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The Relevance of Educational Investment to Economic Growth in Kenya

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Abstract
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 explores the relationship between the role of investment in education and economic growth. The study is guided by two specific objectives; to determine the significance of physical capital formation on economic growth and to establish the contribution of labour input to economic growth. It uses time series techniques to investigate the relationship between government education expenditure per worker and economic growth in Kenya during the period 1963 to 2014.The data were collected from Kenya Government Ministries, Kenya National Bureau of Statistics and from the World Bank. The study has used the multiplicative Cobb-Douglas production function, in which human capital is treated as an independent factor of production, as in the human capital augmented growth model. Unit root and Granger-causality tests are carried out to make allowance for dynamic relationships, non-stationarity, and spurious regression problems. Empirical results show that education expenditure per worker has a positive and significant impact on economic growth, both in the long run and in the short run. Cointegration estimates show that an increase of 1 percent in education per worker raises output by 0.5 percent in the long run. Also, in the long-run, a 1percent increase in fixed capital formation raises output by 0.15 percent, and a 1 percent increase in the use of labour leads to a 0.21 percent 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 suggest that it is worth investing in education because it contributes to economic growth. The Government of Kenya and the private sector of Kenya need to consider increasing their investment in education.
Keywords: Educational Investment and Economic Growth

Introduction

Since 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 has been in recognition of the fact that labour, capital and technological advancement have been the three big endogenous driving influences which promote sustainable economic development (Schulz, 2002). Now, human capital investment is becoming more and more important to economic growth. This change in emphasis has come as a result of the increasing realization that the difference between prosperity and poverty for a country seems to be dependent upon how fast it grows its human capital over time. In this context, education has been 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, seems to influence human development. Worldwide, education is viewed as a principal route out of poverty in many countries, as evidenced by the amount of 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 developing 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 their systems of education are efficiently managed, so that the limited funds allocated to this sector can have maximum impact, and that cost-recovery measures are adopted (Crespo and Lutz, 2007). For instance, in the sub-Saharan Africa, investments towards education account for between 25 percent to 60 percent of the national budgets of these c*ountrie*s (Lutz et al, 2007). During Kenya's independence in 1963, 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 sector's share has been between 28-32 percent of the total budget based on the 2005-2011 budgets (KNBS, 2010; Ngang'a, 2010). About 30 percent of the national budget goes to education. This investment goes towards enhancing the free primary school education, subsidized secondary school education and loans to the

students at higher institutions of learning, besides the direct cost that the government incurs in training students at the university level (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 greater stability and improved standards of living. However, it is still not clear whether this is how it also affects the Kenyan economy, because no study has explicitly addressed the issue in Kenya.

Economic growth in Kenya has been deemed low when it is considered that up to 30 percent of the budget of the country finances educational investments. Comparatively, 25 percent of the budget goes to agriculture and about 8 percent of the budget is invested in the key industrial sector that can produce more direct benefits in terms of employment creation and industrial production. It has been argued that economic growth is attached more to the accumulation of physical capital than to human capital (Barro, 1997), yet in Kenya, trained workforce, especially the trained graduates, find it difficult to create meaningful jobs in the labour market, but instead seek employment in both the public and private sectors (Osir, 2005). There is also the lack 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 indicates that growth may be directly related to the level of investment, there are a number of inconsistencies such as the amounts of money invested in the education sector that goes to training and salaries, as well as the existence of a number of externalities that may affect investment in education and limit its contribution to economic growth. As yet, there is still no attempt in Kenya to link the aforementioned factors to economic growth despite the large investments towards education.

The link between economic growth and education in some of the early work on the economics of education has been based on the argument that a major effect of more education is that an improved labour force has an increased capacity to produce. Because better-educated workers are more literate and numerate, they should be easier to train, and 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 addressed in Kenya. A shortage of educated people may limit growth, but it is unclear that a more educated labour force will increase 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 widespread demand for salary increases for the work force in Kenya, which the government has continued to respond to by providing the well educated work force with higher salaries, yet it is not clear whether the increased salaries for the work force contribute to increased productivity and, therefore, to improved economic growth. Finally, although it is possible that investment in education may reflect positively on 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 in education. These externalities have rarely been addressed in Kenya in the wake of increased investment in education. This study aims to address this and the other gaps identified above. The study is based on Kenya's experience. Kenya's economic growth rate has been low since independence. The economy has been growing at rates between 2 percent and 5 percent for the last 15 years, after initial growth rates of between 0.1 percent and 1.1 percent between 1990 and 2000.This growth has been considered low in view of the fact that 30 percent of the national 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, but the majority of Kenyans are employed in agriculture- related activities.

Theoretical Framework

This study has used a perspective of growth theory contributed by Lucas (1988), which is in turn related to previous work by Uzawa (1965). In this perspective, the level of output is treated as a function of the stock of human capital. In the long run, sustained growth is only possible if human capital can grow without bound. This makes it difficult to interpret the Uzawa-Lucas concept 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 which the quality of education could be increasing over time. In this view, the knowledge imparted to school children in the year 2000, for example, is superior to the knowledge that would have been imparted in 1950 or in 1990 and, therefore, makes 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 viewpoints places more emphasis on modelling the incentives that firms have to generate new ideas. Endogenous growth models based on the contribution of Research and Development (R and D), notably the landmark contribution of Romer (1990), yield the result that economic 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 increase growth rate indefinitely. In practice, the generality of these results, and the contrast with the Uzawa-Lucas model, should not be overemphasized. 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 only 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 increase in the level of output, brought about through a transitional increase in growth rates.

An 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 relating to the socially optimal outcome. The reasoning is that although policy intervention has only small effects on the allocation of time to education, it can have a substantial effect on economic growth. Romer (2000) maintains that models of growth driven by Research and Development (R&D) are determined by the quantity of inputs and not simply by the expenditures upon them. 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 equilibria are possible, since the incentives of workers to invest in human capital, and those of firms to invest in R&D are interdependent.

The Model and its Estimation

Human capital can be looked at in two ways; the narrow way which considers only education, or the broader way which adds health to the education component. It has become conventional to discuss human capital in its narrow sense because expenditure on education and training is measurable. We follow the approach in Lin (2003), and Bakare and Sanmi (2011), where output is modeled as a function of labour and capital inputs, as well as a measure of educational stock. The production function is thus expressed as:

$$y_t = Ak_t^{\alpha} L_t^{\beta} h_t^{\gamma} \varepsilon_t \quad \text{..... (1)}$$

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

$$H_t = ew_t L_t \quad \text{.....(2)}$$

Where ew_t is 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) in (1) to obtain:

$$y_t = Ak_t^{\alpha} L_t^{\delta} ew_t^{\gamma} \varepsilon_t \quad \text{.....(3)}$$

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 the level of education of workers, on the other. The model makes it possible to relate output to education expenditures.

Taking natural logarithms, the production function in its log form becomes:

$$\ln y_t = \ln A + \alpha \ln k_t + \delta \ln L_t + \gamma \ln ew_t + \varepsilon_t \quad \text{..... (4)}$$

Where ε_t is a random error term which is normally distributed with a zero mean.

Thus, the growth of output is a function of growth of capital stock, employment and average education expenditure per worker. If $\alpha + \delta + \gamma = 1$, it is said that the production process exhibits constant returns to scale. If $\alpha + \delta + \gamma > 1$, the production process exhibits increasing returns to scale and, if $\alpha + \delta + \gamma < 1$, the production process exhibits decreasing returns to scale. Some tests are carried out to make adequate allowance for the dynamic relationship, non-stationarity, and spurious regression problems. Stationarity of the variables is 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 is applied.

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.
Labour input (L_t):	The number of workers or number of people in the economically active population status.
ew_t:	Education expenditure per worker in Kenya shillings converted to real terms by using the CPI as the deflating factor.

The Data

This study employed secondary data from various sources. Data were collected from the World Bank and from Kenya National Bureau of Statistics, spanning from1967 to 2015. Data collected include economic output, physical capital input, labor input and educational stock. GDP at current prices, gross fixed capital formation and education expenditure data were obtained from Kenya National Bureau of Statistics' (KNBS) *Statistical Abstract*. GDP deflator and consumer price index (CPI) data were obtained from the World Bank. Database on labour was collected from KNBS. It comprised private and public sector workers. Gross fixed capital formation data were deflated using GDP deflator to obtain real capital formation data. Consumer price index (CPI) was used to deflate education expenditure data since it is the most appropriate deflator for expenditures.

Two methods used in the analysis of data, namely descriptive statistical analysis and econometric analysis. Descriptive statistical analysis involves the comparison of means, cross tabulation, use of tables, pie charts and bar graphs. Econometric analysis utilizes a multiplicative Cobb- Douglas production function to arrive at the estimation of parameters. The data were collected and analyzed using econometric procedures. Basic properties of the data are analysed to arrive at suitable regression procedures. The study presents the findings of stationarity and diagnostic tests. In addition, the findings of the co integration analysis are also presented. Unit root tests are conducted using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) approaches to check the order of integration of the time series data. A careful examination of the trends of the variables reveals that education expenditure depicts no trend component but the other variables have a trend component. As a result, unit root tests are done with constants, except for education expenditure.

Discussion of Results

Descriptive Statistics and Correlations

Figures 1, 2 and 3 indicate positive relations between growth of real GDP, on the one hand, and changes in real expenditure on education, real capital formation input and labour input, on the other. The relation between real GDP and real capital formation is the strongest, with a correlation coefficient of 0.57 as indicated in Table 1. There is also a positive relation between growth of real GDP and real education expenditure per worker, with a correlation coefficient of 0.13. Figure 3 shows a positive relation between real 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 within the theoretical framework of the model.

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

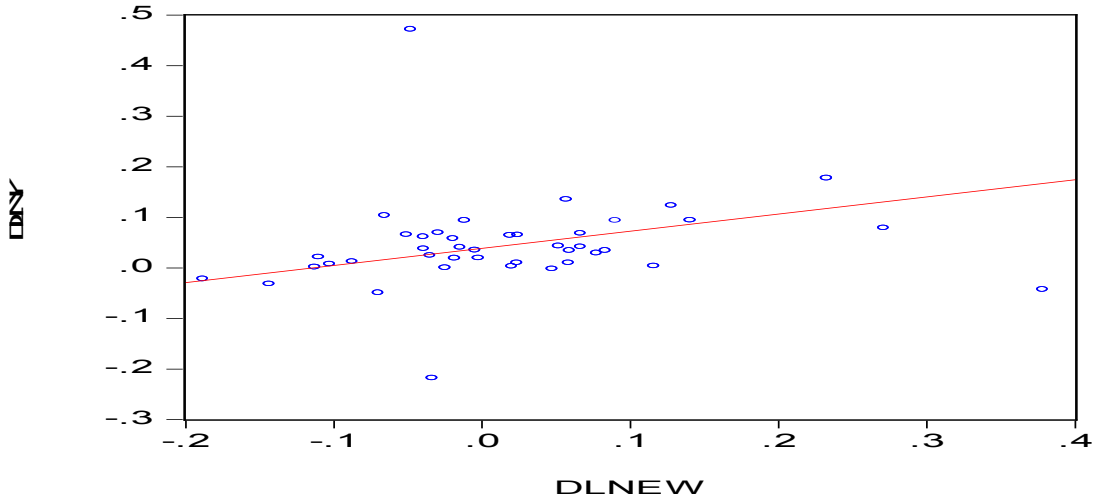


Figure 2: Relationship between Changes in Output and Changes in Capital Formation (Investment)

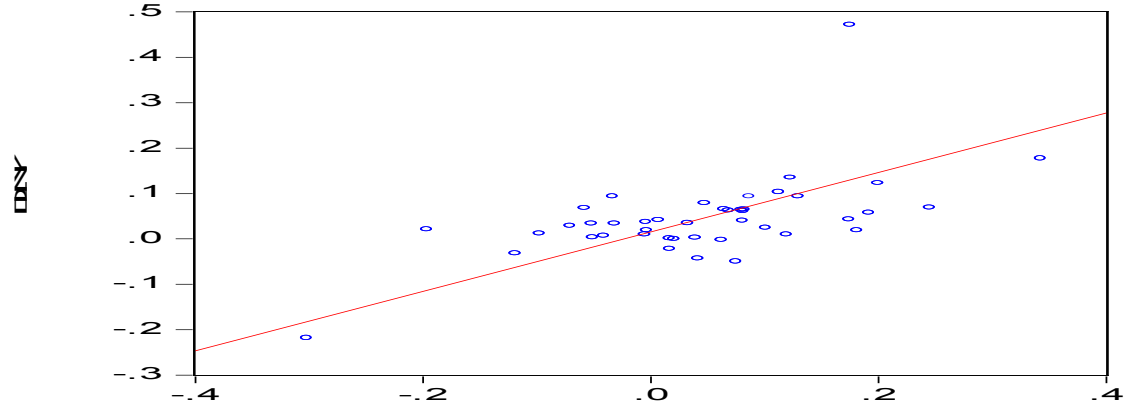


Figure 3: Relation between Changes in Output and Changes in Number of Workers

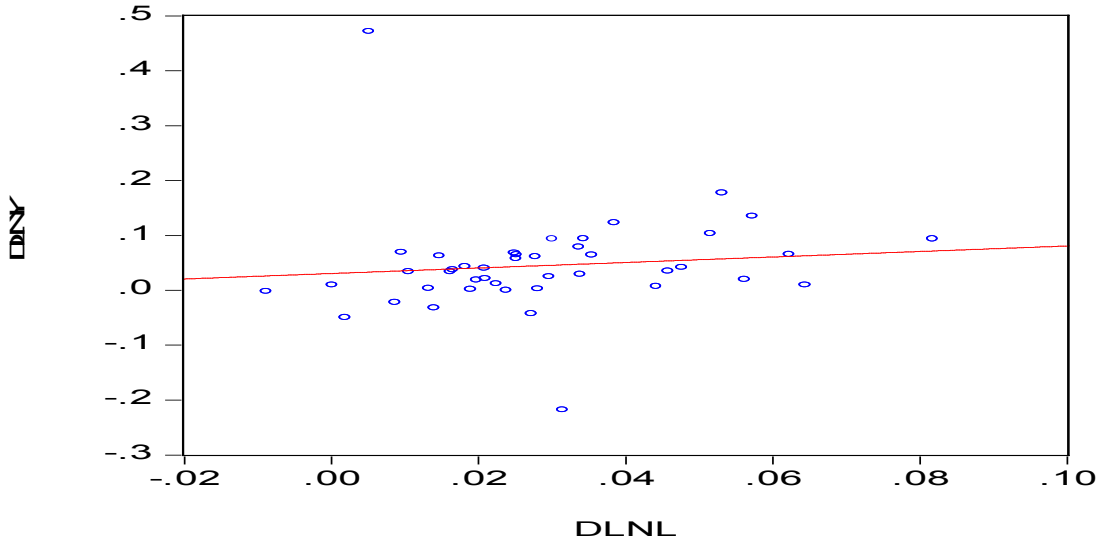


Table 1: Correlation Coefficients

	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 indicate that capital formation, labour input and education expenditure per worker are significant determinants of GDP. Causality runs from these three variables to GDP, being significant at the 5 percenct level for capital formation and for education expenditure per worker. It is significant at the 1 percent for labour input. These results are as expected within the theoretical framework of the model.

Table 2: Results of the Bivariate Granger-Causality Tests

Dependent variable	Causal variable	Lags	Statistic for causality test (probability)
lny	lnew	2	$\chi2$=7.702** (0.024)
lny	Lnk	2	$\chi2$= 7.738** (0.021)
lny	lnL	2	$\chi2$= 8.945*(0.011)
lnew	lny	2	$\chi2$= 2.562(0.278)
lnk	lny	2	$\chi2$= 7.248**(0.027)
lnL	lny	2	$\chi2$= 1.914(0.384)

**Hypothesis of causality accepted at the 5 percent level
*Significant at the 1 percent level

Unit Root Tests

The order of integration of the time series is checked by applying the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests with the help of the Eviews Econometric Software. A careful examination of the trends of the variables reveals that education expenditure per worker depicts no trend component but the other variables have a trend component (see Figure 4). Therefore, unit root tests are conducted with constants, except for education expenditure. No constant and no trend were chosen when computing ADF and PP tests for education expenditure. The ADF and PP unit root test results show 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 percent significance level for all variables in their level form but is rejected at the 1 percent significance level for all variables in their first differences. The results are presented in Table 3.

Figure 4: Time Trends of the Variables

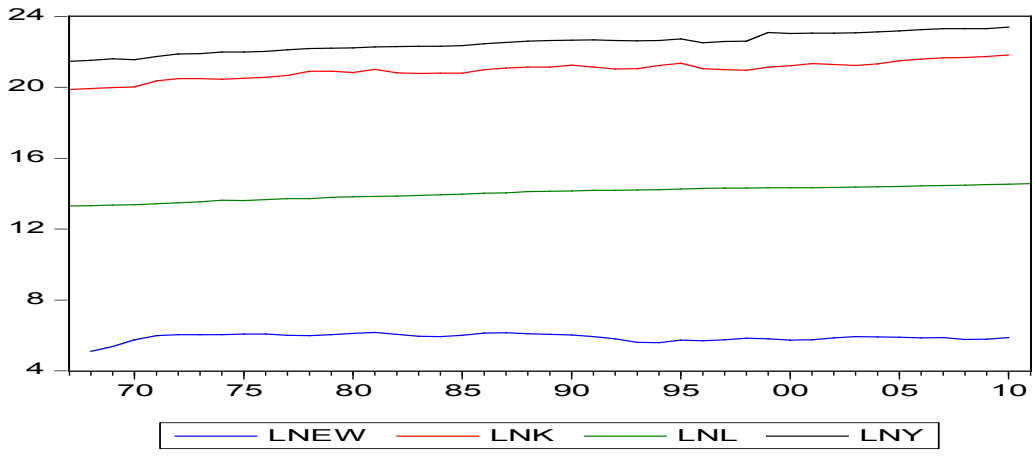


Table 3: Test for the Presence of Unit Roots in the Data

		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 the 1% level

Cointegration Test

Two tests using the Johansen Cointegration procedure are performed, namely; Trace-and Maximum-eigenvalue tests. A linear deterministic trend in the data is allowed by intercept and trend in the test. The lag intervals in first differences specified in the cointegration tests are from 1 to 2. Table 4 shows both the Trace-and Maximum-eigenvalue test outcomes. The results suggest one cointegration equation at the 1percent level of significance. The estimated cointegration vector is presented in the Table 4. Education expenditure per worker is the most significant variable. Gross fixed capital formation has the expected positive sign. Unexpectedly, the labour variable has a negative coefficient, but it is not significant. Therefore, the long-run equation is obtained as:

$lny_{t-1}= 18.33 + 0.042*t + 0.52*ln(ew_{t-1}) + 0.15*ln(k_{t-1}) - 0.21*ln(L_{t-1})$

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

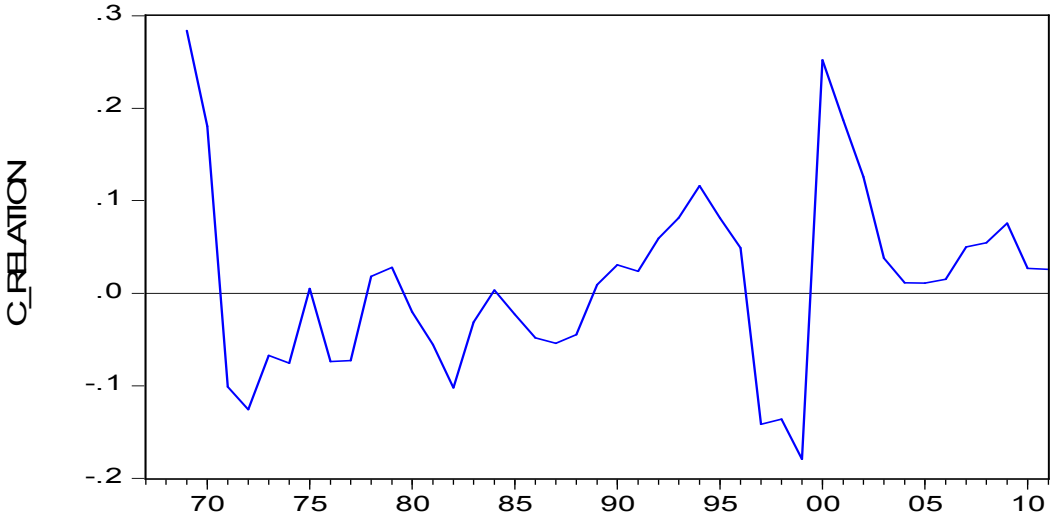
Table 4: Johansen Cointegration Test Results (Unrestricted Cointegration Rank Test)

Null	Alternative	Statistic	5 percent 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) : $logy_{t-1} = 18.33 + 0.042*t - 0.52*log(ew_{t-1}) - 0.15*log(k_{t-1}) + 0.21*log(L_{t-1})$.

The graphic presentation of the cointegration relation is given in Figure 5, which shows 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 of the existence of cointegration among the variables.

Figure 5: Cointegrating Relation



The study concludes as follows on the long-run equation: an increase of 1percent in education expenditure per worker raises output by about 0.5 percent; while a 1 percent increase in fixed capital formation raises output by 0.15 percent. Unexpectedly, a 1percent increase in labour leads to 0.21 percent decrease in output in the long-run. Labour has, however, turned out to be an insignificant determinant. The results of the effects of education expenditure per worker are comparable with those found by Barro(1991), who found that a 1 percent increase in average years of schooling leads to 0.6 percent increase in real GDP growth. An important result is a 0.5 percent increase in output in response to 1 percent 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 are of the opinion that the direction of causality runs from economic growth to education. If the latter were true, then education would be 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 the 1 percent level of significance, only one restriction, $\alpha(1,1)=0$ imposed on lny is rejected. We, therefore, conclude that in Kenya, education 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 the 1 percent level of significance. Only real GDP is endogenous at the 1 percent level of significance. So, real GDP is treated correctly as the dependent variable. These results are shown in Table 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 the 1% level

Error Correction Model

The error correction model is known also as 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 begins with three lags of changes in capital formation, labour input and education expenditure per worker. Insignificant lags are removed sequentially by observing the changes in the information criteria - Akaike information and Shwarz and Hannan-Quinn criteria.

The ordinary least squares estimates for the error correction model are presented in Table 6. The standard errors of the estimated coefficients are given in parentheses. The diagnostic tests, including Breusch-Godfrey serial correlation test, Breusch-Pagan-Godfrey heteroskedasticity test, Jarque-Bera normality test, and Ramsey Reset and CUSUM stability test, 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 and do not suffer from serial correlation and heteroskedasticity. The model is found to be stable. The CUSUM option in Figure 6 plots

the cumulative sum of the recursive residuals together with the 5 percent critical lines. The test finds parameter stability since the cumulative sum is within the area between the two critical lines.

The estimates of the error correction model show that the coefficient of the error correction term, or the 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 a disturbance. The estimates show that an increase in 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 percent is to raise growth by 0.13 percent. An increase of 1percent in capital formation or investment raises growth in the short-run by 0.23 percent.

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 in 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); and they are both highly significant at the 5 percent level.

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

Variable	Estimated coefficient (standard errors)
Δlny(-3)	0.012(0.049)
Δlnk	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 percent level
*significant at 1 percent level.

Summary and Conclusions

The objective of the study was to estimate the effects of changes in government education expenditure on output. Using logarithmic transformation, the growth of output is postulated as a function of capital stock, employment, and average education expenditure per worker. Simple correlations show positive relation between growth of GDP, on the one hand, and investment, on the other (strong at 0.57). There is also a positive relation between growth of GDP and education expenditure per worker (0.13), and also between growth and labour (0.11).

Granger causality tests indicate that capital formation, labour input and education expenditure per worker are significant determinants of GDP. Causality runs from these three variables to GDP, being significant at the 5 percent level for capital formation and education expenditure per worker and at the 1 percent level for labour 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 percent significance level for all variables in their level form but can be rejected at the 1 percent significance level for all variables in their first differences. Because the data become stationary after differencing once, we conclude that the variables are 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 relation. That is, whether they are cointegrated, or move closely together in the long-run.

Two tests are performed using the Johansen Cointegration procedure – Trace- and Maximum - Eigenvalue tests. The results suggest one cointegrating equation at the 1 percent level of significance. Education

expenditure per worker is the most significant variable. Gross fixed capital formation has the expected positive sign. Unexpectedly, the labour variable has a negative coefficient, but is not significant. The study concludes as follows on the long-run equation: an increase of 1 percent in education expenditure per worker raises output by about 0.5 percent; while a 1 percent increase in fixed capital formation raises output by 0.15 percent. 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% 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 the 1 percent level of significance, only the restriction imposed on lny is rejected. The study thus concludes 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 the 1 percent level of significance. Only real GDP is not weakly exogenous at the 1 percent 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 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 a disturbance. The estimates show that an increase in 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 percent is to raise growth by 0.13 percent. An increase of 1 percent in capital formation or investment raises growth in the short-run by 0.23 percent.

In this study human capital is 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 1972 to 2015. Human capital is measured as the average expenditure on education per person for employed people. Time trend is introduced to capture the effect of technical progress. The study has used cointegration and error correction estimation procedures to examine the impact of government education expenditures on real GDP in Kenya and 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 decision to increase budgetary 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 show also that investment matters for economic growth in both the short run and long run.

Recommendations

Increases in education expenditure per worker, according to the results of this study, lead to increases in GDP and, therefore, the policy advice given to the Kenyan authorities by the international development partners to increase expenditure on education in order to improve the economy's growth performance is economically sound. As a caution, however, for education expenditure 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, resources allocated to the education sector may not have appreciable positive impact on economic growth.

In Kenya, education is the key to nation-building. It is also a well-accepted fact that providing the right knowledge and skills to the youth can ensure the overall national progress and economic growth. The Kenyan education system recognizes the role of education in instilling the values of secularism, egalitarianism, respect for democratic traditions and civil liberties and quest for justice. The education sector in Kenya is evolving and has emerged as a strong potential market for investments in training and education sector, due to its favorable demographics (young population) and being a services-driven economy. Further, Kenya's expanding role in sectors such as software development, generic pharmaceuticals and healthcare, would require the country to invest into learning and training segment as well. The education sector in Kenya is also considered as one of the major areas for investments as the entire education system is going through a process of overhaul. There is therefore a dire need to encourage foreign direct investment alongside increased budgetary allocation to the education sector in order to achieve the projected economic growth and development.

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 of this study have shown that investment in education matters for economic growth. Thus, macroeconomic policies aimed at increasing foreign direct investment (FDI) and domestic investment is crucial. Security and political stability play an important part in attracting FDI and retaining human capital. Investment in physical capital need to be improved since it has the greatest impact on economic growth.

References

Acemoglu, D. ,"Matching Heterogeneity and the Evolution of Income Distribution". *Journal of Economic Growth*, 2 (1997):61-92.

Aigbokhan, B., Imahe,O. and Ailemen, M.I.,"Education Expenditure and Human Capital Development in Nigeria: Any Correlations so Far", Research Paper, Ambrose Alli University, Ekpoma, 2007.

Angel de la Fuente, "Education and Economic Growth: a Quick Review of the Evidence and Some Policy Guidelines", Prime Minister's Office, Economic Council of Finland, 2006.

Ansari, M.I., and Singh S.K., "Public Spending on Education and Economic Growth in India: Evidence from VAR Modelling", *Indian Journal of Applied Economics*, 6.2 (1997): 43-64

Appleton S., and Teal F., "Human Capital and Economic Development." Economic Research Paper, No.39, 1998.

Appleton, S., "Education and Health at the Household Level in sub-Saharan Africa." paper for the AERC Collaborative Research Project on `Explaining African Economic Growth, 1950-2000', AERC, 1999.

Bakare A.S and Sanmi O., "Health Care Expenditure and Economic Growth in Nigeria: An Empirical Study". *Journal of Emerging Trends in Economics and Management Sciences*, 2.2 (2011): 83-87.

Balsley, H.L., *Quantitative Research Methods for Business and Economics*. Random House, New York, 1970.

Barrett, A. and O'Connell P.J., (2001), "Does Training Generally Work? The Returns to In-Company Training." *Industrial and Labor Relations Review*, 54.3 (2001):647-662.

Barro, R., "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics,* CVI .2 (1991): 407-43.

Barro, R. "Determinants of Economic Growth: A Cross Country Empirical Study." Lionel Robbins Lectures, MIT Press, Cambridge, USA, 1997.

Barro, R.,"Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106 (1991): 440-443.

Barro, R. and Lee J.W., "International Data on Educational Attainment: Updates and Implications" *Oxford Economic Papers,*53(2001): 541-563.

Barro, R.J. and Sala-i-Martin X., *Economic Growth.* New York: McGraw-Hill, 1995.

Becker Gary S. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Chicago, University of Chicago Press, 1964.

Benhabib, J. and Spiegel M., "The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-country Data." Journal of Monetary Economics 43 (1994) 143-174.

Bigsten, A., *Education and Income Determination in Kenya*. Gower Publishing Company Limited. Gower House, Croft Road, Aldershot, England, 1984.

Bils, M. and Kenlous P., "Does Schooling Cause Growth? "*American Economic Review*" 90.5 (2000), 1160-1183.

Blundell Richard, Dearden, Lorraine and Barbara Sianesi." "Estimating the Returns to Education: Models, Methods and Results."Centre for the Economics of Education, London School of Economics, Houghton Street, London WC2A 2AE, 2001.

Brynin, M., "Graduate Density, Gender and Employment." *The British Journal of Sociology*, 53.3 (2002): 363-381.

Büchel, F., and Pollmann-Schult, M., "Overeducation and Skill Endowments: The Role of School Achievement and Vocational Training Quality." IZA Discussion, Paper Series, No. 337, 2001.

Caselli, F., Esquivel G. and Lefort F., "Reopening the Convergence Debate: A New Look at Cross Country Growth Empirics" *Journal of Economic Growth*, 1996: 363-89.

Cohen, D. and Soto M., "Growth and Human Capital: Good Data, Good Results." CEPR Discussion Paper No.3025, 2001.

Coulombe Serge, Jean-François T., and Sylvie M., "Literacy Scores, Human Capital and Growth Across Fourteen OECD Countries." International Adult Literacy Survey, Culture, Tourism and the Centre for Education Statistics, Statistics Canada, Ottawa, Ontario, K1A 0T6, 2004.

Daron A., "A Microfoundation for Social Increasing Returns in Human Capital Accumulation", *Journal of Economic Growth*, 2 (1997): 61–92.

de la Fuente A, "The Macroeconomics of Human Capital", Instituto de An´alisisEcon´omico, CSIC, 2004.

de la Fuente, A. and Doménech R.,"Human Capital in Growth Regressions: How Much Difference Does Data Quality Make?" *Journal of the European Economic Association* 4.1 (2006): 1-36.

de la Fuente, A. and R. Doménech, "Schooling Data, Technological Diffusion and the Neoclassical Model", *American Economic Review,* 91.2 (2001): 323-27.

Easterlin, R., "Why Isn't the Whole World Developed?. *Journal of Economic History,*41 (1981): 1–19.

Economic Policy Committee, *Budgetary Challenges Posed by Ageing Populations: The Impact of Public Spending on Pensions, Health and Long-term Care for the Elderly and Possible Indicators of the*

Long-term Sustainability of Public Finances. Economic Policy Committee, 2006.
Foster, A. and Rosenzweig M., "Technical Change and Human-Capital Returns and Investments: Evidence from the Green Revolution." *American Economic Review*. 86.4 (2009): 931-953.
Frankfort-Nachmias, Chaca, and David Nachmias, *Research Methods in the Social Sciences*. New York: St. Martin's, 1992.
Gitau, P.N., *Mastering PTE Education.* Kenya Literature Bureau, Nairobi: Kenya, 2008.
Gounden, A.M., "Investment in Education in India." *Journal of Human Resources,* 2.3 (1967): 347-358.
Hanushek, E. and Kimko D., "Schooling, Labor Force Quality and the Growth of Nations." *American Economic Review*, 90.5 (2000): 1184-208.
Harmon, C., I. Walker and Westergaard-Nielsen N., "Introduction" In Harmon C; Walker I; and Westergaard-Nielsen N., (Ed), *Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education.* Edward Elgar, Cheltenham, 2001:1-37.
Hujer, R.; Caliendo, M.; and Radi D., "Methods and Limitations of Evaluation and Impact Research", In: Descy, P.; Tessaring, M. (eds), *Evaluation and Impact of Education and Training: Background Report*. Luxembourg: Office for Official Publications of the European Communities, 2003.
Igun, Stella E., "Human Capital for Nigerian Libraries in the 21st Century." *Library Philosophy and Practice* 8.2 (2006):1-4.
Islam, N., 'Growth Empirics: a Panel Data Approach. *Quarterly Journal of Economics*.110 (1995): 1127–1170
JhinganM.L., *The Economics of Development and Planning.* (Thirty Eight Edition), Vrinda Publications (P) Ltd, Delhi, India, 2005.
Temple J., "*Growth Effects of Education and Social Capital in the OECD Countries.*" *OECD Economic Studies*, OECD Publishing, 2 (2001): 57-101.
Jones, C.I. "Time -series Tests of Endogenous Growth Models." *Quarterly Journal of Economics*, 110, (1995): 95-525.

Jones, C. I. "R&D-Based Models of Economic Growth." *Journal of Political Economy*, 103 (1995): 759-784.
Kealey, D.J. and Protheroe D.R., "The Effectiveness of Cross-cultural Training for Expatriates: An Assessment of the Literature on the Issue", *International Journal of Intercultural Relations*, 20.2 (1996): 141–65.
Kenya National Bureau of statistics (KNBS), Government of Kenya, 'Economic Survey', various issues. The Government Printer, Nairobi.
Knack, S. and Keefer P., "Institutions and Economic Performance: Cross-country Tests Using Alternative Institutional Measures." *Economics and Politics.*7.3(2010): 207-227.
K.I.E Secondary Business studies(Inventor 1,2007)
K.I.E Secondary Business studies (Inventor 3,2004)
Knight, J. B. and Sabot, R. H., **"**The Returns to Education: Increasing with Experience or Decreasing with Expansion?." *Oxford Bulletin of Economics and Statistics*, (1981): 51-71.
Knight, J. B., Sabot R.H.; and Hovey D.C., "Is the Rate of Return of Primary Schooling Really 26 Percent?." *Journal of African Economies*, (1992): 192-205.
Krueger, A. and Lindahl M., "Education for Growth: Why and for Whom?," *Journal of Economic Literature,* 39 (2001): 1101—1136.
Landau, D., "Government Expenditure and Economic Growth: a Cross-Country Study." *Southern Economic Journal*, (1983): 83-92.
Lawal, Abiodun and Wahab, T. I.,"Education and Economic Growth: The Nigerian Experience". 'Journal of Emerging Trends in Economics and Management Sciences' (JETEMS) 2 .3 (2011): 225-231.
Leeuwen, Bas van, *Human Capital and Economic Growth in India, Indonesia, and Japan: A Quantitative Analysis 1890-2000*. Printed in the Netherlands, 2007.
Lin, T.C. "Education, Technical Progress, and Economic Growth: the Case of Taiwan." *Economics of Education Review*, 22 (2003): 213–220.
Lucas, R. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22, 1988.
Lutz, W., Goujon, A.K.C. and Sanderson W., "Reconstruction of Populations by Age, Sex and Level of Educational Attainment for 120 Countries for 1970–2000." Vienna Yearbook of Population Research, 2007: 193–235, Available at http://hw.oeaw.ac.at.
Manda, D. K., "Globalisation and the Labour Market in Kenya." Discussion Paper No 6, The School Development Studies, University of East Anglia, UK, 2002.
Mankiw, G., Romer, D. and Weil D., "A Contribution to the Empirics of Economic Growth."*Quarterly Journal of Economics*,107 (1992): 407-437.
Matveev, A., "The Advantages of Employing Quantitative and Qualitative Methods in Intercultural Research."*Bulletin of Russian Communication Association*, 1.1 (2002), 59-67.
Mincer, J.*, Schooling, Earnings and Experience,* Columbia University Press, New York, 1974.

Nakamura J. I., "Human Capital Accumulation in Pre-modern Rural Japan.",*TheJournal of Economic History*, 41.2 (1981): 263-281.

Ngang'a, K.P., "Investments Towards Educational Attainment in Kenya from 2000 to 2010". *Daily Mirror Investment Newsletter Quarterly*, 8 June, 2010:13-21.

Njuguna, S.L. "Investments in Kenyan Education System in the Rise: Are There Tangible Benefits?" *African Economic Journal*. 11(2008): 89-97.

Osir, K.L.O. "Difficulties in Sustained Training of the Workforce in Kenya: What Are the Challenges and Solutions". Proceedings of the 5th International Conference on Sustainability of Education, Durban, South Africa, 2005.

Oulton, N. "Total Factor Productivity Growth and the Role of Externalities", *National Institute Economic Review,* 162 (1997): 99—111.

Pritchett, L.,"Where Has All the Education Gone?".Mimeo, World Bank, 1999.

Pritchett, L., "Where Has All the education Gone?"*The World Economic Review*.15.3 (2001): 11-17.

Romer, P.M., "Endogenous Technological Change?." *Journal of Political Economy,*98.5 (1990): 71-102.

Rustichini, A. and Schmitz J.A., "Research and Imitation in Long-run Growth". *Journal of Monetary Economics*, 27.2 (1991): 271-292.

San Segundo, M., "Decentralization and Diversification in Spain". *Higher Education Management*, *9*.3 (1997): 89–100.

San Segundo, M.J. Es rentable la educacion en Espana? Unanalisis de los rendimientos de los ingresosindividuales en 1981 y 1991, La desigual dad de recursos, FundacionArgentaria.

Schulz. *On the Human Capital Investment*. Beijing: Beijing Economic College Press, 2002.

Schutz, T.W., "Investment in Human Capital". *The American Economic Review*, 51.1, 1961: 1-17.

Self, Sharmistha, and Grabowski, R., "Does Education at All Levels Cause Growth? India, A Case Study". *Economics of Education Review* 23 (2003): 47–55.

Sianesi, B. and J. Van Reenen, "The Returns to Education: A Review of the Macro-economic Literature". Discussion paper, DP 6, London: CEE – Centre for the Economics of Education, (LSE), 2000.

Sianesi, B. and van Reenen, J., "The Returns to Education". *Macroeconomics*, 17 (2003):157-200.

Solow, R.M., "Technical Change and the Aggregate Production Function". *Review of Economics and Statistics,*39.3 (1957): 312-320.

Stevens, M., "Human Capital Theory and UK Vocational Training Policy". *Oxford Review of Economic Policy*, 15.1(1999): 16-32.

Temple, J. "A Positive Effect of Human Capital on Growth". *Economics Letters,*65 (1999): 131—134.

Temple, J. "*Growth Effects of Education and Social Capital in the OECD Countries".* ECO/WKP 36, Paris: OECD, 2001.

Todaro M., 'Economics for Developing World,(second edition-1985)

Topel, R., "Labor Markets and Economic Growth". In O. Ashenfelter and Card D. (eds.), *The Hand book of Labor Economics*, Vol. III, , Amsterdam, Elsevier, 1999.

Uzawa, H. "Optimal Technical Change in an Aggregative Model of Economic Growth". *International Economic Review*, 6 (1962):18-31.

Wawire N. H. W. and Nafukho F. M., "Investment in Human Capital through Institutions of Higher Education for the Revival of Kenya's Economy" In Nafukho, F. M. and Chen (Ed.), *Proceedings of the Academy of Human Resource Development*. Bowling Green, Ohio: AHRD, 2006:1184 – 1190.

World Bank, *Basic Information Document on Investment on Education: The Impacts on the Living Standards in the World Economies.* Development Research Group, The World Bank, Washington, D.C, 2010.

Zanden, J. V. "The Carpenter, the Printer ,and the Rise of the European Knowledge Economy *".*Academic Lecture , University of Utrecht, 2004.