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EDUCATION AND ECONOMIC GROWTH NEXUS IN SUB-SAHARAN AFRICA

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Abstract

This study estimated the effects of education on economic growth in Sub-Saharan Africa using a set of cross country panel data from 11 countries during the period 2005-2011. The methodological procedure applied in the analysis followed the Breusch-Pagan Lagrangian Multiplier test and Hausman test techniques. Based on the Fixed Effects (FE) model, estimated results indicate that all levels of education; primary, secondary and tertiary schooling, have positive but insignificant impacts on income per capita growth. The computed R-squared indicates that nearly 21.79 percent total variation in income per capita growth was accounted for by primary, secondary and tertiary education during the period 2005-2011. The F-statistic (=15.45; p <0.05) indicates significance of the model; while the interclass correlation value indicates that nearly 99.53 percent of the variance was due to differences across panels.

Keywords: education, economic growth, primary, secondary, tertiary, enrolment

INTRODUCTION

Education remains as one of the most powerful instruments for sustained economic growth (World Bank, 2012). Modern growth theory regards education human capital as an effective engine of economic growth (Gyimah-Brempong, Paddison & Mitiku, 2006). Following Quang (2012), education improves individuals' knowledge and productive capabilities that stimulate economic growth. Thus, raising the schooling levels of the population is an integral part of the productive development strategy. Hanushek & Woessmann (2007), however, maintain that although a number of countries have expanded schooling opportunities, the approaches undertaken remain ineffective towards yielding the anticipated student outcomes. While considerable studies indicate that education contributes positively towards economic growth, questions still remain on which levels of education significantly drive economic growth. In context of developing economies, some studies emphasise tertiary education as the major source of economic growth (Romer, 1990; Hall & Jones, 1999); while other studies regard primary education as the major driving force of economic growth (Petrakis & Stamatakis, 2002;

and McMahon, 2002). In this respect, the objective of this study was to analyse the effects of education in promoting the economic well-being of countries in the Sub-Saharan African region.

LITEREATURE REVIEW

In either endogenous or expanded neoclassical growth model, education can be regarded to have a positive effect on economic growth. According to Azariadis & Drazen (1990) and Rebelo (1991), even the minimum level of education is needed in order for education to have a measurable impact on economic growth. Hanushek & Woessmann (2007) maintain that the availability of microeconomic evidence of human productivity-enhancing effects of education provides a reasonable ground to consistently review the effects of education on the economic well-being of countries. Artadi & Sala-Martin (2003) indicate a positive relationship between primary school enrolment rates and income per capita in African countries.

Appiah & McMahon (2002) reveal that education positively affects income growth through improved health and environment. Agiomirgianaskis, Asteriou & Monasitiriotis (2002) and Voon (2002) report that, ceteris paribus, the higher the level of education, the stronger the growth impact of growth. Borrowing from Barro (1991), Barro (1999) and Mankiw, Romer & Weil (1992), studies by Hanushek (1995) and Krueger & Lindahl (2001) report significant positive association between mean years of schooling and economic growth. However, studies by Benhabib & Spiegel (1994), Barro & Lee (1994), Barro (1999), Barro & Sala-i-Martin (1995), Bils & Klenow (2000) and Pritchett (2001) find no significant relationship between higher education and economic growth.

Extending further from Hanushek &Woessmann (2007), a possible reason of such findings could be linked to the rationale that ignoring quality differences in education significantly distorts the true picture of the relationship between education and economic growth.

RESEARCH METHODOLOGY

The study used cross country data for sixteen countries during the period 2005 to 2011. Annual data on GNI per capita growth, primary enrolment ratio, secondary enrolment ratio and tertiary enrolment ratio were used in the study. Data on all the variables were obtained from the World Bank's World Development Indicators (World Bank, 2012) online database. The estimation procedure applied followed statistical evaluation of the Pooled OLS regression, GLS Random Effects (RE) model and Fixed Effects (FE) model using the Breusch-Pagan Lagrangian Multiplier test and Hausman test approaches.

$$\text{Pooled OLS model}: Y_{it} = \alpha + X'_{it}\,\beta(\alpha_i - \alpha + e_{it}) \quad \text{---------- (1)}$$

$$\text{Random Effects (RE) model}: Y_{it} = \alpha + X'_{it}\,\beta + (u_i + \upsilon_{it}); \upsilon_{it} \sim IID(0, \sigma_v^2) \quad \text{---------- (2)}$$

$$\text{Fixed Effects (FE) model}: Y_{Iit} = \alpha_i + X'_{it}\,\beta + u_i + e_{it} \quad \text{---------- (3)}$$

The Breusch and Pagan Lagrangian Multiplier test was run on the RE model to choose between the Pooled OLS model and RE model. The LM test was run based on the formulation:

$$LM_u = \frac{nT}{2(T-1)}\left[\frac{\sum(\sum e_{it})^2}{\sum\sum e_{it}^2} - 1\right]^2 = \frac{nT}{n(T-1)}\left[\frac{\sum(T)\bar{e}_i}{\sum\sum e_{it}^2} - 1\right] \sim \chi^2(1) \quad \text{---------- (4)}$$

Following rejection of the hypothesis that Pooled OLS was appropriate (Table 2), the Hausman test was run to choose between RE model and FE model based on the specification:

$$H = \left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right)' \left[\left(V\left(\hat{\beta}_{FE}\right) - V\left(\hat{\beta}_{RE}\right)^{\wedge}(-1)\right)\right]\left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right) \quad \text{---------- (5)}$$

Results of the Hausman test was used to select the appropriate model between RE and FE at 5% level of significance. Differences across panels were measured by interclass correlation; which approaches 1 if the respective individual effects dominate the idiosyncratic error. The econometric estimation method used was a single equation model formulated as:

$$GNI\ per\ capita\_g_{it} = \alpha + \beta_1(\text{Primary edu}_{it}) + \beta_2(Secondary\ edu_{it}) + \beta_3(Tertiary\ edu) + u_{it} \quad \text{- (6)}$$

RESULTS & DISCUSSION

Breusch and Pagan Lagrangian Multiplier (LM) Test

The Breusch and Pagan LM test was applied on the RE model estimates (Table 1) to test whether Pooled OLS regression was the appropriate model to apply for analysis.

Table 1: GLS Random Effects results

R-squared:	within = 0.4603		obs per group: min = 1			
	Between = 0.6495		avg = 3.0			
	overall = 0.5141		max = 7			
			Wald chi2(3) = 17.55			
	corr(u_i,x) = 0 (assumed)		Prob > chi2 = 0.0005			
GNI per capita growth	Coeff.	Std. Err.	z	P >| z |	95% Conf.	Interval
Primary enrolment	.000428	.0005465	0.78	0.434	-.0006432	.0014991
Secondary enrolment	.0009415	.0005161	1.82	0.068	-.00007	.001953
Tertiary enrolment	.000252	.0004773	0.53	0.598	-.0006835	.0011875
_cons	.358887	.0631989	5.68	0.000	.2350193	.4827546
sigma_u	.11517118					
sigma_e	.0083721					
rho	.99474356					

The Breusch and Pagan Lagrangian Multiplier test for random effects results (Table 2) rejected the null hypothesis that the Pooled OLS model was appropriate.

Table 2: Breusch and Pagan Lagrangian Multiplier test for Random Effects results

	Var	sd = sqrt(Var)
GNI per capita growth	.0253879	.1593359
e	.0000701	.0083721
u	.0132644	.1151712
Test: Var (u) = 0	Chibar2(01) = 45.50	Prob > chibar2 = 0.0000

The FE model was further run (Table 3) to appropriately select between the RE and FE.

Table 3: Fixed Effects results

R-squared:	within = 0.4720			obs per group: min = 1		
	between = 0.6019			avg = 3.0		
	overall = 0.3964			max = 7		
				F(2, 64) = 6.26		
	corr(u_i, Xb) = 0.5728			Prob > F = 0.0033		
GNI per capita growth	Coeff.	Std. Err.	z	P >| z |	95% Conf.	Interval
Primary enrolment	.0006848	.0005022	1.36	0.187	-.0003597	.0017292
Secondary enrolment	.0005603	.0004791	1.17	0.255	-.0004361	.0015567
Tertiary enrolment	.0004799	.000432	1.11	0.279	-.0004184	.0013782
_cons	.3084014	.0460767	6.69	0.000	.2125796	.4042233
sigma_u	.15797371					
sigma_e	.0083721					
rho	.99719921					
F test that all u_i = 0:	F (11, 21) = 534.72			Prob > F = 0.0000		

The Hausman test (Table 4) was applied to select the appropriate model between RE and FE.

Table 4: Hausman test results

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b – V_B)
	FE1	RE1	Difference	
Primary enrolment	.0006848	.000428	.0002568	.000155
Secondary enrolment	.0005603	.0009415	-.0003812	.0001655
Tertiary enrolment	.0004799	.000252	.0002279	.0001044
Test H0: difference in coefficients not systematic				
chi2(3) = 9.33			Prob > chi2 = 0.0252	

Following the results from the Hausman test, the null hypothesis that the Random Effects model was appropriate was rejected; indicating that the differences between the FE model and the RE model were systematic. Therefore, the coefficients of the FE model were efficient. Based on results of the FE model, education; as measured by primary, secondary and tertiary enrolment ratios; revealed positive but insignificant effects on income per capita growth in Sub-Saharan Africa during the period 2005-2011. Although statistically insignificant, but primary education; in

comparative terms, had the highest positive effect on economic growth; followed by secondary education; and tertiary education had the least effect on economic growth. Overall, the R-squared statistic indicates that nearly 39.64 percent total variation in income per capita growth was accounted for by education in the region. The interclass correlation shows that nearly 99.71 percent of the variance was due to differences across panels.

CONCLUSION & SCOPE FOR FURTHER RESEARCH

The results of this study are consistent with the findings by Barro & Lee (1994), Benhabib & Spiegel (1994), Barro & Sala-i-Martin (1995), Caselli et al., (1996), Barro (1999), Bils & Klenow (2000) and Pritchett (2001) who find no significant positive relationship between education and economic growth. Following Hanushek & Woessmann (2007), such findings could be linked to the notion that ignoring quality differences in education potentially distorts the true underlying picture of the nexus between education and economic growth. Linked to this view, the UNESCO (2011) indicate that although secondary enrolment increased in sub-Saharan Africa, most youth enter the labour market with no training, hence they cannot be absorbed for employment. Against this background, future research on the effect of education on economic growth should focus on education quality rather than quantity. Analyzing indicators of quality differences in education can provide an improved picture of the magnitude to which education affects growth.

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