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HUMAN CAPITAL AND ECONOMIC GROWTH NEXUS IN TANZANIA: AN ECONOMETRIC ANALYSIS

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ABSTRACT

Debates on the nature of linkages between human capital and economic growth have captured attention of many economist researchers. This study utilizes Granger causality test to investigate the causal effect of estimated variables, covering the period of 1970 to 2017 in Tanzania. Similarly, Bound test approach was employed to explore cointegration among variables. The findings support endogenous growth theory that human capital is decisive factor for growth by yield a positive and significant effect on short and long term dynamics. Likewise, the data set employed suggest unilateral causality of human capital towards economic growth. This conclusion has marked a note on macroeconomists policy makers towards strengthening of resources allocation on human capital investment in favor of attainment of sustainable economic growth.

KEYWORDS: *Human Capital, Economic growth, Bound test and Granger causality test.*

I. INTRODUCTION

The linkage between human capital and economic growth has been brought out by many economic studies. It has been sought, among many existing resources an economy can have in its production equation, healthier, educated and well trained manpower, is potential in unlocking productivity capabilities that may exist at given technological level (Haldar & Mallik, 2010). This piece of work has initiated by Adam Smith when showing how investment in education affect wealth of nations and further reemphasize by neoclassical economists (Awel, A. M., 2013). The large body of literature noticed that an economic growth is not only depending on physical factors, nonetheless it is influenced by more complex and intangible factors like human capital (Daghighiasli, A. and et al., 2014). That is, a well-functioning and prosperity of any economy relies upon the level and efficiency of physical and human capital accumulation.

Among notable early works shed the light on this matter is endogenous growth theory developed by Lucas (1988) and Romer (1990). This model has emphasized the role of investment in human capital towards achieving technological progress and innovation (Awel, A. M., 2013). Endogenous growth model has further demonstrated that the attainment of sustainable growth of any economies is not possible out of human capital development. That is, a developed human capital makes workers to be more productive resulted from increasing income growth and hence improvement of economic assets.

Given the broader body of existing literatures explaining the relationship between investment of human capital and economic growth particularly those analyzing its causality have mixed conclusions. Some empirical studies conclude that human capital and economic growth have unilateral causality while others have bidirectional causality. Among unilateral causality studies is that of Haldar, S. and Mallik, G. (2010); Suri, T. et al., 2011; Faisal, F. et al., 2011; Daghighiasli, A. and et al., 2014; which highlighted that human capital leads to output growth. In the same realm, Diebolt, Guiraud and Monteils, 2003 and Mehrara, M. and Musai, M. 2013; have concluded to the contrary, output growth is causative of human capital development. Finally, Awel, A. M., 2013; Francis and Iyare, 2006 suggested bidirectional causality between human capital and economic growth. With this mixed results of causality, which one is more credible in relation to Tanzania context? This paper has built on this question for the purpose of revealing the causality of human capital and economic growth in Tanzania using relative long term time series data set (1970 to 2017). In addition, the study investigated the short and long terms dynamics between the estimated variables.

With limited economic resources, understanding the direction of causality helps one to prioritize during policy selection thus allocate resources in one sector of the economy to achieve maximum ends to both sectors.

II. METHODOLOGY

A. Analytical Framework

The literature debate of causality has not end on the directional of causality but also on the methodologies employed and proxy variables used to estimate human capital. Boldin *et al.*, 2008; Dananica and Belasku, 2008; Ljungberg and Nilsson, 2009 have adopted bivariate analysis on estimate causality whereas Awel, A. M, 2013; Dauda, 2009 and Islam *et al.,* 2007 have used multivariate approach on their analysis. On the other hand, literatures used different proxies on human capital. This has been pointed out that scarcity of data accessibility is the reasons for such differences (Awel, A. M., 2013). Some studies have used public expenditure in education as the proxy for human capital (Khalifa, 2008; Pradhan, 2009; Chandra and Islamia, 2010) others used enrollment rates (Babatunde and Adefabi, 2005; Amin et al. 2012). Similarly, Maksymenko and Rabbani, 2009 uses average years of schooling as the proxy for the same variable.

This study will employ multivariate approach to establish the nexus between human capital and economic growth. Similarly, a study has adopted a model developed by Lucas (1988) following the improvement made by Rebelo (1991) and Romer (1990) on the inclusion of physical capital as the function of human capital accumulation. The fundamental presumption made on this function is that, human capital is the sole source of innovations which creates a stock of physical capital and enhances economic growth. The primary theoretical framework on such relationship was drawn by Cobb Douglas production function which state that an output growth is function of capital (K), labour (L) and technology (A).Therefore, a modify Cobb Douglas production function will be with the following form:

$$y = Ak^{\alpha}h^{\beta}$$

Where, y is the labour productivity, k is output per capital, h is average human capital. The model can be express in natural logarithm to yield a linear function form express as,

$$In(y) = In(A) + \alpha In(k) + \beta In(h)$$

From the estimated equation of relationship between human capital and economic growth, two hypotheses can be developed based on the theoretical and empirical discussion made. Firstly, the human capital leads to economic growth and not economic growth leading to human capital. Secondly, human capital impacts economic growth positively in the long run.

B. Data Description

The empirical analysis has been carried out with relative longer trend time series data from 1970 to 2017 to investigate the causal relationship between human capital and economic growth in Tanzania context. Real GDP per Capita and public expenditure in education data have obtained from Bank of Tanzania (BoT) annual reports and budget speeches whereas the Gross enrolment ratio of primary level was obtained from UNESCO. For the case of this paper, a real GDP per capital was used as the proxy measure for economic growth. Public education expenditure in education and Gross enrollment ratio of primary level has been used to reflect a human capita variable. More importantly, this paper views human capital development as an investment in education though practically the theme also involves health and social capital. Another important thing to note is an extrapolation has been made in some data missing especially in Gross enrollment ratio of primary school in early 1970's.

C. Empirical Estimation

Unit Root Test

The foremost important in time series studies is to investigate whether variables mean; variance and covariance are time invariant since most of the macroeconomics variables are non-stationaries. Relies on non-stationary variables will have enormous consequences because researchers cannot develop an inference. Alternatively, the regression results will be spurious (Granger and Newbold, 1973)

There has been a widely proposed test technique used to measure stationarities like Dickey Fuller (DF), Augmented Dickey Fuller (ADF), Phillips-Perron (PP), Zivot Andrews tests to mention but a few. For the purpose of this study, Augmented Dickey Fuller (ADF) and Zivot Andrews tests are employed to test the existence of stationarity because they have superior properties over other approaches. ADF and Zivot Andrews tests have an advantage of providing reliable results even the error term is not white noise. Moreover ADF test worked properly on assumption that error term is white noise. Likewise, Zivot Andrews's test is appropriate to take into account structure breaks prone in time series data. In such understanding the ADF test will take the following function form:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t$$

In this function form, a null hypothesis is assumed δ=1, which means that the variable y_t is stationary and alternative hypothesis assumes δ≠1, such that the variable y_t is not stationary. The optimal lag length is determined by Schwarz's Bayesian Criterion (SBC) and ε_t is white noise error term.

In the same realm, the structural breaks of time series variables resulted in changes of either variable level or trend or both. As mention early, Zivot Andrews test is capable to hold such changes through three sets of equations by estimate break data as endogenously rather than exogenously. The first sets of equation assume allow an endogenous change in level of series. The second allows endogenous change in rate of growth and the third equation allows both changes. Hence, Zivot Andrews test will be in the following function form:

$$\begin{cases} y_t = \alpha_1 + \alpha_2 DU_t + d(DT_B)_t + \beta t + \delta y_{t-1} + \sum_{i=1}^{m} \rho \Delta y_{t-1} + \mu_t \\ y_t = \alpha_1 + \alpha_2 DU_t + \varphi DT_t + \beta t + \delta y_{t-1} + \sum_{i=1}^{m} \rho \Delta y_{t-1} + \mu_t \\ y_t = \alpha_1 + \alpha_2 DU_t + d(DT_B)_t + \varphi DT_t + \beta t + \delta y_{t-1} + \sum_{i=1}^{m} \rho \Delta y_{t-1} + \mu_t \end{cases}$$

In this model, each sub-set of the equation has included a dummy variable (DU_t) under the null hypothesis that the variable has a unit root. Simply, a dummy shows a change in the level, such that DU_t= 1 if the time is after the break date ($t>T_B$), otherwise is zero (DU_t=0) and T_B is a date of break. DT is the change in the slope of in the trend equation such that DT_t=t if $t>T_B$ and zero otherwise. DT_B is the crash dummy such that DT_B =1 if $t=T_B + 1$ and otherwise zero.

Cointegration and Error Correction Model

Two variables are cointegrated if there is an existence of long run equilibrium relationship. Similarly to other methods, econometrics literatures have a list of approaches used to investigate the long run relationship between variables. Among notable approaches is a residual approach commonly known as Engle and Granger two steps method, Vector Autoregration Model (VAR), Johansen's approach and Bounds approach also known as Autoregressive Distributed Lag (ADRL). These methods have been also used to reparametrizing to the Error Correction Model (ECM). That is it explains the speed of adjustment toward equilibrium resulted from shocks.

This study will employ Bound test approach developed by Pesaran and Shin (1996) and Pesaran, Shin and Smith (2001) because of its superior properties over other methods. First, it is preferable when dealing with variables that do not have the same order of integration, I(0) or I(1) or combination of both to estimate short and long term dynamics relationship. Secondly, the ARDL approach is effective in removing the problems associated with omitted variables and auto-correlation and lastly, it can lead to robust results even using of a small sample. The ARDL will have the following function form:

$$InY_t = \beta_1 + \sum_{i=1}^{p} \beta_2 InY_{t-i} + \sum_{i=1}^{p} \beta_3 InP_{t-i} + \sum_{i=1}^{p} \beta_4 InE_{t-i} + \delta_1 InY_{t-1} + + \delta_2 InP_{t-1} + + \delta_3 InE_{t-1} + \varepsilon_t$$

Where Y_t is Real GDP per capita, P_t is public expenditure in education, E_t is the Gross enrolment ratio for primary level, ρ is the lag length and ε is an error term which assumed to be white noise. On regression process the bound test is using the F-statistics to identify the existence of long run equilibrium relationship between variables. Apparently, summations parts of the equation represent the long run relationship between estimated variables. The null hypothesis is assuming that there is no cointegration between variables (Ho: β1=β2=β3=β4=0) and the alternative hypothesis has been built on the existence of cointegration between variables (H1: β1≠β2≠β3≠β4≠0). Specifically, conclusion of long run relationship is derived from the set of critical values generated in the model. If computed F-statistics lies below the lower critical bounds values we reject alternative hypothesis on fever of null hypothesis. Similarly, when lies above the upper critical values we reject the null hypothesis in favor of the alternative hypothesis. More importantly, the model will be inconclusive if the computed F-statistics is between the upper and lower critical values.

Once the long run relationship between the variables is known, then it is possible to investigate the speed of adjustment toward equilibrium resulted from the shock on the system. The ARDL Error Correction Model will be utilized for the following functional form.

$$InY_t = \beta_1 + \sum_{i=1}^{p} \beta_i InY_{t-i} + \sum_{i=1}^{p} \gamma_i InP_{t-i} + \sum_{i=1}^{p} \delta_i InE_{t-i} + \varphi ECM_{t-1} + \mu_t$$

Where ϕ is a parameter which indicates the speed of adjustment such that when the parameter approaches zero, it indicates the system is slow toward equilibrium resulted into shock and when the parameter approaches one, it indicates the system is relatively faster to its equilibrium.

III. RESULTS AND DISCUSSION

A. Unit Root Test

In this study stationarity of the variables were detected by using ADF test. Table 1.1 indicates that test statistics of all variables failed to reject the null hypothesis that variables have the unit root at the level. Alternatively, after the first difference all variables are stationary which implies that are integrated of order one I(1). Correspondingly, table 1.2 indicates the results from the Zivot Andrews test. Similar results were observed on all variables employed in the model. Zivot Andrews test was carried to curb expected structure change in the series after a massive change of education policy started in 1995.

Table1.1 ADF Test Results

Variable	Estimate at level			Variable	Estimate at First Difference.		
	Test statistics	Critical values (5%)	No of Obs.		Test statistics	Critical values (5%)	No of Obs.
Y_t	-2.823[0]	-4.512	48	ΔY_t	-6.493[0]***	-3.516	48
P_t	-3.517[1]	-4.512	48	ΔP_t	-4.418[1]**	-3.516	48
E_t	-3.083[1]	-4.512	48	ΔE_t	-4.176[0]**	-3.516	48

Note: The asterisks ** and *** indicate significant at 5% and 1% respectively. The symbol Δ indicate the first difference has been taken and number inside parenthesis shows the optimal lag length according to Akaike Information Criterion (AIC).

Table 1.2 Zivot Andrews Test Results

Variable	Estimate at level			Variable	Estimate at First Difference.		
	Test statistics	Critical values (5%)	No of Obs.		Test statistics	Critical values (5%)	No of Obs.
Y_t	-1.356	-5.877	48	ΔY_t	-9.356[2002]***	-5.877	48
P_t	-2.901	-5.877	48	ΔP_t	-7.722[2008]***	-5.877	48
E_t	-2.247	-5.877	48	ΔE_t	-6.022[2005]**	-5.877	48

Note: The asterisks ** and *** indicate significant at 5% and 1% respectively.

B. Cointegration Analysis

Time series properties of the variables indicated in Table 1.1 and 1.2 support utilization of ARDL since variables are I(0) and I(1). As indicate early, F statistics must be greater than upper critical bound to satisfy a condition for reject null hypothesis in favor of the alternative hypothesis. Table 1.3 justifies the existence of cointegration as computed F statistics lies above upper critical bound. Apparently, the bound criteria were extracted from Pesaran, Shin and Smith, 2001 table of unrestricted intercept and no trend at 5 percent critical values. Therefore, the data set verifies existence of the long run cointegration relationship as the value of F statistics is above the threshold of even 99 percent confidence interval.

Table 1.3 Bound Test

Test Statistics	Values	K
F statistics	8.064***	3

	Critical Values Bound	
Significance	**Lower Bound**	**Upper Bound**
1%	6.84	7.84
5%	4.54	5.73
10%	4.04	4.78

Note: The asterisks *, ** significant at 10and *** indicate %, 5% and 1% respectively

Once the cointegration property is known, it is possible to estimate the parameters of the long run and short run relationship. Schwarz Bayesian Criterion has been utilized to determine the lag length of the estimated model. The order of the model is ARDL (2,0,2) on which parameters of the long run relationship were estimated. Table 1.4 shows that the past values of Gross enrollment ratio for primary level has not yet realize on the performance of economic growth and for this case GDP per capita though is positively related. The data set utilized has shown different result on public expenditure in education, that is past values of public expenditure in education has positive and significant explain the variation of GDP per capita.

Table 1.4 Estimation of the long run coefficient using ARDL

Variable	Coefficient	Standard Error	t-statistics	Probability
D (*Ln*GDP per Capita (-1))	0.894	0.352	9.782	0.087
D (*Ln*GDP per Capita (-2))	1.009	0.084	14.694	0.110
D (*Ln*Public Education Expenditure)	0.062**	0.451	11.073	0.036
D(*Ln*Gross Enrollment level (-1))	7.031	0.089	8.753	0.248
D(*Ln*Gross Enrollment level (-2))	5.104	0.007	16.159	0.106
Constant C	-23.861*	0.542	26.243	0.064
R Squired: 0.9845				
Adjusted R-Squired: 0.9673				
F-Statistics: 112.4213				
Probability: 0.0000				

Note: The asterisks *, ** significant at 10and *** indicate %, 5% and 1% respectively

The short run relationship was carried to explain how the system improves toward equilibrium whenever deviation occurs. As stated early, the ARDL Correction Error Model was employed in the short term analysis. Table 1.5 shows similar results as in the long run relationship except Gross enrollment ratio for the primary level to be significant explain the variation of GDP per capita but with a negative sign. More important the coefficient of error correction term is has a negative value and statistical significant at 99 percent confidence interval as expected. The coefficient value of error correction tells us that 57 percent of deviations from the equilibrium of the previous period shocks converge to the balance again in the current period.

Table 1.5 Estimation of the short run coefficient using ARDL

Variable	Coefficient	Standard Error	t-statistics	Probability
D (*Ln*GDP per Capita (-1))	4.675	0.911	18.648	0.099
D (*Ln*GDP per Capita (-2))	13.254	0.472	14.273	0.233
D (*Ln*Public Education Expenditure)	0.038**	0.065	15.466	0.051
D(*Ln*Gross Enrollment level (-1))	-0.007	0.846	5.112	0.653
D(*Ln*Gross Enrollment level (-2))	-0.011*	0.267	24.497	0.011
Constant C	-34.528**	0.751	33.001	0.047
ECM (-1)	0.574***	0.452	13.854	0.001

R Squired: 0.8406
Adjusted R-Squired: 0.7647
F-Statistics: 34.7643
Probability: 0.0000
DW-statistics: 1.7524

Note: The asterisks *, ** significant at 10and *** indicate %, 5% and 1% respectively

Diagnostic and structure test were also measured to determine the consistency of the parameter estimate and stability of the model chosen. On diagnosis test the finding suggest the model is free from serial correction problem, function form misspecification and normality problem. Similarly, Figure 1.1 and 1.2 indicate that all coefficients of estimated ARDL error correction model are stable as they fall within the critical bounds. Apparently, the two graphs are cumulative sum of recursive residuals (CUSUM) and cumulative sum of square of recursive residuals (CUSUMSQ) which are used to measure the stability of estimated coefficients of the equation.

Figure 1.1: CUSUM Test

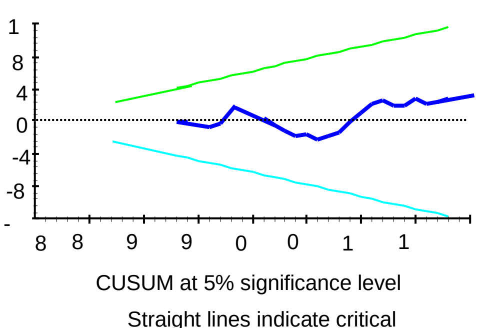
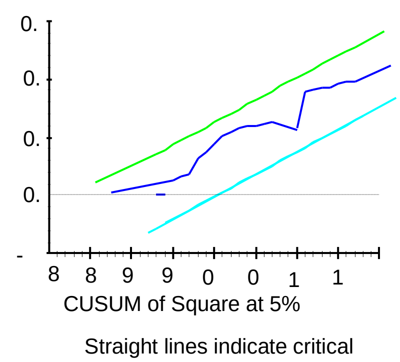


Figure 1.2 CUSUMQ Test



C. **Causality Test**

Since the long run and the short run relationship between the variables are already known, another crucial area of this paper is to establish the causal relationship between the estimated variables. The Granger causality test was employed to detect such causality after determining the optimal lag length by Akaike Information Criteria (AIC). A table 1.6 shows there is unitary causality at 4 lag length. That is only public education expenditure Granger cause GDP per capita at 95 percent confidence interval.

Table 1.6 Granger Causality Test between Estimated Variables

Null Hypothesis	Obs.	F-statistics	Prob.
ΔLn_Public Educ Expenditure does not Granger cause ΔLn_GDP per capita	30	1.486	0.014
ΔLn_GDP per capita does not Granger cause ΔLn_Public Educ Expenditure		4.072	0.271
ΔLn_Gross Enrollment Ratio does not Granger cause ΔIn_GDP per capita	30	7.034	0.163
ΔIn_GDP per capita does not Granger cause ΔLn_Gross Enrollment Ratio		3.159	0.304

IV. CONCLUSION AND RECOMMENDATIONS

This study utilizes different econometric tools to explain the link between human capita and economic growth in Tanzania context from 1970 to 2017. The data set verify there is cointegration relationship between estimated variables and more importantly suggest the existence of unitary causality. That is the past values of the public expenditure in education which is the proxy for human capital investment explain the variation of economic growth measured with GDP per capita. The result praises the fundamental roles of human capital investment. That is human capital investment influence innovation, increase in labour productivity and accumulation of capital stock which in turn enhance economic growth. Hence, policy makers should prioritize allocation of more resources on public expenses to achieve a country sustainable development.

The findings also note unexpected result on Gross enrollment ratio for primary level. It indicates a negative effect on economic growth. The surprising results might be explained by the challenges encountered in the education system in Tanzania such as; student's drop-out rate, repetition rate, transition rate and performance rate. These results stimulate the effort undertaken by Tanzania government toward attainment of quality education.

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