GROWTH & LABOR FORCE EDUCATIONAL STRUCTURE: PANEL DATA SET FOR SELECTED EU COUNTRIES

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Introduction

Human capital and education are considered as important determinants of long run growth. There have been several empirical studies which conclude significant positive impact of education on growth (Barro – Lee, 2000). At the same time there are authors concluding there is no such demonstrable relation (Soderbom, 2001). This paper aims to test the relationship between economic growth and labor force educational structure. It tries to answer the question whether changes in labor force educational structure influence GDP and if so how and in which direction. Does higher percentage share labor force with tertiary education raise the GDP?

Intuitively we believe there might be positive impact of labor force with tertiary education on growth or in other words one might assume the more workers with tertiary education the higher GDP per capita. The relationship is being tested on panel data set of 21 European countries within 1996-2006 empirical model based on random effects panel data regression is introduced.

Methodology & data characteristics

Data were acquired from International labor organization database ILO (KILM 5th edition, available at www.ilo.org). The panel data set covers 21 European countries within 1996-2006. The panel can be divided basically on two parts: developed west European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Spain, Sweden, United Kingdom) and post-soviet east countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia).

Growth is measured as total GDP per capita GDPpc (in USD constant prices 1990). Labor force is defined as population economically active aged over 15. The level of education is measured by ISCED 76 and ISCED 97 methodology which consider basically three levels of education: primary education (primary), secondary education (secondary), tertiary education (tertiary). The regression model concerns following variables:

- \( l_{\text{GDPpc}} \): log GDP per capita as a dependent variable
- \( l_{\text{GDPpc} - 1} \): Lagged values of dependent variable, in order to take the autoregressive component of the time series into account (doing so improves Durbin Watson coefficient)
- \( l_{\text{PRIMprc}} \): log of percentage of labor force with primary level of education
- \( l_{\text{SECprc}} \): log of percentage of labor force with secondary level of education
- \( l_{\text{TERTprc}} \): log of percentage of labor force with tertiary level of education

When testing panel data set one usually decides between fixed and random effects. If the panel data set can be considered as a random selection of units, which is our case, random effects can be applied. The Breusch Pagan and Hausman test statistic are usually applied to

1 This creates panel dat se 21 x 11 with some values missing, altogether it enables 175 observations.
Empirical results

First, interesting result comes from labor force educational structure comparison of eastern and western countries (Figure 1). Eastern countries data declare that in average there is 20/60/20 (primary/secondary/tertiary; in %) educational structure distribution. For e.g. Czech Republic has in average 10/80/10. Whilst western countries declare different labor force educational structure: 30/45/25. In average labor force of western countries dispose of more tertiary educated persons but at the same time there are more persons with only primary education as well. Eastern countries in average dispose of more persons with secondary education. This finding evokes hypotheses that tertiary educated workforce increase economic growth; this hypotheses has not been proved by this paper.

Figure 1 - Average of distribution of labor force educational structure within 1996-2006 (in %)

Source: ILO, own calculations

Second, the main results of regression analyses are summarized in Table 1. These results indicate only week relationship between educational structure and GDP per capita. Slight
negative relation has been found between percentage of labor force with only primary education and GDP per capita. This means that increase in percentage share of labor force with primary education invokes decrease in GDP per capita.

The results can be summarized in following log-log model:

$$\log GDP_{pc} = 0.25 - 0.018 \log PRIM_{prc} - 0.001 \log SEC_{prc} + 0.005 \log TERT_{prc} + 0.98 \log GDP_{pc}(-1)$$

If the percentage increase of labor force with primary education is increased by 1% it invokes decrease in GDP per capita by 0.018%.

For better interpretation use the following example:

In the Czech Republic there was 7.2% of labor force with primary education and GDP per capita 23610 USD in 2006. If the percentage share of labor force with primary education was increased in about 1% i.e. it would grow on 7.27% (7.2*1.01) it would result in GDP per capita decrease on 23185 USD.

**Table 1 – Estimates of GDP per capita models**

(21 cross section units, time-series length 11, 175 observations)

<table>
<thead>
<tr>
<th>Dependent variable: $l_{GDP_{pc}}$</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Const</td>
<td>0.257468</td>
<td>0.126283</td>
<td>0.04302 **</td>
</tr>
<tr>
<td>$l_{PRIM_{prc}}$</td>
<td>-0.0186795</td>
<td>0.00987493</td>
<td>0.06024 *</td>
</tr>
<tr>
<td>$l_{SEC_{prc}}$</td>
<td>-0.00186257</td>
<td>0.0173331</td>
<td>0.91455</td>
</tr>
<tr>
<td>$l_{TERT_{prc}}$</td>
<td>0.0057554</td>
<td>0.00872275</td>
<td>0.51027</td>
</tr>
<tr>
<td>$l_{GDP_{pc}(-1)}$</td>
<td>0.982172</td>
<td>0.00529733</td>
<td>&lt;0.00001 ***</td>
</tr>
</tbody>
</table>

Note: *** indicates significance at 1% level, * indicates significance at 10% level

Breusch-Pagan test = 2.59814 (p-value = 0.106989)
Hausman test = 6.26047 (p-value = 0.180522)

Source: own calculations

Relatively long time-series enables running tests with lagged values of independent variables as well. However, including lagged values of independent variables haven’t explored any further relations. Omitting the lagged value of dependent variable brought statistically significant estimates also by secondary and tertiary educational level (in the same direction as presented in Table 1) but in this case Durbin Watson coefficient is around 0.5 (strong positive autocorrelation) and results are not relevant.

**Conclusions**

The aim of this paper was to examine the relation between growth and labor force educational structure. This relation has been tested on panel of 21 European countries within years 1996-2006. However, presented empirical model does not confirm significant binding between educational structure and growth. The results indicate only week negative impact of increasing percentage share of labor force with primary education on growth. This can be interpreted as follows: increase of percentage share of labor force with primary education invokes decrease of GDP per capita, respectively 1% increase in percentage share of workforce with primary education decrease the GDP per capita in about 0.018%.

In the end we can respond the two answers from the introduction. First, regression results indicate there is a week relation between workforce structure and economic growth. Second, the transcendental assumption that higher percentage share of tertiary educated workers positively support the total output growth has not been proved on presented panel data.
We can sum up that the presented results brought us one suggestion to EU representatives: *Try to decrease the percentage share of people with only primary education. However, presented results do not support governmental decisions to significantly increase the percentage share of labor force with tertiary education.* This conclusion might be further tested on wider and longer panel data sets.

It is worth to note that performed regressions might be extended in subsequent research papers. The model should consider also other variables as physical capital stock, unemployment rates and other variables which will be used as instrumental variables in order to get clear unbiased estimators.

References

Title: Growth & educational structure of labor force: panel data set for selected EU countries

Název: Růst a vzdělanostní struktura pracovní síly: panel dat vybraných zemí EU

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Abstract: This paper aims to test the relationship between economic growth and labor force educational structure. It tries to answer basically two questions: "Does educational structure of labor force influence economic growth?" "Can higher percentage share of tertiary educated workforce contribute to GDP growth?" Results of multiple regression analyses on panel data set covering 21 European countries within 1996-2006 are presented.


Key words: education, labor force in EU, human capital, growth, panel data

Klíčová slova: vzdělání, pracovní síla v EU, lidský kapitál, růst, panelová data

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