An Assessment of Health Care and Economic Growth in Sudan: An ARDL Bound testing Approach.

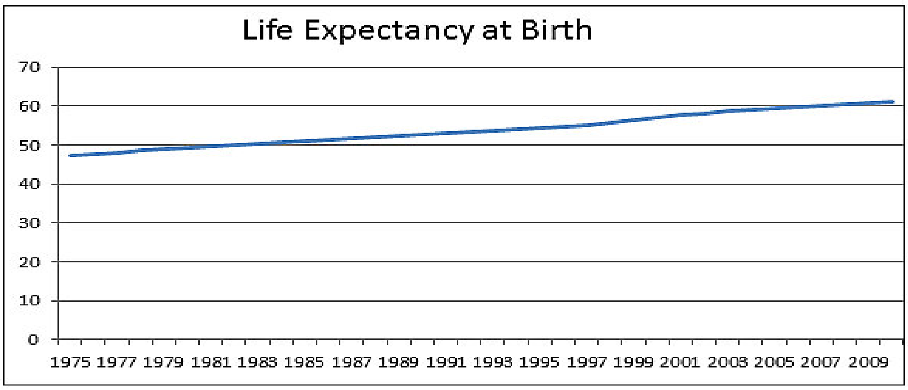
Abdalla Sirag[1*], Peter Adamu[2], Norashidah Mohamed Nor[1]
1. Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia
2. Department of Economics, Faculty of Social and Management Sciences, Kaduna State University
2339 Tafawa Balewa Way, Kaduna, Nigeria
*E-mail of the corresponding author: abdallasirag87@yahoo.com

Abstract
This study examined the long run and short run relationship between health care and economic growth in Sudan. Health care is represented by life expectancy and economic growth by GDP per capita. The study covers the period 1980-2010 and data retrieved from world development indicators of the World Bank. Aside from the theoretical variables and the main variables for this study, some other controlled variables such as expenditure on education and population growth were included in the model. The bounds testing approach for co-integration, Autoregressive Distributed Lag (ARDL) was applied in order to test for long run equilibrium between health care and economic growth. Additionally, Granger causality test was used to assess the causal relationship between health care and GDP per capita. The findings provide strong evidence that health care is positively related to economic growth in the long and short runs. The estimated Granger causality outcomes revealed a unidirectional relationship running from health care to GDP per capita. This is an indication that health care is very significant to economic growth in Sudan and efforts need to be geared towards improving the health status of the people for continuous economic growth and development in Sudan.
Keywords: Health care, GDP, ARDL, Granger Causality

1. Introduction

The health sector is one of the most important social sectors in all countries whether developed or developing. In fact, the relative share of public allocations in the developed countries to health sector is considerably high. On the other hand, developing countries typically distribute limited amounts of public funds and pay less attention to the health sector, thus; the overall health situation in developing countries produces poor outcomes. The role of health care has been addressed widely in economics literature. The level of human capital represented by good health status and education plays an essential role in determining a country's production level. Improvement in health status has a major impact not only on individuals but also at national kevel by increasing growth level. Health care has positive effects on output when life expectancy is high (Leung & Wang 2010). In addition, eliminating some diseases or an improvement in life expectancy at birth will increase GDP growth rates in both developed and developing countries (Ashraf, Ashley Lester, & Weil, 2009).

This paper investigates the impact of overall health care situations, proxied by life expectancy at birth on economic growth. The main focus of this paper is to assess health care and economic growth in Sudan from 1980-2010. A number of studies have examined the relationship between health and economic growth. For instance, Zhang and Zhang (2005) emphasized life expectancy to have a positive impact in improving economic growth and secondary enrolment. It also may have encouraging results on the ratio of investment to GDP. However, Acemoglu and Johnson (2007) discarded the relationship between health and GDP per capita growth.



Source: World Bank, 2012.
Figure 1: Life Expectancy at Birth in Sudan (1975-2010)

Figure 1 shows the trend of life expectancy at birth in Sudan. Clearly, it reveals a slight improvement in terms of life expectancy at birth from 1980 to 2010. In 1980, life expectancy was 49.29 years and it reached 61.11 years in 2010. This indicates that health status is still somewhat low in Sudan despite the marginal improvement over the years.
This study begins with a brief indication of health care related to economic growth. Secondly, the theoretical and empirical literature in relation to health and economic growth is discussed. The third part focuses on data and methodology, followed by results and discussion and finally, the conclusion.

2. Literature Review

The neoclassical theory developed by Solow and Swan (1956) is considered as a fundamental work. It gas contributed to the rise of a wide range of works on economic growth and debate on the capital production relationship and economic equilibrium. However, the neoclassical model showed limitations in explaining economic growth in the long-run. According to Romer (1986), technology determines economic growth endogenously and it depends on economic factors and capital-labour relationship. In addition, human capital variables have been widely accepted as important determinants for economic growth. Grossman (1972) used the Theory of Human Capital to explain demand for health care. He argued that people invest in themselves by demanding health and education in order to increase their income level. This work emphasised the role of health as well as education in determining a country's output. Furthermore, the study implies that a high level of investment is likely due to a good level of health and education. Mankiw, Romer and Weil (1992) revealed the significance of counting nutrition and health with education to analyse the role of human capital. The relationship between economic growth and health is examined by a group of scholars (Fogel, 1994, Barro & Sala, 1995, and Barro, 1996). Improved health status is an essential factor of well-being. It also raises human capital levels and consequently the productivity of individuals and a country`s growth rate.
A significant body of literature has established a positive effect of health care investment on economic growth, especially for low income countries. Bhargava et al. (2001) investigated the effects of health indicators such as adult survival rates (ASR) and total fertility rate on GDP growth rates at five-year intervals in 92 developing and developed countries. The findings revealed fertility rate to have a statistically negative effect on GDP growth rates. Additionally, it showed significant positive effects of ASR on economic growth rates for low- income countries but weak and in some cases negative effects for highly-developed countries such as USA, France and Switzerland.
It is expected that improved physical and mental health will increase productivity of the labour force thereby raising economic growth. Sanso and Aísa, 2006 found that whilst longevity affects the production level, it has no effect on growth. However, they found that the long-run growth rate of the economy does have a positive effect on longevity. In an attempt to analyse the short run and long run causality between economic growth and health in ASIAN countries, Djafar and Husaini (2011) have found that causality between GDP and health is more likely to occur in the long-run than in the short-run, indicating that changes in economic growth may not cause health instantly and vice versa. The countries may also have only short-run causality or only long-run causality. The long run causality from GDP to health is likely to dominate the causality relationship between GDP and health.
Arora (2001) used a combination of variables to express health: life expectancy at birth, at ages five, 10, 15, or 20, and stature at adulthood to examine economic growth in the 19th century in 10 countries with available data. Cointegration analysis and error correction model have were conducted and used, respectively, for every country separately. The study had started with an essential question; Does health affect economic growth temporarily or permanently? The ultimate intention of the author was to test the impact of population's health on growth in cases of exogenous growth theory and endogenous growth theory. The empirical results have shown that health improved the pace of growth permanently not temporarily. Therefore, the data favoured endogenous growth and rejected exogenous growth, while health influenced growth rate and output level in the long run as well. Echevarría and Iza (2006) examined the impact of life expectancy and economic growth in the existence of a social security system with consideration of the role of education. The main finding of this study is that, increases in life expectancy imply changes in schooling and retirement age, which imply changes in the growth rate. Bloom, Canning, and Sevilla (2004) argued that countries with high life expectancies tend to have older labour force with high experience, so they tried to test whether this specific effect influenced the relationship between health and growth. Also, they attempted to estimate the production function to check the existence of an effect of health on labour productivity. Their findings indicated that health has positive and significant impact on economic growth. They also showed that a one-year improvement in a population's life expectancy contributes to an increase of four percent in output.
By using life expectancy at birth as proxy of health care, Zhang and Zhang (2005) explored the theory and evidence in a cross-section of countries to examine the impact of life expectancy on growth and growth determinants. The findings of the study indicated that life expectancy affects growth and secondary enrolment

ratio positively, but it has a negative relationship with fertility rate. Life expectancy also has an encouraging result on the ratio of investment to GDP. They argued that the effect of life expectancy is low in countries with high life expectancy. Improvement in health has been shown to be necessary to increase income in the case of Mexico where permanent improvements in the health of individuals cause lasting increase in income (Mayer, 2001).

In an attempt to analyse the impact of health care on economic growth, Leung and Wang (2010) revealed that health care has a positive effect on productivity when life expectancy is high. They argue that when life expectancy is high, people tend to save more, thus; increased saving boosts total output and welfare. Akram and Khan (2008) analysed the short run and long run impact of healthy human capital on economic growth in Pakistan. Many indicators are used to evaluate the relationship between health and economic growth. The study found that life expectancy, population per bed and mortality rate influence economic growth. Ashraf et al. (2009) indicated that eliminating some diseases such as malaria or tuberculosis in Sub-Saharan Africa countries would lead to increase in GDP per capita by only two percent in the long run, while, an increase in life expectancy at birth from 40 to 60, in this study, raises GDP per capita by roughly 15% in the long run.

In contrast, some existing empirical evidence has shown mixed results for the impact of health on economic growth. Some countries have managed to achieve substantial economic gains despite low health investment and the reverse is also true for some countries where substantial health gains have been achieved despite modest levels of income. Acemoglu and Johnson (2007) investigated the effect of life expectancy on economic growth and they emphasized that the decline in mortality rate is due to new chemicals, drugs, and international health campaigns. Furthermore, population has increased significantly due to the improvement in life expectancy, but birth rate did not decline instantly to balance the increase in life expectancy. They argue that there is no evidence that the increase in life expectancy leads to faster growth of income per capita or output per worker. This indication casts suspicion on the view that health has direct and strong impact on economic growth. Hartwig (2010) examined the question of whether health capital formation stimulates long run GDP growth in rich countries by applying the panel Granger-causality framework. He found no evidence that health capital formation Granger-cause per-capita GDP growth with a positive sign. His findings instead supported the "income view" hypothesis that income growth drives health.

3. Data and Methodology

This study aims to explore the link between health and economic growth in Sudan from 1980-2010. Most of the data were collected from the World Bank, such as GDP per capita (constant 2000US$), life expectancy at birth, population growth, gross capital formation (annual growth) and labour force. Data on labour force were collected from econstats.com, while, education expenditure data were derived from Index Mundi.

Econometrics Model

Based on neoclassical economic growth theories the relationship between economic growth and health can be specified as:

$$Y = A_t L_t K_t \quad (1)$$

Where Y_t is total production function of the economy in specific period t, A_t is total factor productivity, L_t is labour capital stock, and K_t is capital stock.

Let us assume that total factor productivity is a function of health H_t and education E_t, and the other variables are exogenous:

$$A_t = f(H_t, E_t) \quad (2)$$

If we substitute equation 2 in to equation 1 we get:

$$Y_t = H_t E_t Lt K_t \quad (3)$$

Expressing the variables in natural logarithms except PG and GCF:

$$ln\, GDP_t = \beta_0 + \beta_1 ln\, LE_t + \beta_2 lnEEX_t + \beta_3 PG_t + \beta_4 GCF_{\,t} + \beta_5 ln\, LF_t + u_{\,t} \quad (4)$$

where ln GDP is log real GDP per capita (constant 2000 US$), ln LE is the natural logarithm of life expectancy at birth as proxy of human capital health, ln EEX is log education expenditure (current US$) as human capital education; PG is annual population growth as percentage and it has been included as a controlling variable, ln LF is the log of total labour force, and GCF is gross capital formation as annual growth rate.

Unit Root Test

Although, the study uses Autoregressive Distributed Lag approach to examine the long run equilibrium relationship, but the stationary test is necessary to determine either the variables are I(0) or I(1). ARDL approach is suitable for estimating a model with variables even if they are I(0) variables or I(1) variables. Stationary test, furthermore, is important for conducting Granger causality test. Therefore, ADF Augmented Dickey-Fuller test for unit root test is used to check for variables stationarity. In addition, Kwiatkowski–Phillips–Schmidt–Shin KPSS test is used to confirm ADF result.

Autoregressive Distributed Lag (ARDL) Model and Cointegration Analysis

To analyse time series data with different order I(1) and I(0) together, Pesaran et al. (2001) suggested Autoregressive distributed lag model (ARDL) to test for cointegration as an alternative to cointegration model for Engle-Granger (1987). The study uses ARDL approach to test the long run and short run relationship between variables. The ARDL bond testing approach for cointegration can be written:

$$\Delta ln\, GDP_t = \gamma_0 + \sum_{i=1}^{p} \beta_1 \Delta ln\, GDP_{\,t-i} + \sum_{i=0}^{p} \beta_2 \Delta ln\, LE_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta\, ln\, EEX_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta PG_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta\, GCF_{t-i} + \sum_{i=0}^{p} \beta_6 \Delta\, ln\, LF_{t-i} + \alpha_1 ln\, GDP_{\,t-1} + \alpha_2 ln\, LE_{t-1} + \alpha_3\, ln\, EEX_{t-1} + \alpha_4 PG_{t-1} + \alpha_5\, GCF_{t-1} + \alpha_6\, ln\, LF_{t-1} + u_t \quad (5)$$

Equation 5 is to determine the cointegration relationship between the independent variables and dependent variable.

β_1 to β_6 refer to short run parameters and α_1 to α_6 are long run parameters. The null hypothesis is there is no cointegration $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$; the alternative hypothesis is there is cointegration $H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$. The rejection of the null depends on F-test and the critical bound tabulated value for small sample size according to Narayan (2005).

The long run relationship among the variables exists if the calculated value of F - statistic is greater than the upper critical bound (UCB), and if the calculated value of F- statistic is less than the lower critical bound (LCB) the long run relationship does not exist, if calculated value of F-statistic comes in between the range of LCB and UCB then the long run relationship is inconclusive (Hassan & Kalim, 2012). The optimal lag can be selected using the model selection criteria like Schwartz-Bayesian Criteria (SBC). According to Narayan (2005) the maximum lags for small sample size is two lags.

4. Results and Discussion

Table 1 shows the result of stationary test for ADF-test and KPSS respectively. Both tests revealed that LGDP has unit root at level, but it becomes stationary at first difference, which implies that LGDP is I(1). Nevertheless, all other variables were found to be significant at level and thus it indicates the variables are I(0). As the results point out, the variables are either I(0) or I(1), therefore implying that we can confidently apply ARDL approach to this model as using ARDL requires the data to be stationary at level I(0) and first difference I(1) (Narayan, 2005).

Table 2 represents the long run cointegration test analysis, and existence of long run relationship which has been found among the model's variables. Results illustrate that the computed F-statistics is 7.2787. The relevant critical value bounds at five percent level (with unrestricted intercept and no trend) are 3.125 and 4.608 for the lower and upper bounds respectively. Subsequently, the computed F-statistics is higher than the critical value of the upper bound, the null hypothesis of no long run cointegration relationship among the variables can be simply rejected. Having established the presence of a long run association between GDP per capita, life expectancy at birth, education expenditure, population growth, gross capital formation, and labour force, the model can be used to estimate long run and short run parameters.

Table 3 demonstrates the selected long run ARDL model, based on Schwartz Bayesian Criterion (SBC). The results show positive and significant relationship between life expectancy at birth LLE as a proxy of health and GDP per capita LGDP. Additionally, education expenditure LLE and labour force LLF are all statistically significant and positively influence GDP per capita. However, gross capital formation GCF and population growth PG are insignificant in explaining economic growth in this particular model.

The results revealed that improvement in economic growth is associated with improvement in life expectancy at birth. To be precise, improvement of life expectancy by 1% leads to 2.14% increase in GDP per capita. A strong relationship between heath and economic growth has been reported in the literature. Similar to Bloom et al. (2004) and Yakita (2005) and contrary to Acemoglu and Johnson (2007), life expectancy has positive impact on economic growth. This result may be explained by the fact that improvement in health level is summarized by increasing life expectancy from 49 years in 1980 to 61 years in 2010, which is associated with GDP per capita improvement.

Table 1: Unit Root Test Result

Level I(0) / Variables	ADF		KPSS	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LGDP	1.197676(1)	-1.426736(0)	0.657392{4}	0.189979{4}
LLE	0.468185(6)	-4.596486*(5)	0.725442{4}	0.135210{4}
LEEX	-1.240041(0)	-0.954131(0)	0.189124*{4}	0.156779{4}
PG	-1.676975(1)	-3.364946***(1)	0.448985{4}	0.109024*{4}
GCF	-4.647478*(0)	-4.587374*(0)	0.138935*{5}	0.108709*{6}
LLF	-0.086090(0)	-1.373620(0)	0.602413{4}	0.150467{4}
First Difference I(1)	**Intercept**	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
LGDP	-4.533540*(0)	-5.262905*(7)	0.457802*{3}	0.283251{17}
LLE	-3.587654**(5)	-3.240501(6)	0.132576*{4}	0.117154*{4}
LEEX	-5.566849*(0)	-5.820044*(0)	0.272935*{2}	0.124634{7}
PG	-1.548822{1}	-0.375580{0}	0.091057*{2}	0.091557*{2}
GCF	-6.264928*(2)	-6.159850*(2)	0.166294*{24}	0.158171*{24}
LLF	-4.945038*(0)	-4.988650*(0)	0.154848*{1}	0.072870*{0}

** Denotes significant at 1%, ** Denotes significant at 5%, *** Denotes significant at 10%.*
(…) represents optimum lag length in ADF-test based on Schwarz Bayesian Criterion (SBC).
{…} represents the Bandwidth in KPSS-test based on Newey-West Criterion.

Table 2: ARDL Bounds Test for Cointegration

F-Statistics	1% Critical value		5% Critical value		10% Critical value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
7.2787*	4.537	6.370	3.125	4.608	2.578	3.858
K=5 , N=30						
The critical value according to Narayan (2005) (Case III: Unrestricted intercept and on trend)						

**, (**), (***) Significant at 1 %, 5% and 10% respectively.*

These findings are in agreement with Lucas (1988), which showed public expenditure on education is an important human capital variable and it has been found to be positively correlated to GDP per capita in the long run. Noticeably, increasing by 1% in education expenditure will cause GDP per capita to improve by 0.156%. This finding further supports the belief that the level of human capital in Sudan has improved and led to this level of economic growth.

Interestingly, and contrary to Klasen and David Lawson (2007) the study outcome revealed that population growth (PG) has insignificant relationship with GDP per capita. This indicates that population growth level does not affect economic growth. The trend of population growth shows a decreasing trend, meaning that GDP growth rate is more than population growth rate. This, to some extent also agrees with the findings of Bucci's (2012) findings, which showed that population growth could affect real GDP per-capita, or it might not have any correlation with income growth.

Similarly, gross capital formation is positive but not significant in explaining economic growth. However, this finding does not support the previous research, Tawiri 2010) found significant impact for investment in GDP per capita. This reveals the level of investment has no long run impact on economic growth in Sudan over the study period, Comparing Tawiri, (2010) and Rahimi (2011) the result showed that labour force is found to be positively correlated with GDP per capita in Sudan. It can be interpreted as a 1% increase in labour force causing GDP per capita to increase by 0.578%. One of the issues that emerge from these findings is the importance of labour force in motivating economic growth in developing countries such as Sudan.

Table 3: Long Run Model (Dependent variable: LGDP)

Variable	Coefficient	Standard Error	T-Ratio[Prob]
LLE	2.1415*	.37994	5.6364[.000]
LEEX	.15689*	.024544	6.3921[.000]
PG	.036143	.030248	1.1949[.250]
GCF	.1865E-3	.2487E-3	.75017[.464]
LLF	.57812*	.11976	4.8274[.000]
INTP	-14.1690	.60871	-23.2772[.000]

**, (**), (***) denotes Significant at 1%, 5% and 10% respectively. Lag lengths are 2,1,2,2,0,0 selected based on Schwarz Bayesian criterion (SBC).*

Table 4 shows the estimated ARDL error correction model. The results illustrate that the error correction term (ECM_{t-1}) is negative and less than 0.01, showing that the feedback or convergence to long run equilibrium is high, taking the value of -1.1959, indicating that long run deviation of GDP per capita is corrected by 119.59% annually. The results report most of the variables in this model as either statistically significant at one percent or not insignificant at any significant level with an expected sign. Specifically, DLLE, DLEEX and DLLF are positive and significant at one perccent, and DLEEX (-1) is negative and significant at one percent. However, DPG and GCF are positively insignificant.

Table 4: Short Run Model (Dependent variable: DLGDP)

Variable	Coefficient	Standard Error	T-Ratio[Prob]
DLGDP(-1)	.55747*	.14352	3.8841[.001]
DLLE	34.9672*	8.2155	4.2562[.000]
DLEEX	.094826*	.028311	3.3495[.003]
DLEEX(-1)	-.095653*	.020496	-4.6670[.000]
DPG	-.020469	.047430	-.43157[.671]
DPG(-1)	.65490*	.12297	5.3256[.000]
DGCF	.2231E-3	.2762E-3	.80762[.429]
DLLF	.69135*	.13497	5.1222[.000]
DINTP	-16.9442*	2.5819	-6.5627[.000]
ecm(-1)	-1.1959*	.19832	-6.0299[.000]

**, (**), (***) denote Significant at 1 %, 5% and 10% respectively. Lag length is (2,1,2,2,0,0) selected based on Schwarz Bayesian criterion (SBC).*

Appendix 4 reports the results of Granger causality between life expectancy and economic growth. It can be seen that the null hypothesis is rejected at five percent significant level and life expectancy does Granger cause GDP per capita. Nevertheless, the Granger causality does not run from LGDP to LLE. In other words, at five percent we fail to reject the null hypothesis and LGDP per capita does not affect life expectancy. In this study, unidirectional Granger-causality relationship runs from LLE to LGDP per capita. In this case LLE causes LGDP per capita to increase but not vice versa.

From the result showed in Appendix 1, clearly, it can be seen that R^2 is equal to 0.99542 and it indicates that the overall goodness of estimated model is very high. Moreover, the diagnostic test outcomes demonstrate that the model has passed all of the Autocorrelation, Functional form, normality, and Heteroscedasticity tests. In other words, the model is correctly specified with no Serial correlation and Heteroscedasticity and the error is normally distributed. In addition, Appendix 2 and Appendix 3 show stability tests CUSUM and CUSUM square. From the figures, it is observable that the plots of both CUSUM and CUSUM square are within five percent of critical bands. This implies that the estimated model is stable. Therefore, confidently the author argues that this model can produce robust and reliable results.

5. Summary and Conclusion

Over the last 20 years, an enormous number of studies have investigated the relationship between health and economic growth. Most of the empirical findings confirmed positive relationship, however; a few studies such as Acemoglu and Johnson (2007) argued that increasing life expectancy is not associated with economic growth. In addition, Castell and Rafael Dome´nech (2008) emphasized the possibility of a negative relationship between life expectancy and economic growth.

This study is designed to determine the effect of health care (life expectancy as proxy) on economic growth denoted by GDP per capita in Sudan. ARDL bounds testing approach is used to estimate the relationship during the period 1980-2010. Also, Granger causality test was employed to determine the causal relationship between life expectancy and GDP per capita. In agreement with the majority of related studies, the empirical findings of this study show that life expectancy is positively correlated with economic growth in Sudan for the period under study. This indicates the importance of health care to economic growth and development in Sudan. A possible reason could be the slight improvement in life expectancy which in turn leads to a significant rise in economic growth. Furthermore, education expenditure is significant and positively related to economic growth. Total labour force in Sudan is found to be highly significant in explaining GDP per capita. However, population growth and gross capital formation have no effect on economic growth. The Granger causality test outcomes revealed that a causal relationship is running form life expectancy to GDP per capita. In other words, the level of health denoted by life expectancy led to economic growth in Sudan from 1980 to 2010.

The findings of this study contribute substantially to the understanding of the importance of health in developing countries, especially in Sudan. The results of the study ensured that minor advancement in health care can make a crucial difference in income level for both individuals and the country. Although, the level of health in Sudan is still low, however; the slight improvement in life expectancy has influenced economic growth positively. The empirical findings in this study provide a new understanding of the role health care plays in enhancing income level in developing countries such as Sudan. The evidence from this study indicates that health very influential in determining the economic growth process. In addition, health is a crucial investment in order to improve the country's income (Grossman, 1972). Moreover, the economy depends more on labour rather than investment, therefore; the levels of population health and education are very relevant in influencing economic growth in the country.

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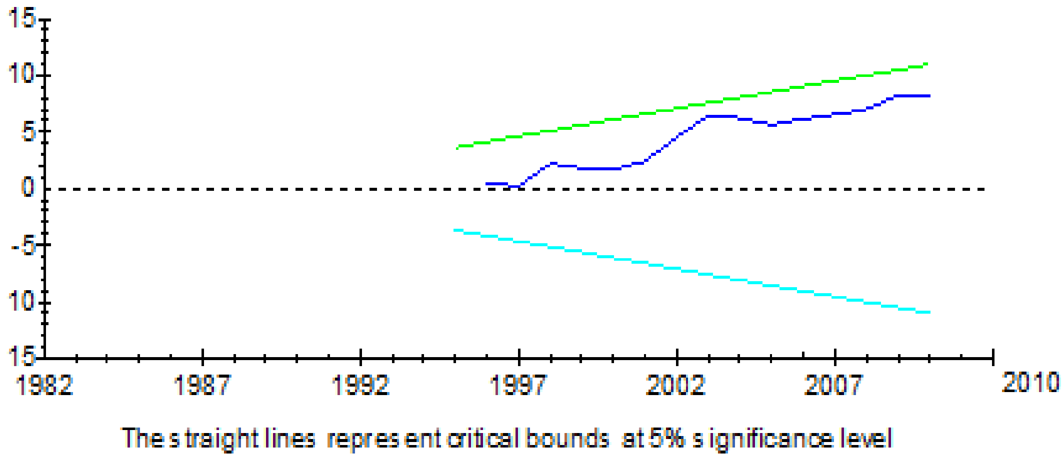
Data Source:
World Development Indicator 2012 www.data.worldbank.org
EconStats 2013 www.econstats.com
Index Mundi 2013 www.IndexMundi.com

Appendix 1 (Diagnostic Tests)
Table 5

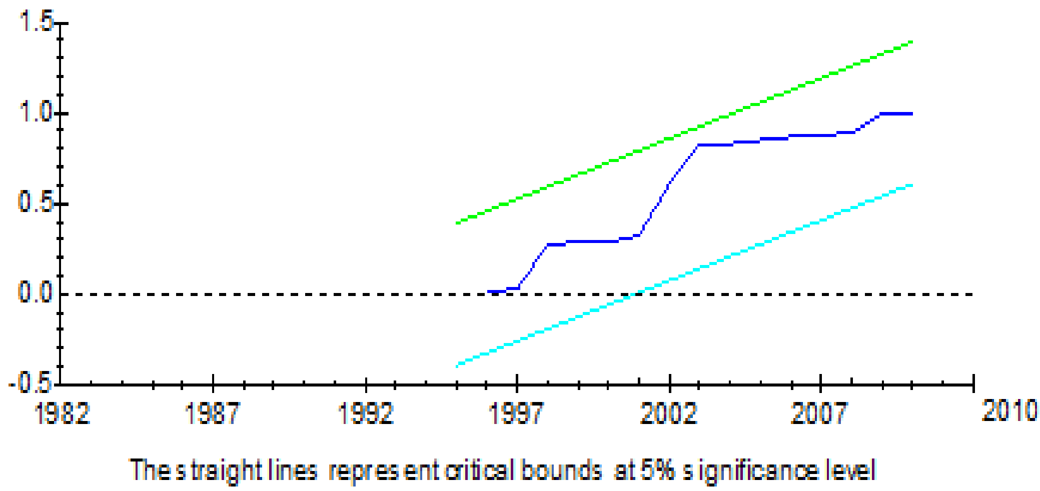
Diagnostic Test	**LM Version**	**F Version**
Serial Correlation	CHSQ(1)=.079589[.778]	F(1, 15)=.041280[.842]
Functional Form	CHSQ(1)=1.1563[.282]	F(1, 15)=.62292[.442]
Normality	CHSQ(2)=1.5151[.469]	Not applicable
Heteroscedasticity	CHSQ(1)=1.8833[.170]	F(1, 27)=1.8752[.182]
R-Squared	.99542	
DW-statistic	2.0715*	

**, (**), (***) denote Significant at 1 %, 5% and 10% respectively.*

Appendix 2 (CUSUM TEST)
Figure 2



Appendix 3 (CUSUM Square TEST)
Figure 3



Appendix 4 (Granger Causality Test)
Table 6

Null Hypothesis	F-Statistic(Prob.)
LLE does not Granger Cause LGDP	3.78329**(0.0271)
LGDP does not Granger Cause LLE	0.32077 (0.9127)

**, (**), (***) denote Significant at 1 %, 5% and 10% respectively. The number of lags is 6.*