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Role of Educational Investment on Economic Growth and Development in Kenya

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Abstract
The Government of Kenya spends 30% of its budget on education. It is commonly assumed that education has an important positive effect on economic growth, but to date the evidence for this assumption has been surprisingly weak. This study aimed at exploring the relationships between the amount of investments in education and economic growth. It was an attempt to explore the extent to which education level of the Kenyan labor force affects its economic growth that is its output level. It was guided by the following specific objectives; to examine the impact of physical capital formation on economic growth and to investigate the contribution of labor input on economic growth. This study used time series techniques to investigate the relationship between government education expenditure per worker and economic growth in Kenya during the period 1967 to 2010.The data was collected from Kenya National Bureau of Statistics and the World Bank. The study used the multiplicative Cobb-Douglas production function where human capital was treated as an independent factor of production in the human capital augmented growth model. Unit root and Granger-causality tests were carried out to make adequate allowance for the dynamic relationship, on stationary, and spurious regression problems. The empirical results show that education expenditure per worker has a positive and significant impact on economic growth both in the long run and short run. The cointegration estimates show that an increase of 1% of education per worker raises output by 0.5% in the long run. Similarly, in the long-run, a 1% increase in fixed capital formation raises output by 0.15%. Also, a 1% increase in labor leads to 0.21% decrease in output in the long run. Correlation tests also show that there is a positive relationship between investment in education and economic growth. These results justified that it is worth investing in education since it contributes to economic growth. The Government of Kenya and the private sector who are the beneficiaries of this study need to increase the amount of investment in education.
Keywords: Educational Investment, Economic Growth and Error Correction Model

Introduction

Since the late 1980s, much of the attention of macroeconomists has focused on long-term issues, notably the effects of government policies on the long-term rate of economic growth. This was in recognition that human capital and technological advancement are the two big endogenous driving influences promoting sustainable economic development (Schulz, 2002). Now, people take human capital investment as more and more important to economic growth. This emphasis reflects the recognition that the difference between prosperity and poverty for a country depends on how fast it grows its human capital over time. In this context, education was found to be fundamental in the development of human capital (Foster and Rosenzweig, 2009). Thus the stock of education or human capital, usually proxied by average years of schooling in the working-age population was found to influence human development. Worldwide, education is viewed as a principal route out of poverty in many countries. Such an important attachment to education can be established based on the investment that goes towards education in relation to other programmes in most countries (Knack and Keefer, 2010).

Many countries of the world have allocated huge sums of money in their national budgets to enhance attainment of education to the citizens (World Bank, 2010). Education is attracting growing interest from economic policy-makers, perhaps for two main reasons. First, the best available economic evidence suggests that rising educational attainment is an important influence on economic growth. Secondly, education accounts for a sizeable share – around 14 per cent in the world as a whole – of public expenditure (Barro and Lee, 2001). The expansion of formal education and training in developed economies in recent years has had substantial and easily observed implications for the skill levels and skill structures of the populations and employed workforces of these countries.

Governments, policy makers, and civil society have emphasized that developing countries need to invest more in education and ensure that systems of education are efficiently managed so that the limited funds allocated to this sector have maximum impact, and that cost-recovery measures are adopted (Crespo and Lutz, 2007). For instance in the Sub-Saharan African, investments towards education account for between 25 to 60% of the national budgets of these c*ountri*es (Lutz et al, 2007). During Kenya's independence there was shortage of skilled labour which limited the growth expansion of the country. To improve on this situation, the government of Kenya devoted a large share of its budget to expanding education. For instance the education sectors share has been between 28-32% of the total budget based on the 2005-2011 budgets (KNBS, 2010; Ngang'a, 2010). In Kenya, about 30% of the national budget goes to education. This investment goes towards enhancing the free

primary education, subsidized secondary education and loaning to the students at higher education of learning besides the direct cost that the government incurs in training students at the university levels (Njuguna, 2008). The motivation for such an increase lies in the belief that the education of children in developing countries is crucial for future economic growth and lasting democracy, thereby leading to a greater stability and improved standards of living. However it is still not clear whether this affects Kenya`s economy.

Economic growth in Kenya has been deemed low when it is considered that up to 30% of the budget of the country finances educational investments. Comparatively, 25% of the investments goes to agriculture and about 8% of the budget is invested in the key industrial sector that can produce more direct benefits in terms of employment creation and industrial production respectively. It has been argued that economic growth is attached more to the accumulation of physical capital than human capital (Barro, 1997). Yet, it was previously shown that Kenya trained workforce are poor in job creation especially the trained graduates who find it difficult to create meaningful jobs in the labour market bur instead seek employment in both the public and private sector (Osir, 2005). There is also deficiency of a well-developed entrepreneurial class motivated and trained to organize resources for efficient production, which may be reflected in the overall economic growth. Although macroeconomic evidence indicate that the level of investments may be directly related to economic growth, there are a number of inconsistencies such as the amount of money invested on the education as a sector that goes to training and salaries as well as existence of a number of externalities that may affect investments on the education and limit its return to the economic growth. As yet, there is still no attempt to link the aforementioned factors to economic growth despite the large investments towards education. On the basis of the foregoing this study was carried out.

The link between education and economic growth in some of the early work on the economics of education was based on the argument that a major effect of more education is that an improved labor force has an increased capacity to produce. Because better-educated workers are more literate and numerate, they should be easier to train. It should be easier for them to learn more complex tasks. In addition, they should have better work habits, particularly awareness of time and dependability with eventual reflection on the outputs from their work (Temple, 1999). But exactly how education increases productivity, how important it is, and in what ways it is important are questions that have no definite answers and have not been evaluated in Kenya. A shortage of educated people may limit growth, but it is unclear that a more educated labor force will increase economic growth. It is also unclear what kind of education contributes most to growth general schooling, technical formal training, or on-the-job training and what level of education contributes most to growth primary, secondary, or higher education. Moreover, there has been considered demand for salary increment for the working force in Kenya, which the government has continued to fulfill by providing most of the well educated workforce with higher salaries, yet it is not clear whether the increased salaries for the workforce contribute to increased productivity and therefore improved economic growth in the country. Finally, although it is possible that investment in education may reflect positively on increased economic growth in the country, there are other externalities that may not have been anticipated that may affect the
overall growth of the country and therefore limit the intended multiplier effect of the increased investment on the education and positive economic growth. These externalities have rarely been determined in Kenya in the wake of increased investments on education

Materials and Methods

Study Area

This study was based on Kenya's experience. Kenya's economic Growth rate has been low since independence. The economy has been growing at a rate of 2-5% for the last 10 years after initial growth rates of between 0.1-1.1% between 1990 and 2000.This growth has been deemed low yet 30% of the budget goes to education. The main drivers of the Kenyan economy are tourism, agriculture, industry and commerce. Tourism and agriculture have remained the highest foreign exchange earners. Majority of Kenyans are employed in agricultural related activities. Kenya is well endowed with Physical and human capital.

Research Design

This study used theoretical and empirical approach based on the study of economic benefits accrued from investment in education. Multiplicative Cobb-Douglas production function was used to determine the impact of investment on education on economic growth in Kenya.

Data sources and collection

This study employed secondary data from various sources. Data was collected from World Bank and Kenya National Bureau of Statistics spanning from1967 to 2010. Data collected include economic output, physical capital input, labor input and educational stock. It looked at the economic impact of Government of Kenya expenditure on education. GDP in current prices, gross fixed capital formation and education expenditure data

was obtained from Kenya National Bureau of Statistics (KNBS) statistical abstract. GDP deflator and consumer price index (CPI) was from World Bank. Database on labor was collected from KNBS. It comprised private and public sector workers. Gross fixed capital formation was deflated with GDP deflator. Consumer price index (CPI) was used to deflate education expenditure since it was the most appropriate deflator for expenditures.

Methods of Data Analysis

Theoretical Framework

This study used the perspective of the Growth Theory. One of the most prominent and influential contributions is that of Lucas (1988), which is in turn related to previous work by Uzawa (1965). In these models, the level of output is a function of the stock of human capital. In the long run sustained growth is only possible if human capital can grow without bound. That makes it difficult to interpret the Uzawa-Lucas conception of human capital in terms of the variables traditionally used to measure educational attainment, such as years of schooling. Their use of the term 'human capital' seems to relate to the Uzawa-Lucas model in that the quality of education could be increasing over time. In this view, the knowledge imparted to school children in the year 2000 is superior to the knowledge that would have been imparted in 1950 or 1990 and will make a greater difference to their productivity in later employment. Even if average educational attainment is constant over time, the stock of human capital could be increasing in a way that drives rising levels of output. Yet this argument runs into difficulties, even at the level of university education. There may be some degree courses in which the knowledge imparted currently has a greater effect on productivity than before (medicine and computer science) but there are other less vocational qualifications for which this argument is less convincing.

An alternative class of models places more emphasis on modelling the incentives that firms have to generate new ideas. Endogenous growth models based on the analysis of research and development, notably the landmark contribution of Romer (1990), yield the result that the growth rate partly depends on the level of human capital. The underlying assumption is that human capital is a key input in the production of new ideas. In contrast with the Uzawa-Lucas framework, this opens up the possibility that even a one-off increase in the stock of human capital will raise the growth rate indefinitely. In practice, the generality of these results, and the contrast with the Uzawa-Lucas model, should not be overdrawn. The Uzawa-Lucas framework can be seen as a model of knowledge accumulation in a similar spirit to that of Romer, but easier to analyze and restrictive assumptions are needed to yield the Romer result that the long-run growth rate depends on the level of human capital (Jones, 1995). But even under more general assumptions, a rise in the level of human capital is likely to be associated with a potentially substantial rise in the level of output, brought about through a transitional increase in growth rates.

Interesting aspect of growth models as argued by Rustichini and Schrnitz (1991) is that individuals may under-invest in education. They presented a model in which individuals divide their time between production, original research, and the acquisition of knowledge. Each individual knows that acquiring knowledge through education will raise their productivity in subsequent research, but since they do not fully capture the benefits of research, they will tend to spend less time in acquiring knowledge relative to the socially optimal outcome. They found that although policy intervention has only small effects on the allocation of time to education, it can have a substantial effect on the growth rate. Romer (2000) maintained that models of growth driven by Research and Development (R&D) are determined by the quantity of inputs and not simply the expenditure upon it. Incentives like tax credits to encourage R&D may be ineffective unless they encourage a greater number of scientists and engineers to work towards developing new ideas. In most endogenous growth models based on research and development, the stock of human capital is taken to be exogenously determined. Acemoglu (1997) and Redding (1996), have relaxed this assumption, and considered what happens when individuals can choose to make investments in education or training, while firms make investments in R&D. For some parameter values multiple equilibrium are possible, since the incentives of workers to invest in human capital, and those of firms to invest in R&D are interdependent.

The Empirical Model Estimation

Human capital can be regarded in two ways; the narrow sense which deals with just education or the broader sense which adds health to the education component. It has become conventional to discuss human capital in its narrower sense because expenditure on education and training is capable of measurement. We follow the approach in Lin (2003), and Bakare and Sanmi (2011) where output is modeled as a function of labour and capital input and of the measures of educational stock using the multiplicative Cobb-Douglas production function. The production function is thus expressed as:

$$Y_t = AK_t^{\alpha} L_t^{\beta} H_t^{\gamma} \varepsilon_t \quad \ldots\ldots 1$$

Where Y is real output, K is physical capital, L is labor input, H is the quality of human capital and A is an exogenous knowledge and technological factor which makes physical capital and labor more productive. α, β and γ are the physical capital, labor and human capital shares respectively and t is the time trend. α, β and γ are the parameters to be estimated. Human capital is defined as:

$$H_t = EW_t L_t \quad \ldots\ldots 2$$

Where EW_t are the average years of education or education attainment per person of employed people. If we assume that the average level of education per worker is directly proportional to the average expenditure on education per worker, we can substitute equation (2) into (1) to obtain:

$$Y_t = AK_t^{\alpha} L_t^{\delta} EW_t^{\gamma} \varepsilon_t \quad \ldots\ldots 3$$

Where $\delta = \beta + \gamma$

Theoretically, a positive correlation is expected between growth in output on the one hand and increases in capital stock, employment and education of workers on the other. The above model enabled the researcher to relate output to education expenditures.

Taking natural logarithms, the production function becomes:

$$\ln Y_t = \ln A + \alpha \ln K_t + \delta \ln L_t + \gamma \ln EW_t + \varepsilon_t \quad \ldots\ldots 4$$

Thus, the growth of output is a function of growth of capital stock, employment and average education expenditure per worker. Given the above Cobb-Douglas production function, if $\alpha + \delta + \gamma = 1$, it can be said that the model exhibits constant returns to scale. If $\alpha + \delta + \gamma > 1$, the production exhibits increasing returns to scale and exhibits decreasing returns to scale if $\alpha + \delta + \gamma < 1$. Some tests were carried out to make adequate allowance for the dynamic relationship, non-stationarity, and spurious regression problems. Stationarity of the variables was tested to decide whether to carry out cointegration analysis and thus estimate an error correction model. To get direction of causality between education and economic growth, the Granger causality test was done.

Definition of variables

Variable	Definition of variable
Output (Y_t):	Real GDP (or GDP at constant prices)
Physical capital (K_t):	Real capital stock which includes gross fixed capital formation (e.g buildings, equipment and other construction) in millions of shillings converted into real terms using the GDP deflator.
Labor input (L_t):	The number of workers or number of people in the economically active population of employment status.
EW_t:	Education expenditure per worker in Kenya shillings converted to real terms by deflating with the CPI.

Two methods were used in the analysis of data that is descriptive statistics and econometric models. Descriptive statistics involve the comparison of means, cross tabulation, use of tables, pie charts and bar graphs. Econometric models utilized multiplicative Cobb- Douglas production function to arrive at the estimation of parameters. The data collected was analyzed statistically using econometric procedures. The researcher described the data available and considered their basic properties. The study also presented the findings of stationarity and diagnostic tests. In addition the researcher described the findings of the co integration analysis. Unit root tests were done using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) to check the order of integration of the time series. A careful examination of the trends of the variables revealed that education expenditure depicted no trend component but the other variables had a trend component. Therefore, unit root tests were done with constant, except for education expenditure.

Results and Discussions

Descriptive Statistics and Correlations

Figures 4.1, 4.2 and 4.3 indicate positive relationship between growths of GDP on the one hand and changes in expenditure on education, capital formation and labor input on the other. The relationship between GDP and capital formation was strongest with a correlation coefficient of 0.57 as indicated in table 4.1. There was also a positive relationship between growth of GDP and education expenditure per worker with a correlation coefficient of 0.13. Figure 4.3 shows a positive relationship between growth and changes in labor input. The correlation is 0.11 as shown in table 1.The correlation results turned out to be as expected in the theoretical model.

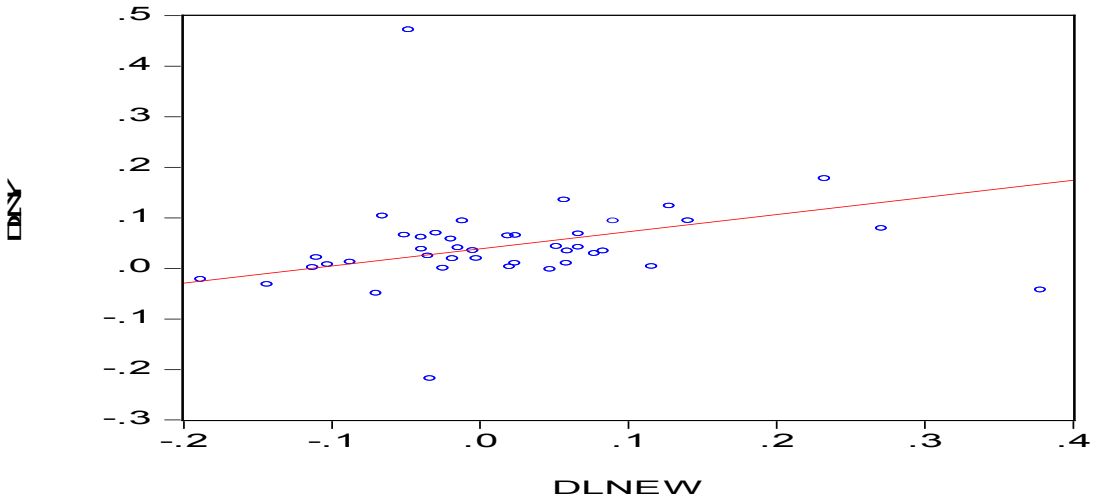

Figure 1: Relationship between Changes in Output and Changes in Expenditure per Worker

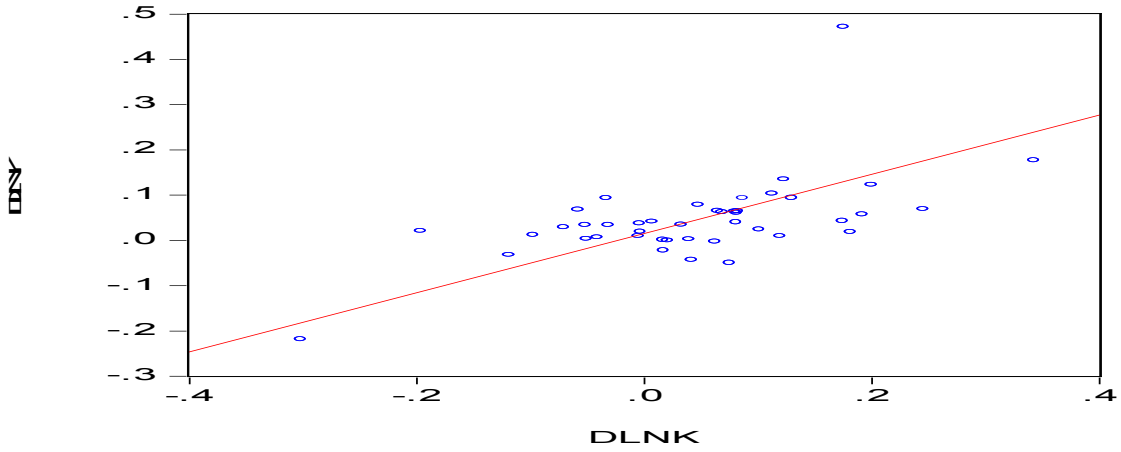

Figure 2: Relationship between changes in output and Changes in capital Formation (Investment)

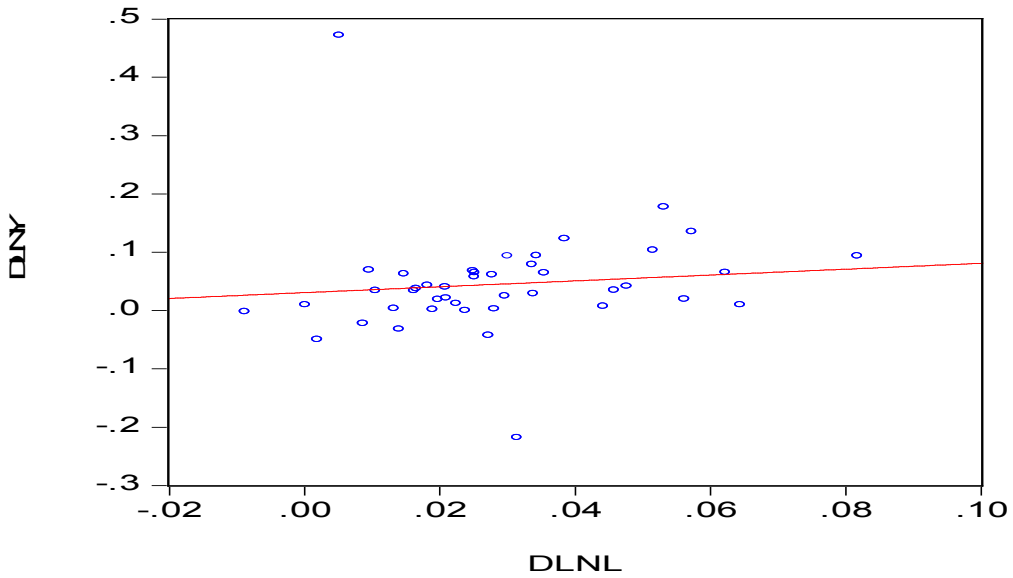

Figure 3: Relationship between Changes in Output and Changes in Number of Workers

Table 1: Correlation coefficients

	DLNY	DLNEW	DLNK	DLNL
DLNY	1.00			
DLNEW	0.13	1.00		
DLNK	0.57	0.27	1.00	
DLNL	0.11	0.16	0.00	1.00

Granger-Causality

Granger causality tests indicated that capital formation, labor input and expenditure per worker were significant in affecting GDP. Causality runs from these three variables to GDP- causality being significant at 5% level for capital formation and labor education expenditure per worker. It was significant at 1 % for labor input. These results were as expected in the theoretical model and compared favorably with results of other studies such as Self *et al* (2003).

Table 2: Results of the Bivariate Granger-Causality tests

Dependent variable	Causal variable	Lags	Statistic for causality test (probability)
LOGY	LOGEw	2	$\chi 2$=7.702** (0.024)
LOGY	LOGK	2	$\chi 2$= 7.738** (0.021)
LOGY	LOGL	2	$\chi 2$= 8.945*(0.011)
LOGEw	LOGY	2	$\chi 2$= 2.562(0.278)
LOGK	LOGY	2	$\chi 2$= 7.248**(0.027)
LOGL	LOGY	2	$\chi 2$= 1.914(0.384)

**Hypothesis of causality accepted at 5% level
*significant at 1% level

Unit Root Tests

The researcher started by checking the order of integration of the time series by applying the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests using the Eviews Econometric Software. A careful examination of the trends of the variables revealed that education expenditure depicted no trend component but the other variables had a trend component (see figure 4 below). Therefore, unit root tests were done with constant, except for education expenditure. The researcher chose no constant and no trend when computing ADF and PP tests for education expenditure. The ADF and PP unit root test results showed that the null hypothesis of a unit root could not be rejected, that is, H0: the series is non stationary, cannot be rejected at the 5% significance level for all variables in their level form but is rejected at the 1% significance level for all variables in their first differences. The results are in table 4.3.

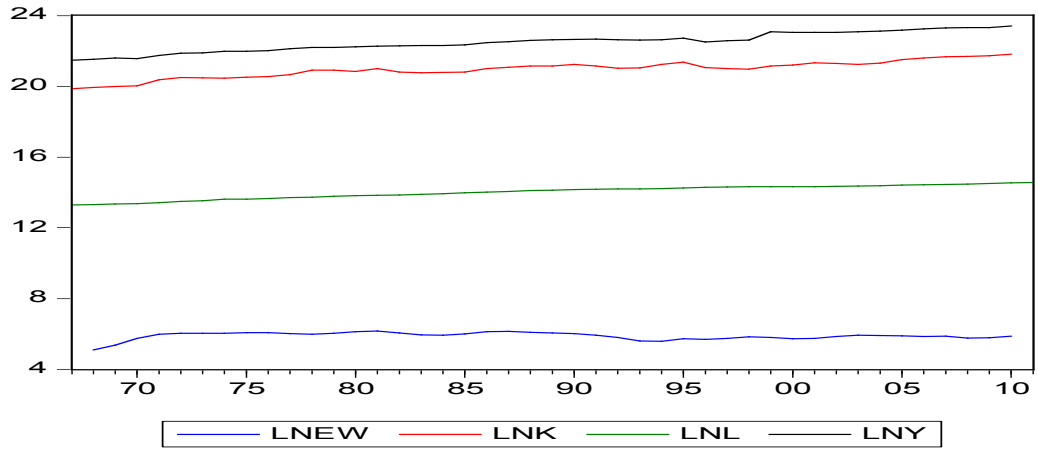

Figure 4: Time Trends of the Variables

Table 3: Test for the presence of unit roots in the data

		ADF		PP	
Variable in level	**Label**	**Calculated value**	**Critical value**	**Calculated value**	**Critical value**
Y	Real GDP	0.66	-2.93	3.21	-2.93
K	Real fixed capital formation	0.41	-2.93	1.10	-2.93
L	Number of workers	0.59	-2.93	0.82	-2.93
Ew	Education expenditure per worker	-0.12	-1.95	0.31	-1.95
Data in first differences					
Y	Real GDP	-7.25*	-2.93	-7.46*	-2.93
K	Real fixed capital formation	-5.58*	-2,93	-5.52*	-2.93
L	Number of workers	-4.92*	-2.93	-5.02*	-2.93
Ew	Education expenditure per worker	-5.50*	-1.95	-3.40*	-1.95

*Significant at 1% level

Cointegration Test

Two tests using the Johansen Cointegration procedure were performed, that is, Trace and Maximum eigenvalue tests. A linear deterministic trend in the data was allowed; in other words the analysis included intercept and trend in the test. The lag intervals in first differences specified in the cointegration test are from 1 to 2. Table 4 shows both the Trace and Maximum-eigenvalue test outcomes. The results suggested one cointegration equation at the 1% level of significance. The estimated cointegration vector is shown in the table. Education expenditure per worker is the most significant variable. Gross fixed capital formation has the expected positive sign. Unexpectedly, the labor variable had a negative coefficient but it was not significant. Therefore, the long-run equation was given as:

$LogY_{t-1}= 18.33+0.042*t+0.52*log(Ew_{t-1})+0.15*log(K_{t-1})-0.21*log(L_{t-1})$

Where t is the time trend introduced to capture the effects of technical progress in the long-run equation.

Table 4: Johansen Cointegration Test Results (Unrestricted Cointegration Rank Test)

Null	Alternative	Statistic	5% critical value
Cointegration test based on Trace test			
r=0	r=1	79.28	63.89
r≤1	r=2	33.89	42.92
r≤2	r=3	15.97	25.87
r≤3	r=4	4.90	12.52
Cointegration test based on the maximum eigenvalue test			
r=0	r=1	45.39	32.12
r≤1	r=2	17.93	25.82
r≤2	r=3	11.06	19.39
r≤3	r=4	4.90	12.51
r≤4	r=5		
Estimated normalized cointegrating vector			
Variable	Vector	Standard error	
Log(Y)	1.00	--	
Log(Ew)	-0.52	0.07	
Log(K)	-0.15	0.08	
Log(L)	0.21	0.13	
Trend	-0.04	0.003	
Intercept	-18.33	--	

Cointegrating Relation (C_Relation) = $\log Y_{t-1}$-18.33+0.042*t-0.52*log(Ew_{t-1})- 0.15*log(K_{t-1})+0.21*log(L_{t-1}).

The graphical depiction of the cointegration relation is shown in Figure 5 below. It is clear that the resulting cointegration relation is stationary as expected. A combination of cointegration variables is expected to result in a stationary series. The cointegration relation is a good proof for the existence of cointegration among the variables.

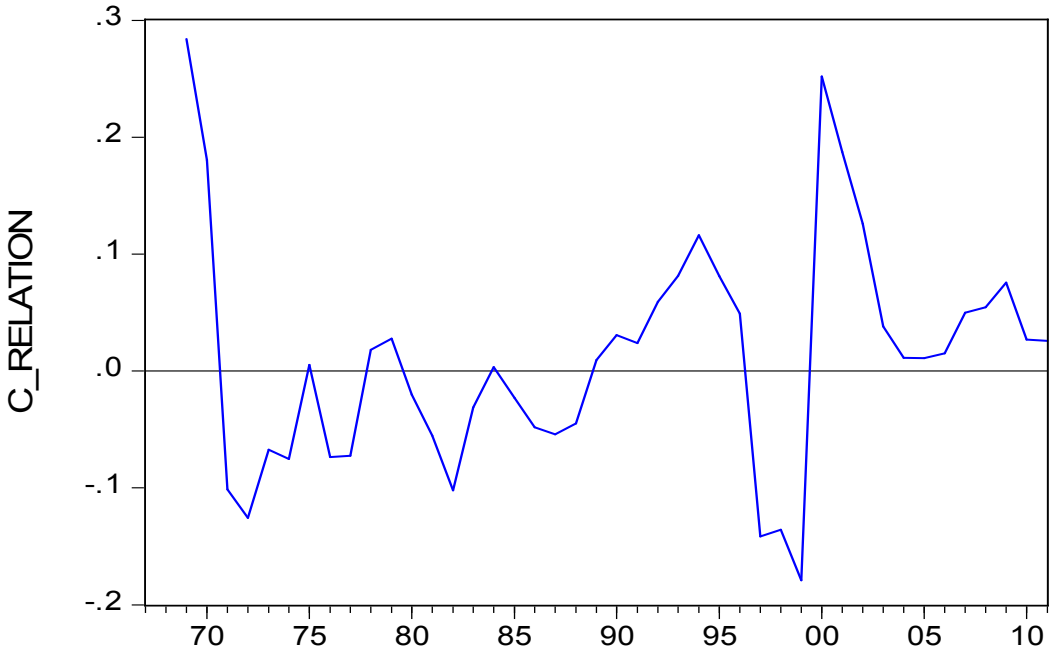

Figure 4: Cointegrating Relation

The study concludes as follows on the long-run equation; an increase of 1% of education expenditure per worker raises output by about 0.5%, while a 1% increase in fixed capital formation raises output by 0.15%.Unexpectedly, a 1% increase in labor leads to 0.21% decrease in output in the long-run. This may need to be investigated in further research. The results on the effect of education expenditure per worker are comparable with those found by Barro(1991), who found that a 1% increase in average years of schooling leads to 0.6% in real GDP growth. The result found in this study is 0.5% increase of output in response to 1% increase in education expenditure.

Tests for Weak Exogeneity and Direction of Causality

The direction of causality in the literature is still debatable. Some researchers believe that education causes growth. Others however, are of the opinion that the direction of causality runs from economic growth to education. If the latter is true, it can be said that education is a dependent variable and economic growth an exogenous variable in the model. This calls for weak exogeneity tests to know for sure the direction of causality. Weak exogeneity tests involve testing the restrictions on the cointegrating vector that the adjustment coefficients of the variables are zero. The variables are considered weakly exogenous if the imposed restrictions are binding and not rejected. At 1% level of significance, only one restriction, $\alpha(1,1)=0$ imposed on LOGY is rejected. The researcher concluded that in Kenya, expenditure per worker is weakly exogenous. This means that causality runs from education to output and not vice versa. Capital formation and labor are also weakly exogenous at 1% level of significance. Only real GDP is endogenous at 1% level of significance. So, real GDP is treated correctly as the dependent variable. These results are shown below in table 4.5.

Table 5: Tests for Cointegration Restrictions for Weak Exogeneity

Variable on which the cointegration relation is normalized	Cointegrating restriction	LR-test for binding restrictions	Probability
LOG(Y)	$\alpha(1,1)=0$	$\chi2=10.68$*	0.001
LOG(Ew)	$\alpha(2,1)=0$	$\chi2=2.18$	0.14
LOG(K)	$\alpha(3,1)=0$	$\chi2=0.71$	0.40
LOG(L)	$\alpha(4,1)=0$	$\chi2=3.87$	0.05

*significant at 1% level

Error Correction Model

The error correction model is also called the short-run model. It combines short-run dynamics with cointegration or long-run equation. The error correction term measures the speed of adjustment to equilibrium. The analysis began with three lags of changes in capital formation, labor input and expenditure per worker. Insignificant lags were removed sequentially by observing the changes in the information criteria- Akaike information criterion, Shwarz and Hannan-Quinn criteria.

The ordinary least square estimates for the error correction model is given in table 4. The standard error of the estimated coefficients is given in the parentheses adjacent to the estimated coefficient. The diagnostic tests including Breusch-Godfrey serial correlation test, Breusch-Pagan-Godfrey heteroskedasticity test, Jarque-Bera normality test, and Ramsey Reset and CUSUM stability tests confirm that the model passes each and every test. The tests show no evidence of specification problems. The residuals resulting from the equation are normal, do not suffer from serial correlation and heteroskedasticity. The model is found to be stable. The CUSUM option showed in figure 4.6 plots the cumulative sum of the recursive residuals together with the 5% critical lines. The test finds parameter stability since the cumulative sum is within the area between the two critical lines.

The estimates for the error correction model show that the coefficient of the error correction term or the so-called speed of adjustment has a negative sign as expected. Since it is -0.37, it takes 2 years and 9 months (=1/0.37 years) for GDP to return to equilibrium or long-run level following a shock or disturbance. The estimates show that an increase in the education expenditure per worker significantly raises economic growth; with an estimated coefficient of 0.13. Therefore, the short-run immediate effect of increasing education expenditure per worker by 1% is to raise growth by 0.13%. On the other hand, an increase of 1% change in capital formation or investment raises growth in the short-run by 0.23 %. Surprisingly, labor input increase in the short-run decreases output. Further research is required to understand more on these effects.

When one examines the trend of output growth as shown in figure 4, it can be seen that output growth was affected by shocks in 1996 and 1999. When the model is estimated without the dummy variables, the residual series indicate these shocks in 1996 and 1999. Therefore, normality of the residuals is maintained by accounting for these shocks. Hence, the dummy variables entered in the model capture supply shocks in 1996 (referred to as DUM1) and 1999 (DUM2); they are both highly significant at 5% level.

Table 6: Short-run Model / Error Correction Model Estimates; dependent variable = ΔLOGY

Variable	Estimated coefficient (standard errors)
ΔLOGY(-3)	0.012(0.049)
ΔLOGK	0.228*(0.042)
ΔLOGL(-2)	-0.635* (0.212)
ΔLOG(Ew)	0.129** (0.054)
DUM1	0.163*(0.028)
DUM2	0.342*(0.028)
ECM(-1)	-0.367*(0.053)
C	0.049 *(0.008)
R-squared	0.95
Adjusted R-squared	0.94
S.E of Regression	0.02
F-Statistic	98.36* (Prob=0.00)
Akaike Information Criterion	-4.52
Schwarz Criterion	-4.18
Durbin Watson Statistic	2.27
Diagnostic tests	
Jarque-Bera (Normality test)	$\chi 2$=1.37 (Prob=0.50)
Breusch-Godfrey serial correlation LM test	$\chi 2(2)$=1.71 (Prob=0.72)
Breusch-Pagan-Godfrey heteroskedasticity test	$\chi 2(7)$=6.85 (Prob=0.44)
Ramsey Reset Stability test	$\chi 2(1)$=0.08 (0.78)

** indicates significant at 5%
*significant at 1% level.

Summary and Conclusions

The objective of the study was to estimate the effect of changes in government education expenditure on output. Using logarithmic transformation, the growth of output was postulated as a function of capital stock, employment, and average education expenditure per worker. Simple correlations showed positive relationship between growth of GDP on the one hand and investment on the other (strong at 0.57). There was also a positive relationship between growth of GDP and education expenditure per worker (0.0.13), as well as labor (0.11).

Granger causality tests indicate that capital formation, labor input and expenditure per worker were significant in affecting GDP. Causality runs from these three variables to GDP- causality was significant at 5% level for capital formation and education expenditure per worker and it was significant at 1 % for labor input. The ADF and PP unit root test results show that the null hypothesis of a unit root could not be rejected at the 5% significance level for all variables in their level form but was rejected at the 1% significance level for all variables in their first differences. Because the data became stationary after differencing once, it wasconcluded that the variables were integrated of order 1. It therefore made sense to proceed with the test for cointegration. This helped check if the variables could produce a stationary relationship i.e, whether they were cointegrated or moved closely together in the long-run.

Two tests were performed using the Johansen Cointegration procedure - Trace and Maximum eigenvalue tests. The results suggest one cointegrating equation at the 1% level of significance. Education expenditure per worker was the most significant variable. Gross fixed capital formation had the expected positive sign. Unexpectedly, the labor variable had a negative coefficient but was not significant. The study concluded as follows on the long-run equation; an increase of 1% of education expenditure per worker raised output by about 0.5% while a 1% increase in fixed capital formation raised output by 0.15%. Unexpectedly, a 1% increase in labor leads to 0.21 decrease in output in the long-run. The results on the effect of education expenditure per worker were comparable with those found by Barro (1991). Barro (1991) found that 1% increase in average years of schooling led to 0.6% increase in real GDP growth.

The study proceeded to test for weak exogeneity to know for sure the direction of causality. Weak exogeneity tests involve testing the restrictions on the cointegrating vector that the adjustment coefficients of the variables are zero. The variables are considered weakly exogenous if the imposed restrictions are binding and not rejected. At 1% level of significance, the only restriction imposed on LOGY is rejected. The study concluded that in Kenya, expenditure per worker is weakly exogenous. This means that causality runs from education to output and not vice versa. Capital formation and labor are also weakly exogenous at 1% level of significance. Only real GDP is not weakly exogenous at 1% level of significance. So, real GDP is treated correctly as the

dependent variable. The estimates for the error correction model show that the coefficient of the error correction term or the so-called speed of adjustment has a negative sign as expected. Since it is -0.37, it takes 2 years and 9 months (=1/0.37 years) for GDP to return to equilibrium or long-run level following a shock or disturbance. The estimates show that an increase in the education expenditure per worker significantly raises economic growth; with an estimated coefficient of 0.13. Therefore, the short-run immediate effect of increasing education expenditure per worker by 1% is to raise growth by 0.13%. On the other hand, an increase of 1% in change in capital formation or investment raises growth in the short-run by 0.23 %.

In this study human capital was introduced in the aggregate production function to improve the performance of the growth model and examine the effectiveness of education on economic growth in Kenya during the period 1967 to 2010.Human capital was measured as the average expenditure on education per person for employed people. Time trend was introduced to capture the effect of technical progress. The study used cointegration and error correction estimation procedures to examine the impact of government education expenditures on real GDP in Kenya .The empirical results indicate that average education expenditure per worker is positively correlated with economic growth. Exogeneity tests indicate that education expenditures are weakly exogenous, suggesting therefore that they cause economic growth and not vice versa. The findings support recent Government actions of increasing allocations to education. In the long run this will improve the economy's growth performance. Of course improved execution of the budget will increase the impact of education expenditure on the economy. The results also show that investment matters for economic growth in both the short and long-run.

Recommendations

The increase in education expenditure per worker according to the results of the research leads to increase in GDP and therefore the policy advice given to the Kenyan authorities by the international donor community to increase education expenditures in order to improve the economy's growth performance is economically sound. As a caution, however, for education expenditures to have the intended results to the fullest, it is imperative that there be competent administration at lower levels of government to formulate and execute the budget and to allocate resources efficiently within the education sector. Otherwise without this background resources allocated to the education sector may not have appreciable positive impact on economic growth.

On the policy front, to enhance the country's growth performance, it is necessary to fully restore and consolidate macroeconomic stability by continuing to implement sound economic policies. The results have shown that investment in education matter, for economic growth. Thus, macroeconomic policies aimed at increasing investment through foreign direct investment (FDI) and domestic sources are crucial. Security and political stability also plays a part in attracting FDI and retaining human capital. It is recommended that further research be done to find among other things the relationship between labor and long-run growth. Investment on physical capital need to be improved since it has the greatest impact on economic growth.

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