International Journal of Economics, Commerce and Management
United Kingdom Vol. V, Issue 4, April 2017
http://ijecm.co.uk/ ISSN 2348 0386

THE IMPACT OF HUMAN CAPITAL DEVELOPMENT ON ECONOMIC GROWTH IN ZAMBIA: AN ECONOMETRIC ANALYSIS

Miyanda Righteous Hakooma
Teacher, Ministry of General Education, Government of Zambia, Zambia
miyandamimi@gmail.com

Venkatesh Seshamani
Professor of Economics, University of Zambia, Zambia
vseshamani@gmail.com

Abstract

This study examined the impact of human capital on economic growth in Zambia both in the short and long run using Johansen's co-integration test and the Error Correction Model. The study used yearly data from 1970-2013. The findings of the co-integration test indicates the presence of a long run relationship between economic growth proxied by GDP per capita and human capital proxied by government expenditures on health and education and secondary school enrolment. The estimated long run model reveals that human capital in the form of health proxied by public expenditure on health is the main contributor to real GDP per capita rise followed by education human capital proxied by secondary school enrolment. These findings are consistent with the endogenous growth theories which argue that an improvement in human capital in the form of skilled and healthy workers improves productivity.

Keywords: Human Capital, Economic Growth, Education, Health, ECM model, Zambia

INTRODUCTION

Economists have long believed in the importance of human resource development in the economic growth and development process. For instance, besides emphasizing the importance of education at various points in his magnum opus, Adam Smith (1776) specifically included the acquired and useful abilities of all the inhabitants or members of the society in his concept of fixed capital. Alfred Marshal (1890) also emphasized the importance of education as a national investment and regarded it as the most valuable of all capital that is invested in human beings.

Human capital is the term economists often use for education, health, and other human capacities that can raise productivity. Human capital can therefore be conceived as developed skills, knowledge and the capabilities of all the people of the society and which are needed in the labor market for the production of goods and services. In economic terms, it could be described as the accumulation of knowledge and its effective investment in the development of an economy (Harbison and Myers, 1964).

Interest in human capital was spurred by the works of Schultz (1961), Becker (1964), Uzawa (1965), Mincer (1970) and Rosen (1976). What followed was a plethora of studies on the impact of human capital on a wide range of issues. In particular, there have been numerous empirical studies on the relationship between human capital and economic growth which we review in the next section.

Harbison (1971) stated that the wealth of a nation is critically determined by its level of human capital. For him, differences in the level of socio-economic development across nations is determined not so much by natural resources and the stock of physical capital as by the quality and quantity of human resources. Harbison's proposition has been reinforced by several others. For instance, Bergheim (2005) argued that human capital is crucial so as to increase the productivity of labor and physical capital. The ILO report (2002) states "It has been increasingly recognized that it is people's endowments of skills and capabilities, and investment in education and training, that constitute *thekey* to economic and social development. Skills and training increase productivity and incomes, and facilitate everybody's participation in economic and social life". (p.3).

REVIEW OF EMPIRICAL LITERATURE

Growth studies incorporating human capital yield conflicting results. For cross sectional studies four categories of results are easily identified.

The first category consists of studies which show a positive and significant contribution of human capital to productivity growth. Among these studies are Hicks (1980), Wheeler (1980), Weede (1983), Landau (1983, 1986), World Bank (2000), Grammy and Assane (1996), Ojo and Oshikoya (1995), and Barro (1991). Barro's 1991 study of 98 countries between 1960 and 1985 used school enrolment rates as proxies for human capital. His finding is that the growth rate of real per capita GDP is positively related to initial human capital proxied by 1960 school enrolment rate. For Romer (1990), human capital is the key input to the research sector, which generates the new product, or ideas that underlie technological progress. Thus countries with greater initial stocks of human capital experience a more rapid rate of introduction of new goods and thereby tend to grow faster. Mankiw, Romer and Weil (1992) used the augmented Solow Growth model with the product of secondary school enrolment ratio and the proportion of the labor force of secondary school age as a measure of flow of investment in human capital. Their results showed that investment in human capital substantially and significantly influenced per capita income growth. Even when primary school enrolment was used as suggested by Romer (1995) and Klenow and Rodriquez-Clare (1997), the results still show that human capital is highly significant. Quadri and Waheed (2011) found that the health adjusted education indicator was a highly significant indicator of economic growth, which indicates that both health and education sectors should be given special attention to ensure long-run economic growth.

In its study of East Asia, the World Bank (2000), indicates that it is the massive investment in both primary and lower secondary education that significantly explained the development “miracle” experienced in the region. More recently, Jimenez and King (2012) from the World Bank state that human capital is key to East Asia’s continuing growth. They, however, caution, that it is necessary to focus on improving the quality of education rather than on simply expanding quantity – a point emphasized by others as well (see our reference to the study by Hanushek, 2013 below).

Using varied forms of human capital investment such as school enrolment, human development index and economic liberty index, Grammy and Assane (1996) have found that human capital formation positively and significantly contributed to labor productivity.

In their study of African countries, Ojo and Oshikoya (1995) found literacy rate and average year of schooling to be positively related to per capita output growth. Using other indices such as school enrolment, they found that the signs of their coefficients were either wrong or statistically insignificant. A significant departure from the cross sectional or cross country studies is that of Ncube (1999). Incorporating, human capital variable (proxied by total enrolment) into the standard growth model, he found a very strong long-run relationship between human capital investment and economic growth in Zimbabwe. A more recent study by Imoughele & Ismailia (2013) concludes that investment in human capital through education could bring about economic growth in Nigeria.

The second category of studies found negative and/or insignificant relationship between education and economic growth. Studies in these categories include Benhabib and Spiegel (1994), Jovanovich et al (1992), Islam (1995), Caselli et al (1996) and Pritchett (2001). Benhabib and Spiegel (1994) use a standard growth accounting framework that includes initial per capita income and estimates of years of schooling from Kyriacou (1990) and found a negative coefficient on growth of years of schooling. This negative effect of educational growth was found to be robust to the inclusion of a wide variety of ancillary variables (e.g. dummies for SSA and Latin America etc.) and to the inclusion of samples. Jovanovich, Lach and Levy (1992) found negative coefficients on education for a non-OECD sample. Studies based on panel data to allow for country specific effects such as Islam (1995), Caselli, Esquivel and Lefort (1996) consistently found negative signs on schooling variables. Even Barro (1991) found a negative impact of human capital on growth when student – teacher ratios (showing quality of education) and adult literacy rates were used as proxies for human capital.

The third category of cross country studies have shown that the influence of human capital is not uniform for all countries or groups of countries. While a positive relationship exists between human capital and growth in some countries, in others the relationship is negative. Lau, Jamison and Luat (1991) pooled data in 58 developing countries from 1960 through 1986 to estimate an aggregate production function with average educational attainment of the labor force as a proxy for human capital. Their finding is that primary education has an estimated negative effect in Africa due to ignorance, Middle East and North Africa, insignificant effects in South Asia and Latin America, and positive and significant effect only in East Asia. For Africa, they found secondary education to have negative and significant effect in Secondary Education model. In models with both levels of education, they found a negative and insignificant relationship for Primary and Secondary education. Other studies in this category include Psacharopoulos (1985) and Romer (1989).

Again, the results are different for the two main components of human capital, namely, education and health. For instance, the study by Churchill, Yew and Ugur (2015) shows that while the effect of government education expenditure on growth is positive, the growth effect of government health expenditure is negative. However, when the researchers used a combined measure viz. government expenditure on both education and health, the results are positive.

The fourth category of studies found insignificant relationship between human capital and economic growth. Behrman (1987) and Dasgupta and Weale (1992) for instance, have found that changes in adult literacy are not significantly correlated with changes in output. World Bank (1995) also reports the lack of partial correlation between growth and educational expansion. In Pritchett [2001], we find that cross – national data shows no association between increases in human capital attributable to the rising educational attainment of the labor force and the rate of growth of output per worker. Specifically, he reports that the estimate of the impact of growth in educational capital on growth per worker is negative and insignificant.

One recent paper by Hanushek (2013) argues that the poor relationship between human capital and economic growth in the developing countries is because of inadequate attention paid to the quality of schooling and commensurately lower achievements in cognitive skills.

ZAMBIA

The preceding survey of empirical studies show that there is no definitive evidence of the existence of a significant causal relationship between human capital and economic growth. The ambivalent results of the numerous empirical studies are best summarized by Wilson and Briscoe (2004) in the following paragraph in the concluding section of their paper: “There is no guarantee that any investment in human capital will result in a positive return, whether it be investment in training, deployment of highly-skilled labor, R&D or in some other form. There will always be some risk and uncertainty. In general, there is evidence that such investments pay off but each case needs to be considered on its merits.” (p. 61).

Also, there are relatively fewer empirical studies that have specifically examined the impact of human capital development on economic growth in developing countries. And no such study has been undertaken in Zambia so far.

Another point worthy of note is that while education and health are both important constituents of human capital, most of the studies have restricted human capital only to education. Among the few studies that consider health, one can cite Barro (2013), Bleakley (2010) and Bloom et al (2001). In our study, we include both education and health.

Since Zambia has been allocating much resources and efforts to the education and health sectors anticipating productivity improvement of the citizens and thereby economic growth, it is important from a policy perspective to know to what extent such allocations and efforts are proving to be worthwhile.

Accordingly, the purpose of this study is to empirically evaluate the impact of human capital development on economic growth in Zambia both in the short run and in the long run.

METHODOLOGY

Model specification

In this study, we use a multiple regression model based on the theoretical framework developed by Mankiw, Romer and Weil (1992). Gross domestic Product Per Capita (GDPPC) in Zambia depends on Government’s expenditure on Health (GEH), Government’s expenditure on Education (GEE), and Secondary School enrolment rate (SER). That is,

GDPPC = f(GEH, GEE, SER).

And the multiple regression model is stated as:

$$GDPPC = \beta_0 + \beta_1 GEH + \beta_2 GEE + \beta_3 SER + \mu, \quad \beta_1, \beta_2, \beta_3 > 0$$

The Data

Our study made use of annual data for Zambia for a 43 year period from 1970 to 2013 on all the variables. This sample would be quite adequate for the econometric exercise we are carrying out in this study. Models such as the VECM that we have used tend to gobble up degrees of freedom pretty quickly and so the larger the data points, the more reliable will be the results. Given that we have three coefficients to be estimated, 43 observations though not very large, are enough to provide reliable estimates.

The data was sourced from the Ministry of Finance, World Bank Development Indicators (WI), IMF's International Financial Statistics, and statistical abstracts and economic surveys from the Central Statistical Office yearly Bulletins.

Estimation techniques

Econometric time series techniques were employed and the data was processed using the software package STATA version 13. Specifically, the following tests were conducted:

- The Augmented Dickey-Fuller (ADF) test for stationarity of variables;
- Johansen test of co-integration of variables (eigenvalue and trace statistic);
- Vector Error Correction Model (VECM);
- Post-estimation diagnostic tests.

ECONOMETRIC RESULTS

The entire set of econometric results are provided in the Appendix. Here we provide only key tables.

Table 1: Unit root analysis

Variable	ADF Test Statistical Value	MacKinnon Critical Value at 1%	MacKinnon Critical Value at 5%	MacKinnon approximate p-value for Z(t)
GDPPC	-0.611	-3.628	-2.930	0.8683
GEE	-1.977	-3.628	-2.930	0.2967
GEH	-1.921	-3.628	-2.930	0.3220
SER	1.686	-3.628	-2.930	0.9981

From the results obtained, all the variables are non-stationary as their t-values are greater than the critical values at 1% and 5% and all their p-values are not significant.

Table 2: ADF Test Statistics Results

Variable	ADF Test Statistical Value	MacKinnon Critical Value at 1%	MacKinnon Critical Value at 5%	MacKinnon approximate p-value for Z(t)	Order of Integration
GDPPC	-5.280	-3.634	-2.952	0.0000	I(1)
GEE	-6.154	-3.634	-2.952	0.0000	I(1)
GEH	-6.111	-3.634	-2.952	0.0000	I(1)
SER	-3.735	-3.634	-2.952	0.0034	I(1)

Table 2 above shows that GDP per capita (GDPPC), Government expenditure on Education (GEE), Secondary School Enrolment Rate (SER), and Government expenditure on Health (GEH), are all stationary at first-order difference at 5% level of significance.

Table 3: Johansen's Test for Co-Integration

```
Trend: constant                                         Number of obs =      42
Sample:  1972 - 2013                                             Lags =       2
```

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	20	-1889.9442	.	123.8381	47.21
1	27	-1843.9008	0.88837	31.7512	29.68
2	32	-1835.0915	0.34262	14.1326*	15.41
3	35	-1828.7321	0.26127	1.4139	3.76
4	36	-1828.0252	0.03310		

The study tested the long run co-integration properties between the variables. This was to help identify any equilibrium relationship between variables in the system.

The results of the co-integration test shown in Appendix 2, indicate the trace statistic at r = 0 of 123.83 exceeds its critical value of 47.21, and hence we reject the null hypothesis of no co-integrating equations. At r = 1 the trace statistic value of 31.75 also exceeds its critical value. However, at r=2, the trace statistic of 14.13 is less than its critical value of 15.41, so we cannot reject the null hypothesis that there are at least two co-integrating equations. Because Johansen's method for estimating r is to accept the first r for which the null hypothesis is not rejected, we accept r = 2 as our estimate of the number of co-integrating equations between the variables. This now becomes the basis for the vector error correction model.

Vector error correction was established in order to investigate the short-run dynamics of variables acting together in the long-run and the results are presented in table 4.

Table 4: Vector Error-Correction Model

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_gdppc						
_ce1						
L1.	-.1305733	.0511499	-2.55	0.011	-.2308254	-.0303213
gdppc						
LD.	.0242768	.1512126	0.16	0.872	-.2720944	.320648
gee						
LD.	-7.46e-11	3.02e-11	-2.47	0.013	-1.34e-10	-1.55e-11
ser						
LD.	.000652	.0002006	3.25	0.001	.0002588	.0010452
geh						
LD.	6.882198	13.77127	0.50	0.617	-20.10899	33.87338
_cons	-8.757293	5.777339	-1.52	0.130	-20.08067	2.566084

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
gdppc	1	.	.	.	.	.
gee	-7.31e-10	2.92e-11	-25.03	0.000	-7.88e-10	-6.74e-10
ser	.0030246	.000138	21.92	0.000	.0027541	.0032951
geh	46.80645	16.12826	2.90	0.004	15.19564	78.41725
_cons	-1296.218	.	.	.	.	.

Ce1 is the coefficient of the equilibrium coefficient of error correction term. It is the speed of adjustment towards equilibrium and since the coefficient is negative and statistically significant, that is, its probability value is very low, it implies that the variables adjust at a rate of 13.1% towards long run equilibrium. Hence the error correction model is valid. That means deviations in the short-run will be eliminated and the series converges to the long-run equilibrium value again among the series moving together in the long-run. Furthermore, the results indicate that in the short run, secondary school enrolment has a positive relationship with GDP per capita.

Although the coefficient of government expenditure on education is statistically significant, it is negative and hence inconsistent with á priori expectations. The coefficient for expenditure on health is positive implying a positive relationship with economic growth. However when tested for statistical significance, the coefficient is found to be statistically insignificant.

When Johansen normalization restriction is imposed after error correction, the coefficients of government expenditure on education (GEE),secondary enrolment rate (SER) and government expenditure on health in the normalised co-integrating equation are all significant. However, the coefficient of government expenditure on education is negative and inconsistent with a priori expectation. The unexpected sign of the coefficient of government expenditure on education (GEE) contradicts economic growth theories. Hence, further research should be done to identify the possible reasons (e.g. education quality) behind such a result.

In the above regard, in a different vein, one can take cognizance of a paper by Benos and Stefania (2014) which suggests that among factors that could produce unexpected or divergent results in empirical research studies could be the way in which the research is conducted, for example, differences in model specification and type of data used, as well as the quality of research outlets where the research papers are published.

The results of secondary enrolment and government expenditure on health both perform well with a priori expectations as they are positive and significant. These findings concerning the long run positive impact of secondary education enrolment and government expenditure on health are consistent with the endogenous growth theories developed by Lucas (1988) , Romer (1990), Mankiw, Romer and Weil (1992)) which argue that improvement in human capital, that is, skilled and healthy workers, leads to increased productivity that enhances output.

Post-estimation diagnostic Tests

Appendix IV provides the results for the following diagnostic tests.

i. autocorrelation

The chi-value of 15.87 from the Lagrange multiplier test, has a high probability of 0.46 hence we fail to reject the null hypothesis of no autocorrelation.

ii. Test for multicollinearity

The VIF test results indicate that there is no variance inflation factor that is greater than 10 hence we conclude that multicollinearity is not a serious problem.

iii. Model specification

The computed F statistic of 2.66 from the Ramsey RESET test has a probability of 0.063 which is higher than 0.05 hence we conclude that the model has no omitted variables and hence is not mis-specified.

CONCLUSION

The results of our study reveal that long-run economic performance can be improved significantly when the ratio of public expenditure on health services increases and when secondary school enrolment improves. The findings of this research concerning the long run positive impact of the education and health human capital are consistent with the endogenous growth theories [mainly advocated and/or developed by Lucas (1988) , Romer (1990), Mankiw, Romer and Weil (1992)] which argue that improvement in human capital (skilled and healthy workers) leads to productivity improvement and thereby output growth. These results are identical to those obtained by Kidanemirium (2013) for Ethiopia.

However, in our study, government expenditure on education is seen to have a negative impact on economic growth in the short run, which is inconsistent with a priori expectations. This may be because as some have argued, policy makers in developing countries do not pay sufficient attention to the quality of education. As has been brought out in our literature review, human capital building is not simply a matter of increasing numbers of educated people; such numbers have to be matched commensurately by quality.

Concerns regarding the low and declining standards of education in Zambia have been prevalent for quite some time. For instance, it has been found through SACMEQ (Southern and East African Consortium for Monitoring Educational Quality) studies that the reading and numeracy skills of primary school students are appallingly low. (See, for instance SACMEQ III, 2007). And today, with the proliferation of private universities and other tertiary institutions of learning, higher education is becoming increasingly commercialized and quality seems to be increasingly sacrificed at the altar of pecuniary profit. In summary, the following are the main conclusions of our study:

- It is worthwhile investing in human capital to boost economic growth in Zambia;
- There is, however, scope to strengthen the linkage between human capital and economic growth;
- In order to strengthen the linkage, it is not enough to spend more but also pay serious attention to quality;
- Further research is required to investigate whether there are also other factors besides quality that need to be considered to forge the human capital – growth nexus.
- Further studies are also required using alternative models and methodologies to better validate the robustness of the research results and put policy formulation on firmer ground.

RECOMMENDATIONS

We, therefore, recommend that:

- The Zambian Government should continue to invest in the education and health sectors. As per the latest statistics available (UNDP, 2016), government education expenditure as a percentage of GDP in Zambia in 2012 was one of the lowest in the world. It was a meager 1.3 % compared to Botswana: 7.8%; Lesotho: 13%; Kenya: 6.7%; Malawi: 5.4%; Namibia: 8.4%; South Africa: 6%; Swaziland: 7.8%; Tanzania: 6.2%; and Uganda: 3.3%;
- Along with increasing expenditure, it must be recognized that the quality of education is as important as, if not even more important than, the quantity of educational spending. In the absence of quality, a human being cannot be transformed into human capital.
- In respect of spending on health, the Zambian Government should seek to adhere to the agreed norm of spending at least 15% of its annual budget on health as per the Abuja Declaration of 2001 endorsed by African countries. Even in its budget for 2017, government has allocated only 8.9% to health.
- Further studies can be undertaken using alternative models and additional explanatory factors to gain better insights into the nexus between human capital and economic growth in Zambia.

REFERENCES

Barro, R. (2013): Health and Economic Growth, Annals of Economics and Finance, Vol. 14, issue 2, pp. 329 – 366.

Barro R.J. (1991): Economic Growth in a Cross Section of Countries, Quarterly Journal of Economics, Vol. 106, pp. 407- 443.

Becker, G. (1962): Investment in Human Capital: A Theoretical Analysis, Journal Of Political Economy, Vol. 70, Pp. 9-44.

Becker, G. (1964): Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, 3rd Edition, 1993, Chicago and London: The University Of Chicago Press.

Benhabib, J. And M. Spiegel (1994): The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data, Journal of Monetary Economics, Vol.34, pp.143 - 173.

Benos, N. & Z. Stefania (2014): Education and Economic Growth: A Mete-regression Analysis, World Development, Vol. 64, Issue C, pp. 669 – 689.

Bleakley, H. (2010): Health, Human Capital and Development, Annual Review of Economics, Vol. 2, pp. 283 – 310.

Behrman, J. (1987): Schooling in Developing Countries: Which Countries Are the Over andUnderachievers and What Is Schoolings Impact? Economics of Education Review, Vol. 6, #2, pp. 111 – 127.

Bergheim, S. (2005): Global Growth Centres 2020, Duetche Bank Research Current Issues Working Paper, Frankfurt.

Bloom, D. E., D. Canning & J. Sevilla (2001): The Effect of Health on Economic Growth:Theory and Evidence, NBER Working Paper No. 8587, Cambridge, MA.

Caseli F, G. Esquivel &F. Lefort (1996): Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics,Journal Of Economic GrowthVol.1 #3,pp.363-389.

Churchill, S.A., S. L. Yew & M. Ugur (2015): Effects of Government Education and Health Expenditures on Economic Growth: A Meta-Analysis, Greenwich Political Economy Research Center, Greenwich University, Greenwich.

Dasguputa P.& M. Weale (1992): On Measuring the Quality of Life,World Development Vol. 20 #1,pp.119-131.

Foster, P. (1987): The Contribution of Education to Development, in G. Psacharopoulos (Ed): Economics of Education, Research and Studies, pp. 93-100, Pergamon, Washington D. C.

Grammy, A.&D. Assane (1996): New Evidence on the Effect of Human Capital on EconomicGrowth,Applied Economic Letters 4, pp. 1211 – 124.

Griliches, Z. (1996): Education, Human Capital, And Growth: A Personal Perspective, NBER Working Paper 5426, Cambridge MA.

Hanson, P. And M. Henrekson (1994): What Makes A Country Socially Capable Of Catching Up? Weltwirtschftliches Archiv, Review Of World Economics, Band 130, Heft 4, pp. 760-780.

Hanushek (2013): Economic Growth in Developing Countries: The Role of Human Capital, Stanford University, California.

Harbison (1971): A Human Resource Approach to the Development of African Nations, Discussion Paper #19, Princeton University, New Jersey.

Harbison, F.&C. Meyers (1964): Education, Manpower and Economic Growth: Strategies of Human Resource Development, McGraw Hill, New York.

Hicks N. (1980): Economic Growth and Human Capital, World Bank Working Paper 408.

ILO (2002): Learning and Training for Work in the Knowledge Society, ILO Office Report IV, Geneva.

Imoughele, L. E. & M. Ismailia (2013): Effect of Public Educational Expenditure on Economic Growth in Nigeria (1980 – 2010), Interdisciplinary Journal of Contemporary Research in Business, Vol. 4, # 11, pp. 237 – 250.

Islam N. (1995): Growth Empirics: A Panel Data Approach, Quarterly Journal Of Economics, Vol. 110, #4, pp. 1127 – 1170.

Jimenez, E. & E. M. King (2012): East Asia's Human Capital Key to Continuing Growth, East Asia Forum, Australian National University, Canberra.

Jovanovich B., S. Lach, V. Lavy (1992): Growth and Human Capital's Role as an Investment in Cost Reduction, New York University, New York.

Kidanemirium, G. G. (2013): The Impact of Human Capital Development on Economic Growth in Ethiopia: Evidence from ARDL Approach to Co-integration, Ethiopian Civil Service University, Addis Ababa.

Klenow, P. & Rodraquez-Clare, A. (1997): The Neo-classical Revival in Growth Economics:Has It Gone Too Far?NBER Macroeconomic Manual 1997, Vol. 12, Cambridge MA.

Kyriacou G (1991) Level and Growth Effect of Human Capital: A Cross-Country Study of The Convergence Hypothesis, Economic Research Report 91 (26), New York University, New York.

Landau (1986): Government and Growth in the Less Developed Countries: An Empirical Study, Economic Development and Cultural Change, Vol. 35, pp. 35 – 75.

Landau, D. (1986): Government and Economic Growth in Less Developed Countries: An Empirical Study for 1960 - 1980, Economic Development and Cultural Change, Vol. 35, #1, pp. 35 – 75.

Landau, D. (1983): Government Expenditure and Economic Growth: A Cross-country Study, Southern Economic Journal, Vol. 49, #3, pp. 783 – 792.

Lau, L. J., D. T. Jamison &F. L. Louat (1991): Education and Productivity in Developing Countries: An Aggregate Production Function Approach, World Bank, Washington D.C.

Lucas (1988): On the Mechanics of Economic Development, Journal of Monetary Economics, Vol. 22, #1, pp. 3 – 42.

Mankiw, N. G., D. Romer & D. N. Weil (1992):A Contribution to the Empirics of Economic Growth, Quarterly Journal of Economics, Vol. 107, #2, pp. 407 – 437.

Marshall, A. (1890): Principles of Economics, Macmillan and Company Limited, London.

Mincer, J. (1970): The Distribution of Labor Incomes: A Survey With Special Reference to the Human Capital Approach, Journal of Economic Literature Vol.8, #1, pp. 1 – 26.

Ncube M. (1999): Human Capital Improvement for Economic Growth in Zimbabwe? African Journal of Economic Policy, Vol. 6, #2, pp. 1-14.

Odusola .A.F (1988): Human Capital Investment and The Empirics of Economic Growth in Nigeria: Rekindling Investment for Economic Development in Nigeria, Nigerian Economic Society Annual Conference, Ibadan.

Ojo, O.& T.W. Oshikoye (1995), Determinants of Long Term Growth: Some African Results, Journal of African Economics, Vol. 4,#2,pp. 163-91

Pritchett, L. (2001): Where Has All That Education Gone?, The World Bank Economic Review, Vol. 15, #3, pp. 367 – 391.

Psacharopoulos, G. (1985): Return to Education: A Further International Update and Implications, Journal of Human Resources, Vol. 20,pp. 563-603.

Pritchett (2001): Where Has All That Education Gone? World Bank Economic Review, Vol. 15, #3, pp. 367 – 391.

Quadri, F. & A. Waheed (2011): Human Capital and Economic Growth: Time Series Evidence from Pakistan, Pakistan Business Review, Vol. 12, #4, pp. 815 – 833.

Romer P. (1990): Human Capital And Growth: Theory And Evidence, NBER Working Paper # 3173, Cambridge MA.

Romer, P. (1986): Increasing Returns and Long-Run Growth, Journal Of Political Economy, Vol. 94,#5, pp. 1002-1037.

Romer, P. (1989): Capital Accumulation In The Theory Of Long-Run Growth in R. Barro (Ed), Modern Business Cycle Theory, Harvard University Press, Cambridge MA.

Romer, P. (1995): Comments on N. Gregory, Mankiw: The Growth of Nations. Brooking Papers on Economic Activity,pp. 313 -20

Romer, P.M. (1990), Endogenous Technological Change, Journal of Political Economy Vol. 98, Pp. 71-102.

Rosen, S. (1976): A Theory of Life Earning, Journal of Political Economy, Vol. 84, pp. 45 – 67.

Schultz, T. (1961): Investment In Human Capital, American Economic Review, Vol. 51,#1, Pp. 1-17.

Shaffer, H. G. (1961):Investment in Human Capital: Comment,The American Economic Review, Vol. 51, #5, pp. 1026 – 1035.

Smith, A. (1776) 1979:An Enquiry into the Nature and Causes of the Wealth of Nations, Clarendon Press, Oxford.

Solow R. M. (1957): Technical Change and the Aggregate Production. Review of Economics and Statistics, Vol. 33, #3, pp. 312 – 320.

Southern and East African Consortium for Monitoring Educational Quality (SACMEQ) (2007): SACMEQ III Zambia, Lusaka.

United Nations Development Programme (UNDP) (1996): Human Development Report 1996,Oxford University Press, New York.

United Nations Development Programme (UNDP) (1997): Human Development Report 1997, Oxford University Press, New York.

United Nations Development Programme (UNDP) (2016): Human Development Report 2016, Oxford University Press, New York.

Uzawa, H. (1965): Optimal Technical Change in an Aggregate Model of Economic Growth, International Economic Review, Vol. 6, pp. 18 – 31.

Weede, E. (1983): The Impact of Democracy on Economic Growth: Some Evidence from Cross-National Analysis, Kyklos, Vol. 36, Issue 1, pp. 21 – 39.

Wheeler D. (1980) Human Resource Development and Economic Growth in Developing Countries: A Simultaneous Model. World Bank Staff Working Paper# 407, World Bank, Washington D. C.

Wilson, R. A. & G. Briscoe (2004): The Impact of Human Capital on Economic Growth: A Review, in Descy, P. & M. Tessaring (Eds): Impact of Education and Training, Office for Official Publications of the European Communities, Luxembourg.

World Bank (2000): Human Capital Formation as an Engine of Growth: The East Asian Experience, ISEAS Publishing, Singapore.

APPENDICES

APPENDIX I: AUGMENTED DICKEY-FULLER (ADF) UNIT ROOT TEST

GDP per capita at levels

```
. dfuller gdppc

Dickey-Fuller test for unit root                   Number of obs   =        43

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.611            -3.628            -2.950            -2.608
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.8685
```

GDP per capita at first difference

```
. dfuller d.gdppc

Dickey-Fuller test for unit root                   Number of obs   =        42

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -5.280            -3.634            -2.952            -2.610
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

Secondary Enrolment at levels

```
. dfuller ser

Dickey-Fuller test for unit root                   Number of obs   =        43

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              1.686            -3.628            -2.950            -2.608
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9981
```

Secondary Enrolment at first difference

```
. dfuller d.ser
```

Dickey-Fuller test for unit root   Number of obs = 42

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.754	-3.634	-2.952	-2.610

MacKinnon approximate p-value for Z(t) = 0.0034

Government Expenditure on Education at levels

```
. dfuller gee
```

Dickey-Fuller test for unit root   Number of obs = 43

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.977	-3.628	-2.950	-2.608

MacKinnon approximate p-value for Z(t) = 0.2967

Government Expenditure on Education at first difference

```
. dfuller d.gee
```

Dickey-Fuller test for unit root   Number of obs = 42

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-6.154	-3.634	-2.952	-2.610

MacKinnon approximate p-value for Z(t) = 0.0000

Government Expenditure on Health at levels

```
. dfuller geh
```

Dickey-Fuller test for unit root   Number of obs = 43

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.921	-3.628	-2.950	-2.608

MacKinnon approximate p-value for Z(t) = 0.3220

Government Expenditure on Health at first difference

```
. dfuller d.geh

Dickey-Fuller test for unit root                     Number of obs   =        42
```

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	-6.111	-3.634	-2.952	-2.610

MacKinnon approximate p-value for Z(t) = 0.0000

APPENDIX II: JOHANSEN TEST FOR COINTEGRATION

Trend: constant   Number of obs =   42
Sample: 1972 - 2013   Lags =   2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	20	-1889.9442	.	123.8381	47.21
1	27	-1843.9008	0.88837	31.7512	29.68
2	32	-1835.0915	0.34262	14.1326*	15.41
3	35	-1828.7321	0.26127	1.4139	3.76
4	36	-1828.0252	0.03310		

APPENDIX III: VECTOR ERROR CORRECTION MODEL

```
Sample:  1972 - 2013                              No. of obs      =        42
                                                  AIC             =   89.3659
Log likelihood = -1849.684                        HQIC            =  89.77535
Det(Sigma_ml)  =  2.10e+33                        SBIC            =  90.48298
```

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_gdppc	6	31.3259	0.2651	12.96755	0.0436
D_gee	6	2.5e+11	0.8377	185.7859	0.0000
D_ser	6	24158.2	0.5880	51.38017	0.0000
D_geh	6	.383522	0.0927	2.867312	0.8253

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_gdppc						
_ce1						
L1.	-.1305733	.0511499	-2.55	0.011	-.2308254	-.0303213
gdppc						
LD.	.0242768	.1512126	0.16	0.872	-.2720944	.320648
gee						
LD.	-7.46e-11	3.02e-11	-2.47	0.013	-1.34e-10	-1.55e-11
ser						
LD.	.000652	.0002006	3.25	0.001	.0002588	.0010452
geh						
LD.	6.882198	13.77127	0.50	0.617	-20.10899	33.87338
_cons	-8.757293	5.777339	-1.52	0.130	-20.08067	2.566084

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_ce1						
gdppc	1	.	.	.	.	.
gee	-7.31e-10	2.92e-11	-25.03	0.000	-7.88e-10	-6.74e-10
ser	.0030246	.000138	21.92	0.000	.0027541	.0032951
geh	46.80645	16.12826	2.90	0.004	15.19564	78.41725
_cons	-1296.218	.	.	.	.	.

APPENDIX IV: DIAGNOSTIC TESTS

Multicollinearity test

. estat vif

Variable	VIF	1/VIF
dgeh	1.05	0.948830
dgee	1.05	0.954917
dser	1.01	0.991303
Mean VIF	1.04	

Autocorrelation test

. veclmar

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	30.6932	16	0.01472
2	15.8703	16	0.46205

H0: no autocorrelation at lag order

Model Specification test

. estat ovtest

```
Ramsey RESET test using powers of the fitted values of dgdppc
       Ho:  model has no omitted variables
                 F(3, 36) =      2.66
                 Prob > F =      0.0631
```