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RELATIONSHIP BETWEEN HUMAN CAPITAL AND ECONOMIC GROWTH: AN APPLICATION TO DEVELOPING COUNTRIES

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Abstract

High and sustainable economic growth, that is an important indicator of life quality, is an essential condition in the realization of economic growth. In this regard, achieving strong economic growth in developing countries which mostly need development today, is one of the most debated topics. For many years, physical capital has been recognized as the most important determinant of economic growth. New approaches to economic growth have been developed since 1980s. In this context, according to endogenous growth theory, it is stated that the most important determinant of economic growth is the human capital stock. Today, while the subject of economic growth is examined, the effect of human capital on economic growth is intensively investigated. In this study, the impact of human capital on economic growth for selected 32 developing countries is investigated by panel data analysis method using data from the period 2000-2014. The focus of the study is also the direction and degree of effect of the increase in the level of education on economic growth. According to empirical analysis results, it is founded that human capital positively affects economic growth. It has also been found that its positive effect on economic growth has reduced while the education level has increased. On the other hand, the results of the analysis indicate that physical capital has a positive impact and that the labor negatively affects economic growth in the studied countries. However, it has been determined that the effect of human capital on economic growth is lower than that of physical capital.

Keywords: Human Capital, Economic Growth, Developing Countries, Fixed Effects Model

1. Introduction

Economic growth is one of crucial indicators of an increase in living standards and welfare level in a country. In this respect, the determinants of economic growth are at the forefront of the issues that economists examine. In the traditional growth models, the resources of economic growth are accepted as physical capital, labor, natural resource and entrepreneur. However, recent studies have revealed that economic growth cannot be represented only by these factors depending on the changing economic and social situations. For example, Schultz (1961) and

Denison (1962) have suggested that a large part of economic growth cannot be accounted for by conventional production factors in their work on the US economy.

In modern growth theories, economic growth is stated by some new factors. A number of social and human factors are examined as determinants of economic growth and a special importance is given to human capital which has not been emphasized before (Karagul, 2003). The term of human capital was used for the first time by Becker (1964) and then attracted attention of many economists. Human capital can be defined as knowledge, skills, abilities and qualities that facilitate the acquisition of individual, social and economic welfare (OECD, 2001). In addition to this definition, although human capital is defined as a trained and skilled labor force, health and nutrition as well as education are seen as important components (Taban, 2014). As the definitions suggest, enhancing the human capital is important for all countries, but more important for developing countries that have not fully achieved development, because human capital positively affects economic growth by increasing the productivity of physical capital, creating employment opportunities, providing technological development and spillover effects (Cakmak and Gumus, 2005).

In the majority of studies, it can be said that human capital is related to education. In that, education is regarded as a dynamic social force that changes the structure of society and provides better living standards for individuals. In addition, no matter how large the physical, financial and natural resources are, there is a need for qualified labor force that can effectively use these resources for the sustainable economic growth. In this respect, the increase in education level has a positive effect on total output by contributing the accumulation of human capital and increasing the quality of the labor force (Cakmak, 2008; Yalcinkaya and Kaya, 2016).

Because of the great importance of human capital and education on economic growth, in this study, the effects of education on economic growth are examined for selected developing countries during the 2000-2014 period. It is aimed to contribute to the literature in terms of both method and selected country group through the evidences obtained from study. In this context, the theoretical literature between education and economic growth and empirical literature is summarized in the second and third parts, respectively. In the fourth and fifth part of the study, the econometric model and data set are introduced and in the sixth part of the study empirical analysis results are presented. In the summary section, the study is completed with a general evaluation.

2. Theoretical Background

Analyzing the factors affecting economic growth has been the focus of many studies. In this sense, many writers have presented different perspectives on economic growth within the framework of the studied period.

When the literature on growth theory is examined, it is seen that it is examined in three groups. According to early Post-Keynesian growth theories, it is stated that saving and investments are important in ensuring growth. Neo-classical models emphasize the importance of technical progress as the fundamental determinative of economic growth. In the new theory of growth known as the endogenous growth theory, R&D expenditures, human capital increase and externalities are accepted as the fundamental determinants of economic growth (Evenson and Singh, 1997).

The Harrod-Domar model states economic growth depending on the savings rating and capital productivity. This model was seen as a pioneer of the external neo-classical growth model, also called the Solow model. In the model, the production function that establishes the relationship between input factors and output is used to calculate the rate of economic growth and is assumed to be exogenously determined in the production function. Therefore, the only factor that ensures to the economic growth according to Neo-Classical theory is technological change that is determined externally and emerged randomly (Idea, 2008).

The theory was re-examined in a model developed by Solow (1956) and Swan(1956). In the model, it is assumed that physical capital investments have a key role for economic growth and capital and labor are considered as main production factors. It is also stated that law of

diminishing returns for labor and capital is valid and that a certain amount of GDP can be produced by different combinations of capital and labor. This shows that there is a capital-labor ratio determined by the relative use of labor and capital. In the later period, human capital was included in the Solow-Swan model as an initiative for endogenous growth theory. According to this model, investing in both human and physical capital provides a temporary increase in economic growth rate, as diminishing marginal productivity and the capital depreciation rate will prevent the production increase in the long run. In later empirical studies, it has been seen that the rate of technical progress, which is expressed by increase in total factor productivity, explains the vast majority of the long-term growth rate of industrialized countries. However, it was not revealed what causes the technical progress that constitutes the part of economic growth that cannot be clarified by capital accumulation and expressed as Solow Surplus. As a result, in the Neo-Classical growth theory, it is considered that the only source of economic growth is technological change and it fails to explain how human capital has increased productivity (Sala-i Martin, 1990; Johansson, 2015; Idea, 2008). Since the late 1970s, endogenous factors of capital have begun to be incorporate in the production function to reveal the factors that produce technological change. As a result, endogenous growth theory appeared.

According to Romer (1990), human capital has a critical importance for endogenous growth models. Technological development is the most important factor of economic growth and its emergence requires the use of human capital, since the level of knowledge possessed enables new information to appear. Thus, technological development and correspondingly a higher economic growth rate can be achieved.

The level of education is regarded to be one of the most significant indicators of human capital level and one of the important determinants of economic growth, since there is information on the basis of human capital. Increasing the level of education of the individuals in the society enables them to be more productive both socially and economically and to make significant contributions to economic growth and development. Therefore, educational indicators representing human capital are used in many studies. The basic indicators used in studies based on the endogenous growth model can be expressed as follows: Student / teacher ratio, class capacity, teacher's salaries, teacher's qualifications, literacy rate, school enrollment rates, schooling years, test scores, etc. (Stroombergen *et al.* 2002).

3. Empirical Literature

When studies examining human capital and economic growth are taken into consideration, it is determined that the studies mostly utilized the Cobb-Douglas production function, used by Lucas (1988), which includes the human capital variable. Also, it has been seen that the indicators related to education representing human capital have been used in the great majority of studies. As a result of the studies, it has been stated that education generally has positive effects on economic growth. Romer (1989) assesses the effect of human capital level on economic growth for 112 countries using annual data for the period of 1960-1985. The literacy rate representing the human capital was used in the study, since it can be obtained for a large country set and allows for an easier comparison between countries. As a result of regression analysis for the models he has established, he has found that the literacy rate positively affects economic growth.

Barro (1991) conducted a study of 98 countries for the years 1960-1985, and observed that there is a positive relationship between per capita real GDP and the level of human capital represented by primary and secondary school enrollment rates. He has found that birth rates are lower and investment rates are higher in countries with higher level of human capital.

Mankiw *et al.* (1992) examined the effect of human capital on economic growth for three different countries group during the years 1960-1985 by analyzing panel data. They used the ratio of high school graduate working population representing human capital variable. As a result, they found that the higher saving rate is, the higher education level and the greater population has significant effects on per capita income.

Lau *et al.* (1993) found that an additional one-year average education per workforce increased the real output by approximately 20% in the 1970-1980 period in Brazil. Barro (1998) examined the determinants of economic growth using data from 1960-1995 for 100 countries. According to empirical analysis results, higher initial schooling have positively affected economic growth. It is also seen that political freedom has a weak influence on economic growth.

Gyimah-Brempong *et al.* (2006) tested the expanded neoclassical growth model with the panel GMM method to investigate the effect of higher education on economic growth in African countries during the period of 1960-2000. As a result of the research, they found that primary, secondary and tertiary education which they use as education level positively affects economic growth. In addition, the growth flexibility of higher education was estimated at 0.09% and it has been determined that this rate is approximately two times higher than the growth flexibility of physical capital investments. This result has been interpreted as an indicator of the need for human capital as much as physical capital for economic growth in African countries.

Keller (2006) analysed the impact of primary, secondary and tertiary education on economic growth in Asian countries in panel data analysis using data from the period of 1971-2000. The number of primary, secondary and tertiary enrollment rate, the share of government expenditures on education in GDP and public expenditures per student are determined as independent variables. As a result of the research, it was observed that expenditures especially on primary education had positive effects on economic growth. Moreover, it has been found that the rate of secondary school enrollment positively affects economic growth.

Yakisik and Cetin (2014) analyzed the extended Solow model for Turkey using the data of 1980-2012 period using the ARDL method. Secondary and tertiary education enrollment rates were used to represent human capital in the study. As a result of the analysis, while no effect of higher education was observed, the rate of secondary school enrollment was found to have important positive effects on economic growth.

In addition, the results of studies conducted by Benhabib and Spiegel (1994), Jones (1996), Engelbrecht (1997), Herbertsson (2003), Self and Grabowski (2004), Park (2006), Abu-Qarn and Abu-Bader (2007), Permani (2008), and others (Benhabib and Spiegel, 1994, Telatar and Terzi (2010), Keskin (2011), Hoşgorur and Gezgin (2005), Caliskan *et al.* (2013), Ozsahin and Karacor (2013), Yalcinkaya and Kaya (2016), Govdeli (2016) show that various educational indicators used as human capital positively affect economic growth.

4. Econometric Method

In this study, panel data analysis was used to examine the relationship between education and economic growth in developing countries. A panel data refers to the pooling of observations of cross-sectional units, such as individuals, households, companies, states and countries, over several time periods. The main advantage of the panel data set over a cross-section is the great flexibility to researchers in modeling behavioral differences across units. Panel data also has the advantages such as that it gives more information and is more variable, fewer problems of multiple connections between explanatory variables, has higher degree of freedom and higher effectiveness (Hill *et al.* 2011; Greene, 2003; Hsiao, 2003; Baltagi, 2005). Although these advantages make it possible to make more reliable estimates, there are some problems in panel data analysis. Problems such as autocorrelation, heteroscedasticity and cross section dependency encountered in the analysis prevent efficient estimations. Therefore, if the estimation model contains these problems, estimates should be made correcting standard errors with robust estimators, or appropriate methods (Gujarati and Porter, 2009; Tatoglu, 2013). A general model can be stated as the following:

$$y_{it} = x'_{it}\beta_{it} + \varepsilon_{it} \quad (1)$$

where β_{it} measures the effects of x_{it} in t period for unit i . This model is excessively general and it is necessary to make some assumptions in the estimation of β_{it} coefficient. The standard

assumption is that the coefficient β_{it} is stationary for all units and periods out of the intercept term. This condition can be written as:

$$y_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it} \quad (2)$$

In this equation, x'_{it} is a vector of explanatory variables and does not include a constant. Accordingly, the effect of a variation in x is the same for all of units and periods. However, the mean level of i . unit may be separate than the average level of j . unit. α_i ensures that the effect of those variables is captured, which is unique for i . unit and constant over time. It is supposed that the error term (ε_{it}) is independent with mean zero and constant variance (σ_{ε}^2) and has a similar distribution over unit and time. If α_i is considered to be an unknown parameter of dimension N , the model in equation (2) is expressed as the fixed effects model. According to another approach, it is assumed that the intercepts of the units are different but that is determined from a distribution with σ_{α}^2 variance and μ mean. Accordingly, it is assumed that these drawings are free from the explanatory variables. This leads to a random effect model in which unit effects are treated as random. The error term in this model comprises of two components; the time-invariant component α_i , and the time- independent component ε_{it} . The model can be written as follows;

$$y_{it} = \mu + x'_{it}\beta + \alpha_i + \varepsilon_{it} \quad (3)$$

μ represents an unobservable error component (intercept term) that takes into account the individual differences of each unit. In most panel data analysis, the fixed effect model or the random effects model is used (Verbeek, 2004; Gujarati and Porter, 2009).

In the fixed effects models, while the slope parameter is assumed to be the same for all units, it is assumed that the intercept term does not alter according to time but varies between units or it varies according to time but does not alter between units. In this respect, while the model is called "the one-way fixed effect model" in which the differences in intercept term are appeared by unit or time effect, the model in which the differences are caused by both unit and time effects is called "the two-way fixed effect model". The random effects model assumes that the intercept term indicating individual effects is inconstant. Thus, in this approach, it is assumed that the difference between the cross-sectional units randomly emerged. Similarly, with the assumption that unit or/ and time effects are exist, the model could be estimated with one way or two-way random effects approach (Hill *et al.* 2011; Cemrek and Burhan, 2014; Cetin and Ecevit, 2010). The Hausman (1978) specification test is applied to decide which model to use in the Hausman test, the basic hypothesis (H_0) is that "there is not a correlation between explanatory variables and unit effect", while the alternative hypothesis (H_a) is that "there is a correlation between explanatory variables and unit effect". If the calculated p-value (probability value) is less than 0.05, the H_a hypothesis is accepted and the estimates are made by the fixed effect model. If it is determined that the calculated probability value (p-value) is bigger than 0.05, then the H_0 hypothesis is approved and the estimates are made by the random effects model (Tatoglu, 2013).

5. Model and Data Set

In this study, the effect of human capital on economic growth for selected 32 developing countries is investigated by panel data analysis method using data from the period of 2000-2014. In the study, the country set was defined as 32 economically relatively large countries with the best economic performance in the upper-middle income group according to the classification of the World Bank. In the study, the model and variable set for panel data analysis are displayed in the following equation and Table 1:

$$PERCAP_{it} = \alpha + \beta_1 LABOR_{it} + \beta_2 CAP_{it} + \beta_3 PRI_{it} + \beta_4 SEC_{it} + \beta_5 TER_{it} + \varepsilon_{it} \quad (4)$$

Table 1. Variables used in the study

Variable	Description	Expected Sign	Source
PERCAP	GDP per capita (constant 2005 US\$)		World Bank
LABOR	Total labor force according to ILO definition	+, -	World Bank
CAP	Gross fixed capital amounts (% of GDP)	+	World Bank
PRI	School enrollment rate, primary (% gross)	+	World Bank
SEC	School enrollment rate, secondary (% gross)	+	World Bank
TER	School enrollment rate, tertiary (% gross)	+	World Bank

The dependent variable is GDP per capita (constant 2005 US\$), which is considered as the measure of economic growth while independent variables are labor force, gross fixed capital formation (% GDP), primary education enrollment rate, secondary education enrollment rate and tertiary enrollment rate. Theoretically, it is expected that all of the independent variables, outside the labor force, will have a positive effect on the dependent variable. The 32 countries that compose the cross-section of the study are given in Appendix.

6. Estimation Results

In the model, the presence of unit and/ or time effects between countries was investigated by F test. As shown in the Table 2, unit effects and time effects are found to be present separately in the model and both the unit and time effects are found to be meaningful together. In conclusion, it is accepted that there is two-way effect in the model.

Table 2. F test Results

	F- statistics	p-value
Unit and Time Effect	1272.03***	0.0000
Unit Effect	576.38***	0.0000
Time Effect	36.11***	0.0000

Note: ***, remark statistical significance at the 1% levels.

After determining that the two-way model is valid, according to the Hausman test results to determine whether the random effects are valid for the model, it was found that the test statistic had a value of 23,41 and statistically had a significance of 1% ($p = 0.0001$). In other words, since the significance level of the test statistic (p-value) is less than 0.05, then the H_0 hypothesis, which assumes that the difference between the parameters is not systematic and consequently the random effect model is valid, is rejected and the fixed effect estimator is valid.

In addition, the presence of autocorrelation, heteroscedasticity, and cross-section dependency problems, which prevented efficient estimation of models, has been tested. Accordingly, Durbin-Watson (DW) and Local Best Invariant (LBI) tests were used to test the presence of autocorrelation. According to the test results, the DW test statistic was 0.2422 and the LBI test statistic was 0.6070 and the autocorrelation problem was found because the values were lower than 2. According to the modified Wald test results which investigated heteroscedasticity, it was found that $\chi^2(32)$ was 5743.06 and $\text{Prob} > \chi^2$ was 0.0000. It was observed that there was heteroscedasticity problem in the model. Finally, in search of cross-section dependency, Pesaran CD test suggested by Pesaran (2004) was used. It was detected that the DW test statistic was 0.2422 and the LBI test statistic was 0.6071. As a result of the test, it is seen that there is a problem of cross-section dependency.

Because of the above problems, the model has been tested with the Driscoll-Kraay method, which does not affect the coefficient values under the assumption of autocorrelation,

heteroscedasticity and cross-section dependence and allows estimation with resistant standard errors. The empirical analysis results of the model are shown in Table 3. According to analysis results, it is seen that LABOR, SEC, TER, CAP variables have significant effects on PERCAP, but the effect of PRI variable is statistically insignificant.

Table 3. Estimation Results for Equation 4

Dependent Variable: PERCAP			
Independent Variables	Coefficient	Std. Error	t-statistics
LABOR	-0.1999***	0.0495	-4.04
PRI	1.9333	1.3999	1.39
SEC	0.0019***	0.0006	3.32
TER	0.0006*	0.0004	1.69
CAP	0.0084***	0.0015	5.56
Time Dummy Variables			
2001	0.0084***	0.0025	3.33
2002	0.0417***	0.0030	13.82
2003	0.0704***	0.0037	18.92
2004	0.1286***	0.0036	36.16
2005	0.1657***	0.0042	39.55
2006	0.2104***	0.0063	33.64
2007	0.2595***	0.0076	34.02
2008	0.2892***	0.0098	29.50
2009	0.2932***	0.0093	31.48
2010	0.3422***	0.0100	34.00
2011	0.3676***	0.0108	34.09
2012	0.3790***	0.0112	33.80
2013	0.3993***	0.0122	32.70
2014	0.4454***	0.0136	32.61
Constant	11.0561***	0.7671	14.41
Number of Observations	430		
F statistics	660025.43		
P value	0.0000		
R ²	0.83		

Note: *, **, and *** respect statistical significance at the 10%, 5%, and 1% levels, respectively.

According to the analysis results, a 1% increase in the labor force reduces the per capita income by approximately 0.20%. Theoretically, in a country where the population growth rate is high and the capital-labor rate is low, it is possible that the increase in the labor force will negatively affect economic growth. Considering that the average population growth rate of the country set in the period studied is relatively high at 1.17%, it can be argued that the declining productivity of labor is a matter of course. Therefore, it can be stated that the increase in labor force does not increase production and negatively affects economic growth.

When we examine at the relationship between human capital and economic growth, which is the focus point of the study, it has been found that the 1% increase in the secondary school enrollment rate, which was used as one of the indicators of the human capital, increases economic growth by only %0.002. It has also been observed that the effect of the increase in the tertiary school enrollment rate on economic growth is lower than the increase in the secondary enrollment rate. It has been determined that the effect of primary school enrollment rate on economic growth is statistically insignificant. In short, it has been seen that the human capital in the examined country set does not play a significant role in economic growth.

As expected, gross fixed capital formation variable has positive sign and it is statistically significant at 1% level. This result shows that a 1% increase in gross fixed capital formation increases the economic growth value by %0.008.

As a result, it was determined that the increase in the human capital stock determined as the focus point positively affected the economic growth in this study conducted with the data of 2000-2014 period of the selected developing countries.

7. Conclusion

In this study, the interaction between human capital and economic growth was examined using the panel data method. In this context, an econometric study has been carried out by using the data of 32 developing countries in upper-middle income level for the 2000-2014 period. Fundamental factors affecting economic growth have been investigated and then, it has been tried to be determined how primary school enrollment rate, secondary school enrollment rate and tertiary school enrollment rate affect economic growth.

According to the results, it has been seen that the increase in the labor force negatively affects economic growth but positively affects the increase in physical capital and human capital. It has also been found that physical capital is more effective than human capital on economic growth. According to these results, two basic deductions can be made. First, since the studied countries do not have sufficient physical capital stock, the increase in the labor force has a negative effect on economic growth by reducing the efficiency of labor. Secondly, the increase in human capital levels is not adequately assessed. Because it is difficult to employ them in the jobs suitable for their education levels, the level of individual's education increases in the countries studied. In other words, it can be said that the increase in the level of education has reduced the marginal social development of education and therefore contributed to economic growth at low rates. In this respect, sustainable economic growth in developing countries depends on improving the human capital level by taking into account the relationship of complementarity with physical capital.

As a result, it has been determined that the increase in the human capital positively affects the economic growth statistically. In line with other studies in the literature, it is concluded that economic growth is not only dependent on physical capital but also on human capital.

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Appendix. The Countries covered in the Study

Albania	India	Panama
Algeria	Indonesia	Peru
Botswana	Iran, Islamic Rep.	Philippines
Bulgaria	Jordan	Poland
Chile	Korea, Rep.	Qatar
China	Lebanon	Romania
Costa Rica	Macedonia, FYR	Russian Federation
Cuba	Malaysia	Thailand
Czech Republic	Mauritius	Tunisia
Greece	Mexico	Turkey
Hungary	Mongolia	