CITIES AND HUMAN CAPITAL

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ABSTRACT

Endogenous theories of economic growth acknowledge human capital as a factor of growth. Recently, the attention is focused on the role of cities in economy because of their ability to concentrate economic actors in close proximity. Cities generate and attract high qualified people, who are interesting for high-tech firms and firms which offer knowledge-intensive services. High education, skills and knowledge of workers are highly valued on labour market. Therefore cities play an important role in economy, because they represent places with tremendous potential for generating growth. This article focuses on analysing the human capital and its economic meaning in Slovak cities.

KEYWORDS: *cities, human capital, economic growth*

INTRODUCTION

Economists started to pay more attention to the issue of human capital in economy in the second half of the 20th century. Among the pioneers who explored the relationship between education and income levels, are mostly quoted American economists Jacob Mincer and Gary S. Becker. The main impact of their works was the finding of a positive relationship between the educational level of a worker and the amount of his salary. A major achievement in this area has made Paul Romer (ROMER, P., 1986), who included it in a neoclassical model of economic growth knowledge as an input factor. Specifically, in his long-term growth model the use of knowledge as an input to production, that generated increasing marginal productivity, ensured long duration growth. Robert Lucas followed up on his work. In his research (LUCAS, R., 1987) he dealt with the compliance of the neoclassical growth theory, international trade, and some of the main features of economic development. He developed three models of growth based on the use of real macroeconomic data. The first model dealt with the accumulation of physical capital and technological change, the second with the accumulation of human capital through education and third with the accumulation of specialized human capital through skills and education at work. The main result rested in the finding that countries which have invested resources to support education, respectively in research and development, achieved in the long term period significantly higher economic growth than other countries. Therefore, according to the author, the accumulation of human capital has a significant impact on economic growth. In addition, another important finding was a demonstration of the importance of cities in this matter. Also N. Gregory Mankiw, David Romer and David N. Weil (MANKIW, N. G., ROMER, D., WEIL, D. N., 1992) in their empirical research looked on the matter of human capital in economic growth. They incorporated investing in human capital to the Solow model. Their results indicate that the Solow model is consistent with the international evidence if one acknowledges the importance of human capital as well as physical capital. Last but not least important conclusions are drawn from the empirical research of Robert J. Barro (BARRO, R. J., 1999). Also from his macroeconomic analysis came out a result that has confirmed close relationship between economic growth and the impact of human capital. Based on analysis of more than one hundred countries, which monitored indicators were examined from 1960 to 1995, he found a strong positive correlation between the growth of the indicator of gross domestic product (GDP) per capita and the average number of years of schooling in the second and third level of education. From the elaborated analysis was clear, that countries

where schooling at higher levels of study was "longer", achieved higher GDP per capita than countries where school attendance was "shorter".

1 CITIES AND HUMAN CAPITAL

Cities play a fundamental role in the economy because on the relatively small area, they concentrate many economic actors who carry out even more economic activities among themselves. Cities are attractive to companies because they provide agglomeration economies in various forms, such as a large supply of labour, a large selection of specialized suppliers, or the ability to watch and discuss ideas from competitors and many other benefits. Theoretic background for agglomeration economies, as a reason of the existence of cities in economy, was elaborated primary by Alfred Marshall (MARSHALL, A., 1920) and Jane Jacobs (JACOBS, J., 1969). In relation to human capital, cities can both generate highly educated people, because they contain educational institutions such as colleges, universities and various other educational organizations, and on the other hand they also allow raise ideas, skills and knowledge between the different actors who are located inside them. According to Enrico Moretti (MORETTI, E.., 2003) the importance of higher education and a greater amount of knowledge that cities offer have a positive impact not only for individuals, who can raise their classification and also their position in the labour market, but also for society represented by all residents. They all can learn from each other and share and take over their findings and ideas. Through this process they all can improve their skills and abilities and in the end, also ameliorate their positions in the labour market. Additional amenities that cities with highly educated population offer include lower crime, better environment in the form of a large number of parks or even greater control of elected representatives.

In the last two decades many economists, geographers, sociologists and other academics dealt with the issue of cities, their relations to human capital and tried to construct models of their growth. In economic terms, among the most important certainly include James E. Rauch, Edward L. Glaeser, Jonathan Eaton, Zvi Eckstein, Jesse M. Shapiro or Michael Storper. First mentioned economist focused in his model on the concentration of human capital in cities and its meaning to productivity growth. In his research (RAUSCH, J. E., 1993) tested whether the cities with higher average levels of human capital provide higher wages. He found that in cities is higher productivity due to the stock of human capital represented by the average length of education. The research further showed that by increasing the average length of education for

an individual for one year can increase his productivity by 2.8 percent. Edward L. Glaeser et al. aimed attention on the link between urban characteristics and urban growth. The main findings of their work (GLAESER, E. L. et. Al., 1995) rest in fact that income growth and population growth are closely linked. They also found that both growths have a positive relationship with education, a negative relation to unemployment and also a negative relation to the share of employment in the manufacturing sector. Similarly, Jonathan Eaton and Zvi Eckstein (EATON, J., ECKSTEIN, Z., 1997) analysed the relationship of urban population growth and human capital accumulation. According to their model, cities with larger populations will in the future, despite of the possibilities of free migration, achieve a higher stock of human capital, higher wages and higher real estate prices. They conducted the research on the 20 largest cities in France and Japan. Jesse M. Shapiro (SHAPIRO, J. M., 2003) monitored the relationship between the growth of university educated population and employment growth in cities. His analysis showed that urban growth was generated from two-thirds by the growth of human capital and one-third by increase in citizens' quality of life. Used indicators were wages and property prices. The major contribution of his work rested in the finding, that the element of human capital in the growth of a city does not manifest only through knowledge spillovers, as many authors have argued (based on the works of Alfred Marshall and Jane Jacobs), but significantly manifest by improving the quality of life, represented by higher prices in real estate. The agglomeration effects and supply of educated and urban populations were analysed in a research paper, elaborated by Edward L. Glaeser and Matthew G. Ressenger (GLAESER, E. L., RESSENGER, G. M., 2010). In their article they state that agglomeration effects are more obvious in cities with a larger pool of human capital, as in cities with fewer educated people. And last but not least, an important element in the relationship between urban growth and human capital plays the migration. Theories interpret the cause of migration due to various advantages that cities provide for citizens from rural areas. Table 1 provides an overview of the above-mentioned scientific approaches to this paragraph.

Table 1 Summary of approaches used by different authors

	Author (s)	Research question	Definition of a city	Used indicators	Conclusion
1.	Rauch, J. E. (1991)	How large is the effect of an additional year of average education on total factor productivity in cities?	SMSA (Standard Metropolitan Statistical Area)	1. productivity (wages) 2. average level of formal education (average years of schooling)	The effect of an additional year of average education on total factor productivity is 2.8 percent.
2.	Glaeser E. L., Scheinkman J. A, Shleifer A. (1995)	What are the economic forces that explain city growth in United States cities?	SMSA (Standard Metropolitan Statistical Area)	1. income per capita 2.median years of schooling	Income and population growth are positively related to initial schooling.
3.	Eaton, J., Eckstein Z. (1997)	Based on historic data on cities from France and Japan, how in the future will develop their relations between growth and accumulation of human capital?	Urban agglomerations (Large Metropolitan Areas)	1. wages 2. rents 3.time spent on learning	Cities with larger population will in the future achieve higher stock of human capital, higher wages and higher rents.
4.	Shapiro J. M. (2003)	What is the relationship between concentration of skilled residents in a metropolitan area and growth in quality of life?	SMSA (Standard Metropolitan Statistical Area)	1. share of population with high school degree, some college or college degree or higher. 2. wages	Two-thirds of the growth effect of human capital is due to enhanced productivity growth, the rest is caused by growth in the quality of life.
5.	Glaeser E. L., Ressenger M. G. (2010)	Are metropolitan areas with higher levels of skills more productive than metropolitan areas with lower skills?	SMSA (Standard Metropolitan Statistical Area)	1. wages 2.share of adults with BAs	Agglomeration effects (wage growth) are much stronger for cities with more skills.

Source: Own elaboration

2 SIMPLE MODEL OF ECONOMIC GROWTH

The research question of this model was, whether there is a relationship between human capital and economic growth in cities of the Slovak Republic. The aim of this paper was to investigate the relationships of two alternative approaches addressing factors of economic growth of cities. The main attention was paid to test the theoretical approach that explains urban growth through human capital. As an alternative, it was used the one that explains the urban growth through theories of agglomeration economies. The model also included parameters for standard theories, labour and capital. To determine the relationship of individual approaches over the observed period was used the method of panel regression. The basic equation, which represented the studied relationship, had this form:

Economic growth = Human capital + Agglomeration economies + Labour + Capital

The dependent variable was represented by a parameter of economic growth (in this model, it was represented by the average wage) and independent variables were represented by the parameters of human capital (share of tertiary educated population), agglomeration economies (population density), labour (total number of employees) and capital (total number of firms).

3 DATA

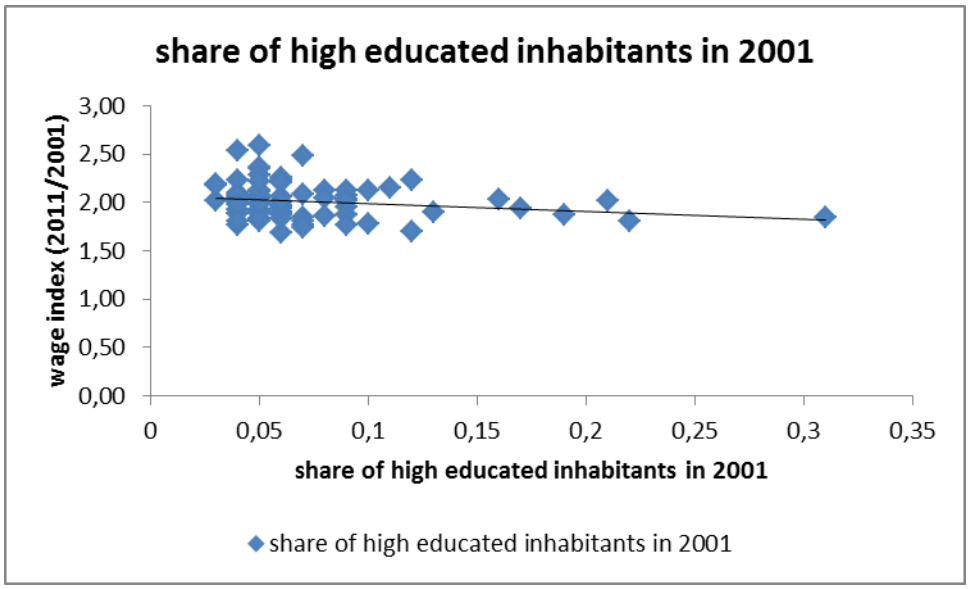
Because of the absence of useful data at the level of a city (level LAU2), in the model were used data for districts (LAU1). Therefore it cannot be literally talked about examining cities, but rather about examining city regions. A similar approach was used by authors of articles mentioned in Table 1. They also used for observations larger spaces than cities, so in this model, the term city means city region. Examined parameters were the average wage, the share of tertiary educated population (share of high educated inhabitants), the population density, total number of employees (employment) and total number of firms (firms). Dependent variable was represented by the indicator of the average wage and the independent variables were the share of tertiary educated population, population density, total number of employees and total number of firms. Analysed territorial units, in this case “city regions”, were represented by 79 districts of Slovak Republic. The data for the average wage, as well as the data on population density came from the Statistical Office of Slovak Republic. Data on share of population with tertiary education were obtained from population and housing Censuses.

The analysed period amounted years between the last two censuses of population, i.e. 2001 to 2011. Data on the number of inhabitants with tertiary education for each year between Census periods were obtained by the statistical method of linear interpolation.

4 RESULTS

From the Graph 1 it can be seen dependency between wage growth during the period and the initial share of human capital (share of high educated inhabitants) in Slovak city regions. From this relationship it can be seen that significant wage increases amounted cities that did not have the largest stock of human capital in the initial year. On the contrary, the highest wage growth can be seen in city regions with low levels of human capital.

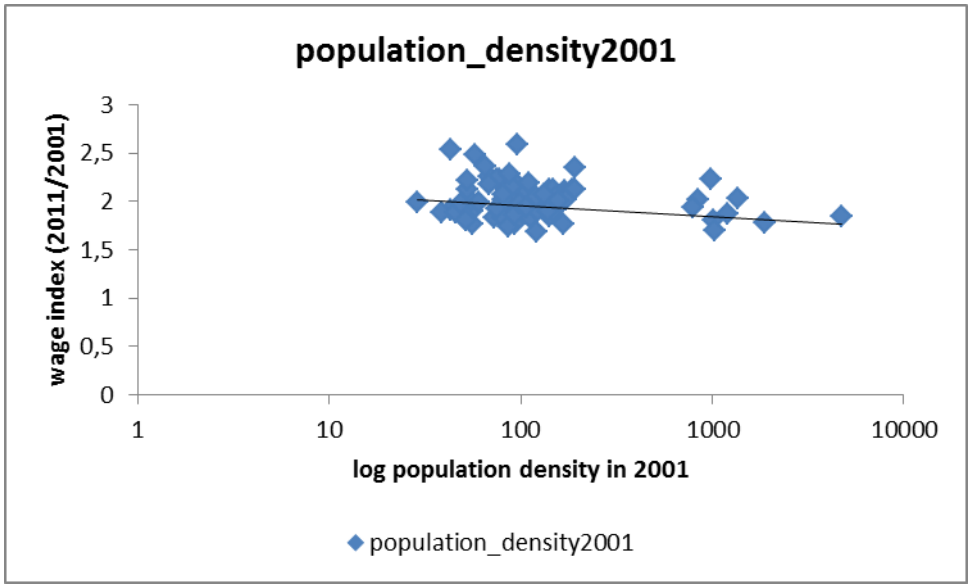
Graph 1 Dependency of wage growth and initial share of human capital



Source: Own elaboration

Graph 2 shows the relationship between the growth of wages in the cities during the examined period and the population density from the first year. Also from this relationship it can be seen that the highest economic growth did not occur in city regions with the highest population density, but it occurred in city regions with significantly lower population density.

Graph 2 Dependency of wage growth and initial population density



Source: Own elaboration

From the results of elaborated panel regression it can be seen, that all independent parameters are statistically significant because p-values are zero. However, looking at the coefficients of each parameter it is clear that values of the share of population with tertiary education and the value of firms reached positive values, while values of population density and employment reached negative values. Overall, the model explained 64 percent of the variability of observed parameters.

Figure 1 Panel regression

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Random-effects GLS regression                   Number of obs      =       869
Group variable: code                            Number of groups   =        79

R-sq:  within  = 0.8420                         Obs per group: min =        11
       between = 0.5735                                        avg =      11.0
       overall = 0.6413                                        max =        11

                                                Wald chi2(4)       =   3409.33
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
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wage	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
share_tertiary_educated	4192.221	113.5685	36.91	0.000	3969.631	4414.811
population_density	-.1858122	.0154712	-12.01	0.000	-.2161353	-.1554892
employment	-.0054039	.000723	-7.47	0.000	-.006821	-.0039869
firms	.0603748	.0039031	15.47	0.000	.0527248	.0680248
_cons	212.1791	14.95921	14.18	0.000	182.8596	241.4986
sigma_u	57.215524					
sigma_e	53.900101					
rho	.52981106	(fraction of variance due to u_i)				

Source: Own elaboration

5 DISCUSSION

The results from Graph 1 are different from every theoretical model that is listed in Table 1. According to the conclusions of individual authors, cities with a larger pool of human capital should achieve higher economic growth, which, however, in the case of Slovak cities (city regions) is not confirmed. The explanation for these results could be that the growth of tertiary educated inhabitants has been enormous during the period especially in smaller urban regions. Results from Graph 2 can be interpreted as higher economic growth experienced city regions with lower population density, respectively cities that offer a smaller amount of benefits from agglomeration economies. Explanation for these results may lay in the fact that too many economic actors in the labour market make a big competition, which reduces the average amount of wages. Data from elaborated panel regressions suggest that the parameter representing the theoretical approach of human capital had a positive effect on the economic growth of cities, while the parameter representing agglomeration economies had a negative effect. It is important to add to these results that the elaboration of separate panel regressions for both independent variables went positive and the multicollinearity test between them did not show any problem of close, mutual relation. Because this model only dealt with four variables

and did not take into account other relevant factors, there can be several alternative explanations for these concrete results.

CONCLUSION

To answer the research question, according to the results of elaborated panel regression, there is a positive relation between human capital and economic growth in cities of Slovak republic. However, it has to be added that the results come from a very simplified model that compares only four theoretical approaches and it did not take into account other specifics that might have a significant impact on the economic growth. To gain greater knowledge about the relationship between economic growth and human capital in Slovak cities, it is therefore necessary to add more parameters into the model.

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