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Original Research Article

Long-Term Impact of Human Capital on Economic Growth: A Panel Data Analysis on the Balkan Countries

ABSTRACT

The aim of this study is to investigate empirically the impact of human capital on economic growth in the long run empirically by using the data of the Balkan countries. Panel cointegration technique and Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) methods are used in the econometric estimations. FMOLS estimations indicate that one point increase in tertiary education enrollment rate and in the ratio of the health expenditures to GDP increase real GDP per capita by 1.3 percent and 9.9 percent, respectively. In addition, FMOLS results show that one point increase in the ratio of the health expenditures to GDP increases real GDP per capita by 13.1 percent. According to DOLS estimations, similar results are obtained. Once labor productivity is taken as dependent variable in the models, it is concluded that an increase in human capital increases labor productivity in the Balkan countries.

Key Words: Human capital, Balkan countries, FMOLS, DOLS.

1. INTRODUCTION

Human capital can be defined as the complete set of knowledge and skills of the human workforce in the respective organization, which can be utilized for its interests. Basic resources of human capital (skills) are present in the nature of the respective person and can be improved through education. Education is the endeavor of improving the existing natural skills and bringing them to perfection as closer as possible. Improvement of the skills of the employees or executives by way of providing trainings to them and conveying such skills and the experiences to the personnel enhance the workflow and performance. In particular, the decision-making skills of executives in enterprises can be improved through trainings conducted in the light of the past experiences. Increase in efficiency is ensured by means of bringing the skills to perfection through experiences and of reducing mistakes. It enhances the economic growth on one side and renders the growth sustainable and in the nature that can increase employment on the other. In general, impact of human capital on economic growth takes place through two channels. First; human capital sets the stage for the development of new commodities and products. Development of new commodities and products and creation of new markets during the recent years have, as can be observed in the computer and communication sectors, increased the economic potentials and ensured the growth of the corporations and countries. Second; human capital causes the firms to gain competitive advantage on the current markets and to increase their market shares accordingly. Both impacts in question provide contribution to the increase of economic growth on macro basis. As asserted by Teece [1], immovable assets (like human capital) constitute a significant competitive advantage for the knowledge-intensive enterprises. In addition, Amir and Lev [2] have demonstrated that the industries based on knowledge economy, like telecommunication, biotechnology, and software sectors, make significant amount of investments in the immovable assets like research-development and development of new products. Valuation of the immovable assets is important for such sectors because the fundamental determinant of the difference between the book values, market values, and real values of the respective company in its immovable assets; that is to say, its human capital and/or intellectual capital.

In consideration of the fact that the concept of human capital in the economy literature expresses the investments that increase the efficiency of an individual in a broad sense, the factors of education and health stand out when it comes to measuring human capital. Those two factors are basically in the nature of being complementary to each other. Increase of growth by the education factor takes place through various mechanisms. Investment in human capital brings about increase in the efficiency of labor and provides positive contributions to the labor incomes and growth performance. In addition, education decreases the tendency of having excessive number of children and, accordingly, slows down the population growth rate. Education affects the total factor productivity by means of enhancing the countries' ability to adapt to the technologic growth that increases the domestic production [3]. As asserted by Hanushek and Dongwook [4] and Schultz [5], being healthy improves the intellectual capital of an individual, which causes the outputs obtained from education to

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be more successful. In the empirical literature, there are studies that underline the positive impact of the education factor [6, 7, 8] in addition to the studies that emphasize that the improvements in the health section of human capital contribute to economic growth [9, 10, 11]. In this framework, it is necessary to handle the two factors first in analyzing the impact of human capital on economic growth.

The Balkan countries that constitute the sample countries in this study have an economic structure that have not yet performed the sufficient development in terms of human capital and that face structural economic problems accordingly. Uvalic [12] asserts that excessive economic dependence of, in particular, the western Balkan countries[1] on the European Union countries causes them to be fragile against global crises. In dealing with the structural economic problems by the western Balkan countries, the importance of human capital investments is grave. Through the reforms performed in the research-development, innovation, and education system, it is possible to reduce the discrepancies between the supply and demand of the labor skills and to increase the international competitive power. In addition, economically, the immigration movements that have increased during the recent years constitute another human capital problem, along with the lack of human capital in the Balkan countries, particularly after the 2008 global crisis.[2] Increase of the human capital in the Balkan countries will constitute the ground for such countries to make better use of the positive developments that might take place in the global economical conditions. The European Central Bank estimates the 2016 growth rate in the Euro Zone as 1.9% while Moody's estimation for the G20 countries in the year in question is 3 percent. The fact that the Balkan countries are in an attention-inviting position in the export of the above countries to the Balkan countries and in the direct foreign investments[3] demonstrates that the Balkan countries have a significant potential. Increase of the human capital elements is considered one of the prime conditions of benefiting from such potential.

This study aims to estimate the impact of human capital on economic growth in the long run by using the data for the Balkan countries. For this purpose, the panel FMOLS and panel DOLS models will be used in the empirical analysis. The impact of human capital on economic growth in the long run will be determined thanks to the help of the models in question. The organization of the study is as follows: The second section has been allocated to the theoretical remarks regarding the relationship between the human capital and economic growth and to the constitution of the model utilized in the study. In the third section, information regarding the methodology and data is presented. Economical estimation results are shown in the fourth section. In the final section, results and assessments are provided.

2. THEORETICAL FRAMEWORK AND MODEL

In the classical economy's growth theory, labor productivity depends on an external factor relating to the proportion between the physical capital and workforce and on the other factors like technological advances. On the other hand, their impact on the efficiency of education is not taken into account. The new growth theory developed in the early 1980s eliminated such deficiency of the Classical theory and mentioned the importance of education and innovation, two elements of human capital, in economic growth in the long run [13]. Human capital was included in the capital definition by Adam Smith for the first time. Subsequently, Mincer [14] underlined that the trainings taking place in both the formal educational processes and the businesses increased the experience and it could cause the increase of the revenues of the employees in the course of time. Mincer's model [14] assumes at the same time that performance is related with the income acquired through time, i.e. age, in terms of the business requirements. Despite the increase in the revenues depending on the improvement of the knowledge and skills in a particular period, there is the possibility that such revenues can start to decline due to the change or omission of the needed skills in the course of time. On the other hand, such decrease in the revenues takes place faster in the employees with lower incomes and skills. Schultz [18] pointed out the deficiencies in the on-the-job trainings in the industries and, by describing humans as investment capital, asserted that such investments could be effective in income distribution. Schultz [18] classified the human capital investments basically in five categories. They are health facilities and services; investments that increase the endurance and vitality of humans; on-the-job trainings (including former type apprenticeship); formal educational activities (education at secondary schools and above); educational activities (especially on agriculture) for adults (not performed by firms); and the immigration of the families and individuals ensuing the alteration of the job opportunities (options). Within the framework of the evaluations of Schultz, the importance attached to the education factor stands out. Such importance causes the factor in question to take place among the fundamental determinants of human capital. For the education and human capital relationship, studies of Ritzen and Winkler [19] who asserted that the complementary or compensative educational programs could reduce unemployment and increase the amount of owned human capital as well as of Kautz et al. [20]

[1] Western Balkan countries are Serbia, Bosnia Herzegovina , Macedonia, Albania, Montenegro , Croatia, and Kosovo [15].
[2] In terms of the immigration mobility in the Balkan countries, see [16].
[3] See [17].

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who demonstrated that non-cognitive skills could be improved through early- conducted development programs can be exemplified. As specified, close relation of human capital with education brings its reflections into economic growth to the surface as well. In addition to education, it is necessary to pay attention to the aspect of human capital relating to health. For example, Becker [21] who investigated the investment types that could be effective in working skills assumed that the health applications, use of vitamins, on-the-job training, schooling, adult educations, and furnishing information regarding economy developed both the physical and mental skills of the employees and that it may increase their incomes.

In the theory of economics, mainly, the impacts of human capital on economic growth have been investigated. Romer [22] and Lucas [23] can exemplify it. Romer [22] highlighted that human capital guided the enterprises toward internal growth by means of allowing the development of new commodities and products through more and efficient research and development endeavors. In addition, he underlined that growth took place through the guidance of the research and development activities by human capital. Lucas [23] pointed out that all the human capital factors affected the external impacts positively and the employees worked more efficiently, which brought along growth. Impact of human capital on economic growth is handled among the internal growth models in the theory of economics. In the Neoclassical models developed by Solow [24] prior to the internal growth models, technological development is designated as external and the source of growth is not explained. In the approach, the labor production factor is considered stable, the assumption of revenues decreasing as per the scale becomes valid, and human capital is not mentioned. In the Neoclassical model, the fact that the accoutrements vary among countries and the decreasing marginal productivity of capital determine the differences of development between them. The convergence hypothesis states that the capital factor will move from the poor countries toward the rich countries, that the poor countries will grow more rapidly than the rich countries, and that, hence, the poor countries will catch the rich countries. On the other hand, the "convergence hypothesis" based on the assumption that technology is external and fixed will be eliminated completely through the technological advancements in the developed countries. In this framework, the Neoclassical growth theory remained insufficient in explaining the difference of development between countries. The internal growth models take the factors of technological change and human capital accepted external in the Neoclassical growth models into account and try to explain the difference of development between countries [25]. In the internal growth models, technological advancement is not designated as external; that is to say, it is determined within the model. As there is the human capital factor in those models, it is asserted that the state of income increasing as per the scale can be valid. Upon the scrutiny of the human capital models among the internal growth models, the relationship between human capital and economic growth could be understood better. Those models assert that the education and health expenditures contribute to economic growth by way of augmenting the productivity of the labor production factor. In creating the economical model regarding the impact of human capital on economic growth, it is necessary to include the investment expenditures into the model. It is because the variable in question takes place among the fundamental determinants of economic growth. The Cobb-Douglas production function constituted accordingly can be demonstrated by way of the equation (1)[4].

$$Y = AK^{\alpha}(hL)^{1-\alpha} \tag{1}$$

where K shows the physical capital stock, h the human capital factor per labor, L the number of the employees, and A the total factor productivity. The production function can be rewritten as production amount per labor (y=K/L):

$$y = Ak^{1-\alpha} \tag{2}$$

where k shows the amount of capital per labor. In keeping with Solow [27], the growth calculation method is used to demonstrate the separation between production increase, input increase, and productivity increase. When the method is applied to Cobb-Douglas production function shown in equation (1), the equation (3) will be obtained. When the equation (3) is expressed as per labor production factor, equation (4) will be obtained:

$$\Delta lnY = \Delta lnA + \alpha\Delta lnK + (1-\alpha)\Delta lnh + (1-\alpha)\Delta lnh \tag{3}$$

$$\Delta lny = \Delta lnA + \alpha lnk + (1-\alpha)\Delta lnh \tag{4}$$

[4] The remarks regarding the relationship between human capital and production based on the Cobb-Douglas production function have been provided by utilizing the views of Lee ve Hong [26].

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In the scope of equation (4), production increase per labor is distinguished as capital increase per labor, human capital increase per labor, and total factor productivity. The equation allows us to distinguish the differences per labor in Gross Domestic Product (GDP) experienced in countries. In this framework, three basic sources of difference are in question: capital-labor ratio differences, differences in human capital, and differences in the total factor productivity. In addition to the investment factor, human capital factor and some control variables must be included in the model as well. Accordingly, the model that expresses an expanded form of the Neoclassical growth model can be demonstrated by means of the equation (5).

$$gdp = f(inv, hc, \Omega) \tag{5}$$

where gdp shows per capita real GDP, inv the investment ratio, hc the human capital, and Ω the control variable set. The econometric models to be constituted using this function are shown in equations (6)-(11).

Model 1: $$gdp_{it} = \beta_{0i} + \beta_1 enr_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{6}$$

Model 2: $$pro_{it} = \beta_{0i} + \beta_1 enr_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{7}$$

Model 3: $$gdp_{it} = \beta_{0i} + \beta_1 hth_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{8}$$

Model 4: $$pro_{it} = \beta_{0i} + \beta_1 hth_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{9}$$

Model 5: $$gdp_{it} = \beta_{0i} + \beta_1 life_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{10}$$

Model 6: $$pro_{it} = \beta_{0i} + \beta_1 life_{it} + \beta_2 cap_{it} + \beta_3 exp_{it} + \varepsilon_{it} \tag{11}$$

In the equations, t=1,…,T shows the time period, i=1,…N the units forming the panel, β_{0i} country based impacts, gdp the real GDP per capita, pro the productivity of the labor production factor calculated as the ratio of the workforce to GDP, and e_{it} the residuals obtained from the long term cointegration relationship. In the economical estimations, various representative variables were used to represent human capital. They are educational capital, health capital, and life expectancy at birth. The tertiary education enrollment rate (enr), one of the variables, was handled to represent the educational capital. It is a widely used variable in the empirical literature. Bils and Klenow [28] and Ranis et al. [29] can be exemplified for such studies. Handled as another human capital variable, other health capital was represented as the share of the health expenditures within the GDP (hth). Despite the use of mortality rate in some studies to represent the health capital (see [30]), the share of the health expenditures within the GDP was used in the model as it allows their compilation as a whole for the countries investigated in the study. Another variable used as an indicator of the health aspect of human capital is the life expectancy at birth (life)[5]. Knowles and Owen [31, 9], Bhargava et al. [11], and Barro [10] can be shown as examples for the studies using the variable in question. Improvements in the fields of education and health increase the productivity of the labor factor and contribute to production accordingly. Hence, the sign of such variables is expected to be positive. On the other hand, it can be observed that the education variable affect the growth ratio negatively in some studies. Pritchet [33] can be exemplified it. In addition, excess life expectancy at birth ensures that the labor factor takes part in production for a long time, which contributes to economic growth. Thus, the sign of the human capital variable represented by using the life expectancy at birth is expected to be positive. To represent the investment ratio given in equation (5), the share of the investment expenditures of gross capital formation within GDP (cap) was used. As the increase in the investment ratio expresses the increase in the physical capital stock, the sign of that variable is expected to be positive. The share of export in GDP (exp)[6] was included in the model to express the Ω control variable provided in equation (5). When the increase in the export ratio is assumed to contribute to economic growth, this variable is expected to be positive. In the econometric models, equations where the labor productivity was handled as dependent variable were estimated as well. This way, it will be possible to analyze the impact of the changes in human capital on productivity, in addition to production. The positive developments in the fields of education and health, two indicators of human capital, are expected to have positive impact on productivity. According to Chirikos and Nestel [34], discrepancies in the health conditions have negative impacts on remuneration ratios and working hours.

[5] In terms of life expectancy and economic growth relationship, see de la Croix and Licandro [32].
[6] On the variables affecting export amount, see Demirhan and Demirhan [40].

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3. ECONOMETRIC METHODOLOGY AND DATASET

In this study where the relationship between human capital and economic growth is investigated, the panel data method was used. Panel data method is based on combining the horizontal section data of economic units in a particular time dimension. The panel data analysis requires the estimation of the equation (12):

$$y_{it} = \beta_{0it} + \beta_{1it}x_{1it} + \cdots + \beta_{kit}x_{kit} + e_{it} \qquad i = 1, \ldots . N \quad t = 1, \ldots . T \tag{12}$$

In the equation (12), i expresses the units and t the time series. yit shows the dependent variable, xit independent variable, β the slope parameters, and e the error term. In researching the impact of human capital on economic growth, the panel unit root tests will be conducted first. In this study, the panel unit root tests recommended by Levin et al. (LLC) [35], Im et al. (IPS) [36], and Breitung [37] will be conducted. In the unit root tests, the models that include the fixed value and that do not include trend will be used. The LLC test utilized frequently in the applied studies and based on ADF type models requires the estimation of the equation (13).

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j}^{pi} pi \Delta y_{it-j} + e_{it} \tag{13}$$

where Δ shows the first difference operator, y_{it} the series observed for the i unit, and t=1,…., T the time period. In the LLC test, for all i's, $\beta_i = \beta = 0$ null hypothesis is tested against the $\beta_i = \beta < 0$ alternative hypothesis. If the null hypothesis is rejected, the result that the series are stationary is obtained. LLC test assumes that β_i, in other words, the autoregressive coefficient, is identical in all units. Hence, in search of the unit root, this test takes all the units in the panel into account; in other words, it examines the status of the unit root in all the units forming the panel. In this framework, the homogenous panel applies in the LLC test.

The IPS test that expressed the expanded form of the LLC test and that is also based on the ADF type models assumes that β exhibits difference as per units; in other words, the autoregressive coefficients are not identical. This means a heterogeneous panel. In this test, each of the cross section series is applied the unit root test and the series are assumed to have different lag lengths. In the IPS test, $\beta_i = 0$, null hypothesis is tested against the $\beta_i < 0$ alternative hypothesis. In other words, the null hypothesis where all the panel cross sections have unit root is tested against the alternative hypothesis created by assuming at least one cross section is stationary.

In addition to the unit root tests described above, the Breitung [37] panel unit root test was conducted as well. The reason for preferring that test is the wish of considering the autoregressive parameter of each unit and its superiority over the other tests in the cases where the number of observations is fewer. The test is employed considering that the null hypothesis series have unit root and the alternative hypothesis is constructed considering that the series are stationary.

Subsequent to the unit root tests, the long-term relationship between the human capital and economic growth will be analyzed. Accordingly, the panel cointegration technique developed by Pedroni [38, 39] will be used. The technique allows heterogeneousness between the units forming the panel and exhibits superiority against the other cointegration tests thanks to that feature of it. Pedroni panel cointegration test is demonstrated by means of the equation (14).

$$y_{it} = \alpha_i + \delta_t + \beta X_{it} + \varepsilon_{it} \tag{14}$$

In the equation (14), i=1,2,….N expresses each unit in the panel and t= 1,2,….T the time period. α_i and δ_t show the fixed effects and deterministic trend specific to the unit, respectively. X_{it} demonstrates the explanator variables vector. In the Pedroni panel cointegration test, there are three tests, 4 of which are within-dimension, and 3 of which are between-dimension. In the within-dimension and between-dimension tests, the null hypothesis is constructed that there is no cointegration between the variables. The alternative hypothesis is constructed that there is cointegration in all the cross section units in the within-dimension tests and that cointegration is present in some of the cross section units and is not present in some others in the between-dimension tests. In this study, Kao [41] panel cointegration test will also be used in addition to Pedroni [38, 39] panel cointegration test. In that test, the null hypothesis is constructed that there is cointegration between the variables and the alternative hypothesis is constructed that there is no cointegration between the variables. The Kao [41] panel cointegration test is based on the application of the ADF type tests to the residuals ($\hat{e}_{it}$) obtained from the OLS panel estimation. The test can be demonstrated by means of the equation (15).

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$$\hat{e}_{it} = \alpha_{it-1} + \sum_{j=i}^{p} \beta_j \ \Delta\hat{e}_{it-j} + u_{it} \tag{15}$$

Subsequent to performing the cointegration test, the long-term coefficients of the variables affecting GDP must be determined. For this purpose, FMOLS method developed by Phillips and Hansen [42] and DOLS method recommended by Saikkonen [43] and Stock and Watson [44] were used in the study. Both approaches are based on the correction of the autocorrelation. FMOLS is non-parametric approach while DOLS is a parametric one. In the FMOLS method, the first differences of the error term and independent variables include in the model to correct the serial correlation. DOLS estimator includes the lag and lead of first differenced explanatory variables into the regression. The problems of serial correlation and endogeneity of the explanatory are alleviated by way of using the two methods in question. According to Kao and Chiang [45], the panel DOLS estimator bears superiority compared to OLS and FMOLS. In addition, Pedroni [46] asserts that the FMOLS method yields robust results in small samples as well.

A logarithmic transformation was applied to income per capita and labor productivity variables, two of the variables used in the study. All data was obtained from the World Bank Development Indicators [47]. In this study, we use several models for researching the relationship between human capital and economic growth. In the models with 3, 4, 5 and 6 numbers, data covering the years between 2000 and 2011 and belonging to the ten Balkan countries was used. The countries are: Algeria, Bosnia, Bulgaria, Croatia, Greece, Macedonia, Romania, Serbia, Slovenia, and Turkey. As the human capital indicator, data of eight Balkan countries, excluding Serbia and Greece, covering the years between 2000 and 2011 was used in models 1 and 2 where the ratio of schooling in higher education (enr) variable is utilized. The reason for choosing such time period in the models used is that the entire range of variables can be obtained in that time range for the respective countries as a whole.

4. EMPIRICAL FINDINGS

4.1. Panel Unit Root Test Results

The panel unit root tests regarding the variables are reported in table 1. The table 1 is separated into two sections. The first section demonstrates the unit root test results in the case where the number of the observations is 96 and 8 countries are used. The second section of the table demonstrates the unit root test results in the case where the number of the observations is 120 and 10 countries are used. The unit root tests were conducted first at the level values of the series. The results of the panel unit root tests vary as per the methods utilized. The LLC test results show that, except *exp*, *cap* and *enr* variables used in model 1 and 2, the null hypothesis that the series are not stationary is rejected at the level of 5%. On the other hand, the results of the IPS, Fisher ADF, and Breitung t-test show that, in general, the series of the variables for the model 1 and 2 are not stationary since the null hypothesis is not rejected at 5% significance level. As a result, it was determined that in the majority of the panel unit root tests, the variables are not stationary in their level values. In consideration of the first differences of the variables, the result that the series do not have unit root was obtained. In this framework, where the variables are integrated in the first differences, i.e. I(1), was assumed. The unit root test results where the number of observations is 120, for the variables used in model 3-4-5 and 6, are shown in the second section of table 1. The test results exhibit parallelism with the case where the number of the observations is 96. In this framework, it is concluded that the variables are not stationary in their level values and that they were stationary when their first differences.

Table 1. Panel unit root test results

Variables	LLC	IPS	Fisher-ADF	Breitung t-test
Model 1- 2 (n=8, t=12)				
Gdp	-2.96***	0.19	12.50	1.24
Δgdp	-5.05***	-2.61***	31.01**	-2.07**
Pro	-3.68***	-0.53	17.87	1.09
Δpro	-4.46***	-2.39***	29.51**	-2.30**
Exp	-0.73	-0.58	20.87	0.004

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Δexp	-5.05***	-3.28***	42.67***	2.61
Cap	-1.87*	-0.66	17.50	1.21
Δcap	-5.64***	-2.94***	34.12***	-2.66***
Enr	0.02	3.68	9.24	3.86
Δenr	-3.95***	-1.83**	29.37**	-1.49*
Model 3-4-5-6 (n=10, t=12)				
Gdp	-3.40***	0.005	16.50	3.81
Δgdp	-3.92***	-1.94**	34.07**	-1.74**
Pro	-3.93***	-0.40	20.34	3.05
Δpro	-4.02***	-2.12**	34.02**	-2.77***
Exp	-0.97	-0.93	30.59*	-0.06
Δexp	-6.22***	-3.97***	55.54***	2.54
Cap	-2.33***	-0.42	21.99	1.08
Δcap	-6.42***	-3.19***	41.98***	-3.55***
Hth	-2.84***	-0.81	22.64	0.40
Δhth	-7.21***	-4.93***	58.80***	1.29
Life	1.40	7.74	1.42	4.19***
Δlife	-9.14***	-8.44***	93.48***	1.86

***, **, * show the significance level of 1, 5, and 10 percent, respectively. In the LLC test, the Bartlett kernel method was used and Bandwidth was determined by means of the Newey-West method. The lag lengths in the LLC, IPS, and Fisher ADF tests were chosen by using Schwarz Bayesian Criterion (SBC)

4.2. Panel Cointegration Test Results

Subsequent to conducting the unit root tests, the cointegration relationship between the variables was investigated. In the test, seven tests, four of which are within-group statistics and three of which are between-group statistics, can be conducted and the presence of a cointegration relationship is determined according to such tests. Pedroni panel cointegration test results are shown in table 2 for each model. According to the Pedroni cointegration test results, the null hypothesis of no cointegration relationship between variables is not rejected in all models except model-5 is not rejected. It is because; the probability value of the t statistics is above 5 percent in the majority of the seven statistics. On the other hand, in consideration of the model-5, the null hypothesis is rejected in four of the seven tests. According to the results, there is a long-term relationship between life expectancy at birth, as an indicator of human capital, and economic growth. On the other hand, panel-ADF and group-ADF tests will yield more significant results in the small samples in consideration of Pedroni [38]. In table 2, in particular statistical significance of the group-ADF tests creates the requirement of considering the existence of a long-term relationship between the variables. In addition, the results of the Kao panel cointegration test conducted to determine the cointegration relationship between human capital and economic growth are shown in table 3. According to the Kao panel cointegration test, the hypothesis that there is no cointegration relationship between the variables was rejected at 1 percent significance level. In view of such results, there is cointegration relationship between the variables. In this framework, when the Pedroni and Kao panel cointegration test results are evaluated collectively, the conclusion that there is a long-term relationship between the variables is reached.

Table 2. Pedroni panel cointegration test results

	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
Panel v-statistics	-0.382056	-0.703307	-0.304298	0.061874	0.602156	0.083374
Panel rho-statistics	1.994116	2.213675	1.546399	1.609543	1.695921	2.038486
Panel PP-statistics	0.384110	1.302973	-0.053860	-0.529592	-1.453046*	-0.261242
Panel ADF-Statistics	-1.757187**	-1.16188	-0.296276	-1.177866	-2.129024***	-2.844996***
Grup rho-	3.342870	3.650768	3.074630	3.271362	3.160835	3.491964

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statistics						
Grup PP-statistics	1.121037	2.038012	-3.601284***	-2.461520***	-2.234279**	-0.391312
Grup ADF-statistics	-1.456025*	-1.392121*	-1.673859**	-3.375653***	-4.414525***	-4.971290***

The lag lengths in the model have been chosen by using SBC. ***, **, * show that the null hypothesis of no cointegration is rejected at the level of 1, 5, and 10 percent, respectively. In the Pedroni cointegration test, Bartlett kernel method was used and Bandwidth was determined by means of the Newey-West method.

Table 3. Kao panel cointegration test results

	Model-1	**Model-2**	**Model-3**	**Model-4**	**Model-5**	**Model-6**
t statistics	-5.15***	-4.34***	-2.42***	-2.77***	-4.18***	-4.34***
Residual Variance	0.001067	0.001407	0.001706	0.001884	0.001337	0.001552
HAC Variance	0.001315	0.001930	0.003211	0.003223	0.001884	0.002318

The lag lengths in the model are chosen by using SBC. *** indicates that the null hypothesis of no cointegration is rejected at the level of 1 percent. In the Kao cointegration test, Bartlett kernel method is used and Bandwidth is determined by means of the Newey-West method.

4.3. FMOLS and DOLS Estimation Results

After finding the long-term relationship between the variables, the coefficients of the variables affecting human capital will be estimated. In this framework, the models are estimated by using the FMOLS and DOLS methods. It is necessary to remind that *gdp* and *pro* were taken as dependent variable in estimating the models. In this sense, model 1, 3, and 5 indicate the models where the dependent variable was taken as *gdp*. The dependent variable in model 2, 4, and 6 is *pro*.

According to the FMOLS estimations obtained for the model-1, where *gdp* was taken as the dependent variable, the impact of the *enr* variable, the human capital indicator, on *gdp* is positive and statistically significant. The result shows that one point increase in tertiary education enrollment rate increases real GDP per capita by 1.3 percent. According to the DOLS estimations developed for the same model, one point increase in tertiary education enrollment rate increases real GDP per capita by 1.1 percent. According to model-3, where *gdp* was taken as the dependent variable, the *hth* variable is positive and statistically significant in both the FMLOS and DOLS estimations. Accordingly, one point increase in the ratio of the health expenditures to GDP increases real GDP per capita by 9.9 percent and 14.5 percent respectively for both estimation methods. According to model-5 that expresses the last model in which *gdp* was taken as the dependent variable, the *life* variable is positive and statistically significant in both the FMLOS and DOLS estimations. Accordingly, one year increase in the life expectancy at birth increases real GDP per capita by 13.1 percent and 13.6 percent respectively for both estimation methods. In the models where the dependent variable is used as *gdp,* the sign of *exp* and *cap*, two of the control variables, appeared to be positive and statistically significant as expected. Such result demonstrates that the increase in export and investment contribute to economic growth.

Table 4. Panel FMOLS and DOLS results

FMOLS	**Model-1**	**Model-2**	**Model-3**	**Model-4**	**Model-5**	**Model-6**
Exp	0.005	0.005	0.009***	0.008***	0.003**	0.004**
Cap	0.013**	0.013***	0.019***	0.017***	0.017***	0.016***
Enr	0.013***	0.011***				
Hth			0.099***	0.091***		
Life					0.131***	0.115***
DOLS						
Exp	0.005	0.003	0.007***	0.006***	0.009***	0.011***
Cap	0.015***	0.015***	0.026***	0.024***	0.016***	0.015***
Enr	0.011***	0.010***				

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Hth	0.145***	0.138***		
Life			0.136***	0.112***

According to the FMOLS estimations obtained for model-2 where *pro* was taken as the dependent variable in table 4, the impact of the *enr* variable, which is the human capital indicator, on *pro* is positive and statistically significant. One point increase in tertiary education enrollment rate increases the labor productivity by 1.1 percent. DOLS estimations for the same model indicate that one point increase in tertiary education enrollment rate increases the labor productivity by 1.0 percent. According to model-4, where *pro* was taken as the dependent variable, *hth* variable is positive and statistically significant in both the FMLOS and DOLS estimations. Accordingly, one point increase in the ratio of the health expenditures to the GDP increase the labor productivity by 9.1 percent and 13.8 percent respectively for both estimation methods. According to model-6 that expresses the last model in which *pro* is taken as the dependent variable, the *life* variable is positive and statistically significant in both the FMLOS and DOLS estimations. Accordingly, one point increase in the life expectancy at birth increases the labor productivity by 11.5 percent and 11.2 percent respectively for both estimation methods. In the models where the dependent variable is used as *pro,* the sign of *exp* and *cap*, two of the control variables, appeared to be positive and statistically significant as expected. Such result demonstrates that the increase in export and investment contribute to labor productivity.

5. CONCLUSION

In this study, impact of human capital on economic growth and labor productivity is empirically analyzed using the data of the Balkan countries for the years of 2000 and 2011. In the construction of the models used in the study, various human capital indicators are utilized. First, panel unit root tests are conducted to determine whether the series have unit root or not and it is concluded that all the variables are stationary in their first differences. Subsequently, panel cointegration tests are conducted to determine the long-term relationship between the variables. Pedroni [38, 39] and Kao [41] panel cointegration test results shows that there is a long-term relationship between the variables. Later on, FMOLS method developed by Phillips and Hansen [42] and DOLS methods recommended by Saikkonen [43] and Stock and Watson [44] are used to estimate the long-term coefficients. The results obtained using both methods are consistent with each other and demonstrate that the human capital indicators contribute to both economic growth and labor productivity. In this framework, the policies oriented to increase human capital in the Balkan countries will enhance economic growth and labor productivity. Especially the policies oriented to improve life quality as well as the structural reforms in the fields of health and education will provide such impact.

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