UNDERGRADUATE EDUCATION AS A FACTOR OF THE EU MEMBER STATES COMPETITIVENESS

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Abstract

Human capital as one determinant of a long term economic growth is often identified with school education. In this paper, the dependency of the total percentage of population in all types of education on the GDP, in all EU15 countries as well as EU25 is demonstrated. The paper also focuses on the spatial aspect of undergraduate education on the level of states as well as NUTS2 as a whole; and also on the university education in technical fields, mathematics, science and technologies that can eliminate overall economic lagging of Europe.
Key words: *undergraduate education, University education, Human capital, the EU, Spatial autocorrelation.*

Introduction

In 2003, the Council of the EU for the Education, Youth and Culture suggested five indicators for measuring progress, so called benchmarks in the area of education and training, and new community programmes Erasmus Mundus and e-Learning. The benchmarks were formulated as follows:

- The percentage of early school leavers should not exceed the average rate of 10%;
- By 2010, the number of graduates in mathematics, science and technology should rise in all Member States by at least 15 percent, while securing gender balance;
- At least 85% of 22-year-olds in the EU should conclude upper secondary education (ISCED 3) by 2010;
- By 2010, the percentage of 15-year-olds with low achievements in reading should be lowered by at least 20% compared with the rate in 2000;
- In the EU, the participation of adult working age population, at the age of 25-64, in life

long learning should reach at least 12.5% by 2010. The Member States have the option to decide which measures they use to achieve these goals.

The main aim of the Lisbon Strategy[1] is to transform the EU into the most dynamic and most competitive knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment by 2010. The main instrument used to accomplish this goal should be *the knowledge* which together with the research and technologies, education and innovations constitute the basic knowledge triangle.

The OECD (1998) defines the human capital as knowledge, skills, abilities and other characteristics of a human which are relevant for economic activity. Becker (1993) further divides human capital into general and specific one. The general human capital means universal abilities, skills and capabilities usable in more-or-less all areas of human activities. On the contrary, the specific human capital includes specific knowledge and skill practicable in a specifically concrete field or type of activity. From domestic authors, e.g. Čaplánová (1999) refers to the concept of human capital as a complex of born and acquired abilities and knowledge that are at a dispose to humans.

Human capital, probably in a bigger extent than other growth factors, carries along many positive effects which are problematically quantifiable in financial terms. The duration of the learning process is taken as one of the measures of the human capital. The measure of how educated people are enables them better process and subsequently create higher quality information. Various authors in their empirical studies work with different measures of human capital.

Mankiw, Romer & Weil (1994) use the school attendance as a measure of the human capital. However, we must be aware that in the case that the value of the indicator of the school attendance as the percentage of particular age group in the country is drawing near 100%, due to the legislation or educational standards in the country, looses the use of such indicator in the analysis its relevance. Barro & Lee (2000) use the duration of learning as a measure. Romer (1994) considers the literacy as one of the measures of human capital.

Many authors studying the relations of human capital and economic growth identify human capital with school education (Gould & Ruftin, 1995, Gundlach, 1995, Benhabib & Spiegel, 1994). At last, we can define the human capital as one of the determinants of economic growth along with land, labour, capital and technological progress (Mankiw, Romer & Weil, 1992, Maudos, Pastor & Serrano, 1999). Lucas (1998) stresses the role of human capital as the engine of the long-term economic growth. Hers (1998) in his studies gives an overview of methodology and outcomes of regression analyses aiming at explaining the relations between human capital and economic growth. In the work of Barro (1998), he shows positive relationship of the economic growth of GDP and the average duration of school attendance at secondary schools. A valuable overview of articles focusing on relations between the human capital and the output is offered by Temple (2000).

Levin & Raut (1997) state that human capital does not determine GDP directly, but in a way that it influences one of its components – the export, the area where new technologies are applied at the most and that brings along the highest rate of human capital appreciation. Dobe (2000) examined the relation between human capital measures and households consumption. Considering international data he came to a conclusion that a higher level of human capital in a country implies a lower level of households' consumption with respect to the GDP. Consequently households save more, what allocates more resources for investments in the country that could eventually influence the economic growth in the long run.

Long-term time lines of GDP performance of the leading world economies show that countries as the USA, Japan and some European countries show almost continuous economic growth in the last 100 years (Becker (1993)). However, according to the Law of diminishing returns the economic growth should - even at growing inputs of capital and labour - slow down, if not stop. The answer to this paradox could be seen not only in the technological advance but also in the human capital development in these countries. The increase in the level of the physical capital raises the labour productivity. Yet, it raises it in a quantitative manner; it enables one unit of labour to produce so much as more units of labour in the past. Moreover, the additional labour force is able to produce the same values with less use of physical capital. Human capital along with technological advance,

1 Lisbon, 23. - 24. March 2000

however, changes qualitatively the structure of usage of physical capital and labour force. It enables the creation of new production sectors, new technologies. The human capital positively affects the development of new technologies using innovations and at the same time helps the society to adapt to the use of these new technologies. Innovation is the bonding element between human capital and an economy performance.

Methodology of Research

Spatial autocorrelation statistics measure and analyze the degree of dependency among observations in a space. If dependence exists, the variable is said to exhibit spatial autocorrelation. It may be classified as either positive or negative. In a positive case the similar values appear together, while a negative spatial autocorrelation has dissimilar values appearing in close association. Moran's I is a measure of spatial autocorrelation developed by Moran. Moran's I is defined as

$$\mathrm{I} = \frac{n}{2A} \frac{\sum_{i=1}^{n}\sum_{j\neq i}^{n} \delta_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2},$$

where n is the number of spatial units indexed by i and j; x is the variable of interest; $\bar{x}$ is the mean of x; and δ_{ij} is a matrix of spatial weights (Arlinghaus, S.L., Griffith, D.A., Arlinghaus, W.C., Drake, W.D., & Nystuen, J.D. (1995). The significance of Moran's I can be assessed using Monte Carlo randomization. Note that when data are spatially autocorrelated the assumption that they are independently random is invalid, so many statistical techniques are invalidated. For the calculation of the Moran's I and the map we used the free software package GeoDa.

The Pearson correlation coefficient measures the strength and direction of a linear relationship between two interval/ratio level variables. The Pearson correlation coefficient between X and Y is defined by

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}},$$

where x and y are the variables of interest; $\bar{x}$ is the mean of x; $\bar{y}$ is the mean of y. After calculating a correlation coefficient, it is reasonable to check its significance. The t-test is used to establish if the correlation coefficient is significantly different from zero, and, hence that there is evidence of an linear relationship between the two variables. A P value is a measure of how much evidence we have against the null hypothesis. If the P value is less than the significance level, then the null hypothesis is rejected.

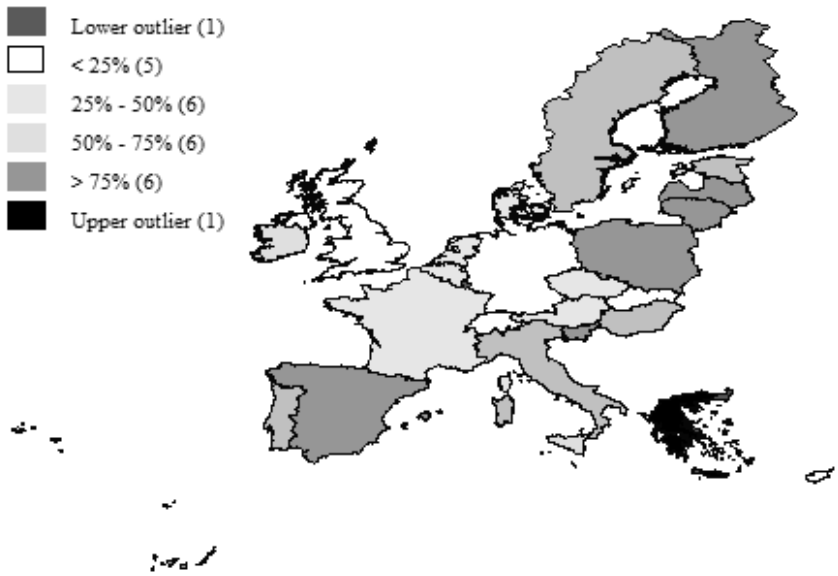
Undergraduate Education

Education is the process of all-purpose humanization of a person; it is the re-formation and improvement of all his abilities. In the history of mankind education serves several basic socio-development functions. It helps the evolution of the personality, not only of an individual but also of a state and the generational evolution of a mankind, evolution of the civilization, the transmission of cultural values and new ideas.

Figeľ (2006) states that education has a great many-sided significance. In the economy, it is an important factor of employment and employability. Education plays a significant role in the social integration of a human, in order not to be isolated and to be able to grow together with the society.

Nowadays, in times of growing migration in the continent it is a crucial factor for the social inclusion. Education has also a political meaning. Educated people react differently on politics, democracy, global issues; they have a different overview, knowledge; they are more immune to demagogy and populism, half-truth, to manipulation, nationalism, xenophobia, or fanaticism. And that is very important for every free society and its future. Figeľ (2006) concludes that education is also a significant cultural factor because through better knowledge it is possible to advocate ethical and legal values, build understanding, respect and trust – all elements of crucial importance for the human as well international relations. Education facilitates the preservation and widening of cultural heritage that must be known and learned first, then absorbed and further built, and eventually passed on next generations.

Higher schools, colleges and universities, in respect with their connection with research and their role in technology transmission, are the key pillars of the forming process of knowledge and information society based economy as described in Bologna Declaration. The numbers of graduates of tertiary education[2] of all three levels reached 2.5 million in 1998 and as many as 3.3 million in 2003 which corresponds to an increase of 32%.



Source: Own processing based on Eurostat data

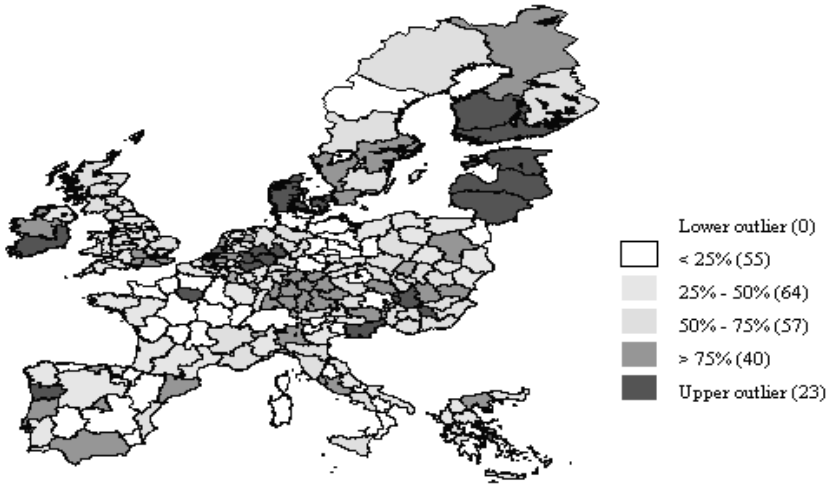
Figure 1. Percentage of students ISECD 5-6 from the total number of students in 2004.

The numbers of PhD. graduates in the same period increased by 16%. The amount of young people in the age range 20-29 decreased by 4% in that period. The number of tertiary education graduates increased in all states except Norway and Finland (Figure 1).

The placement of students ISECD 5-6 (Figure 2) within the EU States varies – from 8.7% in Malta to 28.1% in Greece, in Slovakia 23.1% - but does not show any spatial autocorrelation (P value is 0.0985). This means that the numbers in one state are NOT dependent on numbers in surrounding states. On the contrary, students of ISECD 5-6 on the NUTS2 level are, in the European area, concentrated in concrete areas (prestigious universities). The highly significant (P value is 0.0001)

2 Now, the international classification of education ISCED 97 is valid (available in full text at http://www.uis.unesco.org/) which classifies educational programs according to levels: ISCED 0 – pre-school education, ISCED 1 – primary education, the first degree of basic education, ISCED 2 – lower middle education, basic education of second degree, ISCED 3 – upper secondary education, ISCED 4 – post-secondary education of a non-tertiary type, ISCED 5 – first degree of tertiary education (directly not leading to obtaining higher vocational classification), ISCED 6 – second degree of tertiary education (leading to obtaining higher vocational classification).

Moran coefficient (0.3340) verifies the positive space autocorrelation (Table 1).



Source: Own processing based on Eurostat data

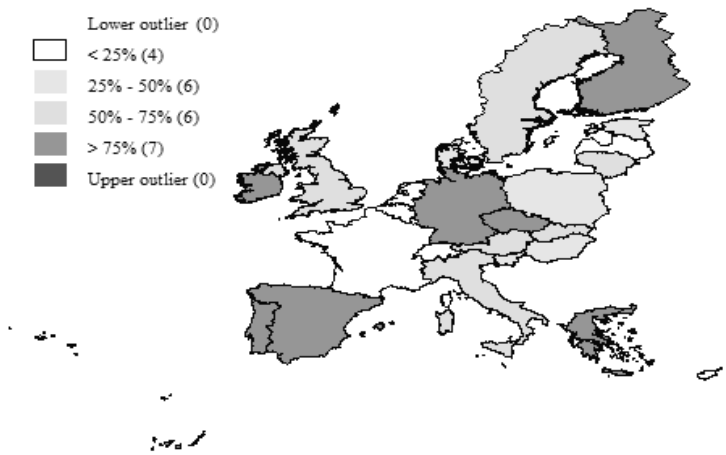
Figure 2. Percentage of students ISECD 5-6 from the total number of students at the level NUTS 2 in 2004

Table 1. Results of testing the spatial autocorrelation of the ratio of students ISECD from the total number of students.

Measure	Moran Coefficient	p-value	Mean value	Average	Standard deviation
On level of States	0.1746	0.0959	-0.0417	-0.0389	0.1681
On level of NUTS2	0.3340	0.0001	-0.0042	-0.0036	0.041

Source: Own processing based on Eurostat data

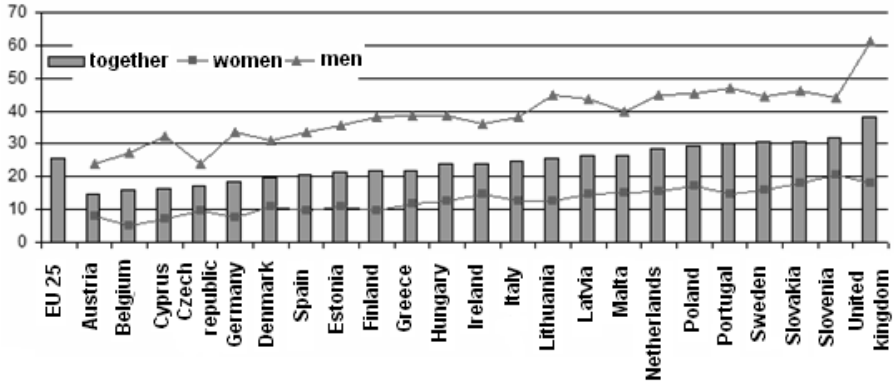
In 2000, the EU set a goal to increase the number of university graduates in technical specializations, mathematics, natural sciences and technologies by 20% in 10 years because the overall economic lagging of Europe could be eliminated in such way (Figure 3).



Source: Own processing based on Eurostat data

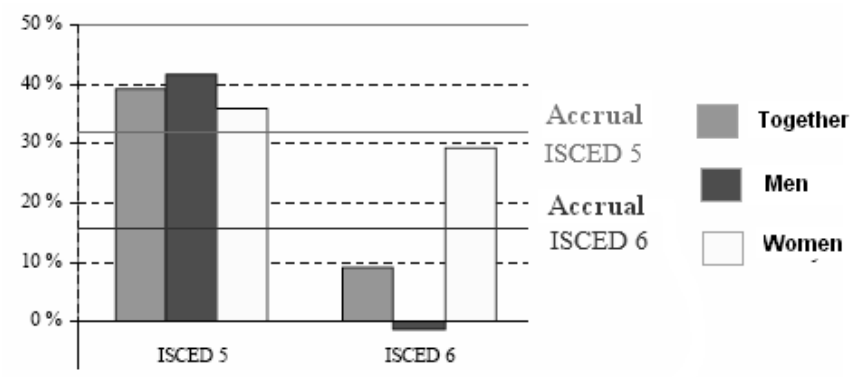
Figure 3. Percentage of university graduates in technical specializations, mathematics, natural sciences and technologies from the total number of graduate in 2004

The number of graduates of tertiary programmes of technical specializations, mathematics, sciences and technologies has more than doubled in 2004 compared to 1998 in following countries: the Czech Republic, Lithuania, Latvia, Malta, Poland and Slovakia (Figure 4, Figure 5, Figure 6). The proportion of university graduates in technical specializations, mathematics, natural sciences and technologies does not show spatial autocorrelation (Moran coefficient I is 0.1148; P value is 0.1687).



Source: Own processing based on Eurostat data

Figure 4. Percentage of university graduates in technical specializations, mathematics, natural sciences and technologies from the total number of graduate in 2004 – gender comparison.



Source: Andren (2005)

Figure 5. Percentage increase of university graduates in technical specializations, mathematics, natural sciences and technologies from the total number of graduate in 2004 compared to 1998.

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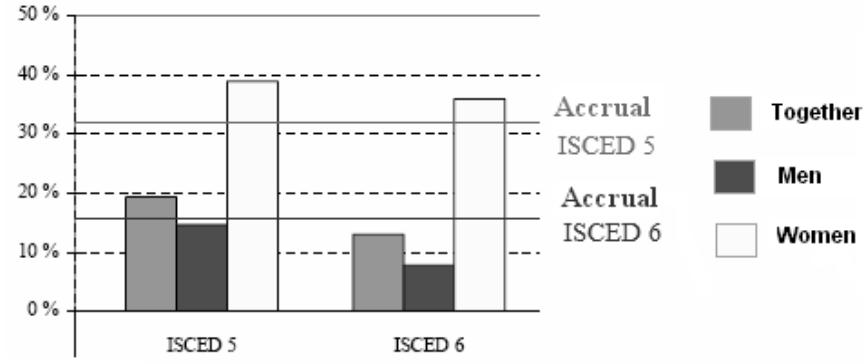
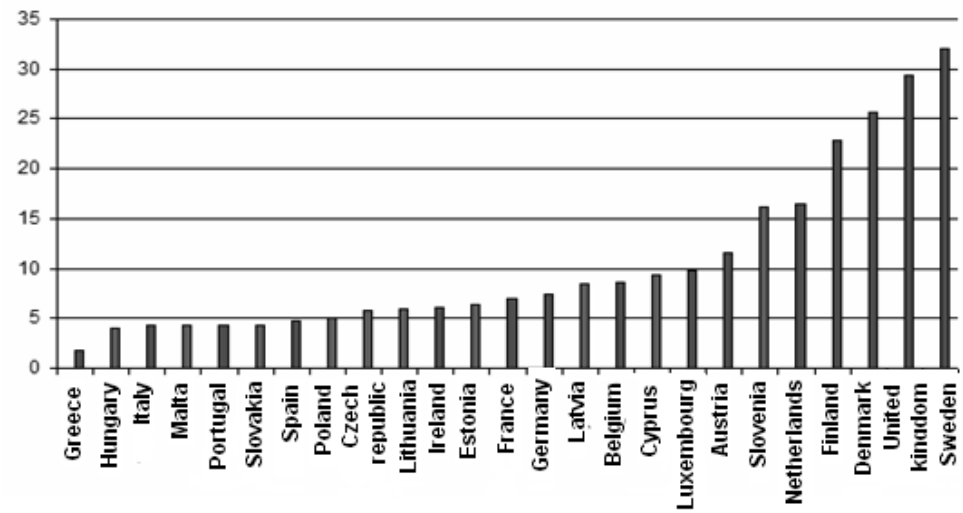


Source: Andren (2005)

Figure 6. Percentage increase of university graduates in technical specializations, mathematics, natural sciences and technologies from the total number of graduate in 2004 compared to 1998.

Life long learning is a crucial political factor with an outreaching impact on the labour market. The goal of the EU is to increase the participation of adults in such life long schemes to at least 12.5%. The actual participation of adults in lifelong learning in the New Member States is very low, around 5-6%. Good results show countries like Sweden, Denmark, the United Kingdom – countries with relatively low unemployment rate (Figure 7).

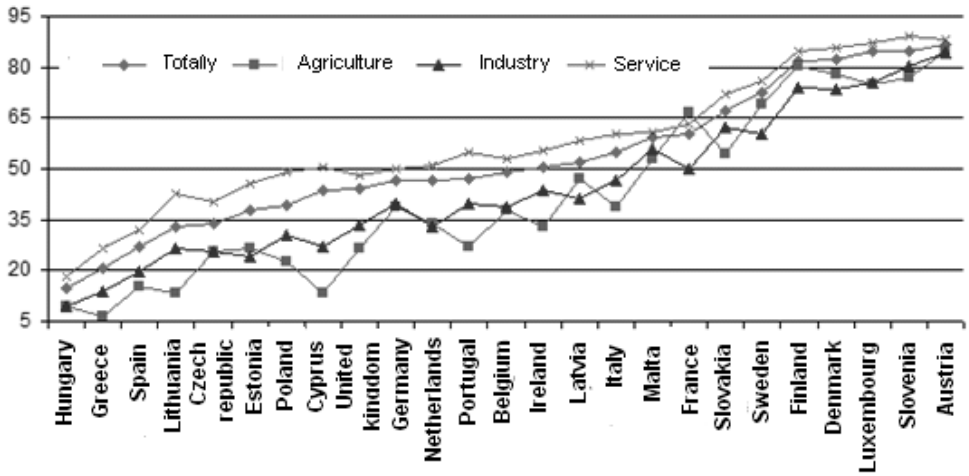


Source: Eurostat data

Figure 7. Percentage of adults participating on life long learning in 2004.

Statistical findings focus on three types of education. Formal education leads to granting officially recognized documents and gaining the qualification. Non-formal education is usually not accompanied with issuing of official certifications. Non-formal education can be carried out at the working place and within the activities of civic groups and NGOs that were created with the aim to supplement formal

educational facilities. Informal education is the natural part of every day life. In contrast to formal and non-formal forms of education, the informal does not have to be deliberate. Moreover, students are often not aware of it and do not (and do not have to) realize how this type of education contributes to their knowledge and skills. The percentage of population in all types of education in the EU Member States (Figure 8) does not show any space autocorrelation (Moran coefficient I is 0.0050, P value is 0.3970 at 9999 simulations).



Source: Eurostat data

Figure 8. Percentage of population from all types of education with respect to the sector of their employment.

Authors studying the relationship between human capital and economic growth simply identify human capital with school education (Gould & Rufčin, 1995, Gundlach, 1995 and Benhabib & Spiegel, 1994). After all, we can define human capital as one of the determinants of economic growth along with the land, labour, capital and technological advance (Mankiw, Romer & Weil, 1992 and Maudos, Pastor & Serrano, 1999). Lucas (1988) stresses the role of human capital as the engine of long term economic growth. Our authors, e.g. Čaplánová (1999), define the term human capital as sum of born and acquired abilities and knowledge which human beings operate with.

Investments into human capital can be transformed into the GDP formation. The decline, or the stagnation, of investments into education results in lower level of education which causes lower flexibility in the labour market. Lower flexibility in labour market causes lower employment which eventually results in GDP decrease. In his study, Hers (1998) offers an overview of various methodologies and outcomes of regression analyses aiming at explaining the relations between human capital and economic growth. Furthermore, Barro (1998) presents positive interdependency between the economic growth and the average duration of secondary school attendance. A good overview of studies focusing on relationship human capital – output is offered by Temple (2000).

It is relatively difficult to measure all partial elements of human capital, therefore individual authors work with selected measures of the human capital only. The measures of human capital used in their studies vary significantly among various authors. Mankiw, Romer & Weil (1992) work with the school attendance. The attendance of primary and secondary schools is advisable to use in the analyses of less developed countries or in horizontal studies of countries in a different state of development. The use of mentioned indicator of school attendance is not advisable, if due to the educational standards in a country or legislation in force the percentage draws to 100. Barro & Lee (2000) work with the duration of education and Romer (1994) uses literacy as the measure of human capital.

Table 2. Pearson coefficient of dependency of GDP, log GDP and percentage of population in all types of education in 2004.

Measure	HDP	log HDP	Percentage of population in all types of education as function of their employment sector			
			Total	Agriculture	Industry	Services
HDP (EU 15)	1.00000	0.97401	0.52241	0.45375	0.49144	0.50685
		< 0.0001	0.0457	0.0893	0.0628	0.0538
log HDP (EU 15)	0.97401	1.00000	0.56166	0.50801	0.52578	0.53879
	< 0.0001		0.0293	0.0532	0.0441	0.0382
HDP (EUN 10)	1.00000	0.99589	0.26545	0.14398	0.23027	0.21291
		< 0.0001	0.4585	0.6915	0.5222	0.5548
log HDP (EUN 10)	0.99589	1.00000	0.24767	0.14417	0.22462	0.18930
	< 0.0001		0.4902	0.6911	0.5327	0.6004
HDP (EU 25)	1.00000	0.95670	0.48692	0.44899	0.45110	0.44658
		< 0.0001	0.0136	0.0244	0.0236	0.0252
log HDP (EU 25)	0.95670	1.00000	0.46856	0.43948	0.43510	0.41799
	< 0.0001		0.0182	0.0279	0.0297	0.0376

Source: Own calculations from Eurostat data

Linear dependency of the total percentage of population in all types of education on the GDP (log GDP), is in all EU15 countries as well as EU25 statistically arguable at the confidence level of 0.05 (Table 2). In the New Member States, however, it is not statistically arguable. The arguability of percentage of population in all types of education as a function of their employment sector and GDP (log GDP) is within EU25 statistically arguable at the confidence level of 0.05.

A crucial economic and political issue of our present development in Slovakia is the convergence of our economy with other world developed economies. Such necessity has been declared in various governmental documents. The gap between Slovakia and other high-income economies can be only narrowed by a dynamic GDP growth. Whereas Slovakia has only limited natural resources and lacks physical capital, the human resources are the only potential source of comparative advantage.

Conclusion

The education should provide for better orientation of common people in the influx of information, their proper understanding, use and mainly their creation. It is very important to unfold more abilities, search for relevant information and learn to work with information and communication technologies. Therefore it is needed to further develop the interest in education, the ability for life-long learning and thus easily adapt to dynamically changing life conditions.

Learning has become the crucial factor for obtaining and forming the human capital. For a long time human capital used to be considered as a key factor of the unemployment reduction only. Today, it is known that human capital is connected with a number of advantages other than economic ones, including the health improvement. The appreciation of advantages of the education has led to an increase of the interest in participation in ever-expanding circle of educational activities for all age categories According to Figeľ (2006), there are many problems concerning education and schooling. The lack of financial resources is only one of them. They may not be the most important thing, yet they are important because by means of money priority and/or motivation can be easily expressed. Investments are needed, especially into infrastructure and modernization of various educational forms. The most serious problem of Europe of today as well as of individual countries is the lagging behind big competitors, mainly the USA, Japan and dynamically developing South Korea, China and India. The world has become more and more open; that is why if Europe constantly lags behind in

expenditures on education, then Europe also lags significantly behind in research. European schools, especially universities, that combine education and research, have long suffered from finance shortage. We can say that as far as the expenditures on education and research from public sources are concerned, the situation in the EU and in the USA is relatively comparable. Considerable differences are in the financing from private sources. The economy is mainly managed by private hands, so the connection should be present there. From conducted comparisons it is clear that in the USA or in Japan the expenditures on education are much higher than in most European countries.

In Figeľ´s words (2006) the EU suggests that the Member States should invest 2% of GDP into the modernization of universities and higher education if they wish to build a knowledge based society. Nowadays, the investments in the EU average around 1.15%. In the World Development Report form 2004 there we can read that in case of countries with high GDP per capita the investments in science and technologies are significantly higher than in countries with low GDP per capita. This fact verifies the interdependency of economic performance and investments into the technology and human capital development. At a higher GDP per capita it is considerably easier to allocate a higher portion of GDP into investments. Moreover, a country that invests in sectors promoting technological advance and innovations gains from such investments profits also generating its GDP.

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