



Faculty of Economics, University of Niš, 13 October 2016

International Scientific Conference

**THE PRIORITY DIRECTIONS
OF NATIONAL ECONOMY DEVELOPMENT**

**HUMAN CAPITAL AND ECONOMIC GROWTH – THEORETICAL
AND EMPIRICAL RESEARCH**

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***Abstract:** In the mid-1980s, the concept of human capital experienced a significant change in its position in economic literature, becoming a subject of great interest to many researchers trying to explain the determinants of economic growth. However, we can say with certainty that the results of these studies have not wholly demonstrated a strong link between human capital and economic growth. Focus on the quantitative measures of education is one of the main reasons for the unconvincing findings of empirical research. However, newer studies, in clarifying certain methodological dilemmas and placing indicators of the quality of education in the forefront, have undoubtedly laid the way for future research that could more reliably determine the positive effect of accumulated human capital on economic growth.*

***Keywords:** human capital, economic growth, education, school quality, cognitive skills tests*

1. Introduction

Up until the middle of the last century, physical capital was universally considered the main (and often only) driver of economic growth. Accordingly, all the dominant theories of economic growth at that time focused on the accumulation of physical capital. The first comprehensive studies that analyzed the possible role of human capital in economic growth only appeared in the 1960s (see: Shultz 1960; Becker 1962). They also introduced in a big way the concept of human capital in the sphere of fiscal policy.

It can be said that the concept of human capital was slow in becoming popularized as a legitimate subject of interest to economists working on the determinants of economic growth. Alfred Marshall, in his “Principles of Economics”, deemed it unrealistic to even consider humans as a part of capital. Human capital was for a long time analyzed only through its connection to the standard of living (measured by income per capita). It is only in recent decades that its contribution to economic growth has taken its rightful primacy in research (Todaro, Smith 2011).

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UDC 005.96:330.5

Already in his first works, Shultz (1960) boldly assumed that the study of human capital could maybe explain many of the conundrums that exist with regard to economic growth. Looking at the ratio of total capital and national income and its relatively constant value over time, Shultz concluded that the reason behind this trend was indeed increased investment in human capital. The fact that the ratio between investment in physical capital and the resulting income was in constant decline could explain the hitherto perplexing growth in national income.

Investment in human capital itself implies investment in education; however, the concept of human capital is much more complex. Becker first defined this broader concept of human capital, which in addition to formal education includes various forms of training and other types of informal education, i.e. all that influences the quality of education and consequently the productivity of workers. (Becker 1964).

The current topicality of this issue is largely thanks to the works of Lucas (1988), Barro (1991) and Mankiw, Romer and Weil (1992). Lucas cast the reproducibility of human capital as its most important characteristic, with the pronounced potential to create positive external effects. Although in his work Barro does not accentuate human capital *per se*, through empirical analysis of the determinants of long-term economic growth he indirectly affirmed the crucial importance of formal education in this context. Not long after, Mankiw, Romer and Weil provided valid theoretical support to the understanding of the complex interaction between human capital and the process of economic growth. According to their model, human capital is viewed as an input of aggregate production function that is characterized by diminishing returns.

2. Human capital in economic growth models

Defining a suitable theoretical framework to fully encompass and, above all, explain the link between the concept of human capital on the one hand and the process of economic growth on the other, implies the deliberation of very complex issues. In analyzing the many theoretical models that in recent decades have produced a rich literature on this subject, it is evident that there are two basic approaches to the question of the relationship between human capital and economic growth.

The starting point of the first approach is the well-known neoclassical Solow-Swan model of growth (Solow 1956; Swan 1956). One of the main conclusions to be drawn from this model is that long-term economic growth is simply an impossible process. The main reason for this are diminishing returns – an intrinsic characteristic to the neoclassical production function. With this in mind, it is clear that diminishing returns as a limiting factor for growth must be overcome somehow. In the Solow-Swan model, this was done by the introduction of the *exogenous* variable of technological progress. In other words, the accumulation of capital alone, without technological progress, cannot bring about economic growth. Technological advancement is the key to overcoming diminishing returns in that it elicits increased productivity of inputs (Stevens, Weale 2004).

Expansion of this basic model can be done with the introduction of additional inputs (alongside the pre-existing work and physical capital). Mankiw, Romer and Weil (1992), in their extended Solow-Swan model, introduced human capital into the production function and showed how this brought about a decline in the importance of physical capital

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for economic growth. Of course, unlike the returns on physical capital, which are relatively easy to measure, the returns of human capital are difficult to quantify since they are tied to the benefits expected in the future by those who accumulate (i.e. constitute) human capital.

On the other hand, criticism of the (fairly restrictive) assumption of technological progress as an exogenous phenomenon is the baseline of the model of *endogenous* growth. In these models, the process of accumulation of knowledge and technological progress is not taken as determined, but rather as coming from the specifications of the model themselves. Obviously, the only way by which production input (including human capital) can result in long-term growth is by surmounting diminishing returns in production. Models of endogenous growth, as a possible means of achieving this objective, see the positive external effects that bring about an increase in the overall level of productivity. According to this theory, it is these differences in the accumulation of human capital of different countries that are the key reason for their diverse long-term growth rates (Lucas 1988).

3. The problems of empirical research on the impact of human capital on economic growth

This field of research, like few others, from its very beginning faced a multitude of empirical difficulties and problems that are yet to be completely resolved. To a great extent, these problems have played a part in the manifest diversity of the results of research, and contributed to the unconvincing conclusions of studies on the impact of human capital on economic growth.

One of the major methodological problems is in the choice of indicators to measure human capital. Most studies use indicators such as the number of enrolled students, the attained level of education or the number of years of schooling, while indirect measures such as the level of literacy are less commonly used. Barro and Lee (1993) took the average number of years of schooling as an indicator of human capital. Vasudeva Murthy and Chien (1997) used a weighted average of the population in primary, secondary and higher education in their work, and Hanushek and Wössmann (2008) used the results of countries in PISA tests. The use of quantitative indicators such as years of schooling (which has become a synonym for the measure of human capital) becomes problematic when comparing human capital among countries, due to the incommensurability of the data. In addition, a major shortcoming of these measures is that they only consider formal schooling as a source of human capital, ignoring the impact of informal education.

Many studies have confirmed the hypothesis that human capital is a very important, and often a crucial factor in the process of economic growth (Barro 1991; Benhabib, Spiegel 1994; Wilson, Briscoe 2004; De la Fuente, Doménech 2006), both through the impact of labor productivity in production as well as through increased technological innovation and its diffusion. According to Benhabib and Spiegel (1994), a 1% increase in human capital leads to a 0.13% increase in the rate of economic growth. Bassanini and Scarpetta (2001) argue that an increase in the years of schooling by one year results in an increase in GDP per capita of around 6%.

The results of some studies that analyzed the existence of a positive impact of human capital on economic growth are somewhat inconclusive (Temple 2001a),

particularly when human capital is viewed as input in the production function (Benhabib, Spiegel 1994; Pritchett 2001). Bils and Klenow (2000) warned that a positive link between human capital and economic growth can be false because of the possible influence of variables not included in the analysis. Ramos, Surinach and Artis (2009) found that the level of education in terms of an explosion of higher education that is not in line with the economic structure could result in an increase in the rate of unemployment due to a mismatch with the needs of the labor market. This is especially evident in countries such as Spain and Cyprus where, despite a significant portion of the population being highly educated, the rates of unemployment are high, and there are low or negative rates of economic growth (Cadil, Petkovova, Blatna 2014). On the other hand, Krueger and Lindahl (2001) concluded that human capital has a positive effect on economic growth, but that it is not the same for all countries, i.e. its effect varies, most probably due to the varying quality of education and institutional arrangements in different countries (Pritchett 2001; Pritchett 2006).

Funke and Strulik (2000) also point out that the effect of human capital on economic growth is not the same in all cases, but rather depends greatly on the phase of development in which a country or region finds itself. More often, physical capital has a decisive influence on economic growth in the early stages of development. Based on the results of Gemmell (1996), who, in emphasizing the complementary nature of physical and human capital, claimed that one part of the influence of human capital on growth comes through attracting investment in physical capital, Wei (2008) empirically showed that it was precisely this channel that was decisive in the overall positive effect of human capital on the speed of economic growth in China.

It is evident from an analysis of the rich literature in this field that the majority of studies use very similar methods to assess the influence of education on economic growth. They use panel data for a larger number of countries (the size of a sample is often over 30), with individual rates of GDP expressed as a function of different indicators from the field of education, as well as other important variables, in the process of economic growth. Of course, GDP is used as a measure of economic growth, while different variables (most often the number of enrolled students, years of schooling, etc.) are used as a measure of human capital.

Establishing the connection between such defined variables is still one of the “cutting issues” in the literature: is the level of education (as predicted in models of endogenous growth (see Benhabib, Spiegel 1994)) or changes in the level of education (as predicted by neoclassical theory (see Cohen, Soto 2007)) the more important actuator of economic growth? (Gemmell 1996; Stevens, Weale 2004; Hanushek, Wössmann 2007; World Bank 2007).

In addition, the measuring of human capital itself is an important issue (Hanushek, Wössmann 2010). In general, the acquisition of valid data seems to be one of the biggest challenges to research in this field. In particular, data on GDP are problematic, especially in the case of undeveloped and developing countries, for at least two reasons. Firstly, the share of the gray economy, which is not reflected in GDP, is considerably higher in these countries than in developed countries (World Bank 2007). Secondly, there is the huge problem in the accuracy, and availability in general, of GDP data in poorer countries that proverbially have very poorly developed national statistics. On the other hand, difficulties with indicators of education are no less problematic. It is more difficult to access data on

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attained levels of education, i.e. educational background, than on the number of enrolled students. Krueger and Lindahl (2001) and Temple (2001b) stress the importance of these and other empirical issues, such as measurement of the indirect effect of human capital.

Problems in methodology in no way end here. Given that most studies use panel data, there is an evident problem in data comparability, especially among countries at different stages of development. Due to the big differences in educational systems, even among countries on similar levels of development, such as OECD countries (see OECD 1998), the problem of comparability of different indicators in the field of education (especially those related to the quality of education) has arisen.

Recognizing these difficulties, more recent studies often try to make a methodological deflection so that instead of panel data for several countries, they direct their analyses toward time series for individual countries (see Jalil, Idrees 2013). In this way, results are obtained that, without the problem of data comparability, show a stronger positive link between human capital and economic growth.

4. Qualitative and quantitative indicators of human capital in economic growth models

After reviewing the literature, it is evident that until now most serious studies have used quantitative measures of education (e.g. Barro 1991; Benhabib, Spiegel 1994), even though they are certainly not the most accurate indicators of accumulation of human capital and do not show its full potential in the process of economic growth. Also, using quantitative indicators alone cannot explain in full the differences in income per capita that exist between countries, and this redirected research onto the quality of educational systems.

Without doubt, the amount of knowledge a student gains in one year of schooling is not independent of the quality of the educational system, i.e. curriculum, quality of teaching, etc. Therefore, in order to determine the effect of education on economic growth, instead of measuring the time students spend in school, it is much more important to measure what they have learnt (Hanushek, Wössmann 2010).

Already in the 1970s it was noted that the time spent in school was not an adequate measure of the amount of attained education (Solmon 1973; Wachtel 1975). Lewis (1985), for example, took the amount of money spent per student as an indicator of quality. The assumption is that smaller classes, more books and better teachers (due to a greater investment per student) positively influence the learning process and later on, the productivity of the student in the labor market. Lewis noted that quality of education is indeed the missing factor in the human capital model of Schultz (1960) and Becker (1964). However, only relatively recent research has unequivocally shown that ignoring differences in the quality of education can seriously distort the statistical relationship between education and economic growth.

A significant number of works provide empirical evidence of the greater importance of the quality of education as a variable with more influence on economic growth than the quantity. (Hanushek, Kimko 2000; Barro 2001; Wössmann 2002; Bosworth, Collins 2003; Coulombe, Tremblay 2006; Hanushek, Wössmann 2008). Coulombe and Tremblay (2006), in their study based on the results of literacy tests, found

that the skills arising from additional years of schooling lead to an increase in the work productivity of almost 7%. In their model, Hanushek and Wössmann (2012) demonstrated the greater impact of the qualitative indicators of human capital on growth, noting that only the portion of years spent in school that directly affects the creation and improvement of cognitive skills has an impact on the differences in rates of economic growth among different countries.

The results of Hanushek and Wössmann's research (2008) are very significant, despite the criticism they received of the specifications of their model (see Breton 2011). Based on a sample of 50 countries, they analyzed the impact of education on economic growth, and in addition to the level of education, used a variable measuring the quality of education, which included the overall cognitive skills of the work force (i.e. not only those acquired by formal education). The variable was the results of international standardized tests of mathematics and natural sciences. This model explains almost 73% of the variation in rates of economic growth. The main conclusion that can be drawn is that the quality of education in a country (measured here by international tests) has a greater effect on its economic growth than quantity (measured by number of years of schooling) does.

Hanushek and Wössmann drew one more conclusion of great importance to the educational policy of undeveloped and developing countries. Given that in these countries in recent years a development strategy is evident that involves the expansion of low-quality schools (in line with the Millennium Development Goals), the authors argue that the education system is in fact in a much worse state when indicators of education quality are analyzed instead of traditional indicators, such as number of enrolled students and years of schooling. Thus, Hanushek (2013) contends that developing countries have indeed made substantial progress with regards to the number of years of schooling, but that without an increase in the quality of education, they will not achieve significant long-term economic growth.

These conclusions to a great extent confirm what Lewis (1985) stated three decades ago – improving the quality of education in developing countries is more important to their economic growth in the long term than simply increasing access to low-quality education.

5. Conclusion

Models of endogenous growth emphasize the central role of human capital in the process of long-term economic growth. Nonetheless, despite the growing importance of the issue of human capital in macroeconomic literature, the results of numerous studies on the impact of human capital on economic growth are not as compelling as could be expected. A considerable number of studies have failed to show the existence of a statistically significant positive relationship between human capital and economic growth.

The main reasons for such empirical results are methodological in nature, i.e. related to the choice of indicators. It is clear that neither GDP, as an indicator of economic growth, nor years of schooling, as the most commonly used indicator of human capital, are the most reliable measures, but from methodological, and often practical, reasons, they have a major role in analyses. However, the link between human capital and economic growth is not so simple that it can be tested in this way. Above all, education is

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characterized by not insignificant positive external effects, which, by definition, are difficult to measure and which, without doubt, ultimately have a positive effect on economic growth.

A particular problem is that most research focuses on the quantity of schooling. However, recent studies in this field have taken into account the fact that every year of schooling does not result in the same level of knowledge. It is becoming increasingly clear that without taking into account the quality of education (measured by tests of achievement and cognitive skills), the true importance of education in the process of economic growth cannot be examined. The relationship between human capital and growth becomes more noticeable when analyzing the quality of education and it is clear that there are great unexplored possibilities for studying this aspect of education.

In addition to using the variables of education quality in research, by analyzing time series of individual countries instead of a sample of several countries, the problem of the heterogeneity of educational systems and regulations in different countries can be overcome in order to reach more accurate results.

Acknowledgments

This paper contains the research results of project No. 176017 funded and supported by the Ministry of Science and Technological Development of the Republic of Serbia.

References

1. Barro, R. J. (1991) Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106: 407–433.
2. Barro, R. J. (2001) Human Capital and Economic Growth. *American Economic Review*, 91: 12–17.
3. Barro, R. J., Lee J. W. (1993) International comparisons of educational attainment. *Journal of Monetary Economics*, 32 (3): 363-394.
4. Bassanini, A., Scarpetta, S. (2001) Does Human Capital Matter for Growth in OECD Countries? Evidence from Pooled Mean-Group Estimates. OECD Economics Working Paper No. 282.
5. Becker, G. S. (1962) Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, 70: 9–49.
6. Becker, G. S. (1964) *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. New York: Columbia University Press.
7. Benos, N., Zotou, S. (2014) Education and Economic Growth A Meta-Regression Analysis. *World Development*, 64: 669-689.
8. Benhabib, J., Spiegel, M. (1994) The role of human capital in economic development: Evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34: 143-173.
9. Bils, M., Klenow, P. J. (2000) Does schooling cause growth? *American Economic Review*, 90(5): 1160–1183.
10. Blankenau, W., Simpson, N. (2004) Public education expenditures and growth. *Journal of Development Economics*, 73: 583– 605.

11. Bosworth, B. P., Collins, S. M. (2003) The empirics of growth: An update. *Brookings Papers on Economic Activity*, 2: 113–206.
12. Breton, R. (2011) The quality vs. the quantity of schooling: What drives economic growth. *Economics of Education Review*, 30: 765–773.
13. Cadil, J., Petkovová, L., Blatná, D. (2014) Human Capital, Economic Structure and Growth. *Procedia Economics and Finance*, 12: 85-92.
14. Castelló-Climent, A., Hidalgo-Cabrillana, A. (2012) The role of educational quality and quantity in the process of economic development. *Economics of Education Review*, 31: 391-409.
15. Cohen, D., Soto, M. (2007) Growth and human capital: Good data, good results. *Journal of Economic Growth*, 12: 51-76.
16. Coulombe, S., Tremblay, J. F. (2006) Literacy and growth. *Topics in Macroeconomics*, 6 (2): 1-32.
17. De La Fuente, Á., Doménéch, A. (2006) Human capital in growth regressions: how much difference does data quality make? *Journal of the European Economic Association*, 4(1): 1-36.
18. Funke, M., Strulik, H. (2000) On endogenous growth with physical capital, human capital and product variety. *European Economic Review*, 44: 491-515.
19. Gemmell, N. (1996) Evaluating the impacts of human capital stocks and accumulation on economic growth: Some new evidence. *Oxford Bulletin of Economics and Statistics*, 58(1): 9-28.
20. Hanushek, E. (2013) Economic growth in developing countries: The role of human capital. *Economics of Education Review*, 37: 204-212.
21. Hanushek, E., Kimko, D. D. (2000) Schooling, labor force quality, and the growth of nations. *American Economic Review*, 90, 1184–1208.
22. Hanushek, E., Woessmann, L. (2007) The Role of Education Quality in Economic Growth. Policy Research Working Paper, No. 4122, World Bank, Washington, DC.
23. Hanushek, E., Woessmann L. (2008) The Role of Cognitive Skills in Economic Development. *Journal of Economic Literature*, 46(3): 607–668.
24. Hanushek, E., Woessmann, L. (2010) Education and Economic Growth., in Peterson, P., E. Baker, and B. McGaw (eds.), *International Encyclopedia of Education*, Oxford: Elsevier.
25. Hanushek, E., Woessmann, L. (2012) Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. *Journal of Economic Growth*, 17: 267-321.
26. Jalil, A., Idrees, M. (2013) Modeling the impact of education on the economic growth: Evidence from aggregated and disaggregated time series data of Pakistan. *Economic Modelling*, 31: 383-388.
27. Krueger, A. B., Lindahl M. (2001) Education for Growth: Why and for Whom?. *Journal of Economic Literature*, 39: 1101–1136.
28. Lewis, S. (1985) Quality of Education and Economic Growth. *Economics of Education Review*, 4 (4): 273-290.
29. Lucas, R. (1988) On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22: 3-42.
30. Mankiw, N. G., Romer, D., Weil, S. N. (1992) A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107: 407–437.

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31. Pritchett, L. (2001) Where has all the education gone? *World Bank Economic Review*, 15 (3): 367-391.
32. Pritchett, L. (2006) Does learning to add up add up? The returns to schooling in aggregate data, in Hanushek, E. A. and F. Welch (eds.), *Handbook of the Economics of Education*, Amsterdam: North-Holland.
33. Ramos, R., Suriñach, J., Artís, M. (2009) Regional economic growth and human capital: the role of overeducation. Working Papers 2009/04, Research Institute of Applied Economics.
34. Savvides, A., Stengos, T. (2009) *Human Capital and Economic Growth*. Stanford: Stanford University Press.
35. Schultz, T. W. (1960) Capital Formation by Education. *Journal of Political Economy*, 68: 571-583.
36. Solmon, L. (1973) The definition and impact of college quality, in Solmon, L.C. and P.T. Tajbman (eds.), *Does College Matter?* New York: Academic Press.
37. Solow, R. M. (1956) Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70 (1): 65–94.
38. Stevens, P., Weale, M. (2004) Education and Economic Growth, in Johnes, G. and J. Johnes (eds.), *International Handbook on the Economics of Education*, Cheltenham: Edward Elgar.
39. Swan, T. W. (1956) Economic Growth and Capital Accumulation. *Economic Record*, 32 (2): 334-361.
40. Temple, J. (2001a) Growth effects of education and social capital in the OECD countries. *OECD Economic Studies*, 33: 57–101.
41. Temple, J. (2001b) Generalizations that aren't? Evidence on education and growth. *European Economic Review*, 45, 905–918.
42. Todaro, M. P., Smith, S.C. (2011) *Economic Development*, 11th ed. Boston: Addison-Wesley.
43. Vasudeva Murthy, N. R., Chien, I. S. (1997) The empirics of economic growth for OECD countries: some new findings. *Economic Letters*, 55: 425-429.
44. Wachtel, P. (1975) The effect of school quality on achievement, attainment levels and lifetime earnings. *Explorations in Economic Research*, 2: 502-536.
45. Wei, C. (2008) The role of human capital in China's economic development: Review and new evidence. *China Economic Review*, 19: 421-436.
46. Wilson, R. A., Briscoe, G. (2004) The impact of human capital on economic growth: a review. Third Report on Vocational Training Research in Europe: Background Report Office for Official Publications of the European Communities, Luxembourg.
47. Woessmann, L. (2002) *Schooling and the Quality of Human Capital*. Berlin: Springer.
48. Wolff, E. (2000) Human capital investment and economic growth exploring the cross-country evidence. *Structural Change and Economic Dynamics*, 11: 433-472.
49. World Bank (2007) *Fiscal policy and economic growth: Lessons for Eastern Europe and Central Asia*. Washington: World Bank.

LJUDSKI KAPITAL I EKONOMSKI RAST – TEORIJSKA I EMPIRIJSKA ISTRAŽIVANJA

Apstrakt: Koncept ljudskog kapitala je sredinom 80-ih godina prošlog veka doživeo značajnu promenu uloge u ekonomskoj literaturi, postavši predmet velikog interesovanja mnogobrojnih istraživanja koja pokušavaju da objasne determinante ekonomskog rasta. Ipak, može se sa sigurnošću reći, da rezultati studija nisu nedvosmisleno dokazali jaku pozitivnu vezu između ljudskog kapitala i ekonomskog rasta. Fokusiranje na kvantitativne mere obrazovanja je jedan od glavnih razloga za neubedljive nalaze empirijskih istraživanja. Međutim, novije studije, razrešenjem pojedinih metodoloških nedoumica i stavljanjem indikatora kvaliteta obrazovanja u prvi plan, nesumnjivo otvaraju vrata za buduća istraživanja koja bi pouzdanije utvrdila pozitivni efekat akumulacije ljudskog kapitala na ekonomski rast.

Ključne reči: ljudski kapital, ekonomski rast, obrazovanje, kvalitet školstva, testovi znanja