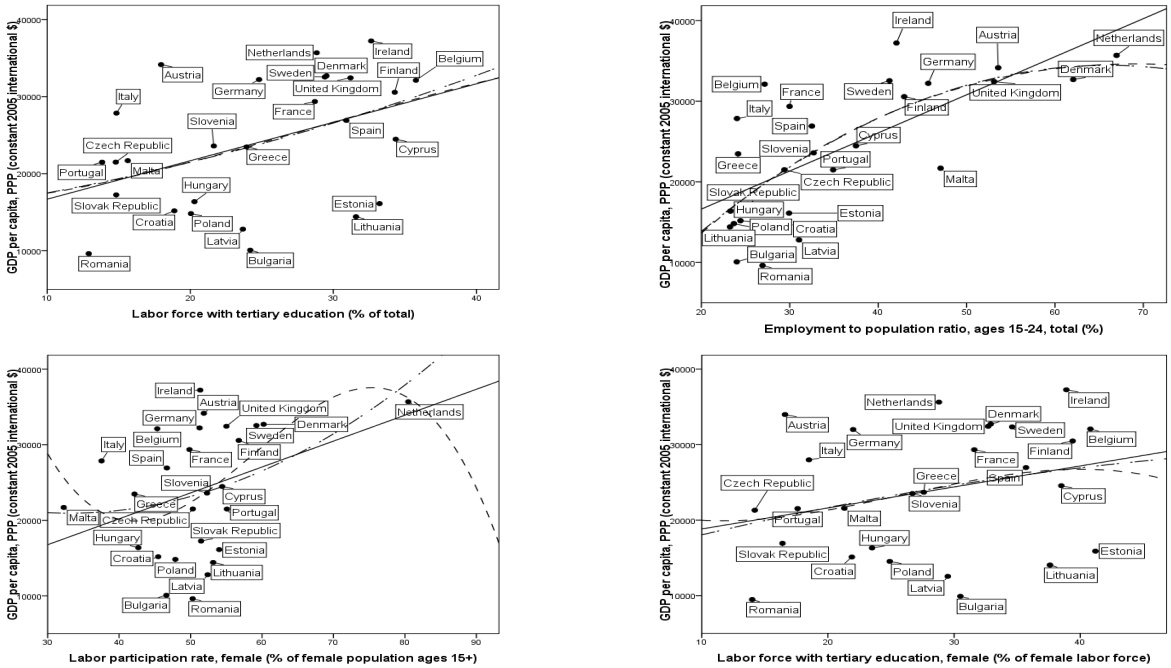
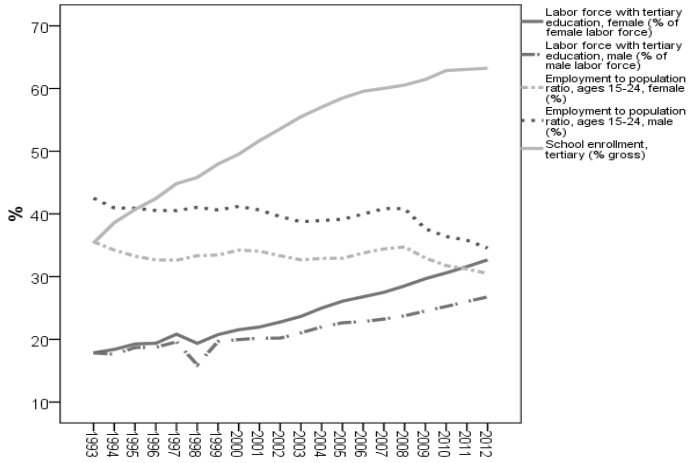
Figure 1. The Relationship between Variables Related To Human Capital and Economic Growth for the EU Countries, Average Values 2000-2012



Source: *our elaborations on World Bank data*

Figure 2. Variables Related to the Composition of the Labor Force (By Gender) and Tertiary Education Enrolment for the European Union, 1993-2012



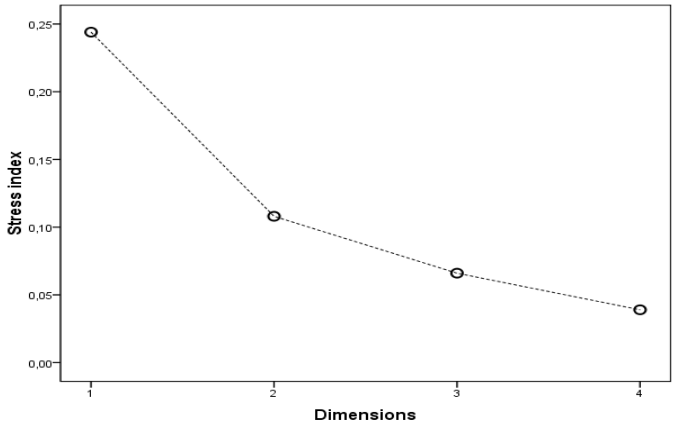
Source: *our elaborations on World Bank data*

Table 1. Values of the Stress Index Basing On Diagram Dimensions

Dimensions	Stress index
1	0,244
2	0,108
3	0,066
4	0,039

Source: *our elaborations on World Bank and United Nations data*

Figure 3. Stress-Dimensions Diagram



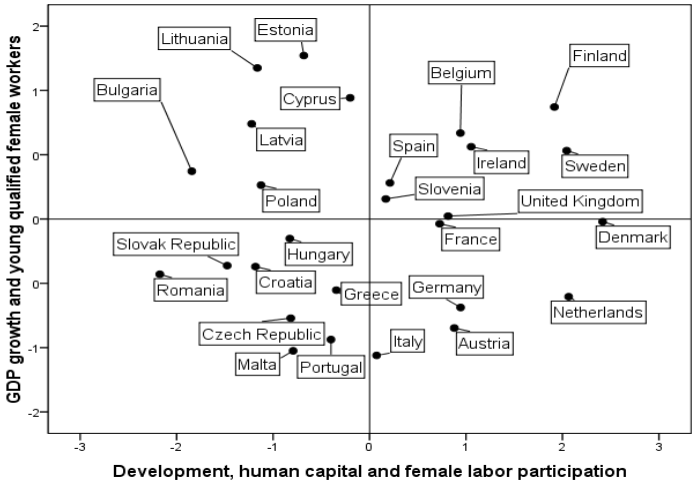
Source: *our elaborations on World Bank and United Nations data*

Table 2. Correlations between Variables and Dimensions

Variable	*Dimension 1*	*Dimension 2*
GDP growth (annual %)	-0,61	0,54
GDP per capita (current US$)	0,96	-0,04
HDI	0,90	-0,07
Public spending on education, total (% of GDP)	0,68	0,35
Research and development expenditure (% of GDP)	0,86	0,06
School enrollment, tertiary (% gross)	0,46	0,42
Labor force participation rate, female (% of female population ages 15-24)	0,76	-0,16
Labor force with tertiary education, female (% of female labor force)	0,41	0,85
Labor participation rate, female (% of female population ages 15+)	0,51	0,21

Source: *our elaborations on World Bank and United Nations data*

Figure 4. Cluster of Countries in a Two-Dimensional Space



Source: *our elaborations on World Bank and United Nations data*