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A Driving Force of Economic Growth in Turkey: Human Capital

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One of the main concerns of developing countries is seeking sources of economic growth. A controversial debate on studies in recent decades focuses on the real basis of economic growth. It seems that physical capital accumulation does not provide a sufficient explanation as a capital factor in the process of economic growth. There are some indicators that illustrate a countries' human capital. The most important one among them is education performance, which is considered a pushing factor of economic growth. Education performance can be seen as an indicator of human capital. In this study, Turkey's education expenditure and gross domestic product (GDP) are investigated between the period of 1970-2013 via the co-integration structure. Results show that education expenditure and GDP are co-integrated in the long-run. The series prove a strong relationship between the GDP and education expenditures.

Keywords: *co-integration, developing countries, economic growth, human capital*

Introduction

Economic growth is mainly defined as an increase in the aggregate production in a country from one period of time to another that is measured as a percentage change in the real GDP. Another definition of the economic growth that could be a measure of growth is the GDP per capita which is evaluated for an individual level of income growth from one period to another. Despite that the GDP per capita became a major indicator for international comparisons it does not inform us well due to the overlook into income inequality differences. Hence, we choose to focus on the GDP growth in this paper.

Production process is the combination of the physical capital and human capital, the labor force and natural resources organized by entrepreneurs through using accumulation of technology. The phenomenon of positive economic growth is derived from increasing the amount of the total production through the expansion of the production potential or by being more efficient with the production process (Kibritcioglu 1998: 207-208). High economic growth rates have became a major economic goal of countries since the 18th century. Therefore the question of the sources of economic growth is old, like the history of economic theory. One can refer to A. Smith's "division of labor" that is expressed with the production of pin in detail on his famous book, *An*

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Inquiry into the Nature and Causes of the Wealth of Nations, as a first idea on the main source of growth performance. However, questions about the origins of economic growth began in the late 18th century. However, there controversial answers and studies have existed since then. Thus, many economists have pointed out different ways and methods which deliver us to several solutions.

This paper examines the mechanism between the human capital and economic growth for Turkish economy in the period of 1970-2013. This paper contains six chapters. The first chapter gives a brief introduction to the definitions and notion of the concepts. Secondly, essential growth theories are illustrated to provide a clear view about the evolution of growth. Then, the concept of human capital is evaluated with its historical background. One can see that a strong relation between human capital and growth exists based upon endogenous growth models. After a quick look on previous empirical studies, chapter 5 reveals the empirical results for the Turkish economy. In the end, education expenditures and GDP will be analyzed in the way of co-integration.

Evolution of Economic Growth Theory

Studies on the growth theory hold silent until Ramsey's (1928) paper which is focused on the amount of saving that determines the intertemporal maximization of collective or individual utility by applying techniques of dynamic optimization. Ramsey's *"Mathematical Theory of Saving*" was not a well-known paper until 1965, when it is transformed into Ramsey-Cass-Koopmans Model. Thus, Solow Model, well-known as the neoclassical growth theory, became a main contribution to the economic growth literature in the 20th century.

Solow's model is an exogenous growth model which implies decreasing marginal returns of capital. The model uses the Cobb-Douglas (CD) production function with constant returns to the scale (CRS) as shown below (Romer D 2012):

$$Y = F(K, AL) = A.K^{\alpha}.L^{\beta} \quad , \alpha + \beta = 1 \qquad (1)$$

where, Y is the total output, K is the capital, L is the labor, A is the "effectiveness of labor" and α and β show the share of capital and labor. The assumption of CRS allows us to work with the production function in an *intensive* form. Dividing both sides to AL yields that:

$$F(K/AL,1) = A.K^{\alpha}.L^{1-\alpha} / AL = f(k) = k^{\alpha} \qquad (2)$$

The dynamics of k, that is the effective labor as a function of capital per unit of effective labor, will show the crucial relation between the rate of saving (s), population (n), depreciation (δ) and technological progress (g).

$$k = s.\ f(k) - (n+g+\delta)k \qquad (3)$$

The exogenous character of the Solow model will be shown in equations 3 and 4. The production function in the CD form leads to an expansion path until k tends to zero that is commonly called the "steady-state" level of capital per capita growth. Reaching the steady state claims that the saving rate compensates the total effect of population, technological progress and depreciation of the capital. Hence, the main sources of the growth rate are determined by the growth rates of population and technological progress which are exogenous in the model (Taban and Kar 2006).

R. Solow (1957) examined the US economy between the years of 1909 – 1949 that describes technology as a pioneer source of economic growth. Solow had pointed out that technological progress is the main part of growth rather than capital accumulation. The model proves that 87.5% of the output per capita comes from technological progress.

The concept of taking technology as an exogenous variable is the main critique of the Solow model. Although the largest part of source of economic growth is derived from technology, taking technological progress as an exogenous variable hardly explains economic growth. Exogenous variables such as technology have just expressed the effects on the dependent variables without informing how and where it comes from. Thus it should be questioned that technological progress explains 87.5% of economic growth while it is taken as exogenous in the model (İnal 2013: 72). This issue became a starting point of endogenous economic growth models in the 1980s. Besides that, the Solow model supposes the property of decreasing marginal returns of capital while endogenous growth models imply increasing marginal returns of capital that is the essential reason of long-run growth. The human capital has an increasing rate of returns unlike the returns of the physical capital (Sala-i Martin 1990).

The most essential difference between neoclassical theories and endogenous growth theories is based on the assumption of the capital's return which embraces diminishing returns of neoclassical economy. Endogenous growth models include human capital into capital stock and the return of the capital can provide increasing returns (Sala-i Martin 1990).

Another question of the debate is the economics of convergence. The idea of convergence claims that the developing countries with a low-income per capita will catch up the richer countries by high growth rates. Eventually, all countries will converge in terms of their per capita income.

Poor countries that have low capital stock will tend to accumulate more amount of capital through the neoclassical mechanism with diminishing returns on capital. This tendency should lead to high growth rates in developing countries but, observed facts on growth rates and the level of income does not fit with the convergence hypothesis. This controversial issue arises from the assumption that countries will have the "same" steady-state level of capital. In other words, all countries have different rates of savings, depreciation, population and levels of technology so it is not appropriate to compare the

countries with each other. If the parameters of the particular countries are close to each other, one can prove the convergence for those selected countries which is called "conditional convergence" (Yeldan 2011).

Mankiw, Romer and Weil (1992) assert a claim that an augmented Solow model with human capital will account for the sources of growth. The model suggests that countries with similar technology and rate of saving and population should converge in terms of income. The concepts of saving, population and education will explain the international differences by taking the fact of conditional convergences. (Mankiw et al. 1992: 432-433)

The effect of the human factor on economic growth was not taken into account although it was emphasized for decades. When the gap between developed and developing countries became loud and clear after World War II, growth theories had started to research the main reasons of this gap (Taban and Kar 2006).

A modern approach to the growth theory, mostly known as "Endogenous Growth Models", mainly focused on research and development (R&D), knowledge, technological progress and human capital. The notion of technology as an endogenous variable is the key subject for the modern economic growth theories since the beginning of the 1980s.

Endogenous growth models suggest the internalization process of technology in the 1980s. Knowledge, human capital, R&D, technological progress, financial innovations, the role of government or market structure are the new alternative candidates of the sources of economic growth through theorizing the form of technology (Berber 2006: 170). Some pay attention to the studies of Romer (1986), Aghion and Howitt (1992, 1998), Grosman and Helpman (1989, 1990, 1991) pay attention to the generation of knowledge while Lucas (1988), Rebelo (1991), Stokey (1988, 1991) Becker et al. (1990), Young (1991) had focused on human capital and Barro (1990) based on public investment (Keskin 2011: 138).

Although endogenous growth models are methodologically alike, they differentiate in terms of driving force of growth. One can classify these models as follows (Taban 2009: 41-42):

- AK
- Knowledge Spillovers
- Human Capital
- R&D
- Public Policy

The effect of the human capital on economic growth constitutes the main part of this paper. Therefore, it is important to see how growth theorists form their model by considering of human capital. Adding up human capital into endogenous growth models can be seen in Lucas (1988) as follow:

$$Y = A.K^{\alpha}H^{1-\alpha} \qquad (4)$$

Where Y is the total output, A is the technology in Cobb-Douglas production function with constant returns to the scale. The term of H refers to human capital where u is the working time of labor force, h is the average level of knowledge per labor, L is the labor factor and u is the working time.

$$H = u.h.L \qquad (5)$$

Equation 6 expresses the human capital part and its dynamics. Lucas assumes that the time devoted to education by labor is 1-u so that education becomes the leading factor of human capital.

$$\Delta h / h = \pi (1-u) \qquad (\pi>0) \qquad (6)$$

The term of π shows the efficiency or quality of education and 1-u shows the time for education. The more qualified the education system and the more time devoted to education leads to the increase of the human capital growth rate. The factor of human capital will increase the total output beyond the restriction of constant return to scale. Thus, the human capital should be the driving force of economic growth.

Technological progress as a main source of growth is quite clear since Robert Solow but thinking technology as an endogenous variable starts with Paul Romer. He claims that technology occurs endogenously when people and firms react to market intensives in an economy. Accumulation of knowledge becomes a leading force of growth as firms producing knowledge are not able to hide completely in a free market. A positive externality arises so that other firms will benefit from the accumulation of knowledge. The reason why, knowledge is the leading factor of growth is the non-rivalry property of knowledge. Romer (1990) defines the non-rival goods which have property used by one firm or person and in no way limit their use by another. Non-rival knowledge and technology can be accumulated unlimitedly and is able to have an increasing return to scale. (İnal 2013: 94-100).

Romer's (1990) model divides economy into three sectors. The research sector uses human capital and accumulated knowledge to produce new knowledge. Researchers produce new designs for the intermediate-goods sector, which uses them to produce new goods. A final sector is a good sector that uses labor, human capital and capital to produce the final output. This mechanism can be shown below in Cobb-Douglas production function after some messy algebra:

$$Y_t = (H_{Yt}, L_t, X_t) = H_{Yt}^{x}.\, L_t^{\beta}.K_t^{\alpha} \qquad (7)$$

$$= H_{Yt}^{x}.\, L_t^{\beta}.K_t^{1-x-\beta} \qquad (8)$$

$$= H_{Yt}^{x}.\, L_t^{\beta}.A.\, x^{-1-x-\beta} \qquad (9)$$

where Yt is the total output, L is the labor force, H_Y is the human capital devoted to produce final good sector, X_t is the different designs that intermediate-goods sector produces and A is the technology. The last line

shows that the model behaves just like neoclassical model with labor and human capital augmenting technological change (Romer 1990: 89).

The Link Mechanism between Human Capital and Growth

The concept of human capital started in the 1960s and its contribution to economic growth creates a new approach on the growth theory in the late of the 1980s. After World War II, western European countries and the USA focused on economic policies that aim to high growth in order to achieve the re-construction of Europe. Efforts to reach high growth rates canalized economists to understand and improve growth transformation. The term of human capital came up through examination of growth in the 1960s. Denison, Schultz and Becker are the first economists who theorized the human capital concept. Denison's study (1962) tries to explain with two components –the capital and labor- in the US growth performance between 1910 and 1960. However, *a third part*, 20% of the total growth, which cannot explain the capital and labor implies the increase in the education of labor force. Education contributes to the improvement of the capacity of the labor force and the force that raises the national income.

Investment on human capital consists of all sorts of expenditures on education and health which are affecting the efficiency of the labor force. The human capital hypothesis states that the biggest impact on the growth and development depends on the qualified labor force. Stable and high growth rates require efficient factors of production especially the labor force. G.S. Becker asserts that expenditures on education and health will increase human capital rather than physical or financial capital. An individual's knowledge, skill or health cannot be separated from them while physical or financial capital is separable (Keskin 2011: 128).

Educational efforts provide a more qualified labor force while health makes people more active and efficient. Investment on human capital helps either increase human capital or lead up to technological progress (Kibritçioglu 1998).

One of the most important problems on Turkish growth performance is the inadequacy and low quality of education. Both growth and development theorists support that human capital play a crucial role on economic growth. Labor force with high human capital leads to the production of high-value added goods and services but Turkey's education policies do not compensate these necessities. (Pamuk 2007: 22-23). Today, human capital becomes an independent factor of the production process in addition to traditional factors of labor and capital. In this context, developing countries with insufficient amount of human capital are not able to produce high value added goods while developed countries with a high rate of human capital produce high-tech products. This demonstrates the significance of investment on human capital (Özyakışır 2011: 54).

Empirical Literature Review

Barro (2001) emphasizes the determinant role of education for the long-run economic growth. Growth performances were analyzed for 100 countries between 1965 and 1995. The results prove that the growth rate is significantly affected by school attainment while males graduate from secondary and higher education levels. However, the link for males is not a valid reason for females. This conclusion arises from the fact that educated women are not well utilized in the labor markets of many countries. A striking aspect of the role of women on growth is primary education that raises the growth rate due to lower fertility rates.

Benhabib and Spiegel (1994) found that the total factor productivity depends on the human capital stock level through using a growth accounting method for cross-country data. Saygılı et. al (2005), investigates the role of human capital in productivity growth by using a detailed panel data analysis for 50 countries that come from a variety of different backgrounds. A positive relation was found between human capital and productivity for all the countries except Turkey because of the lower quality dimension of the human capital, sectorial structure of production in favor of low technology intensive sector, macroeconomic instability, poor governance structures in both public and private sectors, weakness in establishing a competitive market structure, etc.

Education performance as a factor of human capital does not occur in the same way with different countries because of different quality of education for countries. Hanushek (2013) critized that taking school attainment as an indicator of human capital will neglect the quality of education and cognitive skills. Cross-country analyses the focus on school attainment ratios while developing countries have lower cognitive skills and education quality.

Oketch (2006), discusses the sources of economic growth in African countries, and empirically tested determinants of investment in human capital as a percent of GDP. It concludes that the investment on human capital and physical capital are important determinants of economic growth and development in Africa.

Haldar and Mallik (2010) examine the time series behavior of investment in physical capital, human capital and output with a co-integration framework in India between 1960 and 2006. The results suggest that the primary enrollment rate, as an indicator of human capital and openness, is positively related to growth per capita GNP.

Asteriou and Agiomirgianakis (2001), found a co-integrating relationship between education as measured by enrollment rates in primary, secondary, and higher education and the GDP per capita for Greece. Causality runs through educational variables to economic growth, with the exception of higher education.

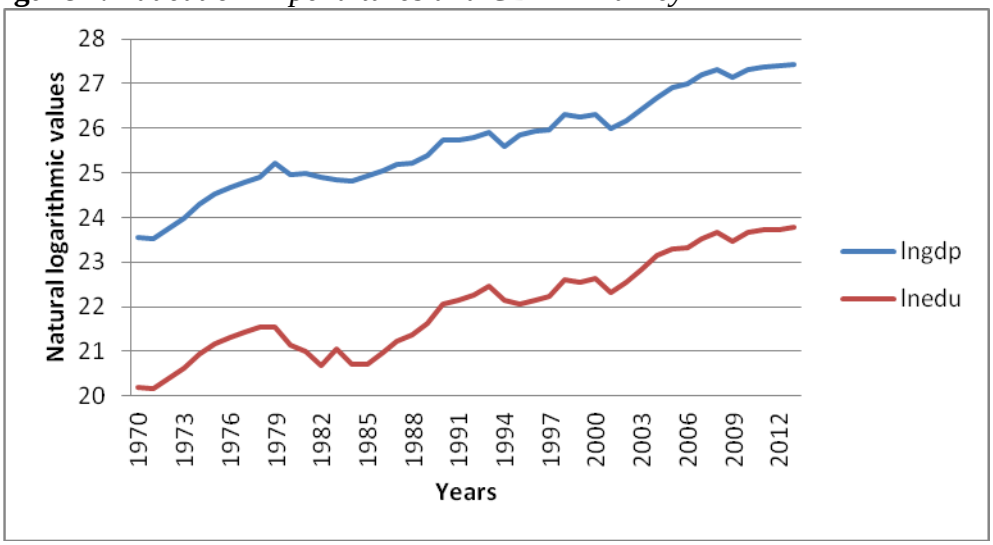
Many studies about the mechanism between human capital and economic growth applied for Turkish economy. Türkmen (2002) found that 31% of the overall growth between 1980 and 2000 based on the increase in accumulation of human capital. Doğan and Bozkurt (2002) found co-integration between

secondary, tertiary enrollment rate and GDP per capita in the period of 1983-2001. Çoban (2004) investigated the relation between growth and education. He concluded that increase in the primary enrollment rate causes economic growth, then growth causes the increase in the secondary enrollment rate (Afşar 2009: 89-90).

Methodology and Results

This paper investigates the relation between total education expenditures and GDP for Turkish economy between the period of 1970-2013. Data is obtained from the World Bank national accounts. The World Bank defines education expenditure as a total spending in education with the inclusion of wages, except for capital investment expenses in Turkey with U.S dollars. GDP is described as a sum of gross value added by all producers in the country including product taxes and excluding subsidies.

Figure 1. *Education Expenditures and GDP in Turkey*



Source: Authors calculations from WB data set

Figure 1 shows the behavior of education expenditures and the GDP in a natural logarithmic form. Taking the natural logarithm of macroeconomic variables causes to linearize the series so that the variance will stabilize and inconsistent observations will be influenced less (Franses & Mcaleer 1998: 654). In this study, both series are analyzed with a natural logarithmic form for GDP and education expenditure. Moreover, strong tendencies of the series lead to a high R^2 even if there is no significant relation between variables. Therefore, stationary time series are important to determine whether the regression is spurious or not (Gujarati 2001: 709).

Stationarity can be examined through the relation between the current value and previous value of the series. Therefore, we regress current values on

the previous period values of the series to understand the process. In this context, unit root tests will determine if a series is stationary or not.

In this paper, Augmented Dickey andFuller (1979) (ADF) unit root test is applied to test the stationarity of series. ADF unit root test which claims the unit root for the null hypothesis is based on the AR process. ADF regression is set as follow:

$$\Delta y_t = \alpha_0 + \rho y_{t-1} + \sum \beta_i \Delta y_{t-i} + \varepsilon_t \qquad (10)$$

In equation 11, the term of ρ shows the lag length which is determined by Akaike & Schwarz criterion and ε_t is the white noise which is defined as a source of randomness. The term of y_{t-i} refers to the lagged values of y_t and $\sum \beta_i \Delta y_{t-i}$ and implies the time trend of the series. The null hypothesis implies that a unit root cannot reject when ρ equals to zero. ADF test results for education and GDP are shown at table 1 and 2. According to the test results, the series of education and GDP are stationary at lag 1.

Table 1. *ADF Statistics for Education Expenditures I(1)*

Variable (edu)	**1 %**	**5 %**	**10 %**	**t-Statistic**	**Prob. ***
Intercept	-3.596.616	-2.933.158	-2.933.158	-5.687.109	0.0000
Trend and ıntercept	-4.192.337	-3.520.787	-3.191.277	-5.617.850	0.0002
None	-2.621.185	-1.948.886	-1.611.932	-5.003.768	0.0000

*MacKinnon (1996) one-tail p values

Table 2. *ADF Statistics for GDP I(1)*

Variable (gdp)	**1 %**	**5 %**	**10 %**	**t-Statistic**	**Prob. ***
Intercept	-3.596.616	-2.933.158	-2.604.867	-6.719.300	0.0000
Trend and intercept	-4.192.337	-3.520.787	-3.191.277	-6.736.510	0.0000
None	-2.621.185	-1.948.886	-1.611.932	-5.186.827	0.0000

*MacKinnon (1996) one-tail p values

According to Table 1 and 2, both education expenditures and GDP series are stationary at their first lag length. To determine whether the variables are co-integrated, Engle andGranger (1987) a co-integration analysis will be applied.

Series are estimated with OLS approach in order to analyze Engle-Granger co-integration. The existence of the unit root on residuals of OLS estimation demonstrates whether the series are co-integrated or not with each other. If residuals of OLS are stationary or I (0), the hypothesis that says variables are co-integrated and have a long-run relation is not rejected (Çetintaş 2004: 26).

Table 3. *Engle-Granger Co-integration*

Engle-Granger Cointegration (dlogedu= c +Bdloggdp) (1st Equation)					
edu = f(gdp)	*1 %*	*5 %*	*10 %*	*t-Statistic*	*Prob.*
Intercept	-3.596.616	-2.933.158	-2.604.867	-6.680.198	0.0000
Trend and intercept	-4.192.337	-3.520.787	-3.191.277	-6.671.088	0.0000
None	-2.621.185	-1.948.886	-1.611.932	-6.763.181	0.0000
Engle-Granger Cointegration (dloggdp= c + Bdlogedu) (2nd Equation)					
Gdp = f(edu)	*1 %*	*5 %*	*10 %*	*t-Statistic*	*Prob.*
Intercept	-3.596.616	-2.933.158	-2.604.867	-7.917.472	0.0000
Trend and intercept	-4.192.337	-3.520.787	-3.191.277	-8.059.977	0.0000
None	-2.621.185	-1.948.886	-1.611.932	-8.014.528	0.0000

In order to apply the Engle-Granger methodology, variables should be integrated at the same degree. If residuals are stationary, variables have a long-run relation and equilibrium. Following the ADF test results claim that education and GDP are co-integrated.

Conclusion

Education is commonly considered as an essential indicator for human capital. Moreover, school enrollment, level of education, total education expenditures, physical materials, number of students and educational staff etc. are the main contributors of education performance.

The share of education expenditures on the total GDP, high schooling rates, providing physical infrastructure are crucial for a developing economy such as Turkeys. On the other hand, qualification and efficiency have a critical role on the education. Education expenditures will be more effective when qualified education facilities, suitable matching between business sectors and cognitive skills of labor force and in-service training activities carry out properly. All factors yield high total factor productivity and increase in the amount of production. Hence, having the qualified education ensures high economic growth rates and welfare.

The link mechanism between human capital and economic growth is investigated by using the Engle-Granger co-integration analysis for Turkish economy. An ADF unit root test is applied to determine if the series are stationary or not. Both education expenditures and GDP are stationary with their first lag length. Both the first and second equations at Table 3 prove the co-integration in all significance levels. In other words; values with intercept, trend and intercept are lower than their t-Statistics. Hence, we conclude that residuals for both equations will simultaneously be zero. Results of co-integration show that education (as an indicator of human capital) and GDP are co-integrated so that these series have long-run relationship with each other. This paper proves the existence of mutual relationship between education and economic growth for Turkish economy within the years of 1970-2013.

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