



HOW IMPORTANT IS HUMAN CAPITAL FOR GROWTH IN REFORMING ECONOMIES?

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Abstract. The aim of the paper is to broaden the research on human capital providing new evidence that human capital matters for economic growth in reforming economies. We propose a new model for measuring human capital. An advantage of the proposed model consists in international comparability; money metric scale and more importantly provide solid evidence on human capital significance for economic growth. This new approach in measuring human capital proved robust to the spurious regression problem involving human capital. Study results shows that human capital is important for growth and that large educational investments are essential to boost accumulation.

Keywords: economic growth, human capital, education, solow residual, endogenous growth.

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1. Introduction

Traditional production factors (land, work and capital) have distinguished and historically proved role in the countries social and economic development. With the 21st century entering they remain important but not primary economic growth sources. We shall not underestimate as well overestimate their importance. International trade evolution with forming of the world capital markets gives countries with poor resources (but with large human capital stock) opportunity to achieve high growth rates. Scientists through their research tried to measure and analyze the influence of the education on the growth rate. Studies on this subject come across significant obstacles in the try to state an overall conclusion. This is because of the education nature and involved time gap – (LAG). LAG is a time gap between the period

spent by a student in learning and entering the labor market using the same knowledge acquired. In the vast research works on economic growth models, problem of measuring human capital stock and its influence on growth economic emerge. Adopting Marshall's capital conception, human capital component was pushed aside. Acknowledgment of human capital importance as augmenting productivity factor dates from Adam Smith. Comparing total costs and benefits (returns) of investing in human capital, educational investment true character becomes reality. We have to look at education not only as productive investment since multiplicative effects are far larger (lower unemployment, less social security transfer, improved standard of living, labor supply restructuring).

Modern economic researchers concentrate their scientific work on educational return's measurement problem as in Becker (1993), Blundell *et al.* (2001) and Blaug (1970, 1987) works. Four main economic streams dealing with this problem are (Harbison, Myers 1964):

- relation between educational costs and wages growth or physical capital formation,
- residual approach in measuring contribution of education to economic growth,
- educational returns rate measurement,
- correlation estimation between school enrollment and GNP.

In the 1960s (Schultz 1961) and (Denison 1962) showed that education contributes directly to the growth of national income by improving the skills and the productive capacities of the labor force. Early tries to measure education contribution to growth were following growth accounting approach or measured the rate of return to human capital. Growth accounting follows production function, which links output (Y) to the input of physical capital (K) and labor (L).

Denison calculated that among 1930 and 1960 almost a quarter (23 percent) of the rate of growth of output in the United States was due to the increased education of the labor force. T. W. Schultz conducted a study on human capital for the 1900–1956 period in USA. He inferred that investments in education grew by 3.5 times compared to wages and gross physical capital. Educational demand elasticity reaches 3.5 meaning that educational investments were 3.5 times more attractive than those in physical capital. Many scientific works tried to show educational contribution to GNP. Among them (Solow 1957) calculates that 87.5% of output increase per work hour accounts for 'residual', with remaining 22.5% to physical capital and labor. Denison (1962) carefully investigate educational contribution to GDP growth. Theory that education improves and speeds up economic growth has been fully explored by (Anderson, Bowman 1965), (Kaser 1966), (Bennett 1967), (Harbison, Myers 1964), (Adelman, Morris 1967), (Horowitz *et al.* 1966), (Layard, Saigal 1966), (Romer 1990), (Barro 1991, 1999, 2001), (Lucas 1988). As to combination of growth factors, in an interesting study of 97 economies, (Plosser 1992) establish the ratio between factors of growth and development (Table 1).

In 14 (out of 97) developing economies with growth rates of about 5%, a pattern of:

1. high net investment share in GDP,
2. low inflation,
3. trade balance,
4. highly educated population,
5. low population growth rates,

6. political stability,
7. strongly independent central banks

is identified. The models considered in this paper are human capital and endogenous growth models. Key assumption for human capital model is that country's human capital stock is a function of:

- forgone earnings (E),
- social expenditures on education (S),
- private expenditures on education (P).

Table 1. Factors of growth and development

Characteristics	Total (average)	Slow growth (<5%) 23 countries	Rapid growth (>3.5%) 14 countries	Correlation between growth and GDP
Growth of GDP per capita	2.03%	-0.26%	4.88%	1.00
Investment contribution in GDP	21%	17%	26%	0.61
Public spending in GDP	15%	15%	14%	0.1
Inflation	23%	41.11%	7.9%	-0.17
Export in GDP	33%	30%	40%	0.31
Import in GDP	28%	24%	35%	0.30
Population growth	2.06%	2.55%	1.26%	-0.36
Population in primary education	74%	44%	98%	0.54
Population in secondary education	21%	6%	34%	0.41
Real GDP per capita 1960	\$1840	\$889	\$1968	

Source: Plosser (1992)

Hall and Jones (1999) in their research find that a large variation in output per worker across countries can be only partially explained by differences in physical and human capital. A country can produce high levels of output per worker in the long run with large investments in physical and human capital followed by high productivity. Prescott (1998) points out differences in output among countries can not be assigned to the human capital. Increasing human capital stock demand more time than the time allocated to market. Only then human capital becomes important for economic growth. Strongest endogenous growth models critics suggest that in many economies, scarcity of estimated human capital stock compared to physical capital is the main obstacle for human capital claimed role as an engine of growth. This paper most important finding is theoretical and policy oriented. Contribution to the theoretical body of knowledge consists in developing a new method for human capital proxies robust to bias problem. Policy makers in reforming economies should build human capital stock via public and private investments to spur growth. Not only, to have results, policy makers must deal with the problem of low incomes to highly educated labor force essential for productivity lift. Without synchronized minimum wage policy for skilled labor on the labor market together with large (gross) investments in education, accumulation process will be slowed and growth limited. This is clearly visible from the Croatian example with Croatia having now human capital stock below the 1980's level. War consequences had a

large negative impact on the human capital stock, but the main reason for low human capital accumulation is wrong macroeconomic management and labor policy. Among most striking policy miscalculation is the belief that the newly formed private production sector will absorb all hidden unemployment labor force from formerly state owned enterprises resulting in massive unemployment since 1990.

2. Literature review on human capital and growth

Previous growth literature underlines human capital accumulation as key factor in country's long run economic performances. However, mainstream theories associated with Solow (1957) argue that macroeconomic policy cannot affect growth rates over the long term. Solow shows capital accumulation would increase the growth rate in the short term, bringing countries to a higher level of income (transition effect), but would not generate any long term GDP growth because of the diminishing returns on capital. Capital deepening should be encouraged only because of the transition effect. Although some economists still accept this framework of economic growth, most of them find that the extended Solow version, given by Mankiw *et al.* (1992), provides more answers. Extended Solow model suggests conventional Solow model could explain most of the variations in GDP between countries highlighting the special role of human capital via education. MRW use the augmented Solow model with human capital to show that the social marginal product of human capital and physical capital is somewhat larger. However, the main focus of their model was on human capital with no special role for the disaggregated level of physical capital.

The theoretical basis for this research is driven from the findings of De Long and Summers (1993, 1994, 1990, 1991; De Long *et al.* (1992) and Temple, Voth (1998). De Long and Summers (henceforth DLS) stressed the main grounds on factors that could be important for GDP growth (De Long, Summers 1991):

- First, the application of capital-intensive technologies has played an important role in those countries that have grown rapidly in the last 100 years.
- Second, there are strong positive externalities associated with equipment investments since total factor productivity growth is largely embodied in the form of new investment goods (Greenwood *et al.* 2000). Ninety-five percent of private-sector research and development in America is undertaken by the manufacturing sector, and within that the equipment sector accounts for more than half of all research and development (De Long, Summers 1990). Therefore, investigating the special role of equipment investments seems to be desirable.
- Third, countries that apply a government-led “developmental state” approach to structural changes invest more heavily, have lower equipment prices and enjoy more rapid economic growth (Hendricks 2000).

Aforementioned assumptions imply that more equipment investments mean faster technological progress generated through positive externalities when working with modern machines (Parente 1994; Romer 1986). As in the Solow model, the main generator of economic growth is technological progress; however, the same progress is not generated by ‘manna from heaven’ but is driven by the applications of suitable macroeconomic policies. Soon after De

Long-Summers released a series of papers emphasizing how equipment investments yield important external benefits. Many economists started investigating this approach. Auerbach *et al.* (1993) found that the link between different components of investments and growth in the OECD countries is fully consistent with the Solow model. He stressed two main shortcomings in the approach of De Long-Summers; first De Long-Summers omitted to conduct any statistical test of the Solow model, and second it fails to survive the test of robustness. In his paper (Temple, Voth 1998) investigates the relationship between equipment investment and growth by using the MRW framework. His research improved the work of De Long-Summers and Auerbach by using a well-recognized and accepted theoretical framework, taking a more rigorous approach to outliers, using data on human capital, taking unobserved heterogeneity into account and by applying instrumental variables. He observes three different samples; first the ‘non-oil’ sample of developing and industrialized countries, second the ‘non-oil’ sample excluding OECD countries, and a third which involves the OECD countries. Results show equipment investment is weakly correlated with growth in the OECD sample but strongly correlated with the large group of developing countries. This is consistent with the De Long-Summers findings. More interesting is the magnitude of the estimated returns on equipment investment that was well over 50 percent and much higher than the estimated return on structure investments. Furthermore, Temple and Voth (1998) carried out robust regression and concluded that the Solow model is strongly rejected for the poorest countries. Another important paper on this topic is Jones (1994) who suggested that there is a strong negative correlation between economic growth and the relative price of machinery. Further research given by Jovanovic and Rob (1997) demonstrated that the difference in equipment prices can generate large income variations in a Solow model if technology is embodied in capital goods instead of being disembodied. Significant doubt on the investment growth nexus remains between the positive causality supporters Kormendi and Meguire (1985), Barro (1991), De Long and Summers (1991), De Long *et al.* (1992), Levine and Renelt (1992) and critics Blomstrom *et al.* (1996).

Growth researchers investigating the impact of human capital on economic growth recognize level and rate effect of human capital on growth (Gould, Ruffin 1993). Level effect means that output, and growth are directly connected to human capital as one of the production factor. Accumulation of human capital as a factor of production can in turn affect the level of output and growth. The rate effect can be seen as a spillover effect where human capital accumulation, i.e. increase in the overall number of people enrolled in education or increasing general level of knowledge of population can lead to new ideas, innovation and technological progress. There is almost a consensus on the fact that human capital positively influences economic growth. Evidence to support the theory was provided also by A. Smith. “Fourthly, of the acquired and useful abilities of all the inhabitants or members of the society. The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise that of the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labor, and which, though it costs a certain expense, repays that expense with a profit” (Smith 1986).

A. Marshall reflections on human capital is seen in “The most valuable of all capital is that invested in human beings” (Marshall 1997).

From A. Smith and A. Marshall’s definition a positive and direct relationship between human capital and output, economic growth is expected. This is a part where economic theory face economic tools and methodology constraints. Human capital as Smith correctly put it “is incorporated in the person” but it represents a form of intangible capital or asset therefore difficult to measure. Among the first to explore the human capital were (Schultz 1961), (Mincer 1958), (Friedman 1955), (Rosen 1983) and (Becker 1993). Becker defines human capital as “a means of production, into which additional investment yields additional output. Human capital is substitutable, but not transferable like land, labor, or fixed capital” (Becker 1993).

Extensive research carried on the subject however remains uncertain about the level of influence and impact of human capital to economic growth. The uncertainty rises from the methodological difficulties in measuring human capital (proxy and measurement errors) and different estimation procedures used in the analyses. Accounting growth framework and the Cobb-Douglas production function is one of the approaches used to estimate human capital to growth relationship. In their research (Benhabib, Spiegel 1994) find no evidence on positive and robust influence of human capital on economic growth. Mankiw Romer and Weil in their research (Mankiw *et al.* 1992) used the proportion of working age population as a proxy for human capital extending the Solow growth model framework to evaluate human capital impact on growth. Their results offer evidence on a direct and robust impact of human capital on growth. Alternative research on the topic using different proxies on human capital (education share in GDP) see (Nonneman, Vanhoudt 1996) or (weighted average of the enrolled population at all educational levels) in (Vasudeva, Chien 1997) yielded different results leaving the human capital growth cause-effect unveiled. An interesting approach addressing the problem of simultaneity between human capital and growth can be found in (Freire-Seren 2001). New insights on the human capital and economic growth nexus can be found in (Baldacci *et al.* 2008), (Barro 2001), (Bassanini, Scarpetta 2002), (Cohen, Soto 2007), (De la Fuente, Doménech 2006), (Vandenbussche *et al.* 2006).

3. Specifications and methodology

We propose to use a theoretical framework developed by (Schultz 1961) as a new proxy for human capital and test the result robustness. Because of the data limitation and cross-country econometric limitations, we decided to use a growth accounting with human capital model and test the hypothesis of the human capital impact on economic growth for a transitional country – Croatia. This could provide additional insight on human capital development and progress in transitional countries and shade some light on an existent relationship between human capital and growth in former socialist countries revealing the importance of human capital for growth in a specific environment such as the one in countries in transition. Croatia is among best candidates as a former socialist country and on the path to EU but not already a member. However, the study results and methodology are not a constraint to transitional countries only since the same methodology to measure and analyze the human capital effect on output can be used on any country.

To analyze the impact of education on GDP using (Maddison 2007), we must first construct human capital variable (in T. Schultz tradition). We write this model as

$$H = f(E, S, P), \tag{1}$$

where *E* is forgone earnings, i.e. average incomes multiplied with the number of secondary and tertiary students (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972); *S* is social expenditures on education, i.e. total public sector expenditures on education together with realized investments in education (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972); *P* is private expenditures on education, i.e. average household expenditures on education (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972); *H* is human capital.

Fig. 1 shows the stock of human capital for Croatia, a former socialist country for the period 1950–2009.

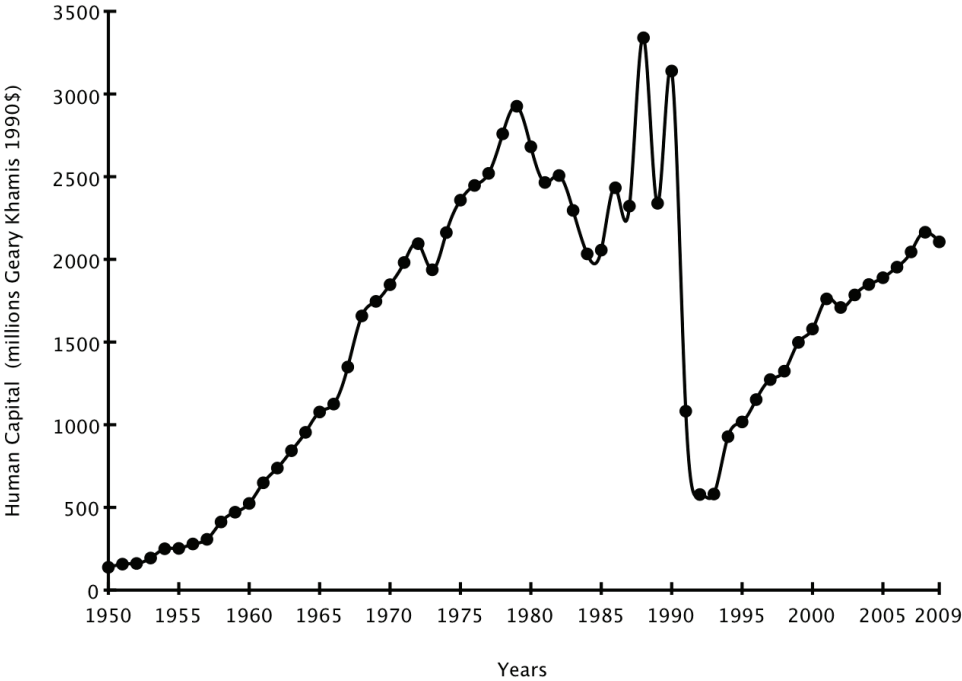


Fig. 1. Human capital stock in Croatia 1950–2009
Source: Own calculations from the data of the Croatian statistical office

From the graph we can notice that until 1980 Croatia experienced a large increase in the human capital accumulation. This was mainly because of a large fall in the private household investment in education as well a decline in the social expenditures of education. However, the main reason for the decline in the stock of human capital was a decline in the overall enrollment rate in education. This trend continued until 1985 and the enrollment trend start to rise until 1990 (Fig. 2). Then the war started and the enrollment numbers logically dropped

to the level that was registered during the 70's and 80's. After 1996 the number of students enrolled in secondary and tertiary education rose steadily.

Another important cause for the large drop in human capital registered at the beginning of 90's was a boom in unemployment and large fall in the level of employment. During the war, industrial infrastructure was destroyed massively and labor force employed in the traditional industrial sector with their skills and working experience become unemployed with minimum chances to find a new job in transforming society. Large (former) public sector was never restored and was replaced by the much smaller private sector that could not absorb such a labor force army present on the market. One of the solutions offered at that time, that however turned to be devastating for the future was an earlier retirement possibility offered to the people that become unemployed because of the war.

As we can notice from the Fig. 1, Croatia never recovered from the dramatic fall in the human capital registered in the 90's that pushed the stock of human capital thirty years back. Today the stock of human capital is at the level that was reached first time in 1975. It is our opinion that this tremendous fall in the human capital stock is responsible for the lost decade of growth and the biggest growth constraint in Croatia for the future economic growth. The way out of could be to pursue labor market restructuring, completely new wage policy, economy restructuring, and massive private and public investments in education. Without this interventions, needed high growth rates for catching up with the developed economies (rates above 10%) will not be reached. This situation today is worsened by the big economic

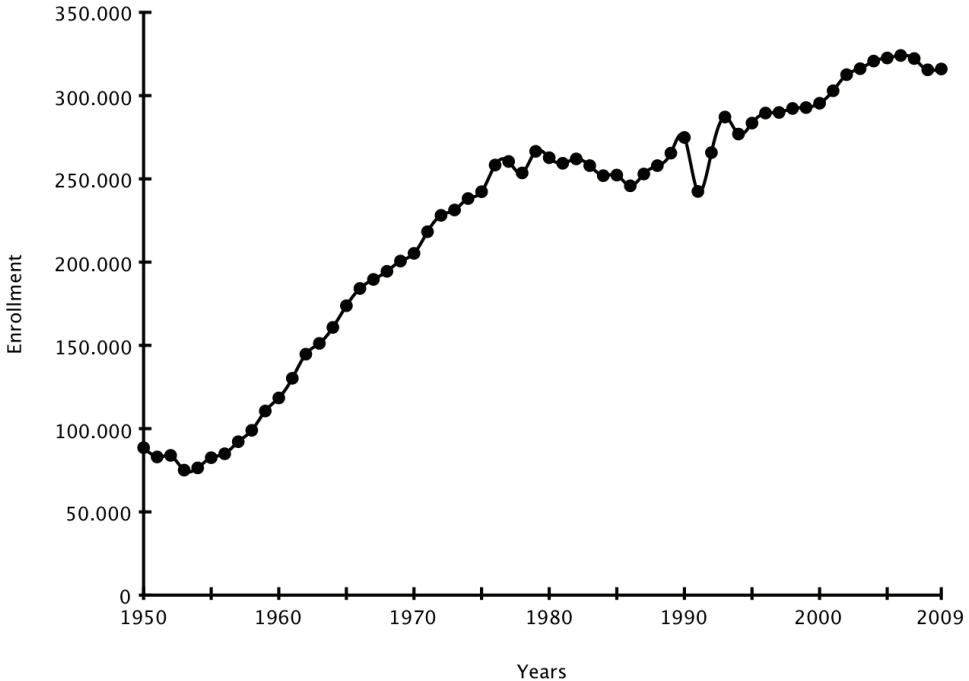


Fig. 2. Total enrollments in Croatia 1950–2009

Source: Own calculations from the data of the Croatian statistical office

crises Croatia is experiencing as a consequence of the global economic crises but also due to internal macroeconomic disequilibrium. Divergent regional economic policy is also one of the biggest constraints for future growth as determined by (Škuflić *et al.* 2010). Škare and Stjepanović identified unemployment as crucial growth constraint using CGEM (Škare, Stjepanović 2011) and (Šimurina, Tolić 2008) research the role of the technology progress in economic development. Educational impact on growth (GDP component approach) in Croatia is measured in the work of (Čišmešija, Sorić 2010) using economic sentiment indicator. How personal training affect job performance (skills and individual capabilities impact on productivity) can be found in (Awang *et al.* 2010). Uneven regional growth in Lithuania is also found to be limiting factor for future growth and sustainable development (Ginevičius, Podvezko 2009). Importance of the education for knowledge economy development and thus sustainable growth is also proven in (Melnikas 2010). Impact of human capital on unemployment through the migration channel in Lithuania is estimated in (Grundey, Sarvutyte 2007).

The growth model with human capital

In order to evaluate the impact of human capital on output in the Croatian economy we propose to use the standard Cobb-Douglas production function form and Growth accounting framework. We assume that the production function for the Croatian economy takes the form (Barro, Sala-i-Martin 2004; Doepke *et al.* 2001):

$$Y_t = A_t K_t^\alpha H_t^\beta N_t^{1-\alpha-\beta}, \quad (2)$$

where Y_t = GDP for Croatia (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972); A_t = Total factor productivity (TFP) or technology; K_t = Capital stock (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972); N_t = Size of the labor force; H_t = Human capital (expressed in Geary-Khamis 1990 international prices \$), (Geary 1958; Khamis 1972).

The production function is of the Cobb-Douglas form with constant returns to capital, labor, human capital and technology.

From (1) total factor productivity is measured by Barro, Sala-i-Martin 2004; Doepke *et al.* 2001)

$$A_t = \frac{Y_t}{K_t^\alpha H_t^\beta N_t^{1-\alpha-\beta}}. \quad (3)$$

For the proxy measure for human capital see the section before since in the calculation we used the proposed measure for human capital instead of the standard average years of schooling, share of education in GDP or enrollment rate. Other standard assumptions are retained, i.e., production function is a increasing function of inputs and TFP, homogeneous of degree one (constant returns to all inputs or constant returns to scale). Input shares (output used to pay for capital, labor and human capital) are calculated as follows Barro, Sala-i-Martin 2004; Doepke *et al.* 2001):

$$\begin{aligned} \text{Capital Share} &= \frac{r_t K_t}{Y_t} = \alpha, \\ \text{Human Capital Share} &= \frac{E_t + S_t + P_t}{Y_t} = \beta, \end{aligned} \quad (4)$$

$$\text{Labor Share} = \frac{w_t N_t}{Y_t} = 1 - \alpha - \beta.$$

Since we are interested in finding the influence of human capital on output we have to decompose the registered economic growth into contribution of individual production factors, i.e. capital, human capital, labor and TFP we have to transform the production function. First we have to take log differences (natural) to get the growth rates:

$$\log Y_t = \log A_t + \alpha \log K_t + \beta \log H_t + (1 - \alpha - \beta)N_t$$

$$\log Y_{t+1} - \log Y_t = \log A_{t+1} - \log A_t + \alpha(\log K_{t+1} - \log K_t) + \beta(\log H_{t+1} - \log H_t) + (1 - \alpha - \beta)(\log N_{t+1} - \log N_t).$$

Differentiating with respect to time t following $\frac{d \log Y}{dt} = \frac{Y}{Y}$ we can write

$$\frac{d \log Y}{dt} = A_t + \alpha \frac{d \log K}{dt} + \beta \frac{d \log H}{dt} + (1 - \alpha - \beta) \frac{d \log N}{dt}$$

$$\text{or} \quad \frac{Y}{Y} = A_t + \alpha \frac{K}{K} + \beta \frac{H}{H} + (1 - \alpha - \beta) \frac{N}{N}. \quad (5)$$

The growth rate (output) in Croatia is decomposed to the growth rate of productivity (A_t) + capital share times growth rate of capital ($\alpha(\log K_{t+1} - \log K_t)$) + human capital share times growth rate of human capital ($\beta(\log H_{t+1} - \log H_t)$) + labor share times growth rate of labor force $(1 - \alpha - \beta)(\log N_{t+1} - \log N_t)$. In the section that follows we present the results obtained from the equations above.

4. Empirical results

Regression results provide strong evidence on human capital importance for the economic growth in Croatia as we can see from the table beyond (Table 2).

Table 2. Growth breakdown analysis

Dependent variable: Real GDP (rgdpgro)

Independent Variables	OLS Basic
Laborgro ($1 - \alpha - \beta$)	0.1020422 (0.1061308)
Capitalgro (α)	0.2846925** (0.1444698)
Hcapitalgro (β)	0.1400503*** (0.0302096)
War (dummy variable)	-0.423202* (0.094184)
A_t (TFP)	0.0109252 (0.0094184)

Standard errors in parenthesis

*** Significant at 1 percent.

** Significant at 5 percent.

* Significant at 1 percent

Source: Own calculations from the data of the Croatian statistical office

with

$$\text{Capital Share} = \frac{r_t K_t}{Y_t} = \alpha = 0.2846925 .$$

$$\text{Human Capital Share} = \frac{E_t + S_t + P_t}{Y_t} = \beta = 0.1400503 .$$

$$\text{Labor Share} = \frac{w_t N_t}{Y_t} = 1 - \alpha - \beta = 1 - 0.2846925 - 0.1400503 = 0.5752572 .$$

From the table we can see that the model findings are highly statistically significant, especially one associated to the human capital connection to output in Croatia. Among all the independent variables, human capital is highly significant and that is encouraging since other researches carried on the subject didn't provide stronger evidence on human capital – output dependence. Not only, the return to scale level to the human capital stock is the second in level (if we exclude the dummy variable war) suggesting that 1% increase in the human capital stock is associated with 0.1400503 percentage points increase in Croatian output. Comparing these results to other studies we can see that the capital share in GDP is around the expected level (0.30 or 0.40) and labor share (0.60, 0.70). However, there is an important difference from other studies, i.e. the share of human capital in GDP of 0.14 (highly statistically significant). Final results of the growth decomposition for Croatia are presented in the Table 3.

Table 3. Growth decomposition for Croatia 1950–2009

	1950–2009	Percent
Total GDP growth	3.107123	100
– due to Capital	1.407246297	45.29
– due to Human Capital	0.936298756	30.13
– due to Labor	0.975559539	31.40
– due to Technology	-0.211981334	-6.82

Source: Own calculations from the data of the Croatian statistical office

Robustness and statistical significance of the model used is visible from the statistics presented in the Table 4.

Table 4. Model regression statistics

Regression Statistics			
R-squared	0.516061	Log likelihood	103.5520
Adjusted R-squared	0.480213	F-statistics	14.39605
S.E. of regression	0.043727	Prob(F-statistics)	0.0000000
Sum squared residuals	0.103253	Durbin-Watson stat	2.076588

Source: Own calculations from the data of the Croatian statistical office

To further test the model robustness and specially the statistical significance of the human capital variable in the model we used the marginal effect analysis in Stata. With the marginal

effect analysis we derived the elasticity coefficients for the explanatory variables in the model calculating the marginal effects of a change in capital, labor and human capital on the GDP after estimation. Results are presented in the Table 5.

Table 5. Marginal effects analysis of the model

Variable	ey/ex	Std. Err.	z	P> z	[95% C.I.]	X
Laborgro	0.0537301	0.05688	0.94	0.345	-0.057753 .165213	0.015188
Capitalgro	0.467576	0.25459	1.84	0.066	-0.03141 .966562	0.047374
Hcapitalgro	0.2242728	0.06557	3.42	0.001	0.095756 .35279	0.046191
War	-0.1243362	0.07221	-1.72	0.085	-0.265866 .017194	0.084746

Source: Own calculations from the data of the Croatian statistical office

From the table we can see that the elasticity coefficient for human capital, i.e. its marginal effect on the GDP is elastic, important and statistically significant. This is important evidence on the human capital direct effect on output.

Fig. 3 show the relationship between accumulation of capital and GDP in Croatia for the observed period.

From the chart above the neoclassical argument can be confirmed that increased capital results in increased GDP. That is, there is a direct relationship between the accumulation of capital and output measured by GDP.

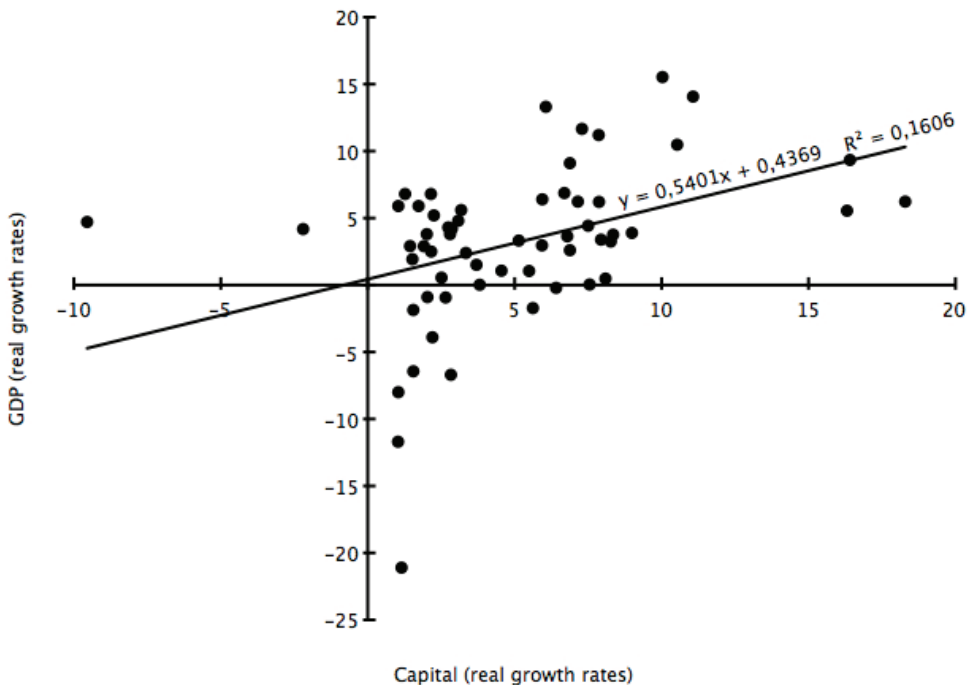


Fig. 3. Capital accumulation and GDP in Croatia 1950–2009
Source: Own calculations from data of the Croatian Statistical Office

It is also obvious from the chart below that there is a positive relationship between increased human capital and GDP in Croatia in the period from 1950 to 2009. However, caution about the consequences of this positive relationship should be exercised since coefficients of elasticity represent the result of the chosen growth model and policy of growth but not potential output. In other words, coefficients of elasticity show dynamics of changes but they not offer information about returns of investments, in particular factor of production. Several studies have shown, for example, that there are different returns on investments in human capital and the capital (Barro 2001). Investments in human capital are considered by modern growth theories as the ‘invisible hand’ that can pull out an economy from the labyrinths of the classical and even neoclassical growth models. Further, those studies have shown as well that inadequate structure of investments, which results in lower growth rates can be compensated by the increased investments in human capitals. In doing so it would not only change the investment structure but also through increased returns on human capital investments and its ‘spill over’ effects would lead to increased growth.

As we can see from the chart (Fig. 4) one third (1/3) of the real GDP growth rate in Croatia for the period 1950–2009 can be explained by the movement in the human capital stock.

Increased employment has been one of the major growth factors in the Croatian economy during the observed period. From the graph 3 and Table 4 (below) it can be concluded that for every percentage of increased employment the output is increased by 0.53%. Comparing those coefficients of elasticity this factor played the most important role in the Croatian

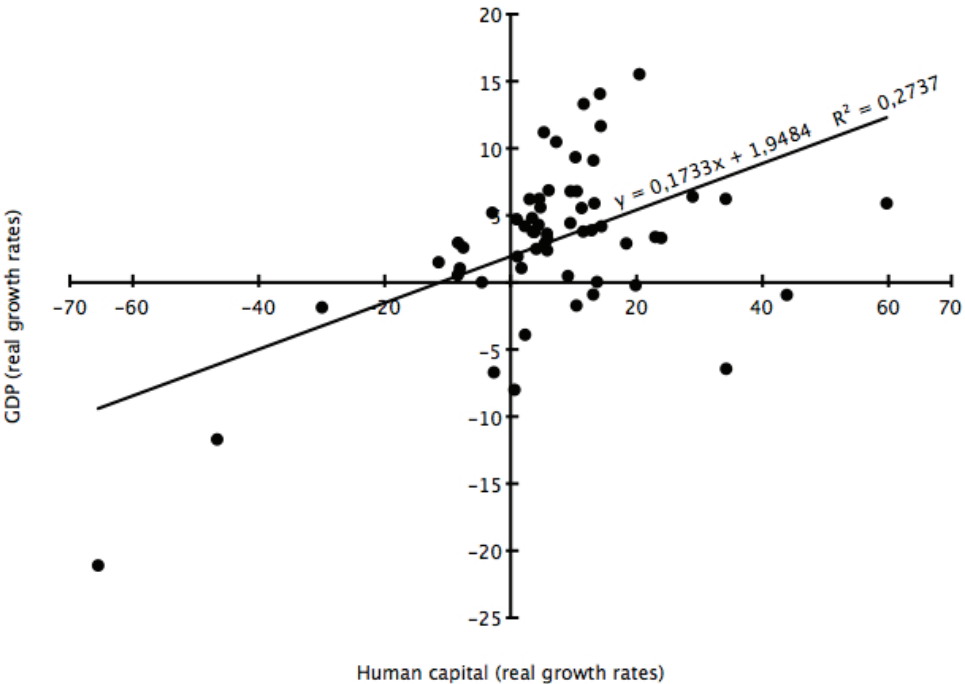


Fig. 4. Human capital stock and GDP in Croatia 1950–2009
Source: Own calculations from data of the Croatian Statistical Office

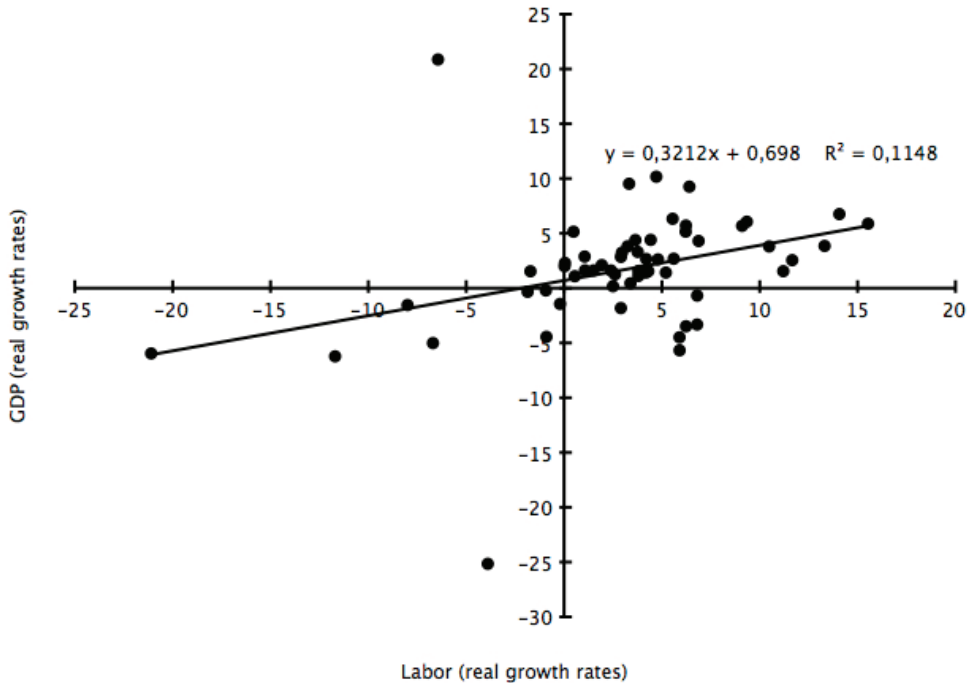


Fig. 5. Labor and GDP in Croatia 1950–2009

Source: Own calculations from data of the Croatian Statistical Office

development in the period from 1950 to 2009 (Fig. 5). From this, it can be concluded that the economic growth in Croatia in the last 60 years measured by GDP was mainly based on the increased employment (labor intensive industry).

Because of the inadequate investment structure, (the lower investments in human capital and technology, and lower efficiency of capital, volatile and decreasing TFP) the Croatian economy has not been realizing potential growth rate of output to equalize it to the growth of accumulation of capital in order to increase the growth of its economy (see Fig. 6).

From the Fig. 6 we can see that TFP is important for output growth in Croatia. One third of the change in output can be attributed to the TFP growth holding other variables fixed. Unfortunately, Croatian government and economic agents were not consciousness of this fact during the last 60 years. The same is today, sixty years after.

Another interesting insight is provided by the data on the Croatian economy. Until 1990 Croatia had educated labor force, which was its key growth source. Technology and technological improvements accompanied by the increase in the TFP were highly volatile and with a negative trend for most of the observed period as we can see from the Fig. 7.

As a result of low technological environment, labor-intensive industries that dominated the industrial sector of the Croatian economy brought up workers' effort along with incorporated skills and capabilities' as growth locomotives. It is more likely to find evidence in highly industrialized and technologically developed countries that support a thesis on low importance of human capital for growth. It is our opinion that the reason for that is two-fold. First, econometric models as not yet developed to distinguish precisely between the cause and effects among variables. Here, we mean that with the quantitative tools at our disposal,

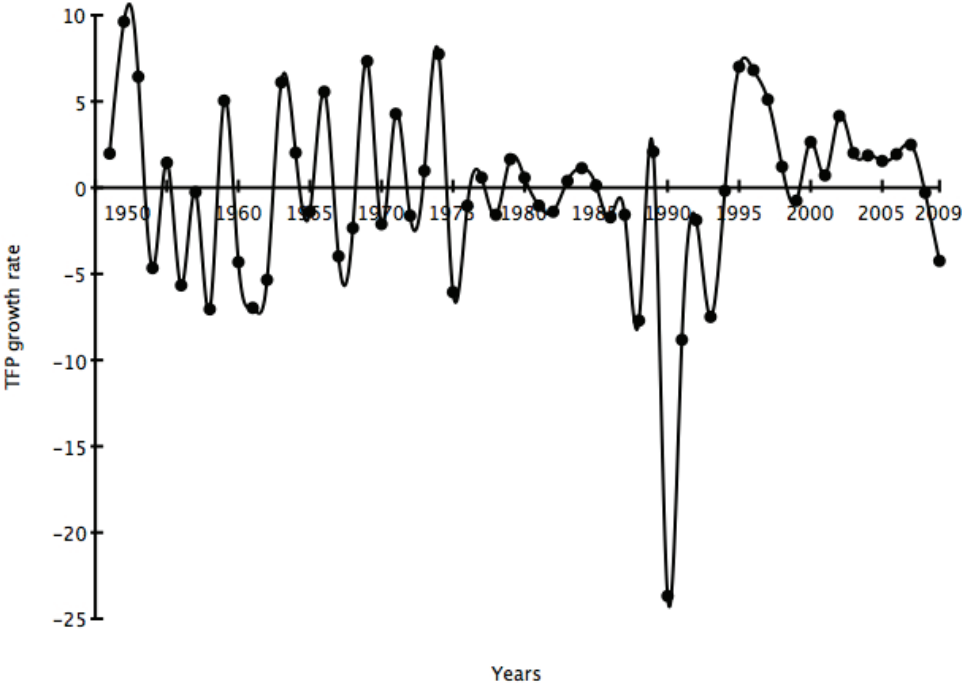


Fig. 6. TFP in the Croatian economy 1950-2009
Source: Own calculations from data of the Croatian Statistical Office

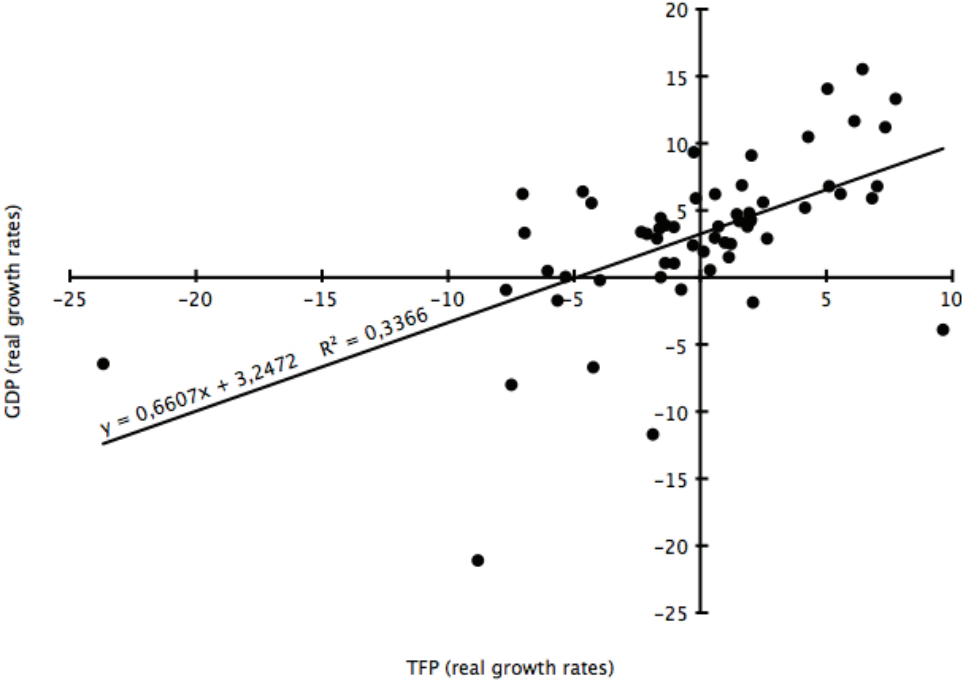


Fig. 7. TFP and GDP in Croatia 1950-2009
Source: Own calculations from data of the Croatian Statistical Office

we cannot without doubt say does human capital encourage technological innovation or it is vice versa? The second is that since the problem of performance lag (lag between investing in education and using the results of increased returns to scale for education) it is logically to assume and expect that technological variables must dominate over human capital. This in turn result in spurious regression results overstating the importance of technology leaving human capital behind. Former socialist economies are particularly indicated for the research on the human capital importance for growth. Croatia is one of them. The reason is that as a former socialist country, Croatia lack of modern market infrastructure such as flexible and efficient labor market, productive and labor market oriented educational system, knowledge and education just in theory promoted as growth engines (in reality, the value of education in understated on micro and macro level). In developed market economies, it is difficult to isolate and study individual economic phenomena impact and relationship between them. This is because their markets are the result of several thousand years of evolution. Dynamics going on at such market is tremendous. These dynamics, in fact, is the main obstacle for promising research and study results, since we cannot “freeze” the market to explore the economic life on and around the market. Underdeveloped economies did not yet reach that level of market infrastructure and market mechanisms to be used in exploration and the quest for economic reasoning and regularities. This makes the former socialist countries just perfect. They market were the product of thousand years of evolution and then after the socialist revolution their collective memory on market life and mechanism was just swept off. After the fall of the Berlin wall, these economies started to minutely collect the pieces of their lost knowledge trying to restore it to the condition that it was before their “economic and market” mind and tradition were erased. For example, in Croatia, labor market not recognizes educated and skilled labor in the sense that on the average highly skilled and educated labor have incomes few times above average labor income. Their income generally ranges about 1.5–2 times the average wage on the labor market. Usually, their knowledge and skills are not properly valued. Therefore, we can easily observe the position of the Croatian economy before educated and skilled labor enters the labor market and after and its relation to the output of the economy.

This is not the case in modern market economies. Skilled and educated labor is expected to be valued even before finishing school. After entering the labor market they immediately get employed in high-tech industries, and their knowledge and skill promptly incorporated in the production process. Generally speaking, human capital incorporates to the existing capital stock making difficult to separate and measure human capital impact on output and firms performance individually from the capital stock. This is not the case for former socialist economies; the time lag before human capital becomes part of the total capital stock is sufficiently large to study the impact of human capital on output. The same is for Croatia.

5. Concluding remarks and discussion

In this paper, we propose to study the relationship between the human capital and output (GDP growth). We selected the Croatian economy to carry out the study. There are several arguments backing up our selection. Croatian economy is a newborn economy emerging in

1990. However, Croatian economy existed many years before the year 1990. The last 50 years it was a part of the former socialist economy of Yugoslavia and as such a socialist economy. Still Croatia has a long tradition as a market economy. Almost 150 years ago a large stock exchange (important in Europe at that time) was present and operating in Croatia. Economic agents learned the way of the market economy more hundreds years ago. After the Second World War, the collective memory of economic agents was swept and replaced with the socialist economy. As a transition country, from 1990 Croatia started to search for a “lost memory” and lost market system. As a consequence, today market in Croatia is based on true market and economic laws but without all needed market infrastructure and not merely integrated markets as in developed market economies.

This gives us the opportunity to study individual economic phenomena separated from the influence of others, a real “*ceteris paribus lab*”. This is especially true for human capital and so Croatian economy is a perfect case study for research on human capital stock impact on output. Main finding of the paper is two fold. One consists in developing a new methodological framework for human capital measurement that we proposed in the paper. An advantage of the proposed framework consists in international comparability, money metric scale, human capital stock can be expressed in money terms and as such a part of the country’s GDP. This gives us the opportunity to more easily evaluate the impact of the human capital stock on country’s output trends and get more robust econometric results. This new approach (second advantage) in measuring human capital proved robust to the spurious regression problem involving human capital calculations. The study results on human capital impact on GDP are encouraging.

We find that the share of human capital in the registered growth of output (GDP) in Croatia for the period 1950–2009 was 30%. This is highly enough considering that in Croatia private, and government spendings on education were extremely low in comparison to modern economies. Calculated elasticity coefficients obtained from the standard Cobb–Douglas production function with constant returns to scale under standard statistical tests proved significant and robust to the sensitivity analysis. Findings show that human capital in Croatia was the second most important engine of growth, and that output is elastic to change in human capital stock. With the Croatian accession to EU expected in the future strong restructuring and change of the educational system is anticipated. This will lead to reposition of human capital within the Croatian economy with a more public and private fund flowing to education. As results of such scenario, we expect to measure larger share of human capital afterward.

This paper provides two additional insights that should be useful in future research on interdependence between education and economic growth. First, prior researches on human capital (educational) impacts on economic growth Lucas (1988), Romer (1986), Arrow (1961), find little evidence for this causality (statistical significance).

As shown in paper analysis this was due to the absence of proper human capital stock valuation methods. Taking into account T. W. Schultz concept of human capital we derive and investigate human capital level for Croatia. Second, the paper analyzes whether systematic disregarding of educational investments’ character (that is low GDP share allocated in education) is responsible for achieving low growth rates in the past but also in the future. Test results for the Croatian economy over the period 1950–2009 suggest that low level of

educational investments along with former socialist economic policy and wrong post-transition macroeconomic management caused low economic growth in the Republic of Croatia.

Research results provide evidence (for Croatia but in our opinion the same is for other reforming countries) that growth results from human capital accumulation or to say human capital does matter for growth. Investigation of the key factors of economic growth in Republic of Croatia should generate valuable insights for policy makers wanting to establish an efficient macroeconomic framework in order to improve the economy's productive and competitive capacity in transition or former transitional countries. This will positively affect GDP, employment and other important economic variables in the long run.

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ŽMOGIŠKOJO KAPITALO SVARBA PEREINAMOSIOS EKONOMIKOS AUGIMUI

M. Škare

Santrauka. Šio straipsnio tikslas – išplėsti mokslinius tyrimus apie žmogiškąjį kapitalą ir pateikti įrodymų, kad jis yra svarbus reformuojamos ekonomikos augimui. Siūloma nauja žmogiškojo kapitalo vertinimo metodologija, kurios pranašumai – tarptautinis lyginamumas, monetarinis vertinimas ir žmogiškojo kapitalo reikšmės ekonomikos augimui akcentavimas. Naujoji metodologija įrodė savo patikimumą vertinant žmogiškojo kapitalo kintamuosius. Empiriniai rezultatai rodo, kad žmogiškasis kapitalas yra svarbus augimui, ir tam reikia didelių investicijų švietimo srityje.

Reikšminiai žodžiai: ekonomikos augimas, žmogiškasis kapitalas, švietimas, endogeninis augimas.

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