HUMAN CAPITAL AND REGIONAL DEVELOPMENT - STRUCTURAL ANALYSIS

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Abstract

Human capital is regarded to be one of the major sources of economic growth and also as one of important determinants of national and regional differences. Usually regions with higher human capital endowment have higher per capita output, lower unemployment rate and higher wages than regions with lower level of human capital. This often leads to theories and models which establish a causal link between human capital and economic performance. However, we should ask whether there is really a direct link between human capital and economic performance or whether the economic structure is not the real basis which the differences are based on. Especially in relation to current economic downturn in many countries it seems that the human capital alone is not a guarantee of economic stability and growth and it is necessary to have human capital which is related to the economic structure – it does not work the other way round. The paper deals with a general idea of the relation between human capital and economic performance but establishes clusters of regions with a similar economic structure and analyzes the relation within these clusters.

Key words: human capital, economic structure, location quotient

JEL Code: E240, C210, R150

Introduction

The impact of human capital on economic growth and development has been analyzed many times in recent decades. This issue has not been analyzed only on a national level but also many studies have been conducted for regional levels as well. The outcome of most of the studies is quite straightforward – the human capital endowment fosters economic growth, enables innovations and causes differences in wages, productivity and the well-being itself. To quote some of those studies we should mention Romer (1986) and Lucas (1988) at the first place, who gave the theoretical link between output growth and human capital endowment. Many studies and analyses followed – Barro (1991) finds human capital as one of key determinants of per capita income, Aghion and Howitt (1998) find human capital to be a

factor which strengthens investment in technology impact on economic growth. At regional level the studies focus mainly on explanation of human capital as a factor which explains regional differences in wages, productivity or income growth. Cheshire and Margini (2000) or Di Liberto (2008) stresses the role of human capital as one of the determinants of regional growth. Similarly, differences in wages among the regions and countries could be, at least partially, explained by differences in the level of education which is reflected in worker characteristics (Dickie and Gerkin, 1987).

However, the question of human capital effect on economic performance is still not settled (Temple 2001). Some recent and even historical studies show that the impact of education on wages and growth is probably not that straightforward as expected. Several decomposition analyses has been made - focusing on explanation of wage differentials on the basis of education returns (prices) and human capital endowment. Most of them revealed that returns are at least as important factor of wage differences as education (human capital endowment) or even more (see Faber and Newman, 1987 or García and Molina, 2002, for example). A special attention was also paid to heterogeneity of human capital impact when regional differences in impact of education on wages were confirmed. Krueger and Lindahl (2001) found that the effect of education on economic growth varies among the countries. López-Bazo and Motelón (2012) also conclude that in the case of Spanish regions there is also a difference in education effect on regional wages when they expect the highest effect of education in the least developed regions. Nevertheless, the main idea that education generally promotes higher wages and growth remains.

There are several "side" issues which are usually omitted in discussions about education and economic performance. The first one is the question of regional prices. For the case of regional analyses it is important to calculate with real wages, real GDP etc. The usually used PPS indicators do not work here as there are no true regional price levels now, regional PPS indicators are based on national average prices. Involving the regional prices lead to substantial reduction in regional differences, mainly in income and wages (Musil et. al 2012). The second issue is the regional (or national) economic structure and the structure of education, i.e. human capital utilization. To reveal the impact of education on economic performance we should focus on regions or countries with a similar economic structure. It is very likely that there is a higher share of tertiary educated people in highly urbanized, service-oriented areas but is it the tertiary education which promotes the higher levels of output and income or the higher income is determined by the economic structure which is attracting people with higher education. Moreover, as can be seen now in many European countries,

education itself does not mean competitiveness and income if it does not reflect the market needs. In Spain for example there is a very high ratio of people with university education but the unemployment rate reaches the highest rates as well. We should always bear in mind that the labour demand is a derived demand dependent on the demand for goods and services (Thirlwall 2002).

The purpose of this paper is to deal with the second issue – to analyze the impact of education on wage differentials within the clusters of European regions with a similar economic structure – a conditional impact of education on wage differentials.

1 Data and model

As stated above we need to compare regions with a similar economic structure to decide the effect of human capital. A similarity in the economic structure is undertaken by using a standard cluster analysis.

The non-hierarchical method of cluster analysis was used to classify the regions into clusters. The method classifies data into clusters based on their properties. The number of clusters is specified by the author at the beginning. The algorithm assigns each point into the cluster, whose centre it is the closest to. The centre of clusters at each run of the algorithm re-calculates the arithmetic average of all cluster points. The aim is to achieve the smallest differences within the clusters.

$$V = \sum_{i=1}^{k} \sum_{x_j \in S} (x_j - \mu_i)^2 \qquad (1)$$

Where k is a number of clusters S_i, μ_i is the mean of points in S_i.

Eurostat NACE Rev1 data for EU NUTS 2 regions in time period 2004-2008 covering 5 sectors1 (Agriculture, Industry, Wholesale services, Financial intermediation and Public Administration) were used. The indicator we use to create clusters with a similar economic structure is the location quotient. The location quotient for sector j in region i is calculated as follows

$$Iq_{ij} = \frac{\frac{E_{ij}}{E_j}}{\frac{E_i}{E}} \qquad (2)$$

Tab.

[1] Of course, this simplification could be revised in any following research and allows to extend the number of sectors to get a more detailed picture.

1: Cluster definition

	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
	mean	std	mean	std	mean	std	mean	std
Agriculture	1.63	0.35	4.30	1.60	0.67	0.23	0.29	0.16
Industry	1.05	0.18	0.97	0.27	1.15	0.24	0.80	0.16
Wholesale services	1.06	0.18	0.92	0.26	1.01	0.14	1.04	0.11
Financial intermediation	0.66	0.19	0.42	0.12	0.85	0.17	1.31	0.32
Public administration	0.96	0.16	0.72	0.14	1.02	0.18	1.19	0.15
Unemployment	9.16	3.58	10.90	3.09	7.41	3.72	6.58	3.08

Note: std - standard deviation
Source: Eurostat, author's calculations

Regions in the first cluster focuse partly on agriculture and partly on industry (connected to agriculture usually) and wholesale services (usually connected to tourism). Although agriculture is quite concentrated in these regions it is naturally not the main source of income. We can say that the economic base in these regions is quite diversified in comparison to other clusters – there is not anystrong concentration of one activity. Typical regions in this cluster are Galicia in Spain or Pomorskie in Poland. A lot of regions in the cluster are economically or structurally impaired (for example, Spanish regions of Galicia and Andalucia or Italian region Calabria or regions from the new member states such as Bulgaria or Eastpolish regions). The cluster contains two non-continental regions too - Madeira and Azores archipelagos.

Regions in the second cluster are characterized by a high proportion of the population employed in agriculture. These are mainly rural agricultural regions with a lower share of industry and a low share of the tertiary sector. These regions mostly produce primary agriculture product but do not process it further as regions in cluster 1. These regions are also not much oriented on tourism in comparison to cluster 1 (with some exceptions). Economic base of regions is most likely not very diversified; these regions concentrate mainly on growing primary agriculture output (wheat, corn, wine, etc). Typical regions in this category are Centro in Portugal or Opolskie in Poland.

Regions in the third cluster have relatively highly concentrated industrial activities in comparison to other clusters. There are usually regions with one to three centres (bigger

cities), historically industrial. However, in comparison to cluster 4, the overall level of urbanization is not very high. Typical regions are Franche-Comté in France, Stredni Morava in the Czech Republic or Dresden in Germany. The fourth cluster can be described as a cluster of the wealthiest and most advanced regions in Europe – a cluster of big (often capital) cities and highly urbanized areas. Most of these are core regions with decisive economic power and the main focus of the economy is on services (especially financial services) and public administration. The concentration of the second sector is the result of the fact that these regions are often capital cities or important administrative centres. Typical examples of regions in this cluster are Prague, Köln, Ille de France, Inner London, Lisbon, etc.

After defining the clusters a simple cross-section model is built. Two dependent variables, which should reflect the region´s competitiveness, were chosen. The first one is regional GDP per capita in PPS which should reflect the production ability of a region. The second one is primary income of households which should reflect the economic level of households. Both indicators are used as relative to EU 27 average (Eurostat database was used again). Regardless the well known problems of both indicators the data are available for most of the EU NUTS 2 regions in the selected period and may be regarded as basic indicators for assessing the competitiveness and economic level. Of course, other indicators (as the unemployment rate) might be taken into consideration in the following research. As an independent variable reflecting the human capital endowment, the ratio of people employed with a university degree to the total number of people employed was chosen. As other, rather complimentary variable, the ratio of employees with a higher education to the total number of people employed was selected. These two variables are highly correlated and we have to put them in the model separately (they are supposed to counteract each other). The formal model is very simple and straightforward consisting on several independent functions as follows:

$$gdp_c = \alpha_{c0} + \alpha_{c1} UE \qquad (3)$$

$$gdp_c = \beta_{c0} + \beta_{c1} HE \qquad (4)$$

$$inc_c = \gamma_{c0} + \gamma_{c1} HE \qquad (5)$$

$$inc_c = \delta_{c0} + \delta_{c1} UE \qquad (6)$$

Where c stands for respective clusters 1-4, gdp is ratio of EU GDP per capita to EU27 average, inc is household´s income per capita in PPS to EU27 average. UE stands for the ratio of employed population with a university degree on total number of employed population; HE

stands for ratio of employed population with a higher education on total number of employed population.

2 Results

Having cross section data and linear functions assumption, standard OLS was used for estimation of (2)-(5). Table 2 shows the results for GDP and Table 3 for household´s income. R-square is in brackets, ***show statistical significance at 95% level of confidence **at 90% level of confidence.

Tab. 2: GDP and human capital

Cluster/variable	1	2	3	4
University education (UE)	-0,17 (0,00)	1,5** (0,1)	0,69*** (0,05)	2,53*** (0,17)
Higher education (HE)	-0,39** (0,08)	-0,88*** (0,64)	-0,7*** (0,2)	-0,65 (0,02)

Source: Eurostat, author's calculations

Tab. 3: Income and human capital

Cluster/variable	1	2	3	4
University education (UE)	-0,44 (0,00)	2,37*** (0,22)	0,57** (0,03)	1,13*** (0,16)
Higher education (HE)	-0,23** (0,02)	-0,91*** (0,65)	-0,68** (0,15)	-0,52** (0,04)

Source: Eurostat, author's calculations

It is quite clear that the general hypothesis that higher level of human capital always promotes higher income and output cannot be approved. Truly the higher ratio of employees with university degree has usually positive impact on economies of structurally similar regions. However, it cannot be said that the impact is always the same and even it is always significant. Moreover, even when a significant relation is found it is not very strong (R2 is usually quite low).

For cluster 1 there is no statistical significance of human capital endowment positive effect on GDP per capita or income. In these agri-industry regions the level of these indicators is evidently independent on education. For the second cluster of highly agricultural regions a positive statistical significance of university education on GDP and income is observed. However, a stronger relation is found only for the level of household´s income. This could be explained by commuting of employees from these regions to other regions; especially bigger cities (cluster 4). Quite surprising is a strong negative relation between both variables and higher education in the region. In cluster 3 of industrial regions there is quite a weak positive relation between university education and GDP per capita or income. Although the education

is statistically significant the R-square is very low. In cluster 4, which is a cluster of big cities concentrated on services, a positive and arelatively stronger relation is found. The impact of human capital endowment (university degree) on GDP per capita is significant and the highest in comparison to other clusters. However, still the fit of the model is not very good (although the best in comparison to others) which means that human capital endowment is one of the sources of higher production and income but not the most important one. Other factors probably affect the economic situation of the regions as well.

3 Conclusion

Human capital is now considered as one of the important sources of economic growth, competitiveness and development. It is without doubt that highly educated population should bring more innovations, be more efficient and yield higher output. However¨, several problems should be addressed before the general conclusion is made. This article deals with one of them – a relation between the impact of education on income and output and economic structure. The hypothesis the article deals with is quite straightforward – is human capital the source of a higher output production and income or is it only a side effect which occurs due to a respective economic structure? Does human capital affect the output always positively or is there any danger that the education does not reflect the market needs? To answer these questions a simple model was developed based on previous split of EU27 NUTS2 regions into four different clusters. The location quotient was used for a description of the economic structure and the cluster analysis was used subsequently to get groups of economically (from the structure point of view) similar regions.

The results are quite interesting. Evidently it cannot be approved that a higher ratio of employees with university education, which was used as a proxy for human capital, would always lead to a relatively higher output in a region. The same situation is in the case of household´s income. Generally the positive effect of university education on GDP or income can be found but the impact is quite weak and often almost insignificant. There is a group of regions where absolutely no relation is found. These are regions with quite diversified economic base, focused usually on agriculture and related industries. Also tourism is quite common in these regions. For other three groups a positive relation can be found but the fit is quite low. The lowest impact of education is observed in industrial regions, the highest in regions of big and capital cities. But even in this last group the goodness of fit is considerably lower than expected. Most likely other effects than human capital endowment stand behind

the differences in output and income. It has to be stressed that this paper serves only as an entry to this problem and other analysis will follow employing different approaches to human capital and to groups of regions definition.

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