

European Comparison of Intergenerational Differences in Private Returns to Education in the Context of Tertiary Education Expansion¹

Miroslav Štefánik^{2,3}

Institute of Economic Research, Slovak Academy of Sciences, Bratislava

European Comparison of Intergenerational Differences in Private Returns to Education in the Context of Tertiary Education Expansion. This paper provides an international comparison of private returns to education which is put into the context of recent increase in tertiary education accessibility. We compare post-socialistic Central European countries: Czech Republic, Poland and Slovakia to countries of continental Western Europe: Austria, Belgium, Germany, France and Luxembourg. Micro-data from the European Survey on Income and Living Conditions are utilised in order to estimate private returns to education using Mincerian earning regressions.

We have found out that while in West European countries the returns to tertiary education acquired after 1995 are higher than returns to tertiary education acquired before 1995, which is in line with expectations based on obsolescence of education, this is not true for the post-socialistic countries. The Central European, post-socialistic countries provide evidence on decline in private returns to education acquired after 1995. This could be related with the character of tertiary education expansion, which was more intensive in post-socialistic countries and rather continuous in the countries of continental Western Europe.

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JEL: *J31, J38, I28, I23, I24*

The strategy EUROPE 2020 declares a target of at least 40% of 30-34 year-olds completing third level of education. This is just a formulation of a broader trend, when all the developed countries are increasing their access to tertiary education (TE)⁴. This movement is most often supported by the necessity to increase the supply of educated and thus skilled workforce in order to satisfy the increasing demand for more complex and sophisticated labour. Consequently, the increase in TE accessibility, to which we will refer as to the expansion of TE, became observable internationally. Some countries entered this path earlier than others, some advanced faster than others, but practically all European countries have chosen the same path of increasing the

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² Address: Mgr. Miroslav Štefánik, PhD., Institute of Economic Research, Slovak Academy of Sciences, Šancova 56, 811 05 Bratislava, Slovak Republic. E-mail: miroslav.stefanik@savba.sk

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⁴ The term "tertiary education" refers to all types of educational programmes classified under the ISCED 97 as level 5 (first stage of tertiary education) and level 6 (second stage of tertiary education). For more information on the definition please visit: http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm (UNESCO, 1997)

accessibility of tertiary education. The very same path is also suggested by the European Commission from the supra-national level.

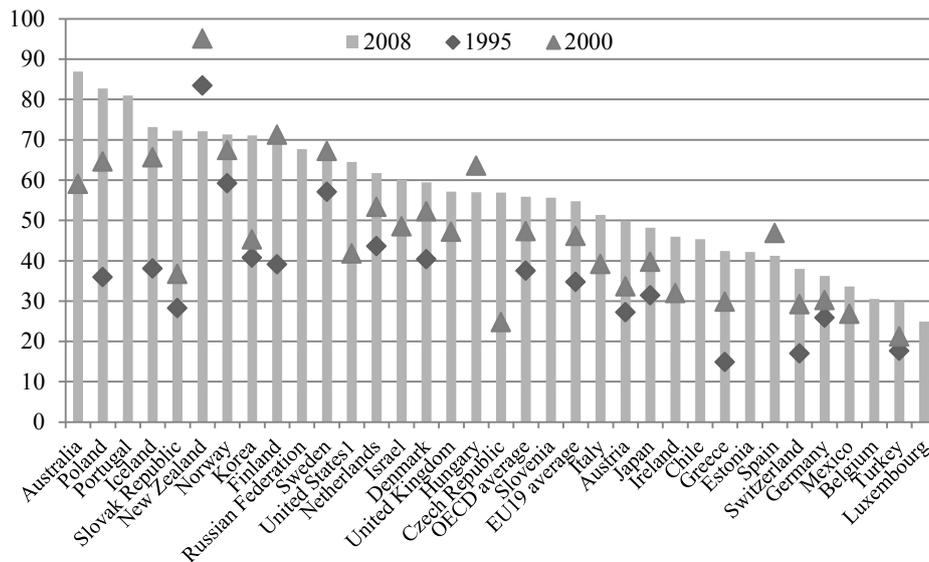
Despite a common path, the starting positions of various countries differ and therefore the adoption of a common path could have different consequences at national levels. This paper focuses on one of such consequences, which we believe, was not taken into account when designing the EU wide target of at least 40% of 30-34 year-olds completing third level of education.

The question is how has the TE expansion influenced the individual returns to education?

Tertiary education expansion

The motivation for this presentation stems from the sharpness of increase in tertiary education accessibility in Slovakia. This development can be observed when looking at the OECD Entry Rates Indicator (OECD 2010). The following figure shows the OECD countries ranked according to entry rates into tertiary education type A⁵.

Graph 1: Entry rates into tertiary-type A education (1995, 2000 and 2008)



Source: (OECD, 2010)

The OECD countries in the graph are sorted according to the figures for 2008. In this rank Slovakia was the fifth country with the highest entry rates

⁵ Second stage of tertiary education (ISCED 6).

among all OECD countries. In contrast, following the figures from 1995, in the graph represented by triangles, Slovakia presented the sixth country with the worst performance in this indicator. In 13 years Slovakia made a jump from being the sixth worst performing to the fifth best performing among the OECD countries⁶. Comparable development can be observed in Poland with figures even a little higher for 1995 as well as 2008. Czech Republic has witnessed a significant increase in the entry rates to tertiary education, but the overall figures are still around the OECD average. Hungary differs from the countries in the region with in contrary declining entry rates to tertiary education, their overall values being close to the OECD average. Besides from these, so called V4⁷ countries, comparably radical increase of tertiary education entry rates can be observed in Iceland, Finland and Portugal.

The starting point of this analysis is presented by the current reality of Central European post socialist countries, namely Czech Republic, Slovakia and Poland. These are countries with one of the highest increase in tertiary education accessibility in last 13 years. Moreover, central planning before 1989 held the accessibility of tertiary education down, because of ideological reasons. This has increased existing differences in tertiary education accessibility between generations.

All three countries have suffered a sharp decline of the number of new-born children during the Nineties because of the destabilising effect of the economic transition from a socialist, centrally planned economy. Those, extremely weak age cohorts born during the Nineties, have already started entering tertiary education⁸. As a result, the accessibility of tertiary education measured as the ratio of newly enrolling students to the reference age group grows because of two separate motions. Firstly by **the increase in absolute numbers of students** (enrolled students and graduates) and secondly by the **decrease of the reference age groups** typically entering tertiary education. The tertiary education expansion, as we will refer to it in this paper, can be defined by these two motions: increase in number of students in tertiary education and decrease in young age groups around the age of 20. The multiplication effect of the second motion is in case of post-socialist countries expected to be higher, because of the low fertility rates during the transition period.

In contrast to the experience of Central European post- socialistic countries we put the experience of continental western European countries, namely Austria, Belgium, Germany, France and Luxembourg. The level of accessibi-

⁶ Counted from those OECD countries which provided data on this indicator.

⁷ From the political cooperation framework of the group of "Visegrad Four" originally signed by Czech Republic, Hungary, Poland and Slovakia.

⁸ Individuals born at the beginning of the transition period in 1990 have reached the tertiary education entrance age of 19 in 2009.

lity of TE differs between these countries with the Entry Rates for Austria being about 50 in 2008 and Luxembourg only around 25. But what these countries have in common is the continuous pace of TE expansion. None of these countries has experienced such a dramatic increase in TE accessibility, which could be compared to Slovakia, Poland or even Czech Republic. Despite these differences, educational systems are to a big extent similar in the V4 countries Germany and Austria because of historical reasons. We have complemented Germany and Austria in the group of continental western countries in order to acquire more observations.⁹

Within this paper we are asking if and how did the TE expansion influenced the private returns to education?

TE expansion and the value of education

When looking for explanations of the value of education, theoretical concepts from the border of economic and sociologic theory are at hand. The oldest from these concepts relevant from our point of view is the **Walrasian classical economic theory principle**. Based on this, we can expect the increase in supply of a good to be leading to a decline in the price of the good. If we think of education as a good and of wage as the price of the good, we should be expecting the wage of workers with tertiary education to be declining relative to the average as a consequence of the TE expansion. This relative decline should be a reaction to the situation of increase in the supply of tertiary educated workers caused by the TE expansion.

Alternatively, **human capital theory** states that the amount of received education is directly linked with the productivity of a worker and thus by the wage of the worker (Becker 1964; Schulz 1974). Strongly formulated, the value of education should be independent of the supply-demand relations on the labour market and the value of achieved education is only related to its contribution to workers' productivity. Based on this assumption, the value of education does not change as a consequence of the TE expansion. Since the Seventies, empirical studies based on the human capital theory are trying to point on the relation of education and wage, or education and productivity. One of the most prominent studies from this stream is the attempt of Jacob Mincer to quantify the contribution of education to individual income, introducing the methodology later known as the private returns to education (Mincer 1973).

In opposition to the human capital theory, a stream of studies pointing at the **screening (filtering or signalling) function** of education emerged. These studies (Arrow 1973; Spence 1973) are arguing with the main assumption of

⁹ Austria also seems to be a little special in this group of countries with declining overall private returns to education, as was pointed out by (Fersterer – Winter-Ebmer 2003).

the relation between individuals' education and his working productivity. In contradiction they put the screening hypothesis stating, that the value of education comes from the additional information it is giving about individuals' skills, abilities, other personal characteristics or motivation. In a simplifying picture, education works as a filter sorting individuals according to their qualities. Increase in accessibility of education weakens the filter and decreases the value of education on the labour market. As a result, the value of tertiary education during and after a TE expansion should be decreasing. Several empirical studies are trying to look for evidence in support for the screening hypothesis (Layard – Psacharopoulos 1974; for a list of the studies see Heywood – Wei 2004).

The question on the relation of the supply of tertiary educated and private returns to tertiary education assumes there is a relation between education and earnings. There is no consensus on the existence of a causal relation between education and earnings within the literature. The main stream of doubts arises from the fact that there could be some unobserved additional factors influencing both, education as well as earnings (Checchi 2006: 163). Attempts trying to deal with this objection, when measuring this effect, have been made through decades. An example of such attempt is employing an instrumental variable to estimate the returns to education using a two-stage least-squares method. Estimating schooling based on an instrumental variable should deal with the effect of unobserved factors correlated with earnings as well as schooling of individuals. The problem of unobserved factors correlated with both earnings and schooling is referred as to the problem of endogeneity of education in an earnings regression equation¹⁰.

To answer our question, based on the theory we have the Walrasian classical economic principle together with the screening hypothesis expecting the value of education to be decreasing as a result of the TE expansion. In contradiction to this expectation, we have the concept of human capital expecting the value of education to remain uninfluenced by the TE expansion because education contributes to labour productivity per se.

Because we are going to compare the value of education between groups according to the year of graduation, our conceptual framework needs to be enhanced also by the dimension of obsolescence. Various empirical studies point at the effect of skills obsolescence in the countries of the continental Western Europe (Blechinger – Pfeiffer 2000; Allen – Van den Velden 2012). Based on this evidence, we expect the returns to education to have an upward slope in relation to year of graduation. Aside from the effect of TE expansion,

¹⁰ We will try to deal with this problem using an instrumental variable approach. See the section on methodology for more information.

the value of education finished earlier should be lower in comparison to the value of education acquired later.

Measuring the value of education

In attempt to measure the value of education, adoption of several assumptions and procedures from economic theory becomes useful. The main assumption is that the individual value of education can be measured from its contribution to variation in wages of individuals. This assumption tries not to deny the social value of education, or other than economic benefits an individual can gain from acquiring education; it simply operationalizes the value of education for the purpose of further analysis, with an unavoidable level of reduction.

Based on this assumption the method of measuring private returns to education introduced by Jacob Mincer can be adopted. The differences in private returns to education will be considered as the differences in individual value of education. According to Mincer, private returns to education are measured using a simple one equation regression model, with logarithm of wage as the dependent variable and individual's characteristics as explanatory - independent variables. One of the individual's characteristics included in the model is schooling, in our case operationalized as a dummy variable referring to the fact whether an individual has acquired tertiary education. The equation can be formalized as follows:

$$\ln W_i = \alpha + \beta_1 S_i + \beta_2 X_i + u_i$$

W_i - wage of an individual

α - constant

β_1 - coefficient of private returns to education

S_i - dummy referring to tertiary education attainment

X_i - set of variables referring to individual's characteristics or other control variables

β_2 - set of coefficients referring to individual's characteristics or other control variables

u_i - error

The β_1 coefficient presents the value of private returns to education counted according to the Mincerian methodology. Some studies interpret this coefficient as a percentage of change in income caused by one unit change in the schooling variable. In case of years of schooling, which was originally used by Mincer, it means the percentage change related to one additional year of schooling.¹¹ The following analysis is using a dummy variable referring to the

¹¹ The percentage interpretation is not completely precise because of the semi-logarithmic character of the equation, but the differences are low in case if years of schooling are used as the schooling variable, therefore it is often used to make the

fact whether the individual acquired tertiary education or not. In this case the coefficient can be interpreted as the difference in income between those who acquired tertiary education and those who did not acquire tertiary education. The analysis behind this article focuses particularly on the differences in this coefficient between sub-groups, defined according to when they acquired their highest level of education.

Based on the classic Mincerian approach we have complemented our schooling variable with the variable referring to potential work experience, which is a difference between the age of an individual and years of schooling. Potential experience is, in line with Mincer, complemented with its exponential function to grasp the decrease of earnings in higher age. Experience is complemented by all individual's characteristics:

- which were available in the used dataset
- had a statistically significant influence on the dependent variable.

The final list of variables referring to individual's characteristics is:

- Potential experience
- Potential experience squared
- Gender
- Size of the employer
- Country
- Number of hours usually worked per week
- Supervision
- Level of urbanisation
- Country

In order to deal with the objection of endogeneity of schooling in an earning regression equation¹², measurements using an instrumental variable approach were performed as well. The instrumental variable used in the analysis was constructed using the age when first full-time employment has begun. The estimates acquired by using the instrumental variable approach were estimated by performing the standard procedure of two-stage least-squares estimation. The results are reported for both, the ordinary least square estimates (OLS), as well as for the estimates based on the instrumental variable approach (IV).

The analysis is based on the comparison of returns to tertiary education of individuals finishing education before and after 1995. Coefficients were estimated separately on the population of post-socialistic Central European countries (V4 countries) with the exception of Hungary and on the population

interpretation more intuitive. In this article a dummy variable referring to tertiary education is used as the schooling variable, for this reason the following formula needs to be applied to count the exact percentage change of earnings caused by acquiring tertiary education: $\text{Change in \%} = (\exp(\text{coefficient of returns to education}) - 1) * 100$. Following results report the coefficients of returns to education.

¹² For more information on the problem of endogeneity of schooling in an earnings regression see: (Card 2001)

of continental Western European countries: Austria, Belgium, Germany, France and Luxemburg¹³.

The equation was estimated on micro data from the European Union Survey on Income and Living Conditions (EU-SILC). Data refer to the period from 2005 to 2009. Individual data were pooled into two groups; referring to the population of V4 countries^{14,15} and referring to the population of Continental Western Europe countries¹⁶ (CWE). All other remaining countries were left out from the analysis. Further division of the sample was done based on the fact if the individual finished the highest level of education before or after 1995.

Results of the analysis

Based on the human capital theory assumption of the value of education being independent from the supply – demand relations, the returns to tertiary education of individuals graduating after 1995 should not be significantly different from those of individuals graduating before 1995. If any difference is admissible, it is the one caused by the obsolescence of education, resulting into the value of tertiary education acquired before 1995 to be lower in comparison to the value of education acquired after 1995. When adopting the methodology of measuring private returns to education using a Mincerian earnings regression, estimated coefficients of returns to education could be used to test these assumptions. The table 1 brings the estimated values of regression coefficients related to the dummy variable referring to acquiring tertiary education. These coefficients could be interpreted as the contribution to income related to graduating in a tertiary education programme. In the following text, these coefficients will be referred as to the returns to tertiary education. The table brings also the standard errors (S.E.) related to the estimation, level of significance of the estimates (p.), the 95% confidence interval of the estimated value of the coefficient (95% confidence interval), number of individuals before weighting included in the estimation (N), the adjusted R-square statistics of the equation (r^2_a). We are not reporting the coefficients of the control variables included in the equation, as they are not necessary for the interpretation of the findings. The results are sorted for the post-socialistic Central European (V4) and continental Western Europe (CWE) countries. In

¹³ Germany and Austria were originally chosen because of the similarity of their educational systems to educational systems in the V4 countries. Germany and Austria were later complemented with France, Belgium and Luxemburg to acquire more observation. The Netherlands was omitted from this group because of data limitations. Measurements provide evidence to support the main findings also if the analysis is performed on the level of individual countries

¹⁴ Czech Republic, Poland and Slovakia.

¹⁵ Several studies, using comparable methodology are available for Czech republic and Slovakia, for example: (Chase 1997) (Filer et al. 1999) (Flabbi et al. 2008) (Lubyova – Sabiriankova 2001) (Lovasz – Pertold-Gebicka 2011) (Štefánik 2012) (Štefánik 2011) (Večerník 2009)

¹⁶ Austria, Belgium, Germany, France and Luxemburg.

each of these groups we report the coefficients for those who finished the highest level of education before and after 1995.

Table 1: **Results of the OLS estimates** (B.-coefficient of returns to tertiary education)

	V4		CWE	
	after 1995	before 1995	after 1995	before 1995
B.	0,542	0,536	0,477	0,326
S.E.	0,019	0,018	0,019	0,014
p.	0,000	0,000	0,000	0,000
95% confidence interval	0,578	0,570	0,514	0,353
N	8231	16796	10889	22395
R² adj.	0,367	0,3271	0,4145	0,4915

Source: EU-SILC UDB 2009 – version 2 of August 2011

Our findings listed in the table above do confirm the assumption of the human capital theory combined with the obsolescence hypothesis only in case of continental countries of Western Europe (CWE). The coefficients of tertiary education estimated in CWE countries were significantly higher for those graduating after 1995 than for those graduating before 1995 (0,477 vs. 0,326). The difference is underlined also by the fact that the 95% confidence intervals of those coefficients do not overlap, with 0,439 the lower bound of the “after 1995” estimate and 0,353 the higher bound of the “before 1995” estimate. The strength of the estimates is surprisingly high, with all the coefficients significant at the 0,001% significance level and the adjusted R-square above 0,4.

A different picture is drawn for the post-socialistic Central European countries (V4) with the coefficients of returns to tertiary education not differing in relation to the time of graduation. The value of education acquired before 1995 was in 2009 nearly the same as the value of education acquired after 1995 regardless of the effect of obsolescence. This is after controlling for working experience, as well as other control variables included into the equation.

The values of particular coefficients can be compared internationally also in absolute terms. This means, for example, that graduating from tertiary education contributes to individuals’ income has a stronger impact in one of the V4 countries, than in one of the CWE countries¹⁷. Education finished before 1995 in a V4 country contributes to the income on average more than education finished after 1995 in a CWE country (0,536 vs. 0,477).

¹⁷ This finding is biased by above average values of returns to tertiary education in Poland, Czech and Slovak values are actually not much higher from German or Austrian values.

The figures presented in Table 1 were based on the simpler type of estimations, using the ordinary least square method (OLS). Because some authors¹⁸ point on the inconsistency of such estimates due to the problem of endogeneity of education, we report also the estimates based on a two-stage least square estimates using an instrumental variable estimated on the age when entering first full time job. The coefficients estimated using the instrumental variable approach are displayed in table 2 in the same sorting as in table 1.

Table 2: **Results of the IV estimates** (B.-coefficient of returns to tertiary education)

	V4		CWE	
	after 1995	before 1995	after 1995	before 1995
B.	0,516	0,638	0,495	0,394
S.E.	0,047	0,041	0,050	0,063
p.	0,000	0,000	0,000	0,000
95% confidence interval	0,608	0,719	0,593	0,518
N	8176	16759	10813	22365
R² adj.	0,3658	0,3244	0,408	0,49

Source: EU-SILC UDB 2009 – version 2 of August 2011

The IV estimates more or less confirm the obsolescence hypothesis to be valid in case of continental Western European countries, as the returns to tertiary education are higher for those finishing after 1995 only in the CWE countries (0,495 vs. 0,394). Nevertheless the difference is smaller in case of IV estimates with the 95% confidence intervals overlapping. The V4 countries show a contradictory pattern, with the value of education higher for those finishing before 1995 (0,638 vs. 0,516). This finding could speak for the decline in the value of tertiary education acquired after 1995 in countries with sharper increase in tertiary education accessibility.

The estimates are significant at the 0,001% significant level and the standard errors are, as expected, a little larger on average in comparison to OLS estimates.

The absolute figures of returns to tertiary education are, again, higher for V4 countries than for the CWE countries. The relatively higher value of newer education in CWE countries was confirmed using both estimation methods. V4 countries do not show any difference in value of education in relation to its “age” in case of OLS estimates. When looking at the IV estimates, we can observe even an opposite pattern with “older” education being more valuable at the labour markets of V4 countries.

¹⁸ For example: (Card 2001) (Card 1999) (Checchi 2006)

The pattern in the relative value of education acquired before and after 1995 differs between post-socialistic Central European countries and the countries of continental Western Europe. This difference may be caused by the differences in the character of the TE expansion in these two groups of countries.

Sensitivity analysis:

Complete results of the analysis can be found in the annex, together with the results estimated on male and female population separately and on national level for each of the countries.

If we look at our research question from the perspective of gender, we can find out that the returns to tertiary education of women in V4 countries, estimated by the OLS method are much higher than the overall returns to tertiary education in V4 countries, or as the returns to tertiary education of men in V4 countries. While the obsolescence hypothesis was confirmed for the male population of V4 countries in 2009, it was not confirmed for the female population. The IV estimates have confirmed this finding for V4 countries. Observed difference in patterns of relative value of education between V4 and CWE countries is caused mostly by female population of V4 countries. This may be caused by the differences in TE attainment between males and females, which have increased during the TE expansion in V4 countries. Another possible explanation could point at the different structure of TE attained by males and females in terms of field of education. Nevertheless a more focused analysis on this topic would be necessary in order to support such explanations.

The very same analysis performed on the national level confirmed the relatively lower returns to tertiary education acquired after 1995 for individuals in all V4, with Czech Republic showing only a negligible difference in case of OLS estimates. The IV estimates revealed much higher difference between returns to tertiary education acquired before and after 1995, confirming the pattern of lower returns for those who graduated after 1995.

This V4 pattern was partially¹⁹ observable also in Austria and Luxembourg. Germany and Belgium bring lower returns to tertiary education of those graduating before 1995, what speaks clearly in favour of the obsolescence of education hypothesis.

Temporary perspective:

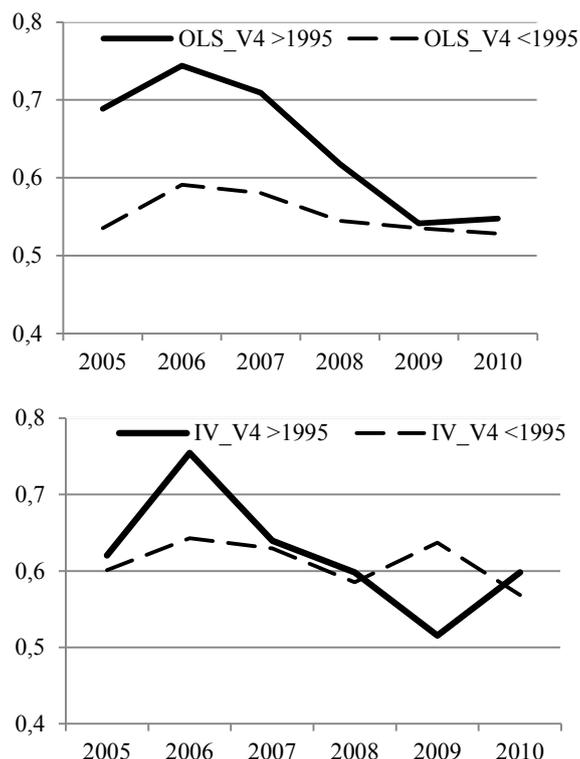
When looking at the development in returns to tertiary education acquired before and after 1995 during the whole period of EU-SILC, we can observe a

¹⁹ In case of IV estimates.

clearly decreasing trend in the value of tertiary education acquired after 1995 in the V4 countries.

In the post-socialistic Central European countries a declining trend in the value of “younger” education can be observed. The value of “older” education, finished before 1995, in the V4 countries remains stable during the reference period.

Graph 2: Coefficients of returns to tertiary education in V4 countries

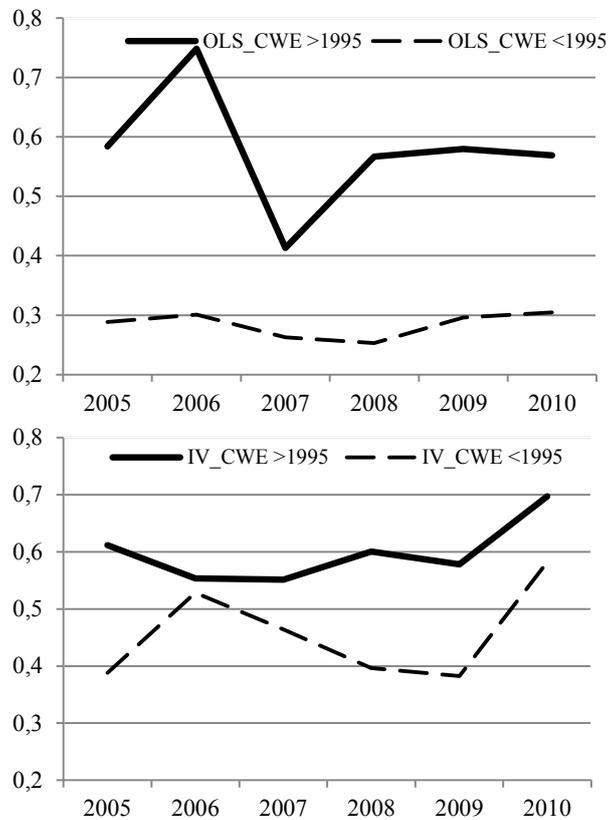


Source: EU-SILC UDB 2005-2009, version 2 of August 2011

The same result was confirmed by the OLS as well as the IV method, with the value of tertiary education acquired after 1995 showing clearly declining trend in contrast to a stable value of tertiary education acquired before 1995.

On the other hand in case of CWE countries there is no clear trend observable, during the reference period, for neither “younger” nor “older” tertiary education.

Graph 3: Coefficients of returns to tertiary education in CWE countries



Source: EU-SILC UDB 2005-2009, version 2 of August 2011

Concluding remarks and discussion

This article draws questions in the light of the EUROPE 2020 target of at least 40% of 30-34 year-olds completing third level of education in 2020. This target was formulated at the pan-European level, implying all the member states should increase the accessibility of tertiary education in order to achieve the target. To justify such policy, questions about relevant national specifics arise. In this context relevant questions are, how this will affect the value of tertiary education from the perspective of individuals and how would this effect differ between the EU countries? To answer these questions we are looking for effects of previous tertiary education expansions and compare these internationally. The comparison utilizes the contrast between Central-European post-socialistic countries (V4) with intensive TE expansion and countries of

continental Western Europe (CWE) with less intensive and continuous TE expansion.

To measure the value of education, the Mincerian methodology of private returns to education based on an earnings regression is used. The coefficients were estimated for those individuals who finished their education before and after 1995, using an ordinary least square estimator, as well as the instrumental variable approach with the two-stage least-square estimator.

In the countries of Western Europe we have observed the value of education acquired before 1995 to be contributing to individual income in a smaller extent, than the value of education acquired after 1995. This is in line with the expected obsolescence of education. There is no clear support for the obsolescence hypothesis in the V4 countries. On the contrary, there is some evidence, mainly from the IV estimates, that the value of education acquired after 1995 was in 2009 lower, than the value of “older” education acquired before 1995. This twist in the relative value of “younger” versus “older” education in V4 countries seems to be a result of a longer trend when the value of education acquired after 1995 was declining during almost the whole observed period from 2006 to 2009. On the other hand a stagnating trend of the value of education acquired after 1995 can be observed for the V4 countries. Stagnating or no clear trend is observable either for education acquired before, nor after 1995, with the value of “younger” education remaining above the value of “older” education, in the CWE countries for almost the whole observed period.

The main conclusion of this article is that at the country level there are differences in the relative value of education acquired before and after 1995. Different pattern in the relative value of “older” versus “younger” education observable in V4 and CWE countries could be a result of the differences in the TE expansion. Because the expansion in V4 countries was more intensive than in the CWE countries, a more general conclusion out of this could be that if TE becomes too intensive the value of newly acquired TE consequently starts to fall down. Unfortunately the evidence presented in this article is not sufficient to support this conclusion. Further research would be needed to put such generalising conclusion on a more solid ground. Nevertheless, the evidence provided in this paper should be strong enough to attract attention to international differences in the value of education.

Dominant stream of argumentation behind the unified EU policy of increasing access to tertiary education stems from the necessity to satisfy the increasing demand for more complex and thus more educated labour force. Internationally differing patterns in relative value of older versus younger education could also be a consequence of differences in demand for labour. Concepts pointing at international division of labour, skill biased organisational

change or on the effect of international trade, could be used to understand international differences in the character of demand for labour. Despite its geographical proximity V4 and CWE countries could be much more distant in the supply chain and trade relations.

From an even more theoretical perspective, each policy aiming to increase the access to tertiary education is rooted rather in the human capital theory than in the alternative concepts such as the screening hypothesis. Conclusions of this article speak in favour of the human capital theory only in case of the continental western European countries, but not in case of the V4 countries.

Miroslav Štefánik graduated with a Magister in Philosophy and Sociology at the Faculty of Philosophy of the Comenius University in Bratislava, and later with a PhD. in Forecasting/Economic Theory at the Faculty of National Economy of the University of Economics in Bratislava. He further improved his skills in quantitative methods during a research stay at the University of Essex and while working at the Statistical Office of the Slovak Republic. Currently he is based at the Institute of Economic Research of the Slovak Academy of Sciences (Department of Economic Modelling and Analyses) where he is focussing on topics such as returns to education; skill needs and labour market policy.

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Used data

EU-SILC UDB 2005-2010, version 2 of August 2011

Annex

Annex 1: Complete results of estimations 2009 EU-SILC data (table 1 and 2 in the text)

Variable		V4				CWE			
		OLS		IV		OLS		IV	
		after 1995	before 1995						
tertiary	B.	0,542	0,536	0,516	0,638	0,4765	0,3257	0,4949	0,3939
	S.E.	0,019	0,018	0,047	0,041	0,0189	0,0138	0,0499	0,0631
	p.	0,000	0,000	0,000	0,000	0	0	0	0
experience	B.	0,071	0,025	0,071	0,025	0,0913	0,0264	0,0882	0,0267
	S.E.	0,004	0,004	0,004	0,004	0,0037	0,0043	0,0037	0,0045
	p.	0,000	0,000	0,000	0,000	0	0	0	0
experience2	B.	-	-0,001	-0,002	-0,001	-0,0021	-0,0004	-0,002	-0,0004
		0,002							
	S.E.	0,000	0,000	0,000	0,000	0,0001	0,0001	0,0001	0,0001
male	p.	0,000	0,000	0,000	0,000	0	0	0	0
	B.	0,189	0,201	0,185	0,202	0,0917	0,1704	0,0998	0,1755
	S.E.	0,018	0,011	0,019	0,011	0,0206	0,0129	0,0213	0,0135
dumurban2	p.	0,000	0,000	0,000	0,000	0	0	0	0
	B.	-	-0,065	-0,132	-0,058	-0,0276	-0,0479	-0,0261	-0,0437
		0,127							
dumurban3	S.E.	0,022	0,014	0,022	0,014	0,0213	0,0128	0,0223	0,0132
	p.	0,000	0,000	0,000	0,000	0,1954	0,0002	0,2421	0,0009
	B.	-	-0,120	-0,154	-0,111	-0,1421	-0,1355	-0,1431	-0,1308
hours		0,148							
	S.E.	0,019	0,012	0,019	0,013	0,0278	0,0157	0,0291	0,0162
	p.	0,000	0,000	0,000	0,000	0	0	0	0
supervision	B.	0,004	0,005	0,004	0,005	0,0078	0,0088	0,0076	0,0088
	S.E.	0,000	0,000	0,000	0,000	0,0004	0,0002	0,0004	0,0002
	p.	0,000	0,000	0,000	0,000	0	0	0	0
emplsize	B.	0,270	0,243	0,278	0,218	0,1762	0,2054	0,1719	0,1949
	S.E.	0,023	0,015	0,027	0,018	0,0185	0,0113	0,0216	0,0144
	p.	0,000	0,000	0,000	0,000	0	0	0	0
_cons	B.	0,004	0,006	0,004	0,006	0,0062	0,0087	0,0062	0,0086
	S.E.	0,001	0,000	0,001	0,000	0,0005	0,0003	0,0005	0,0003
	p.	0,000	0,000	0,000	0,000	0	0	0	0
r2 a	B.	7,356	7,527	7,380	7,486	8,1684	8,414	8,215	8,402
	S.E.	0,067	0,065	0,077	0,067	0,0643	0,064	0,0649	0,069
	p.	0,000	0,000	0,000	0,000	0	0	0	0
N		8231	16796	8176	16759	10889	22395	10813	22365
		0,366	0,3271	0,3658	0,3244	0,4145	0,4915	0,408	0,49

coefficients of country dummies not reported

Source: EU-SILC UDB 2009 – version 2 of August 2011

Annex 2: OLS results of the estimations of returns to tertiary education on male and female population separately

		OLS							
		male		female		male		female	
		V4		V4		CWE		CWE	
		after 1995	before 1995						
tertiary	B.	0,5123	0,4376	0,5632	0,6447	0,5434	0,3400	0,4045	0,3080
	S.E.	0,0276	0,0256	0,0255	0,0249	0,0238	0,0160	0,0308	0,0224
	p.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
N		4374	8804	3857	7992	5811	11571	5078	10824
r2_a		0,3791	0,2931	0,3398	0,31	0,4386	0,2957	0,3731	0,496

Source: EU-SILC UDB 2009 – version 2 of August 2011

Annex 3: IV results of the estimations of returns to tertiary education on male and female population separately

		IV							
		male		female		male		female	
		V4		V4		CWE		CWE	
		after 1995	before 1995						
tertiary	B.	0,5685	0,5408	0,4265	0,7372	0,4512	0,4651	0,5512	0,3173
	S.E.	0,0652	0,0499	0,0691	0,0683	0,0665	0,0741	0,0786	0,1077
	p.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0032
N		4343	8780	3833	7979	5766	11553	5047	10812
r2_a		0,3783	0,2905	0,3317	0,308	0,4286	0,2891	0,3619	0,4951

Source: EU-SILC UDB 2009 – version 2 of August 2011

Annex 4: Returns to tertiary education estimated on the country level

		ols after 1995		ols before 1995		iv after 1995		iv before 1995	
CZ	B.	0,437	0,441	0,452	0,726				
	S.E.	0,044	0,025	0,083	0,055				
	p.	0,000	0,000	0,000	0,000				
PL	B.	0,620	0,796	0,436	0,827				
	S.E.	0,033	0,039	0,095	0,123				
	p.	0,000	0,000	0,000	0,000				
SK	B.	0,273	0,361	0,133	0,486				
	S.E.	0,037	0,027	0,093	0,040				
	p.	0,000	0,000	0,152	0,000				
AT	B.	0,364	0,541	0,261	0,519				
	S.E.	0,089	0,044	0,216	0,140				
	p.	0,000	0,000	0,227	0,000				
BE	B.	0,432	0,343	0,548	0,217				
	S.E.	0,041	0,025	0,114	0,126				
	p.	0,000	0,000	0,000	0,085				
DE	B.	0,442	0,213	0,614	0,175				
	S.E.	0,050	0,033	0,103	0,158				
	p.	0,000	0,000	0,000	0,268				
LU	B.	0,639	0,629	0,760	0,906				
	S.E.	0,074	0,062	0,157	0,132				
	p.	0,000	0,000	0,000	0,000				

Source: EU-SILC UDB 2009 – version 2 of August 2011