A HUMAN CAPITAL AND ECONOMIC GROWTH: COMPARATIVE ANALYSIS OF THE IMPACT OF KNOWLEDGE AND HEALTH ON ECONOMIC GROWTH IN NIGERIA AND TURKEY

Eric Kehinde OGUNLEYE[*]

Bilge ERİŞ[♦]

ABSTRACT

The wealth and poverty of nations can, and have often, been analysed in terms of the state of their human capital. Fundamental to human capital formation for growth at both the micro and macro levels are knowledge or education and health. There is a consensus in the literature that education and health as determinants of human capital are essential for growth. The aim of this paper is to examine the growth process in both Nigeria and Turkey and address the question of whether differences in human capital accumulation are the driving force behind this. The basis for this comparison is that growth rates were much higher in Nigeria than Turkey in the early 1970s. However, the table appeared to have turned with Turkey experiencing higher growth and material prosperity. Could differences in human capital accumulation be responsible for this? Employing both OLS and granger causality techniques in the context of the endogenous growth theory, it is found that while health human capital is an important determinant of growth in Turkey, no relationship between human capital and growth could be established for Nigeria. Turkish higher human capital accumulation, therefore, appears to be one important source of growth differences in these countries.

ÖZET

BEŞERİ SERMAYE VE İKTİSADİ BÜYÜME: BİLGİ VE SAĞLIĞIN NİJERYA VE TÜRKİYE'DE İKTİSADİ BÜYÜME ÜZERİNDEKİ ETKİSİNİN KARŞILAŞTIRMALI ANALİZİ

Ülkelerin zenginlikleri ya da fakirlikleri, beşeri sermaye durumlarına göre değerlendirilebilir ve değerlendirilmektedir. Gerek mikro gerekse makro seviyede ekonomik büyümeye katkıda bulunan temel beşeri sermaye bilgi ya da eğitim ve sağlıktır. Literatürde, eğitim ve sağlığın beşeri sermayenin belirleyicisi olarak ekonomik büyümeye katkı yaptığına dair görüş birliği vardır. Bu bildirinin amacı, Nijerya ve Türkiye'deki büyüme sürecini incelemek ve beşeri sermaye birikimindeki farklılıkların bu süreci götüren güç olup olmadığı sorusunu yöneltmektir. Bu karşılaştırmadaki temel nokta, 1970'lerin başında Nijerya'daki büyüme oranlarının Türkiye'ye göre daha yüksek olması idi. Fakat, tablolardan zamanla çıkan sonuç, Türkiye'nin giderek daha yüksek büyüme oranlarını ve bolluk seviyesini yakalaması olmuştur. Bu durumun oluşmasına beşeri sermaye birikimi farklılıkları ne ölçüde neden olmuştur? EKK ve Granger nedensellik teknikleri kullanılarak ve içsel büyüme modelleri çerçevesinde; sağlık beşeri sermayesinin Türkiye'de büyümenin önemli bir bileşeni olduğu saptanırken; Nijerya'da beşeri sermaye ve iktisadi büyüme arasında bir ilişkiye rastlanmamıştır. Dolayısıyla, Türkiye'deki daha yüksek beşeri sermaye birikimi, iki ülkede gözlemlenen iktisadi büyüme farklılıklarının önemli bir kaynağı olarak görülmektedir.

[*] Lecturer, University of Calabar, and PhD Candidate, University Of Ibadan, Nigeria, erick_oleye@yahoo.com

[♦] MA Student, Marmara University, Turkey, bilgeeris@yahoo.com

1. Introduction

Human capital empowered by good health and sound education is the real wealth of nations. Hence, it is often said that health is wealth and knowledge is power. The wealth and poverty of nations can, and have often, been analysed in terms of the state of their human capital. Fundamental to human capital formation for growth at both the micro and macro levels are knowledge or education and health. In a seminal work, Grossman (1972) emphasised the importance of health as human capital. Similarly, Schultz (1980) argued that population quality is the decisive factor of production and emphasized the merits of investing in education and health (see also Arora, 2001 and Fogel, 2002). There is a consensus, therefore, in the literature that investing in health and education is essential to maintaining a healthy population and workforce, which in turn are necessary ingredient for sustainable economic growth.

The existing and widening gap on the growth rates across economies and regions can be explained by a number of factors, prominent among which is differences in the quality of human capital. For instance, Bloom and Sachs (1998) attributed about 35% of the gap to variations in health indicators such as life expectancy, which they found to have the highest impact amongst the health measures they used.

The aim of this paper is to examine the growth process in both Nigeria and Turkey and address the question of whether differences in human capital accumulation are the driving force behind this. The basis for this comparison is that growth rates were much higher in Nigeria than Turkey in the early 1970s. However, the table appeared to have turned with Turkey experiencing higher growth and material prosperity. Could differences in human capital accumulation be responsible for this? The rest of this paper is divided into five sections. Section 2 provides background information on human capital and economic growth in both Nigeria and Turkey. Section 3 reviews the relevant empirical literature on the relationship between human capital and growth. This section also presents the theoretical framework for the study. Section 4 expounds on the data and methodology employed for the empirical analysis. Section 5 focuses on the empirical findings, while section 6 is the conclusion.

2. Background

In this section, we provide background information on Nigeria and Turkey by reviewing the dynamics of human capital acquisition and economic growth in these countries with emphasis on education investment, health investment, health outcomes and per capita GDP growth.

Given the limited space, we shall not be able to say much about these variables but will allow the readers to glean the gist from the tables. Life expectancies in both countries were at a close range at the beginning of the 1970s. However, the gap between the countries diverged over time. While Turkey has substantially increased its life expectancies from 58.6, 54.9 and 56.7 years for female, male, and total, respectively in 1970 to 73.8, 68.9, and 71.29 years in 2005 (see Table 1). The picture is different and gloomy for Nigeria. Total life expectancy that was 42.11 years in 1970 remained almost unchanged at 43.83 years in 2005. apart from natural disasters and risk emanating from accidents, one important factor in this almost standstill position is low public investment in health and health-improving activities.

Total primary school enrolment rates has been on steady increase in Nigeria except in 2004 when the country experienced a slight drop to 99.22% from the previous year's rate of 100.16%. Male enrolment rates are consistently higher than female for all the years for which data is available. This contrasts sharply with Turkey where female enrolment rates are consistently higher than male. Cultural differences may be responsible for this trend. All the

same, Turkey also experienced rise in enrolment rates over time, albeit with some fluctuations. Contrasting both economies, primary school enrolment rates appear to be more consistent and experienced steadier rise in Nigeria than Turkey.

Data on both secondary and tertiary enrolment rates in Nigeria are not as readily available as they are for Turkey. But for the periods for which data is available, a big and widening gap is observed between the two countries. For instance, while total secondary school enrolment rate was 24.93% in Nigeria in 1991, the figure for Turkey stood at 48.04% for the same year (see Table 3). In 2004, Nigeria had a total enrolment rate of 34.61%, while Turkey recorded 79.23%. the picture is exactly the same for tertiary enrolment, with Nigeria and Turkey recording 6.56% and 29.01, respectively in 2004 (see Table 4).

Different measures of health expenditures for Nigeria and Turkey are presented in Table 6 and 7, respectively. While the per capita health expenditures in Nigeria was $23 in 2004, Turkey had a per capita health expenditure of $324 in the same year. The Nigerian figure represents just about 7% of the Turkish figure. This suggests the source of divergence in health human capital in the country. The tables point to the source of this inequality: low public expenditures in health. While private health expenditures are similar and close for private expenditures, the difference is well pronounced in public expenditures. The signal we get from the slight difference in the private expenditures is that the larger and wealthier the economy, the more individuals will have the wherewithal to engage in out-of-pocket health expenditures.

Figure 2 presents a striking picture of the dynamics of growth in Nigeria and Turkey. The statistic show that the Nigerian economy was far ahead of Turkey in the 1970s. More precisely, while growth was 22% in Nigeria in 1970, it was only 1% in Turkey. From then on, the table drastically turned. While the Nigerian economy was experiencing dwindling and very volatile growth rates, the Turkish economy was consolidating and muzzling up for further growth, though with some level of volatility, too. Apart from this initial condition, the growth pattern of the countries appears similar. However, the Turkish economy appears to be more stable and consistent than Nigeria. As analysed above, the possible source of this stability and growth is the priority accorded human capital development.

3. Literature Review and Theoretical Framework

In this section, we examine the empirical and theoretical relationship on the relationship between human capital development and economic growth. Human capital development is usually attained through both health and education. Investment in health and education help develop manpower that will assist in contributing positively to economic growth. The second part focuses on the theoretical framework on which this study is anchored.

3.1 Literature Review on the Relationship between Human Capital and Economic Growth

Human resources can be defined as the knowledge, skills, attitudes, physical and managerial, required to manipulate capital, technology, and land among other things, to produce goods and services for human consumption (UNECA, 1990). The implication of this definition is that human resources encompasses the totality of humans and their potentials which include, but not limited to attitude, energy, vigour, knowledge, technology, and know-how inherent in the human resources of any economy. The two most important means of acquiring human capital is through acquisition of education or knowledge and health improvement. Two broad measures of human capital are identified in the literature, namely health and education. The effects of these measures of human capital have been analyzed in the literature.

The effect of human capital on economic growth was not accorded recognition until recently. Classical economic growth including the neo-classical growth model of Solow placed large emphasis on physical capital accumulation as the basis for growth. However, the emergence of new growth theories or endogenous growth theories has radically changed this line of thinking by emphasizing the role of human capital, especially knowledge or education in the growth process. This new thinking see growth as emanating from the creation and implementation of new ideas through research and development, learning-by-doing, etc.

Uzawa (1965) is about the oldest theoretical articulation of the impact of education on growth, and this line of thought was followed by Lucas (1988). These models express the level of output as a function of the stock of human capital. The models conclude that in the long run, sustained growth is only possible if human capital grows without bound. Several extensions have been made to relax their assumptions. These include Bils and Klenow (2000) which assume quality of education could be increasing over time. The idea is that even if education attainment is constant over time, the stock of human capital could be growing as a result of higher quality of education. Romer (1990) also posits that the steady-state growth rate partly depends on the *level* of human capital. This conclusion is based on the assumption that human capital is a key input in the production of new ideas, thus given birth to the endogenous growth theory. Acemoglu (1997) and Redding (1996) have further relaxed this assumption by examining what happens when individuals are allowed to choose their investments in education or training and firms make decisions on R&D investments.

Empirical studies on the impact of education on growth have yielded mixed results, at best. While, for instance, Mankiw, Romer, and Weil (1992), Levine and Renelt (1992) and Barro (1991) found positive relationship, insignificant effects were found by Pritchett (1997), Islam (1995), Caselli, Esquivel, and Lefort (1996).

There exists burgeoning literature on the relationship between health and economic growth. Health has long been recognised as an important form of human capital (see Grossman, 1972; Schultz, 1980; and Fogel, 1994). Earlier works before these tend to see the causality between health and economic growth as running from health to economic growth. Today, however, there exists overwhelming evidence both in the developed and developing countries of a two-way causality between them; economic growth improves health and at the same time improved health also significantly enhances economic productivity and growth.

Studies from both developed and developing countries reveal that the stock of health human capital has a quadratic effect on the growth rate of per capita income and that 'investment in health human capital' significantly enhances GDP growth (Gyimah-Brempong and Wilson, 2004). Similarly, Sachs and Warner (1997) found that growth tends to be higher in countries with a medium level of human capital as compared with those with very low or very high levels (Sachs and Warner, 1997).

In the literature the effects of health on economic performance have been decomposed to both the micro and macro levels. Evidence of this link at the micro level is increasing and robust (see Schultz and Tansel, 1992; Strauss and Thomas, 1998; Schultz, 1999a, 1999b, and 2002). Good health is a precondition for school attendance since a child has to be healthy to withstand the rigours of schooling. Also, healthier students have lower absenteeism and higher cognitive functioning, and thus receive a better education for a given level of schooling which in turn guarantees higher income over a long period of time. Good health enhances workers' productivity through improvements in their physical and mental capabilities. Such healthy workers can work harder and longer and think more clearly. It reduces poverty through higher labour participation and reduction in cost of medical services. This is the case irrespective of whether the worker is skilled or unskilled. The fact that people generally live

longer may induce them to save for retirement, thus raising the levels of investment and physical capital per worker.

There is also a robust link between health and income at the macroeconomic level. For example, several cross-country studies have shown a strong link between measures of aggregate health, such as life expectancy or child mortality, and growth per capita (Preston 1975; McKeown 1976; Barro 1991; World Bank 1994; Barro and Lee 1994; Barro and Sala-i-Martin 1995; Sachs and Warner, 1997; Pritchett and Summers 1996; Easterly and Levine 1997; Gallup and Sachs 2000; Arora, 2001; Bhargava, 2001, Fogel 2002 and Aisa and Pueyo, 2004). Improved health increases both the quantity and quality of the labour force, thereby increasing national income.

The paths through which health improvements can influence economic growth, as identified in the literature include it effects on labour market participation, worker productivity, investments in human capital, savings, fertility and population age structure (Easterlin, 1999; Hamoudi and Sachs 1999; Bloom and Canning 2000; WHO, 1998 and Bloom, Canning and Graham 2002).

The literature also contains detailed analysis of the effects of education on economic growth. However, the conclusions of these studies differ sometimes depending on the measures of education used in the analysis. Barro (1991) is one of the studies that have examined the effects of human capital on economic growth by measuring human capital as the rate of school enrolment rates. The study which covers ninety-eight countries and span over a period of twenty-five years found that the human capital measured in this way has a positive effect on growth.

3.2 Theoretical Framework

Neo-classical growth theory does not provide a satisfactory answer to the central question about economic growth (Romer, 1990). This conclusion stems from the conclusion of the models that differences in physical capital cannot account for differences in growth across countries. While the model assumes the drivers of differences in growth across countries is effectiveness of labour, the model treats this variable as a 'black-box', a mystery. In addition, its exact meaning and nature is neither specified nor is it modelled explicitly.

This weakness is corrected by the New Growth or endogenous growth theory. There are two views about these groups of models. A few of these models agree with the Solow model on the ground that capital accumulation is not central to growth. They however, disagree with Solow model on the interpretation of the variable, effectiveness of labour. The new growth theory interprets the effectiveness of labour as knowledge and models its evolution over time. Second, contrary to Solow model, capital is central to growth. This conclusion relies on the extension of capital to include not only physical capital but also human capital. Hence, capital accumulation, especially human capital via knowledge accumulation and education could have a substantial impact on growth. This paper adopts the latter view given the relevance of its assumptions to the countries being studied.

Human capital includes the skills, knowledge, abilities and know-how of workers. This compares to conventional or private economic goods that are characterized by rivalry and excludability. While this model is similar to Solow in terms of its assumption of constant returns to scale, it differs from it significantly because of its conclusion that capital accumulation may induce significant changes in output per worker. Broadly speaking, the process of human capital accumulation is similar to that of physical capital accumulation. However, for simplicity, we concentrate only on the process of human capital accumulation and assume the physical capital accumulation process is exogenous.

This theoretical framework follows Mankiw, Romer and Weil (1992). The output production is given as:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} [A(t)L(t)]^{1-\alpha-\beta} .....(1)$$
$$\alpha > 0, \beta > 0, \alpha + \beta < 1$$

Y is output, K is physical capital stock, H is the human capital stock, A is knowledge, and L represents the number of workers. A skilled worker is assumed to supply a unit of L and some amount of H. This model assumes constant returns to K, H and L.

The next assumptions concern the dynamics of labour, capital, knowledge and human capital:

$$\dot{K}(t) = s_k Y(t).....(2)$$

$$\dot{L}(t) = nL(t).....(3)$$

$$\dot{A}(t) = gA(t).....(4)$$

$$\dot{H}(t) = s_H Y(t).....(5)$$

Where s_k is the fraction of capital devoted to physical capital accumulation, s_H is the percentage of resources devoted to human capital accumulation, n is the population growth rate and g is the growth rate of knowledge. The dot on the variables implies the growth.

Expressing equation (1) per unit of effective labour yields:

$$y(t) = k(t)^{\alpha} h(t)^{\beta} .....(6)$$

As mentioned earlier, given the focus of this paper, we assume the process of physical capital accumulation as exogenous. Hence, we concentrate on the dynamics or equation of motion for human capital accumulation. To obtain this, we differentiate equation (5) by applying both the quotient and product rules:

$$\dot{h}(t) = \frac{\dot{H}(t)}{A(t)L(t)} - \frac{H(t)A(t)\dot{L}(t)}{[A(t)L(t)]^2} - \frac{H(t)L(t)\dot{A}(t)}{[A(t)L(t)A(t)]^2} .....(7)$$

$$\dot{h}(t) = \frac{s_H Y(t)}{A(t)L(t)} - \frac{H(t)}{A(t)L(t)}\frac{\dot{L}(t)}{L(t)} - \frac{H(t)}{A(t)L(t)}\frac{\dot{A}(t)}{A(t)} ....(8)$$

$$\dot{h}(t) = s_H y(t) - nh(t) - gh(t) = 0$$

$$\dot{h}(t) = s_H k(t)^{\alpha} h(t)^{\beta} .....(9)$$

Taking natural logarithm of equations (6) and (9) respectively yield:

$$\ln \dot{h}(t) = \ln s_H + \alpha \ln k(t) + \beta \ln h(t).....(10)$$

$$\ln \dot{y}(t) = \alpha \ln k(t) + \beta \ln \dot{h}(t).....(11)$$

Equations (10) and (11) show the dynamics of human capital accumulation and economic growth, respectively. Where $\dot{y}(t)$ is the growth rate of output per capita, s_H represents the resources devoted to human capital accumulation, $k(t)$ is capital per capita and $\dot{h}(t)$ is the growth rate of human capital. Given the focus of this paper, we shall assume human capital accumulation as given and concentrate on the effects of the accumulated human capital on growth. Hence, equation (11) is our model of interest for empirical estimations in this study.

4. Data and Empirical Methodology

The classical econometric theory is predicated on the assumption that the observed data come from a stationary process, that is, a process whose means and variances are constant over time. However, most economic variables evolve, grow and change over time in both real and nominal terms, sometimes dramatically. Consequently, running a regression among such economic variables with the false assumption that they are stationary will result in spurious or nonsense regression. (Granger and Newbold, 1974; and Nelson and Plosser, 1982). It, therefore, follows that any analysis, forecast and policy recommendations based on such results would be meaningless. To avoid these problems, there is need for a superior analytical method. This need is satisfied by the cointegration and error correction mechanism. The important advantage of the contegration technique is that it helps in answering the question of whether there is a long-run relationship between economic variables while the error correction model help us detrmine the short-run adjustments.

This study employs the dynamic OLS, cointegration and error correction techniques. The first step of our methodology is to test the order of integration, that is, the stationarity of our variables of interest. Two approaches are used in applied econometrics to test stationarity. They are the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and non-parametric adjustment Phillips-Perron test (Phillips and Perron, 1988).

The second step is to test for cointegration. This helps check the existence of long run equilibrium relationship between our series of interest. There are many possible tests for this purpose but the most general of them is the multivariate test based on the vector autoregressive representation of Johansen's maximum likelihood estimation approach (Johansen, 1988; and Johansen and Juselius, 1994). In other words, cointegration indicates causal effects (Engle and Granger, 1987).

The empirical analysis is conducted by estimating the growth model specified in equation (11) using annual observations of per capita growth rates of real GDP as the dependent variable, infant mortality rate per 1000 births, average total life expectancy at birth, primary school and secondary school enrolments, and physical capital as regressors. The data on per capita real GDP growth rates for both Nigeria and Turkey are collected from the World Bank's *World Development Indicators* 2007 CD-ROM. Life expectancy, infant mortality, primary and secondary school enrolment data for Nigeria are sourced from National Bureau of Statistic's Digest of Statistics (various issues), while same data for Turkey are collected from the … T.R Prime Ministry State Planning Organization.

5. Empirical Findings and Discussion

5.1. Unit Root Test

To estimate the empirical models, it is imperative that we check the time-series properties of the data. This helps us determine the stationarity of the data and the order of integration. For this purpose, the Augmented Dickey-Fuller and Phillips-Peron tests are employed. Assuming intercept and trend, the stationarity test results are reported in Table 8. The results suggest that

for Nigeria, all the variables are integrated of order one except per capita GDP growth and life expectancy that are integrated of order zero. Similarly, for Turkey all the variables are integrated of order one or higher except life expectancy that is integrated of order zero.

5.2 Empirical Results and Discussion

Our first preoccupation is to estimate the effects of human capital on economic growth for the two countries by employing the OLS technique. Following Romer (1990), Barro (1991), and Mankiw et al. (1992), we employ both primary and secondary school enrolment as measures of education human capital.

The results for these estimations are reported in Table 8. All the necessary specification and diagnostic tests are carried out with a view to ascertaining reliability of the results. The results of these tests reveal the model is free from all form of errors. The models are estimated with White Heteroskedasticity-Consistent Standard Errors and Covariance. The results reveal several pertinent facts about the nature of economic growth in the two countries and the relative impact of human capital in this process. In the case of Turkey all the variables have the theoretically expected sign except infant mortality, though this effect is not statistically significant at the 10 per cent level. One important finding discernible from the results is that health human capital appears to be the most important human capital factor in explaining the Turkish growth. In fact, this is the only human capital variable that is statistically significant at the 5 per cent level. Physical capital is also established to be of high importance in explaining the Turkish growth process. Indeed, this factor appear to be exerting stronger influence on growth that our measures of human capital. This finding is not strange. It rather confirms the position of the endogenous growth theories that stipulate that the effect of human capital might wane overtime, especially if new discoveries are less important than previous discoveries.

Turning to the Nigerian case, the results cannot establish any meaningful relationship between human capital and economic growth. None of the human capital variables is found to have a statistically significant effect on growth. The model is so poor that the estimated adjusted coefficient of multiple determination is negative. This finding is intriguing. It simply reflects the nature of the Nigerian economy and shows that neither human nor physical capital is driving the growth process. Rather, natural capital appears to be the prime mover of growth in Nigeria. Several factors point to this conclusion. Oil revenue and exports have been accounting for the greatest percentage in both total revenue and total exports. For instance, the total percentage share of oil revenue in total revenue that was at the low level of 26.28 percent in 1970 increased over time to reach 83.5 per cent in 2000 but not before it had peaked at 86.15 in 1992. Similarly, the percentage share of oil exports in total exports has also been growing in leaps and bounds. At a modest level of 57.60 per cent in 1970, the value stood at 98.72 per cent in 2000 and has remained consistently over 90 per cent since 1974. When we examine the percentage share of oil in total GDP, it is found that this consistently account for a good percentage. With a paltry share of 11.27 per cent in 1970, the share of oil in the total GDP increased over the years to peak at 47.53 per cent in 2000. the simple picture we are painting here is that natural capital appears to be the driver of growth in Nigeria. This finding agrees with Barbier (1999) on the "new thinking" concerning the role of natural capital in economic growth.

To further examine the relative strength of education and health human capita in driving the Turkish economy, we estimate models that incorporate each variable separately. The results of these estimations are reported in Table 10. We cannot do the same analysis for Nigeria because of the meaningless nature of the regression results. The results indicate that health human capital when combined with physical capital exerts higher impact on economic growth

relative to education human capital. This finding makes a lot of sense because human capital acquired through education can only be productive if healthy. An individual that is sound in health and live longer, for instance, will be more productive than a less healthy and shorter-lived human capital. This places stronger emphasis on health human capital relative to knowledge accumulation in the growth process. In fact, investing in education human capital development of an individual that is not healthy could be tantamount to waste of resources.

The finding that per capita GDP growth is integrated of order zero in both countries implies that the proposed investigation on the cointegration relationship cannot be pursued further. This means that using the per capita GDP growth as a measure of growth, long-run relationship between human capital and economic growth cannot be established in both countries.

The results of the Pairwise Granger Causality Tests for both countries are reported in Table 11 and 12, respectively. In the case of Nigeria, no causality could be established between growth and infant mortality. This is not strange given the earlier findings in the estimated models and the explanation proffered. Again, this demonstrates our earlier assertion that human capital does not appear to be the driving force behind growth in this country. In the case of Turkey, on the other hand, only one causality can be established, and this runs from growth to infant mortality. Again, this is not surprising given the fact that the percentage share of total health expenditures in GDP is consistently higher in Turkey than Nigeria. This underscores the fact that the wealthier the economy, the more it can spend on improving human capital.

It is noteworthy that causality does not exist between education and growth. One possible reason for this is the nature of education in Turkey. While education level is quantiatively increasing, there seems to be no significant qualitative increase. The number of students enrolled has been increasing over time but at a rate that is higher than the increase in the number of teachers. This implies that that the teacher-student ratio is very low. Hence, even though the education human capital is increasing, the quality does not significantly contribute to the nation's economic growth. Another possible explanation behind this finding is that public investments in education are not channeled to very efficient areas that will have the greatest impact on growth.

6.Conclusion

Several policy implications and conclusions can be drawn from this paper. First, the growth patterns of Nigeria and Turkey are driven by different factors. While human capital is an essential ingredient of growth in Turkey, this cannot explain growth in Nigeria. Amongst the human capital variables, life expectancy appears to be exerting the highest influence on growth in Turkey. This is in consonance with earlier studies (see for instance, Bloom and Sachs, 1998). This demonstrates the importance of health in human capital development. Human capital accumulated through education can only contribute to growth if it is armed with the necessary health capital.

Second, it appears that none of our measures of human capital is driving growth in Nigeria. Maybe natural capital, namely oil does. This is because of the prominent role oil has played and is still playing n this economy. The volatility in growth witnessed earlier in Figure 1 is a reflection of the volatile nature of oil revenue which is dependent on the volatile international price of the commodity. There is need, therefore, for this economy to take the drastic policy measure of investing rents from this resource in accumulating human capital by investing in education and health. Oil is a depletable and exhaustible resource. Investment and diversification of proceeds from this resource is necessary to place the economy on the trajectory of sustainable growth.

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APPENDIX

Table 1: Life Expectancies in Nigeria and Turkey

	Nigeria			Turkey		
Year	Female	Male	Total	Female	Male	Total
1970	43.72	40.57	42.11	58.60	54.90	56.71
1980	46.93	43.74	45.30	63.76	59.20	61.42
1990	47.78	45.03	46.37	68.30	63.80	66.00
2000	44.26	43.33	43.78	72.80	68.10	70.39
2002	43.54	43.08	43.30	73.20	68.40	70.74
2005	44.00	43.66	43.83	73.80	68.90	71.29

Source: World Development Indicators, 2007 CD-ROM.

Table 2: Primary School Enrolment Rates in Nigeria and Turkey

	Nigeria			Turkey		
Year	Female	Male	Total	Female	Male	Total
1991	77.48	96.01	86.91	102.88	94.67	98.85
1999	83.42	102.35	93.09	N/A	N/A	N/A
2000	85.65	104.96	95.52	100.86	91.49	96.25
2001	89.91	109.68	100.02	101.85	93.46	97.72
2002	91.12	110.60	101.09	103.10	95.44	99.33
2003	91.05	108.84	100.16	97.78	91.48	94.69
2004	90.97	107.08	99.22	96.11	90.41	93.31
2005	94.69	110.67	102.88	N/A	N/A	N/A

Source: World Development Indicators, 2007 CD-ROM.

Table 3: Secondary School Enrolment Rates in Nigeria and Turkey

	Nigeria			Turkey		
Year	Female	Male	Total	Female	Male	Total
1991	21.11	28.64	24.93	36.91	58.62	48.04
1999	23.04	25.28	24.18	N/A	N/A	N/A
2001	N/A	N/A	N/A	66.39	88.98	77.84
2002	N/A	N/A	N/A	70.25	92.47	81.52
2003	N/A	N/A	N/A	72.77	97.48	85.30
2004	30.94	38.13	34.61	67.63	90.50	79.23
2005	31.26	37.10	34.25	N/A	N/A	N/A

Source: World Development Indicators, 2007 CD-ROM.

Table 4: Tertiary School Enrolment Rates in Nigeria and Turkey

	Nigeria			Turkey		
Year	Female	Male	Total	Female	Male	Total
1991	N/A	N/A	N/A	8.74	16.44	12.68
1999	5.75	7.35	6.56	17.41	25.46	21.52
2000	N/A	N/A	N/A	18.70	27.44	23.15
2001	N/A	N/A	N/A	19.38	27.17	23.34
2002	N/A	N/A	N/A	20.51	28.15	24.39
2003	7.08	12.98	10.08	24.02	31.89	28.01
2004	7.16	13.11	10.19	24.35	33.55	29.01

Source: World Development Indicators, 2007 CD-ROM.

Table 5: Adult Mortality Rates in Nigeria and Turkey (per 1000 Persons)

	Nigeria	Turkey

Year	Female	Male	Female	Male
1970	501.56	604.76	N/A	N/A
1980	452.76	535.20	N/A	N/A
1990	400.69	476.40	N/A	N/A
1997	434.94	474.28	129	201
2002	494.28	503.65	121	193
2005	495.27	498.62	115	186

Source: World Development Indicators, 2007 CD-ROM.

Table 6: Health Expenditures in Nigeria

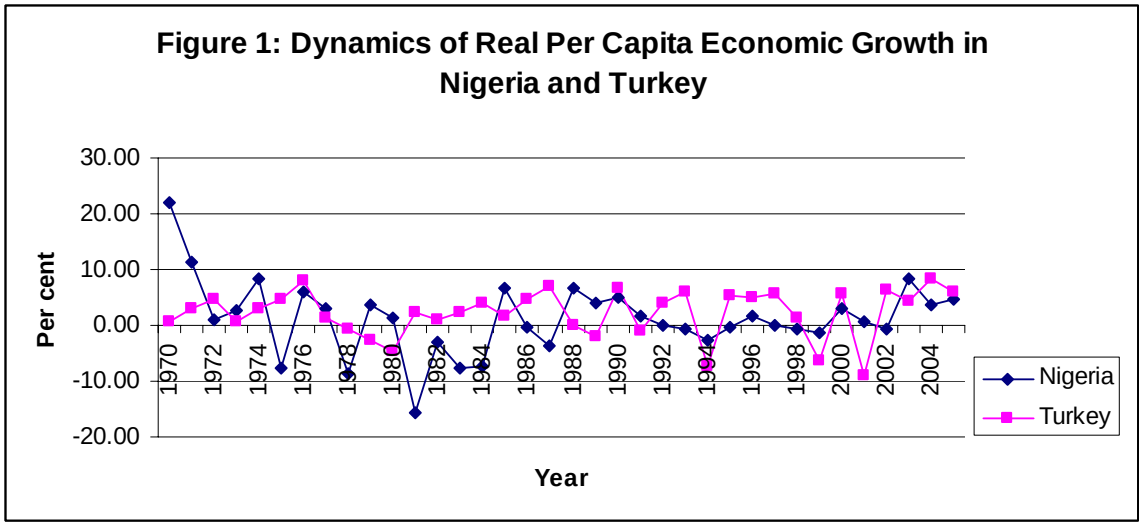
Year	Per Capita ($)	Private Expenditures (%GDP)	Public Expenditures (%GDP)	Total Expenditures (%GDP)
2000	18.00	2.86	1.44	4.30
2001	19.10	3.64	1.66	5.30
2002	18.80	3.72	1.28	5.00
2003	20.80	3.42	1.28	4.70
2004	23.00	3.20	1.40	4.60

Source: World Development Indicators, 2007 CD-ROM.

Table 7: Health Expenditures in Turkey

Year	Per Capita ($)	Private Expenditures (%GDP)	Public Expenditures (%GDP)	Total Expenditures (%GDP)
2000	195.60	2.46	4.16	6.62
2001	158.60	2.38	5.10	7.48
2002	195.60	2.19	5.21	7.39
2003	256.80	2.15	5.43	7.58
2004	324.80	2.14	5.58	7.72

Source: World Development Indicators, 2007 CD-ROM.



Source: Based on World Development Indicators, 2007 CD-ROM

Table 8: Unit Root Test Results

	AUGMENTED DICKEY-FULLER				PHILLIPS-PERRON			
Variables	Level*		First Difference**		Level*		First Difference**	
	Nigeria	**Turkey**	**Nigeria**	**Turkey**	**Nigeria**	**Turkey**	**Nigeria**	**Turkey**
Real Per capita GDP Growth	-5.5150	-6.7767	--		-5.5178	-6.7449	--	--
Physical Capital Stock	-2.5718	-2.2943	-5.2964	-7.4487	-2.6350	-2.1152	-6.1323	-9.8695
Infant Mortality	-3.7798	1.1348	-6.3771	-6.6872	-1.2008	1.3305	-6.3779	-6.6513
Life Expectancy	-5.4261	-1.2862	-7.4213	-2.0031	-5.4645	-1.1036	-13.7014	-2.0855
Primary School Enrolment	-2.2007	-0.2054	-5.6863	-5.1011	-2.2020	-0.2739	-5.7150	-5.1005
Secondary School Enrolment	-2.5333	-0.8671	-4.4799	-5.1802	-1.7571	-0.8569	-4.5638	-5.1828
ECM	-4.8889	-5.1954	-11.3010	-8.4180	-6.8319	-6.1427	-18.2524	-25.8074

Note: *The critical values are -4.2436, -3.5443; and -3.2047 for 1%, 5% and 10%, respectively.

**The critical values are -4.2529, -3.5485; and -3.2071 for 1%, 5% and 10%, respectively.

Table 9: OLS estimation Results

Variables	Nigeria		Turkey	
	Coefficient	t-statistic	Coefficient	t-statistic
ΔINFMORT	-0.9164	-0.0907	0.2531	0.1639
ΔLIFEEXP	-2.4138	-0.3594	63.2060	2.5713**
ΔPRYENR	-0.2005	-0.0651	0.9269	0.6793
ΔSECENR	-0.0935	-0.2379	0.3983	0.2062
ΔGKFGDP	-0.1239	-0.0908	2.0675	3.5698
Constant	3.3006	1.2998	2.3371	16.7923
R^2	0.0089		0.5305	
Adjusted R^2	-0.1618		0.4466	
S.E of Regression	0.7285		0.4465	
F-statistic	0.0525		6.3271	
Durbin-Watson	1.9629		1.6729	

Note: The sign ** implies statistical significance at the 5 per cent level.

Table 10: Estimated Impact of Human Capital on Growth in Turkey

Education Human Capital Model			Health Human Capital Model		
Physical Capital	Primary School Enrolment	Secondary School Enrolment	Physical capital	Infant Mortality	Life Expectancy
2.587364	1.376775	1.078292	2.0435	-0.1234	64.7977
[2.4669]**	[2.0101]*	[0.4708]	[3.6289]***	[-0.0827]	[2.7199]**
Adj. R^2 = 0.3534; F-statistic = 7.1952***; Durbin-Watson = 2.0045			Adj. R^2 = 0.4749; F-statistic = 10.9508***; Durbin-Watson = 1.6697		

Note: The values in square brackets [ ] are the t-statistic, and ***, ** and * implies statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Table 11: Granger Causality Test Results for Nigeria

Null Hypothesis:	Obs	F-Statistic	Probability
Infant Mortality does not Granger Cause Growth	34	0.34247	0.71285
Growth does not Granger Cause Infant Mortality		0.00479	0.99523
Life Expectancy does not Granger Cause Growth	34	1.15353	0.32958
Growth does not Granger Cause Life Expectancy		0.52146	0.59912
Primary Enrolment does not Granger Cause Growth	34	0.27750	0.75966
Growth does not Granger Cause Primary Enrolment		0.38074	0.68672
Secondary Enrolment does not Granger Cause Growth	34	0.79445	0.46142
Growth does not Granger Cause Secondary Enrolment		0.10078	0.90445

Table 12: Granger Causality Test Results for Turkey

Null Hypothesis:	Obs	F-Statistic	Probability
Infant Mortality does not Granger Cause Growth	34	0.85580	0.43540
Growth does not Granger Cause Infant Mortality		3.51962	0.04281
Life Expectancy does not Granger Cause Growth	34	0.66148	0.52370
Growth does not Granger Cause Life Expectancy		1.02658	0.37088
Primary Enrolment does not Granger Cause Growth	34	0.42534	0.65756
Growth does not Granger Cause Primary Enrolment		0.28925	0.75096
Secondary Enrolment does not Granger Cause Growth	34	0.09290	0.91155
Growth does not Granger Cause Secondary Enrolment		1.32976	0.28019