



# A Study on Human Capital and Economic Growth in Botswana

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**Abstract:** This study was undertaken to measure the role of human capital in economic growth of Botswana. We found that human capital contributed to economic growth in Botswana positively although the contribution was not significance. The insignificance of the human capital might have been due the fact that Botswana as a developing country has not reached the threshold level because of the mismatch between growth of technology, industry and manufacturing sector that had not reached the need for qualified educators especially in the areas of science. The other possibility is that the problems of unemployment related to those highly trained workers that occupy the low grade job do not support individual development and economic development of a nation as a whole.

**Key words:** Economic growth, Human Capital, Low grade job, mismatch, Botswana.

## 1. INTRODUCTION

Botswana is among the African land locked countries that lies southern part of the continent bordered Zambia to the west and north, south by the republic of South Africa and to the east in Zimbabwe. It is 570,000 square km about the size of Kenya, Texas or France. Been one of poorest countries that gained independent on 30 September 1966. Botswana had one of the highest economic growths in the world with the average real gross domestic product grown 7% (Mogoe, 2006). In 1992 it is classified as middle income countries in the world, and cited success story in Africa (DaronAcemoglu, et al 2002), becoming the fastest growing economies in the world. Botswana maintained its economic growth for last four and half decades. The source of this growth has been the country rich mineral endowment. Today Botswana is a distinguished country in Africa in a positive way. When Botswana became independent from Britain in 1966, the country was among twenty five poorest countries in the world, as the fascinating GDP growth averaging over 10% in 1975—2005. All this remarkable economic events has not happened without hard work and financial administration of the leader of Botswana. Therefore, this drastic economic change of Botswana's economic growth may be caused by natural mineral endowment or there is human capital that contributed to the economic growth of Botswana after independent. This is the focus of our research.

## 1.1 Problem Statement

Human capital is one of the oldest theories of economics since Adam Smith era and also known in the 1960s Becker, Schultz Theodore and James Heckman have contributed to the theory of human capital and empirically investigated the role of human capital in economic growth. Human capital is a source of economic growth. Therefore, to examine how human capital contributes to the economic growth is addressed in our study for the case of Botswana. Its independence in (1966) Botswana had 22 graduated students from universities and few numbers from high school. Therefore, the inadequate human capital that Botswana had started for its independent day makes an issue of how Botswana gained for the impressive economic growth and what extent that human capital played for the economic growth. Is it a diamond export market that brings about this drastic economic growth? Is there other things backed by the economic growth in the country. And how human capital influenced the economic development of the country prompted us to undertake this research.

## 1.2 Objectives

The general objective of the study is to examine the contribution of human capital to the economic growth in Botswana.

1. To examine the long-run effect of human capital on economic growth in Botswana
2. To assess the contribution of human capital to the economic growth using time series data in Botswana.
3. To examine the direction of causality relationship between human capital and economic growth.

## 1.3 Significance of the Study

The perception of expanding human capital is instrumental for a higher economic growth seems undeniable. However there was not clear empirical evidence that supports the contribution of human capital to the growth. This paper tried to address and asses the specific situation in Botswana. The conventional wisdom is that human capital contributes economic growth through directly as an input of production or facilitating factor of economic growth.

## 1.4 Scope of the Study

This study was undertaken to find the relationship between human capital and economic growth, contribution of human



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capital on growth and other economic variables that contribute economic growth in Botswana during period of 1977—2008. The most challenged period of economic growth in the country, keeping consistent of economic growth rate brings out the middle income country. For this study we implemented time series data. The econometrics methodology to be utilized is the Augmented Dickey-Fuller (ADF) for unit root, co-integration test and Granger causality and impulse response function.

## 2. METHODOLOGY AND MODEL OUTLINE

The researchers used the Vector Auto Regression (VAR) model to study the relationship between human capital and economic growth. The model was mostly used for forecasting a system of interconnected time series and analyzing the dynamic impact of random disturbance on the system of variables. The model is appropriate for that situation as it is less restrictive compared to other models. The model was introduced by Sims (1980) can be written as follows.

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + B X_t + \varepsilon_t$$

Where  $y_t$  is the  $k$  vector of endogenous variables,  $X_t$  is  $d$  vector of exogenous variables,  $A_1, \dots, A_p$   $B$  are matrices of coefficients to be estimated and  $\varepsilon_t$  is a vector of novelty that may be of that period correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables. For this study researcher used Vector Auto Regressive for co-integration test.

According to Mankiw, Romer and Weil (1992) the human capital augmented production function is given by:

$$Y = K_t^\alpha H_t^\beta (AL)^{1-\alpha-\beta} \quad (1)$$

$Y$  = output

$K$  = physical capital

$H$  = human capital

$L$  = labor force

$A_t$  = technological progress

And  $\alpha + \beta < 1$

For this research project researchers used six variables: labor for ( $L$ ), output (GDP per capita) terms of trade, physical capital, official development assistance, human capital while GDP per capita is dependent variable. The model is presented as follows:

$$\text{LogGDP} = \beta_0 + \beta_1 \text{logK} + \beta_2 \text{logTt} + \beta_3 \text{H} + \beta_4 \text{logL} + \beta_5 \text{logODA} + \varepsilon_t \quad (2)$$

Where

$\beta_0$  = intercept

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  coefficients in the model

$\text{Lgdp}$ — natural logarithm of output (GDP per capita)

$\text{LogH}$ — human capital (proxy tertiary level enrollment)

$\text{Log K}$ —log of gross capital formation

$\text{LogTt}$ --- log of term of trade

$\text{Log L}$ --- log of labor force

$\text{Log ODA}$ ---log of Official Development Assistance

$\varepsilon_t$  = error term

## Official Development Assistance (ODA)

Official Development Assistance is a flow of official financing administered with the promotion of economic development and welfare of developing countries. Botswana was one of the highest recipients of official development assistance in 80s but subsequently declined. ODA in Botswana is believed to contribute the economic growth and development. Finally the relationship between official development assistance and economic growth is positive accordingly.

## Human Capital Specification

Being one of the most complex proxies, human capital is multifaceted and includes a complex set of attributes. The stock of human capital held by individuals is hard to measure with precision in a quantitative way (Barro and Lee 2000). There were steps needed find the best proxy for human capital that is quantifiable. The literature of this field has been used different proxy like adult literacy rate, school enrollment, enrollment ratio, average year of schooling. According to the availability of the data the researcher used tertiary education enrollment level data that have been used by many authors in this field and found positive relationship with economic growth.

## Econometric Procedures and Estimation

Generally when a time series data analysis is conducted, the first thing is to do is to examine data stationary using the unit root test in order to ascertain the stationary of variables. The researchers conducted this procedures on every variable in the model namely, labor force, gross domestic product per capita, human capital (tertiary enrollment education), physical capital (gross fixed capital formation), official development assistance and terms of trade. This is followed by the Augmented Dicker-Fuller test implemented after completing the level of integration in each variable followed the co-integration test. The co-integration test was used to analyze the long-run relationship between economic growth and other variables like: human capital, physical capital, official development assistance, terms of trade and labor.

## Unit Root Test

The unit root test should be performed in order to know the level of integration or order of integration.

Unit Root Test is a process to know the stationarity among the variables. Stationar is the process that the mean, variance, and auto covariance that remains the same no matter at what point they are known; that is they are time invariant. nonstationary time series is when have time varying mean or time varying variance or both (Gujarati 2007) testing for stationarity unit root test was used. Hence to test for unit root we follow the Augmented Dicker-fuller test to know the stationarity of the variables at level or first difference. Therefore the equation of Dicker-fuller test is:

$$Y_t = A + \rho y_{t-1} + \varepsilon_t \quad (3)$$



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Where  $y_t$  is the stationary series  $t$  is time  $A$  and  $p$  are a coefficients and  $\epsilon_t$  is the error term. We know that if  $p=1$ , that is the case of a unit root present.

It is based on the following regression:

$Y_t$  is a random walk

$$\Delta Y_t = \delta Y_{t-1} + u_t \dots \dots (4)$$

$Y_t$  is a random walk without drift

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t \dots \dots (5)$$

$Y_t$  is a random walk with drift around a stochastic trend

$$\Delta Y_t = \beta_1 + \beta_2 + \delta Y_{t-1} + u_t \dots \dots (6)$$

Where  $t$  is time error or trend variable. In each case the null hypothesis is that  $\delta=0$  which implied there is a unit root and time series is not stationary. The alternative hypothesis is that  $\delta < 0$  which means time series is a stationary.

The above equation is dickey- fuller test (DF) that assumed error term is uncorrelated. But in the case of correlation dickey-fuller developed Augmented Dickey fuller test. The Augmented dickey fuller test is conducted the augmenting the above three equations by adding lagged values of the dependent variable  $\Delta Y$ . The ADF test consists of estimating the following regression:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^m \alpha_i \Delta y_{t-i} + \epsilon_t \dots \dots (7)$$

Where  $\epsilon_t$  is a pure white noise error term and where  $\Delta y_{t-1}$  is a number of lagged difference terms to include is often determined empirically. In ADF test we still test whether  $\delta=0$  and ADF test follow the same asymptotic distribution as the DF statistics. The optimum of lag length is determined by the smallest value of Akaike Information Criteria (AIC).

Ho:  $\delta=0$  (there is unit root)

Ho:  $\delta < 0$  (stationary)

The null hypothesis of unit root test rejected if the series is stationary. If the computed value of tau statistics ( $\tau$ ) exceeds DF or Mackinnon critical tau value rejecting hypothesis that  $\delta=0$ , in which the case time series is a stationary.

### Co-integration test

Regressing one random walk against another can lead to spurious regression results in that conventional significance tests will tend to indicate relationship between variables when in fact none exists. Sometimes two variables will follow random walk but a linear combination will be stationary, therefore we call co-integrated variables. The theory that was developed by Engle and Granger was important for reasons that go beyond its use as a diagnostic for linear regression. Usually economic theory tells us that two variables should be co-integrated, and a test for a co-integration (pindyck, Rubinfeld, 1998)

If the variable in the regression analyses are not stationary at levels, but they are integrated some order and there exist linear combination of them that is integrated of a lower order  $I(d-c)$ . Where  $c > 0$ , then the variable are said to be co-integrated of order  $I(d-c)$ . Summarizing the meaning that if the variables are  $I(1)$  and a linear combination of them is  $I(0)$  then we concludes that the variables are co-integrated order  $I(1)$ . The

co-integration we infer that there is long-run relationship between variables.

This study conducts the approach developed by Johansen (1998) and Johansen-Juselius (1990). This method uses to test the long-run relationship between co-integrated variables. The Johansen's co-integration test derived on vector Autoregressive (VAR) model and lag length criteria is determined using Akiake's information criteria (AIC).

The co-integration process that explains in VAR model can write as follows:

$$Y_t = \mu + \sum_{k=1}^p \Pi_k Y_{t-k} + \epsilon_t \dots \dots (8)$$

Where  $Y_t$  is the  $g$ -vector of the of  $I(1)$  variables  $u$  is the vector of constant term and  $\epsilon_t$  is the disturbance error or white noise residuals.

For this equation can be rewrite after differencing as follows:

$$\Delta Y_t = \mu + \sum_{k=1}^p \Gamma_k \Delta Y_{t-k} + \Pi Y_{t-1} + \xi_t \dots \dots (9)$$

Where  $\Gamma_k = I - (A_1 + \dots + A_k)$   $K=1 \dots \dots p-1$  and  $\Pi = I - (A_1 + \dots + A_p)$  the coefficient matrix  $\Pi$  is called the impact matrix and contains information about the long run relationship between the variables in the vector. If  $\Pi$  has a full rank,  $n$  then vector process  $y_t$  is stationary. If  $p < r < n$  there exist  $r$  co-integrating variables this implied that there are  $r$  stationary in the combination of  $y_t$ .

The Johansen procedure is based on two types of gauge, the trace statistics and maximum Eigen value test. The equation of trace test written:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^g \ln(1-\lambda_i) \dots \dots (10)$$

Where  $\lambda_i$  is the Eigen value  $r$  is co-integration  $n$  is number of variable  $t$  observation number.

The other test is maximum eigen value statistics test:

$$\Lambda_{max} = -T \ln(1-\lambda_{r+1}) \dots \dots (11)$$

For the purpose of this test is that null hypothesis is the  $r$  co-integration against the alternative hypothesis of  $r+1$  co-integrating vector, where  $r=1 \ 2 \ \dots \dots n$ . the alternative hypothesis of maximum Eigen value statistics test is as follows:

Ho:  $r=1$  (there is co-integration vector)

H<sub>1</sub>:  $r=2$  (there are 2 co-integration tests in the vector)

### Granger Causality Test

Granger Causality is a statistical concept of causality that is based on prediction. According to the Granger Causality, if a signal  $X$  Granger causes  $Y_t$  then past values of  $X$  should contain information that helps predict  $Y_t$  above and beyond



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the information contained in the past values of  $Y_t$  alone. Its mathematical formation is based on linear regression modeling of stochastic process (Granger 1969).

If  $X$  causes  $Y_t$  then change in  $X$  should precede changes in  $Y_t$ . If we are saying  $X$  causes  $Y_t$  two conditions must satisfy. First  $X$  should help to predict  $Y_t$ . Second  $Y_t$  should not help to predict  $X$ . because if  $X$  helps to predict  $Y_t$  and  $Y_t$  helps to predict  $X$  there is one or more variables that causing the observed changes in both  $X$  and  $Y_t$ . The Granger causality test assumes that the information relevant to prediction of the respective variables,  $X$  and  $Y_t$  for our example. The test involves estimating the following pair of regressions:

$$Y_t = \sum_{i=1}^n \alpha_i y_{t-i} + \sum_{i=1}^n \beta_i x_{t-i} + u_{1t} \dots \dots \dots (12)$$

$$X = \sum_{i=1}^n \lambda_i x_{t-i} + \sum_{i=1}^n \delta_i y_{t-i} + u_{2t} \dots \dots (13)$$

Assuming that the disturbance  $u_{1t}$  and  $u_{2t}$  are uncorrelated, Equation (12) assumes that current  $Y_t$  is related the past value of itself as well as  $X$  and equation (13) explains vice versa. There are four cases of causality according to Granger, these four cases of causality is:

Unidirectional causality  $X$  to  $Y_t$  is indicated if the estimated coefficients on lagged  $X$  in equation (12) are statistically different from zero and estimated coefficients on lagged  $Y_t$  in equation (13) is not statistically different from zero. Bilateral causality is when  $X$  and  $Y_t$  coefficient are statistically significantly different from zero in both regressions and when there are no causality the coefficients of  $X$  and  $Y_t$  are not statistically different from zero.

The direction of causality for both short-run and long-run can be determined based on Vector Error Correction Model (VECM). The  $f$ -test and Wald  $\chi^2$  test assist to indicate any short-run causality between dependent variable and independent variables. The implication of long-run causality will be lagged error correction term in VECM.

For our study if the variables are  $I(1)$  we use causality and VECM.

$$\Delta GDP_t = \alpha + \beta_i \text{ect}_{t-1} + \sum_{i=1}^l \xi_i \Delta \log(GDP)_{t-1} + \sum_{i=1}^l \phi_i \Delta \log(\text{ODA})_{t-1} + \sum_{i=1}^l \delta_i \Delta \log(\text{TT})_{t-1} + \sum_{i=1}^l \gamma_i \Delta(\text{H})_{t-1} + \sum_{i=1}^l \lambda_i \Delta \log(\text{L})_{t-1} + \mu \dots \dots (14)$$

$$\Delta H_t = \alpha + \beta_i \text{ect}_{t-1} + \sum_{i=1}^l \xi_i H_{t-1} + \sum_{i=1}^l \phi_i \Delta \log(\text{GDP})_{t-1} + \sum_{i=1}^l \delta_i \Delta \log(\text{TT})_{t-1} + \sum_{i=1}^l \gamma_i \Delta(\text{K})_{t-1} + \sum_{i=1}^l \lambda_i \Delta \log(\text{ODA})_{t-1} + \mu \dots \dots (15)$$

$$\Delta \text{ODA}_t = \alpha + \beta_i \text{ect}_{t-1} + \sum_{i=1}^l \xi_i \text{ODA}_{t-1} + \sum_{i=1}^l \phi_i \Delta \log(\text{GDP})_{t-1} + \sum_{i=1}^l \delta_i \Delta \log(\text{TT})_{t-1} + \sum_{i=1}^l \gamma_i \Delta(\text{L})_{t-1} + \sum_{i=1}^l \lambda_i \Delta \log(\text{H})_{t-1} + \mu \dots \dots (16)$$

$$\Delta k_t = \alpha + \beta_i \text{ect}_{t-1} + \sum_{i=1}^l \xi_i k_{t-1} + \sum_{i=1}^l \phi_i \Delta \log(\text{GDP})_{t-1} + \sum_{i=1}^l \delta_i \Delta \log(\text{TT})_{t-1} + \sum_{i=1}^l \gamma_i \Delta(\text{L})_{t-1} + \sum_{i=1}^l \lambda_i \Delta \log(\text{H})_{t-1} + \mu \dots \dots (17)$$

Where  $\Delta$  is the first difference operator  $\alpha$  is constant term  $\xi_i, \phi_i, \delta_i, \lambda_i, \gamma_i, \mu$  are parameters.

Ect-1 coefficient's significance shows us the long-run causality running from dependent variable to independent variables. The inferring of short-run causality is the significance of independent variables, for example if the  $F$ -statistics and Wald test of  $\chi^2$  test is significance for official development

assistance (ODA) indicating the existence of short-run causality from official development assistance to economic growth in Botswana (GDP- per capita).

For this research, if not find co-integration we wouldn't able to carry out VECM. For examining short run causality between variables in the model. Therefore estimating VAR model as follows,



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$$\Delta \text{GDP} = \alpha + \sum_{i=1}^l \xi_i \text{GDP}_{t-1} + \sum_{i=1}^l \delta_i \Delta \log(\text{ODA})_{t-1} + \sum_{i=1}^l \Phi_i \Delta \log(\text{Tt})_{t-1} + \sum_{i=1}^l \gamma_i \Delta \log(\text{K})_{t-1} + \sum_{i=1}^l \lambda_i \Delta \log(\text{L})_{t-1} + \sum_{i=1}^l \Omega_i \Delta \log(\text{H})_{t-1} \dots \dots \dots (18)$$

For this research the researchers examined causality between economic growth and human capital. Whether human capital causes economic growth or economic growth bring to human capital. Physical capital, official development assistance,

### Co-integration tests: using Johansen-Juselius Test

In order to determine whether a long-run relationship between economic growth and the independent variable, exist or not particularly the objectives of the research is human capital variable. To confirm that all variables are co-integrated at level or first differencing, I (1). We need to ascertain the long run relationship between human capital and economic growth. Using Johansen- juselius multivariate co- integration test ,were used to follow the procedure of testing co-integration between growth and human capital and other variables in the study.

The only variables that are some order of integration are cointegrated in the long-run. We test whether the log GDP integrated in other variable in long-run. The sensitivity of choosing lag is one of the main problems in co-integration. Therefore before doing anything we run VAR model in order to choose the optimal lag length based on Akaike Information Criteria (AIC). The researchers due to the limit observation of data and more variables included in the model restricted lags into 2 lag for maximum lag in this study. And found maximum at lag 2 based on AIC other criteria for choosing lag produced some results except SC which selected in lag 1. Therefore based minimum AIC we used lag 2 for our co-integration analyses.

terms of trade and labor of Botswana Granger causes economic growth and vice versa.

### 3. RESULT AND DISCUSSIONS

#### Unit Root Testing using Augmented Dickey-Fuller Test

For the time series analysis the first step to do is testing for stationarity. Therefore, in order to test the unit root of variables, it uses different methods of testing stationery of the data for our case we use augmented Dickey-Fuller Test for unit roots. Using Augmented Dickey-Fuller test whether it stationary at level or at difference. Table 1.2 summarizes the result of unit root test of the data for each variable in the model conducting Augmented Dickey-Fuller test for the each series we tested three procedures of stationary i.e. without intercept and trend with intercept and trend.

Trace test results shows that there is at least four co-integration tests in the model and maximum Eigen value test indicate at least two co integration equations in the model for conclusion is that there are long-run relationship between economic growth (Lg GDP per capita) and human capital (Log H) physical capital (Log K) official development assistance (Log ODA) and terms of trade (Log Tt) for period of this study

After conducting and tested co-integration lag length criteria and stationary of the data, We come to the objectives of the research. The main objective of the study is to shed light relationship between human capital and economic growth in Botswana. Assessing the contribution of human capital to the economic growth in Botswana and long-run other variables that determine economic growth in the literature review. The researcher’s model consists of six variables transformed into log form. I.e. LGDP per capita, Log H, Log K Log LF, Log ODA and Log Tt. Table 1.1 summarized the normal cointegration equations in our study From the normalized co-integration equation in the long-run can be written as:

Table 1.1 Johansen’s Cointegration equation(s) results

LGDP per capita	Log H	Log K	Log LF	Log ODA	Log Tt	C
1.000000	-0.064991	-1.304835	3.129583	-0.269064	-0.542109	-14.54372
S.E	(0.05986)	(0.05082)	(0.33995)	(0.03286)	(0.14513)	(4.12427)

$$\text{LGDP} = 14.54372 + 0.064991(\text{LH}) + 1.329583(\text{LK}) - 3.12958(\text{LLF}) + 0.269064(\text{LODA}) + 0.542109(\text{LTt}) \dots (1.2)$$

The results of a normalized co- integration equation showed the expected sign. The result show that economic growth is positively related to human capital, physical capital, official development assistance, and terms of trade but negatively related labor force in Botswana.

There is positive relationship between economic growth and gross capital formation. For every 1% increase in gross capital formation will lead to increase 1.33% in economic growth for Botswana for the period of the study. Botswana is one of most developed countries in African standard resulted the strength



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of the country's economic growth; gross capital formation contributes economic growth in Botswana in a huge and have a magnitude to maintain in order to gain high economic growth in the future.

The relationship between economic growth and labor force is negative. For every 1% increase in labor force will decrease 3.13% in economic growth of Botswana. This is not surprising Botswana has one of the highest HIV/AIDS rates in the world. As a small population country, labor force will be main threats of Botswana future economic development. AIDS problem in the country affected labor force of the country. The last census indicates that 37.7% of labor force had affected HIV. This results the loss of productive labor force in their early years. Therefore we conclude that the labor force of the country has not gone with the economic growth of the country, that makes it an area of challenge for any significant improvement of economic development and growth.

There is positive relationship between terms of trade and economic growth. Every 1% or unit increase in terms of trade will cause to increase 54.2% in economic growth. The country is one of the two African countries that had enjoyed stable terms of trade. Since in any improvement in terms of trade bring new opportunity growth for that country, Botswana benefited Southern African Custom Union (SACU) membership and mainly this positive relationship contributed diamond export that actually led the growth of Botswana's economic miracle. Finally the term of trade is very significance and contributed economic growth much more.

We also found positive relationship between (LODA) and economic growth. For every 1% increase in US\$, official development assistance will lead to increase 26.9% in economic growth of Botswana. This implied that unlike many Sub-Saharan African countries that official development assistance couldn't contribute economic growth because of boosting government consumption. This contributed for the economic growth of the country until Botswana became reliable for their growth and development that reduced official development assistance drastically.

### 3.1 Granger Causality Test Results

For time series analysis the econometrics follows the procedure, steps, and criteria and decisions in order to know the co-integration and long run relationship between variables. Our case, lgdp, LH, LK, LODA, LLF and LTOT were used. Next step of focus will be the short-run dynamic between variables in the model testing the Granger causality lgdp as dependent variable at first then making all independent variable for dependent variable respectively. Establishing the direction of causality bearing in mind the main objectives of study is that human capital and economic growth in Botswana and their causality. The result of this study based on VECM. Commencing on the table 6---10 To make easy for our analyses F-test of independent variable with difference indicates the short-run relationship between dependent and independent variables in causality (ect) implied the long run relationship between dependent and other variables in the model.

The Granger causality result shows that human capital doesn't exert any short-run effect on economic growth. There is long run relationship between human capital and economic growth. Implied that the causality of human capital and economic growth in Botswana does not have a short-run effect on economic growth.

Physical capital is an important component that facilitates economic growth in short-run as well as long-run economic growth in the country. Official development assistance and labor force do not exert any short run effect on economic growth ect(-1) is significant implied the long-run relation between economic growth, labor force and official development assistance. This means that causality from labor force and official development assistance.

### Granger Causality Results Based on VECM for DLH

	$\Sigma DLH$	$\Sigma DLGDP$	$\Sigma DLK$	$\Sigma DLODA$	$\Sigma DLLF$	$\Sigma DLT$	ect(-1)
F-statistics	0.8549394(3)	0.360460	0.816673	2.200720	1.206279	0.032539	-0.628205*

NB: ect(-1) denotes the error correction term. Number in bracket indicates the optimal lag based on AIC. D represents difference. F-statistics for the dependent variables in first difference are reported. \*\*\*, \*\*, \* are significance at 1% 5% and 10% respectively

The above table shows that economic growth doesn't cause any short-run causality on human capital, however the ect(-1) has a significant implying the existence for long-run causality between human capital and economic growth in Botswana. Concluded the existence of bilateral causality. This explains that human capital and economic growth will continue in long-run phenomena. The physical capital, official development assistance, labor force, and terms of trade don't exert any short-run effect on human capital but still existence of the long-run co-integration.

### Granger Causality Result Based on VECM for DLK

Granger causality on VECM for DLK obviously shows that economic growth exerted short run causality on physical capital. ODA, labor force and terms of trade exerted short-run effect on physical capital. Human capital does not exert any short-run effect on physical capital. This implies that human capital and physical capital doesn't have any short-run effect on each other. The long-term they are complementary so it must develop each other in order to sustain economic growth in the future of the country.

### Granger Causality Result Based on VECM for DLODA

The Granger causality result for DLODA tell us that there is no short-run causality on ODA on economic growth or GDP per capita but human capital, physical capital, labor force and terms of trade have short-run causal effect on official development assistance.

### Granger Causality Result on VECM for DLLF

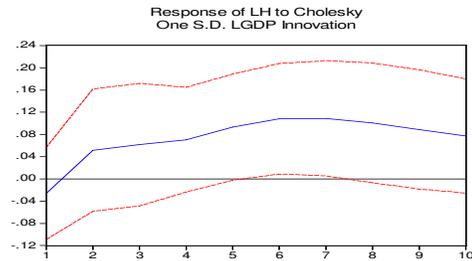
The above table clearly shows that economic growth doesn't exert any short-run effect on labor force in Botswana for the

period of the study. The coefficient of  $ect(-1)$  on labor force does not significance implying the non-existence of long-run relationship between labor force and growth. Explaining that economic growth doesn't have any long-run impact on labor force. Summarizing the above result is that the independence causality between labor force and economic growth in Botswana. The long-run the impact of labor force on economic growth will continue. Therefore, for the indication of the consequences of the long-run economic growth in the country should be considered. Other variables are some there is no any short-run causality effect on labor force. The objective of the study is whether human exert any short-run causality on labor force and vice versa. For conclusion in the long-run labor force will influence human capital. This explains that since the main threats of the labor force is the epidemic disease. It should put their effort to combat and preventing for the spread otherwise any future development and growth will be challenge more than the current circumstance.

### 3.2 Granger Causality Result on VECM for DLTT (DLTOT)

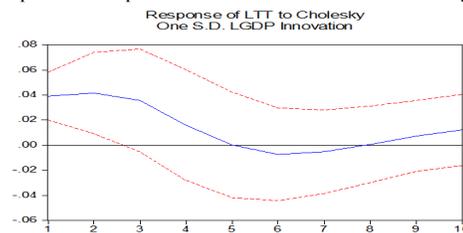
It is clear that economic growth exert short-run causality effect on terms of trade at 5% significance level. The coefficient of the  $ect(-1)$  in terms of trade in regression is not significant Implied that the absence of any long-run impact of economic growth. This can be explained that Botswana enjoyed their export of diamond which made terms of trade to be stable over time. This cannot be continue in the long-run and diamond will not assure in the long-run to economic growth in the country if not diversified in to other untapped areas of economic growth such as Jewelry, tourism, manufacturing and services. Human capital, doesn't exert any short-run effect on terms of trade meaning that independence in short-run but in the long-run causality from human capital to terms of trade concluding that increasing human capital will support terms of trade in the future. Physical capital has exerted a short-run effect on terms of trade and there is bilateral causal relationship between terms of trade and physical capital. This means that when domestic investment increases automatically this will improve terms of trade and economic growth in Botswana. Finally there is a short-run relationship between and economic growth terms of trade and labor force. The impulse response will carried for the following graphs. Graph 1 to 6 will be the impulse responses function of economic growth, terms of trade, labor force, physical capital and official development assistance to the economic growth response respectively. Graph 5.1 plots economic growth on human capital initial negatively respond to economic growth for first almost two years the onward it respond positively and the response was high implied that human capital has a play a vital role in economic growth of the country. This response explains that increases of human capital eventually boast output which turns economic growth in the long-run phenomena

Graph1 the Response of economic growthGrowth to human capital



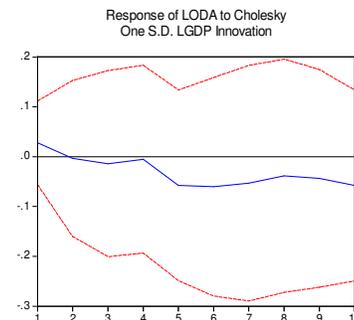
Graph 2 plots economic growth on terms of trade. Graph shows that the response of terms of trade to the economic growth initially is very high but start from 5<sup>th</sup> year reduced, the effect on economic growth due to the slowdown of diamond price in the world in late 1980s until early years of 1990s. This affected the term of trade in Botswana which resulted the shock of terms of trade in economic growth or GDP-per capita.

Graph 2 The Response of Terms of Trade to the economic growth



**Graph 3 plots the response of official development assistance to the economic growth** graph show that at beginning that official development assistance respond positively in highly and the effect became slow then afterward this implied that the shock effect official development on economic growth became less important after 1980s and drastically reduced after 1990s when Botswana became middle income country, promoted the slow of ODA to the economic growth in Botswana during the period of the study. Ass in 2007 the percentage of official development assistance in GNP become 0.06 ([www.Earthtrend.org](http://www.Earthtrend.org)).

Graph 3 The Response of official development assistance to the Economic Growth



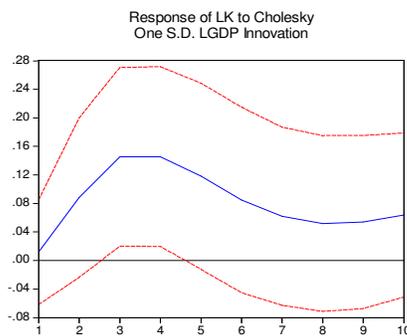


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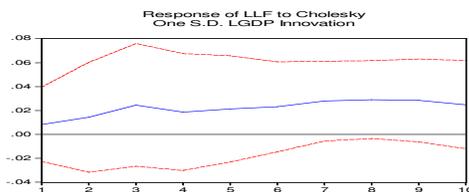
Graph 4 plots the response of physical capital to the economic growth this graph show that physical capital responds highly to the economic growth and the response is almost immediate. Implying that physical capital is one of most important component of economic growth in Botswana this explains that gross capital formation contributes economic growth. Gross capital formation is the pre-requisite of economic growth policy for building infrastructure, housing, water, schools and other social service for the necessity of development and growth of the country.

Graph 4 The response of physical capital to economic growth



Graph 5 plots the response of labor force to economic growth graph shows that labor force response positively to economic growth. Labor force response positively and high to the growth this can be explained that when the labor force increases it will increase output which turn to the growth alone with the increasing of human capital will contributed economic growth. The implication to the impulse of economic growth to labor force; the effect of shock is positive Botswana should concentrate the improvement of labor force and their quality in the future.

Graph 5 The response of labor force to economic growth



## Result and Discussions

This study is about the cointegration and long run relationship between human capital and economic growth in Botswana. The findings of this research is consistence with vale (2007), bas van (2007), Adjistera,et.all (2001) and very close to Asteriou,et, al.(2002) and St aubyn (2009).This study reveals that there is no short-run relationship between human capital and economic growth and found long-run relationship between human capital and economic growth in Botswana. For further the researchers found the short-run causality between economic growth, physical capital and terms of trade

as well in the long-run co-integration. Therefore, though human capital contributed economic growth but it is not significance which may be higher education doesn't reach the threshold of significance or mismatch of job as many graduates in Botswana University or other higher institution in the country did not found the suitable job for their qualification. This might cause the weak contribution of tertiary education and other possibility is that the effect of economic growth of tertiary education still is weak due to the above factors. Physical capital is positive and highly significance because physical capital is one of the most important things of economic growth developing economics. Therefore gross capital information contributed economic growth in Botswana a much about. ODA and terms of trade affect economic growth positively and significance. Labor force related economic growth negatively and highly significance this can be explained the HIV/ AIDs problem of the country. In addition unemployment problem exist the country since the country had based on land agricultural and mining. Sentsho (2001) this combined factors which resulted the negative relationship between economic growth and labor force in Botswana.

## 4. CONCLUSION

The purpose of this study was to examine the relationship between human capital and economic growth in Botswana. The data examined was from 1977 to 2008. The findings of the study supported the results of a quite number of a past studies that were reviewed.

Through this research, it discovered that most of examined variables, like physical capital, terms of trade, ODA and human capital have effects on economic growth. The result shows that human capital contributed economic growth positively. This contribution is observed to be small in quantity, based on the long-run relationship between human capital and economic growth. Concluding that bilateral causality between human capital and economic growth, the contribution of human capital to economic growth is small. This is owing to first we take tertiary education enrollment level as a proxy of human capital. Therefore, it was possible to conclude that there was a mismatch between the qualification and ability to secure job that fit the qualification.

Botswana had done tremendous change in her human capital development, since it's independence day. It still needs to improve human capital in order to achieve it's set of economic development goals and is one of the few countries that has done well for the development targets in the near future. It is certain that Botswana is one of the few developing countries that is fast growing like Malaysia but achievement of it's long run vision to be developed nation before the year 2020, need human capital development. This seems to be good. However other variables, such as physical capital, terms of trade, and ODA have contributed significantly to the country's economic growth within the study period.

Physical capital has played a vital role for the economic growth of Botswana. It is basically one of major contributing



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factors for economic growth in the country during the period of the study. The Granger causality of physical capital to economic growth shows short-run granger causality caused economic growth. Furthermore, the economic growth caused physical capital in short-run and the long-run. This implies that physical capital contributed to the economic growth. The result of this study shows that gross capital formation is positively related to the economic growth. This is highly significance, because 1% increases in physical capital has led to 132.9% to increase in the country's economic growth. The rating of Botswana largely accrued from infrastructure, housing, service sector, tourism, transportation and communication. Specifically, the capital city of Botswana, Gaborone is now recognized as one of the modern cities among middle income countries and indeed in Africa. This recognition came as a result of all this basic services and social amenities, which are resulted of physical capital.

Official Development Assistance (ODA) is positively related to economic growth. This positive effect of ODA is significant in the sense that, it has been contributed to the growth of many developing and middle income countries, especially Botswana. This is because good macro-economic stability, fiscal policy management less corrupt practices which are backed by the contribution of ODA to economic growth of Botswana during the period of study. For every increase in percentage of ODA in US\$, it will lead to increases in economic growth by 26.9%, as a result of sound economic policies and stable macro-economic management. This is because the affect of ODA on economic growth depend on economic policies of the country.

The study also found the negative relationship between economic growth and labor force, which is due to incidence and prevalence of HIV/AIDS in the country. This is perhaps, because Botswana is one of Sub Sahara African countries that have a highly plagued due to the AIDS problem of the country. Botswana had seriously decreases the magnitude of the country's labor force; as such many productive individuals have died of HIV/AIDS and related illness. This condition contributed to the decrease in productive labor force in Botswana and it in turns affected the country's economic growth .In addition, the economic growth is negatively affected by unemployment in the country. This is due to fact that Botswana is based on land intensive agriculture and capital intensive mining. These modes of production have limited impact on the country's employment. In conclusion, every percent increases in labor force leads to 3.12% decreases in economic growth of Botswana during the period of study. This of course, constitute a great, indeed main challenge in the economic growth of Botswana in the future. It is therefore, found that labor force have long-run impact on economic growth which is the concern of economic policy makers in Botswana. Owing to this fact, economic policy makers have to improve labor force, while creating better employment opportunities in the country.

The study shows positive relationship between economic growth and terms of trade in Botswana. This mainly came from diamond export, which makes trade balance more stable

and favorable. This favorable economic situation is relatively unique in Africa region, except for Mauritius which has stable terms of trade. The stability of terms of trade is backed by her membership of southern African custom union (SACU). This facilitated free trade among SACU members, including Botswana. The free trade covers both export and imports that eased the import and export of the member states, and it eases the import and export of goods and services of Botswana a land-locked country.

In the Granger causality test, researchers used five equations, first equation has economic growth (real GDP per-capita) as a dependent variable and independent variables are human capital, terms of trade, physical capital, ODA and labor. Second equation human capital as dependent variable, third equation ODA as a dependent variable fourth equation terms of trade as dependent variable and fifth equation places physical capital as dependent variables.

The first equation which uses real GDP per capita as a dependent variable expresses the Granger causality is significant and  $ect(-1)$  is also significant at 1% level, because it indicates the long-run impact of human capital on economic growth. Through it is found that Granger cause physical capital and terms of trade in short-run and significant at 1% level. For second equation relate human capital as dependent variable found no Grangers cause short-run effect on economic growth but significance. This implies that there is long-run cointegration between human capital and economic growth.

Third equation of the Granger causality test shows that economic growth, human capital, terms of trade does not exert any short-run effect on ODA implies a long-run effect on economic growth. The fourth equation relates labor force to growth. There is any effect of independent variable on labor force but it shows  $ect(-1)$  is not significant. This implies that there was no long run relationship between labor force and economic growth. In other words the economic growth does not affect labor force in short run or long run. Thus, it could be inferred from the above substantiality of economic growth in Botswana depends on improved labor force.

Equation five relates terms of trade as dependent variable Granger causality shows that the GDP per-capita and physical capital granger caused terms of trade in short-run at 5% significant level but there is no short run in ODA and human capital. In addition, there is no long-run relationship between terms of trade and other variables especially economic growth. This explains that terms of trade has no long-run relationship in Botswana economic, because the stability of terms of trade is mainly from diamond, which will not be in the long-run. Therefore, Botswana has to diversify their economic into other areas of growth.

The impulse response function shows that human capital response positively to economic growth in Botswana. Since the impulse of economic growth on human capital is positive and significant, Botswana should concentrate for improving and enhancing tertiary education level, which have been militate against her rapid economic growth in the future.



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## Policy Implication

The result of this study shows that human capital in Botswana contributed to the economic growth. Though the contribution of human capital, especially tertiary education is not much relatively- insignificant, therefore, vital to understand the volume and direction of causality in Botswana human capital and economic growth. While examining this, it is found that the positive contribution of human capital to the economic growth of Botswana amounts to 6.5% during the period of study, human capital contributed economic growth 6.5% during the period of understudy. Still more need to be done improving the human capital and thus achieving to achieve the target of Botswana people and indeed government. To address less contribution of human capital should be concern and government has to build and encourage tertiary education in the area of technology, industry, manufacturing sector, agriculture et cetera. Certainly, adequate investment in educational industry will pave a way for rapid and sustainable human capital development. This human capital will serve as a better and solid engine of economic growth in Botswana to realize her 2020 vision. Until government focus attention on the issue above, Botswana's target of becoming one of the best world economies and greatest in Africa in the near future will be dreaming and main challenges of her economic growth will remain.

The other important finding of the study is that the term of trade in Botswana exerted significant short-run effect on economic growth but there is no long-run relationship between economic growth and terms of trade. This is because the stability of terms of trade mainly came from diamond. It is therefore, not good enough to completely rely on diamond for the country's economic growth and development in the future. In this light, Botswana should diversify the source of its economic growth, such as service sector, tourism sector and agriculture and manufacturing should be considered for sustainable economic growth and development. The Botswana government should encourage domestic investment; gross capital information has had long-run relationship with economic growth. Therefore, the government should keep investing building roads, transportation, and accommodation to facilitate and sustain future economic development and growth. This pertinent because all of the facilities and services above have short-run effect and long run consequence on Botswana economic growth and development. All have short-run effect and long-run consequence. Finally we recommend that the government should improve labor force and combat the spread of HIV/AIDS. This is because these factors (labor force and AIDS) have continued to unleashing negative impact effect on economic growth the sustainability of the growth in Botswana. Finally government should create more job opportunities in the areas of agriculture and mining in order to reduce unemployment rate.

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