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GENDER EQUALITY IN EDUCATION AND ECONOMIC GROWTH IN SELECTED SOUTHERN AFRICAN COUNTRIES

Elsa Alexandra Licumba
Janet Dzator
James Xiaohe Zhang

University of Newcastle, Australia

ABSTRACT

This research examines the impact of gender equality in education on economic growth on a panel data of five Southern African countries between 1970 and 2010. Gender equality in education is measured by a ratio of girls to boys in primary enrolment and economic growth is measured by real GDP per capita at 2005 constant prices. Instrumental Variable Technique is employed and the evidence presented in this analysis suggests that there is a positive, robust and significant effect of gender equality in education on economic growth in the region. This result advocates some policy adjustment in education planning within the region to ensure retention of girl students as well as raising education quality, to stimulate economic growth and advance other valuable development goals.

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Corresponding Author's Email Address: Elsa.Licumba@uon.edu.au

INTRODUCTION

In Southern Africa Development Community (SADC) the issue of promoting gender equality and female empowerment is perhaps the most important of the eight Millennium Development Goals. In June 1998 the SADC created a Gender Unit to assure implementation of gender based policies across the region. Then in 2008 the SADC created the Protocol on Gender and Development (SPG). The target associated with the SPG is among others to eliminate gender disparity at levels of enrolment by 2015 (World Bank 2001).

Since poverty still remains a big challenge in this region when more than half of population lives on less than $2 dollars a day and more than 45 per cent of population living in abject poverty, economic growth has been seen as a key ingredient to reduce poverty as it expands economic opportunities for disadvantaged people (Southern Africa Trust 2011). It has been advised that in order to reduce poverty SADC needs to embrace an inclusive growth approach. This entails recognition by all stakeholders of the importance of both men and women's participation in economic activities. Blackden et al. (2006) explains how the elimination of all forms of gender based inequalities in Africa will represent a huge step towards economic growth and development. Indeed the Africa Partnership Forum (2007) estimates that restricted female participation in education and paid workforce reduces Africa annual growth rate by 0.8 %.

At present, gender parity in education remains an unfinished business as less than half of the SADC member countries have achieved the targeted parity in all levels of education. Therefore the civil society has made strong calls to review the current SPG context. Clearly gender equality in education remains a concern for policy makers in this region not only because this equality in education is a basic human right, but also because it represents an important source of creating sustainable economic growth, employment and productivity.

While there is a sound theoretical framework for a significant role of gender equality in education on economic growth, the empirical evidence for testing this has not been so straightforward. The attempts of testing a positive and significant contribution of gender equality in education on economic growth have derived some mixed results. Furthermore as the empirical evidence comes from various parts of the world, only very little attention has been devoted to the SADC region. This study aims to fill this gap in the empirical literature by providing some new evidences on this matter from the SADC region, and offers some assistance to the policy makers in the region in evaluating their current and past pro-gender equality interventions towards economic growth and development.

The remainder of the paper is organized as follows: next section briefly reviews the literature on gender equality in education and economic growth. This is followed by the introduction of methodology of this research

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and presentations the empirical results derived from the estimations. After a brief discussion on the results, conclusions and policy implications are summarised in the final section.

LIERATURE REVIEW

Theory

The theoretical rationale to address the effect of gender equality and economic growth is based on education human capital and economic growth theories (Stotsky 2006) which have gone through a process of evolution starting from classical theories of economic growth to modern growth theories. In the modern growth theories, human capital especially education plays a decisive role in expanding productivity and production frontiers. In a model developed by Lucas (1988), agents invest in human capital formation via formal education and on job training which in turn increase workers' productivity. While Lucas derives clear policy implications towards human capital accumulation, Lagerlof (2003) among the few theoretical models explains how changes in gender equality in education are likely to affect the process of growth of such human capital.

The Lagerlof model is based on an overlapping generation framework. Agents are seen as having identical preferences and capabilities; however they may be endowed with different amounts of human capital. While a male agent in adult period *t* is assumed to be endowed with h_t^m units of human capital, a female in the same adulthood is endowed with h_t^f units of human capital. For each unit of human capital there is an exogenously given wage, *w* per unit of time worked which is the same for both sexes.

Gender equality is defined by the ratio between female and male years of schooling

$$\mu_t = \frac{h_t^f}{h_t^m}, \quad \text{where } \mu_t \in (0,1) \tag{1}$$

The human capital of a couple's children is denoted by h_{t+1}^m and h_{t+1}^f, being male and female respectively. The cost of rearing children (q_t) is given by

$$q_t = z + bwh_t^f \tag{2}$$

where *z* indicates the units of the consumption goods, *b* the units of time and *w* is wage per unit of time. The sum of male and female human capital of the couple's children is given by:

$$h_{t+1}^m + h_{t+1}^f = \left(\frac{\delta}{1-\delta}\right) q_t \tag{3}$$

where $\delta \in (0,1)$

Using equation (2) and (3) Lagerlof derives the equation for gross growth rate (γ_{t+1}) of the sum of male and female human capital which is given by:

$$\gamma_{t+1} = \frac{h_{t+1}^m (1+\mu_{t+1})}{h_t^m (1+\mu_t)} = \left(\frac{\delta}{1-\delta}\right)\left[\frac{{}^{a}/_{h_t^m} + b\mu_t w}{1+\mu_t}\right] \tag{4}$$

Then this model uses equation (4) to explain the effect of gender equality in education in two distinct economies: growing and non-growing. For a growing economies Lagerlof assumes that $\gamma_{t+1} > 1$ which occurs as h_t^m goes to infinity

$$\lim_{h_t^m \to \infty} \gamma_{t+1} \equiv \gamma^* = \left(\frac{\delta}{1-\delta}\right)\left(\frac{bw\mu}{1+\mu}\right) > 1 \tag{5}$$

He also assumes that in a growing economy $\mu_t > \tilde{\mu}$, where $\tilde{\mu}$, represents a given threshold value for gender equality in education. Therefore in a growing economy γ_{t+1} goes up when μ_t goes up.

In this model as equality in education goes up women's time becomes expensive and couples tend to substitute quantity for quality of children. Fertility rates decline and investment on human capital and income per

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capita rises. On the other hand while human capital rises mortality rates decline, causing growth of population to increase at same pace with income per capita growth. Eventually while mortality rates stabilize and fertility continues to decline, population growth starts to decline, while income per capita growth continues to increase, and stabilizes on a balanced growth path.

In a non-growing economy Lagerlof assumes that gender equality is usually smaller than a given threshold of gender equality, ($\mu_t < \hat{\mu}$) and then $\gamma_{t+1} = 1$ and therefore γ_{t+1} converges to a non-growing state or a Malthusian poverty trap.

Empirical Evidence

A number of cross country growth studies have examined the significance of gender equality in education on economic growth. This literature is marked by the use of different time frames. Most empirical analysis usually starts around 1965 and tends to cover up to 2000. Under this literature there are two distinct forms of analysis: those who consider the impact of separate female and male education and others that focus on the impact of a ratio of female to male education on economic growth. This paper will briefly review both forms.

Separate Female and Male Education Affects Economic Growth

At aggregate level the empirical evidence of the effect of education disaggregated by gender is not overwhelmingly conclusive. Barro and Lee (1994)'s paper is among those who pioneered such investigation of the impact of separate female and male education on economic growth. On a seminal paper entitled *Sources of Economic growth* their study included 115 countries and female education was measured by years of schooling. The results indicate female education displayed a negative and significant coefficient on growth for both secondary and higher education levels. On the other hand male secondary and higher education remained positive and significant for economic growth. The implication is therefore female education may not have a direct effect on economic growth.

These findings have ignited the empirical debate on the role of female education on economic growth and as a result a number of studies have revisited this study. Logerlly and Owen (1999) expressed their concerns on the possibility of the presence of influential observations as well as high collinearity between both female and male education variable. Therefore they conclude that the coefficient observed by Barro and Lee on both female and male education changes significantly when outlier observations are removed from the sample. East Asia countries were identified as potential outlier's countries in the sample. When female or male education variables are excluded from the empirical analysis the size and significance of the coefficients also changes significantly. That is because Logerlly and Owen identified that female and male education variables were highly correlated making it difficult to detach the effect of each one of the variables.

In another paper Dollar and Gatti (1999) highlighted two important issues from the Barro and Lee's analysis. The first one is that the effect of female education on economic growth depends on the countries degree of industrialization where Barro and Lee's findings did not account for. When Dollar and Gatti split the sample into industrialized and non-industrialized nations the results indicate female secondary education to be relevant only for the sample of industrialized countries. The second one is that female education variable does suffer from endogeneity in Barro and Lee's analysis. After the endogeneity is removed, Dollar and Gatti (1999) found that the female secondary education becomes positive but not significant to economic growth. Male coefficient turns out to be negative and not significant as well, for the whole sample.

As per Kalaitzidakis et al. (2001) the effect of gender equality in education depends on a country's level of human capital. Their analysis divided their sample of 11 countries into two main categories: high and low human capital economies. The results indicate that female primary education was only relevant in low human capital economies. A further analysis of Knowles, Lorgelly and Owen (2002) reveal a positive and significant effect of female education on economic growth for their sample thus suggesting that countries with high levels of female schooling will have higher levels of labour productivity and growth, regardless of the degree of industrialization and/or level of human capital.

Ratio of female to male education on economic growth

There is another line of research that focuses on the effect of the ratio of education attainment of different genders. A wider range of indicators including literacy rates (Chaudhry 2007; Baliamoune-Lutz & McGillivray 2009), enrolment and vocational rates (Hill & King 1995; Qureshi et al. 2011; Tansel & Gungor 2013; Brummet 2008) or years of schooling (Klasen 2002; Klasen & Lamanna 2009; Dahal 2011; Brummet 2008) are used to compare the

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divergence between boys and girls. Hill and King (1995) explain the main reason for adoption of education ratio as opposed to separate male and female education is to avoid collinearity problems between female and male education variables. Differing from previous work Hill and King (1995) measured education by enrolment rates and their study suggests that while countries with high gender disparity in education display a negative coefficient of education ratio on economic growth, countries with low gender disparities indicate a positive and significant coefficient for education ratio. Brummet (2008) also tried to avoid the multicollinearity problem by employing an education ratio measure and reports that ratio of primary education to be significant in low income countries.

Baliamoune-Lutz and McGillivray (2009) explicitly addressed the endogeneity problem of gender equality in education variable and discover that gender equality in youth literacy was found to be positive, significant and robust on economic growth. Later on Tansel and Gungor (2013) employed geographic location as an instruments for gender equality in education variable and found that female education to be relevant in developed regions subsample.

In another study Klasen (2002)estimated the effect of a ratio of female to male years of schooling for a mixed sample of 109 countries between 1960 to 1990. The results indicate gender equality measure to display a positive and significant coefficient on economic growth. This finding is robust to changes in specification and when Instrumental Variable is introduced the effect remains positive and significant.

Later Klasen and Lamanna (2009) extended Klasen (2002)analysis with more recent data up to 2000 and expanded the sample to 121 countries. The study confirmed the positive effect of gender equality in education for the aggregate sample but negative and not significant for the subsampled OECD countries. For the case study of a single country, while Dahal (2011) found that gender disparity in education is detrimental for the economic growth in Nepal, Qureshi et al. (2011) confirms that gender equality in education affects economic growth in Pakistan. Majority of empirical analysis in this topic focuses on cross country regression.

Although a number of studies have examined the relationship between gender equality in education and economic growth, to the best of our knowledge, no previous studies have concentrated on Southern African Countries. This paper aims to fill this gap.

DATA AND METHODS

Data

This study uses panel data from SADC countries from 1970 to 2010 to analyse the impact of gender equality in education on economic growth. The study takes data from World Bank, Polity Project version IV and Penn World Tables version 7.1. Table 1 provides a brief definition of each variable included in the analysis, along with a summary of statistics.

Methods

Drawing upon the discussion on previous section and following Baliamoune-Lutz and McGillivray (2009), the relationship between gender equality in education and economic growth is based on the specification of the following model.

$$lnrgdp = \alpha + \beta_1\, inv + \beta_2 open + \beta_3 democ + \beta_4 fert + \beta_5\, lntenrolp_{t-2} + \beta_6 ratiop + \varepsilon_{i,t} \qquad (5)$$

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TABLE 1 VARIABLE DEFINITION AND SUMMARY OF STATISTICS

Variable	Definition	Data Source	Obs	Mean	Std. Dev.	Min	Max
lnrgdp	Real GDP per capita (Laspeyres) at 2005 constant prices	Penn World Table version7.1 (Alan Heston, Robert Summers, and Bettina Aten,2002)	205	7.28	1.11	5.67	9.29
KI	Investment Share of PPP Converted GDP Per Capita at 2005 constant prices	Penn World Table version7.1 (Alan Heston, Robert Summers, and Bettina Aten,2002)	205	29.78	13.38	6.71	64.1
openk	Exports plus Imports divided by Real GDP per capita at 2005 constant prices (%)	Penn World Table version7.1 (Alan Heston, Robert Summers, and Bettina Aten,2002)	205	87.23	46.01	6.69	183.01
democ	Institutional democracy	Polity IV project (Marshall and Jaggers, 2003)	196	4.66	3.94	0	10
fert	Births per woman	WDI(World Bank)	205	4.84	1.62	1.47	6.77
lntenrolp	Enrolment in primary. Public and private. All programmes. Total	WDI(World Bank)	193	13.18	1.34	11.27	15.97
ratiop	Ratio of girls to boys in primary education (%)	WDI(World Bank)	193	100.78	18.70	51.15	150.74

Source: Author's calculations.
Note: Between a 0.97 to 1% parity is achieved; if ratiop is greater than 1(ratiop>1) female have advantage and if it is smaller (ratiop<1) male have advantage.

A set of regression equation have been carried out for the sample, using Stata software version 12. SADC is made up of 15 countries in total however the number of panels was also restricted by data availability. Data on education particularly on enrolment in secondary and tertiary level is not available for some countries and in some cases is only available for few of years which makes the empirical analysis difficult. Therefore the countries were reduced to five namely: Botswana, Lesotho, Mauritius, Mozambique and Tanzania with more focus on primary education enrolment data. Primary education is the basis for development of high quality skills in literacy and numeracy. These skills are seen as critical for scientific development and technology adoption (SADC Gender Protocol 2014 Barometer & 2014). Data on the remaining variables is available from 1970 until 2010 for most countries therefore the study has focused on this period.

Firstly we start by selecting variables that are commonly used in studies that particularly focus on the effects of gender equality in education on economic growth. They include human capital, investment and fertility rates. There are different measures for human capital in empirical literature and this study uses enrolment rates as an indicator of it. Our measure of human capital differs from Klasen (2002) who used years of schooling in a large sample and Baliamoune-Lutz and McGillivray (2009) who used youth literacy. In this study the choice is justified subject to data availability for these countries. Given the possible delay on the effect of education on economic growth, a lagged period of 2 years is adapted as in Haldar and Mallik (2010).

Gender equality is measured by the ratio of female to male enrolment in primary education. It could be that there are better measures of gender equality in education such as years of schooling employed by Klasen and Lamanna (2009) and Klasen (2002), however schooling data is available for every five years only. Given that the sample has been already reduced to five panels, using schooling data would not aid the analysis as observations were small. It should be pointed that enrolment rates has also been included as regressors for gender equality in all studies by Barro and Lee (1994) Dollar and Gatti (1999) and Brummet (2008).

Following Baliamoune-Lutz and McGillivray (2009), Klasen (2002)and Klasen and Lamanna (2009) the study uses trade dependency ratio to measure of country integration in world markets. This represents an important

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variable in the empirical study because within SADC there are trade dynamics happening both at regional and international level. Previous studies have accounted for country's integration by including an indicator for distortions in the trade regime such as black market premium on foreign exchange Barro and Lee (1994) Dollar and Gatti (1999).

Empirical literature explains that governance or institutional context may play a key role in education. A bad institutional environment may disturb growth patterns. It disturbs by causing an environment whereby there is an excess supply of educated labour which causes the marginal returns to education to decline. Also it may affect the quality of education by lowering its standards (Baliamoune-Lutz & McGillivray 2009). This papers accounts for this factor by including democracy in the model which ranges from 0 to 10, yearly. However it is acknowledged that there are better measures of governance such as rule of law used by Dollar and Gatti (1999). This variable has to be dropped because the unavailability of data for the early years.

The four OLS key assumptions for unbiasedness, such as linearity, random selection, multicollinearity and endogeneity, were tested. The human capital variable did display a result deviating from linearity. For that reason it was transformed into logarithm. The remaining variable indicates a result close to linearity and no transformation was needed. The values of each variable within the sample study were randomly selected .The model does not suffer from multicollinearity given that none of the variables has a correlation (*r*) greater than 0.8 as can be seen in Table 2. The variable of interest, *ratiop* displays a correlation value ranging from of 0.01 to 0.4. Wooldrige (2009) explains that this value is acceptable given that some collinearity but not perfect collinearity is accepted.

TABLE 2. PEARSON CORRELATION COEFFICIENTS

	***ln*rgdp**	**inv**	**open**	**democ**	**fert**	***Ln*tenrolp**	**ratiop**
***ln*rgdp**	1.0000						
inv	0.5604	1.0000					
open	0.4505	0.4765	1.0000				
democ	0.8179	0.3892	0.5623	1.0000			
fert	-0.7862	-0.2823	-0.5978	-0.8400	1.0000		
***ln*tenrolp**	-0.6389	-0.5220	-0.6992	-0.6185	0.5829	1.0000	
ratiop	0.1981	0.3816	0.5460	0.0104	-0.0914	-0.4634	1.0000

Source: Author's calculations

Wooldrige explains that the sources of endogeneity can be through functional form misspecification, which in its turn may be associated with omitted bias. Another source of endogeneity is the measurement error. Therefore the study tested for omitted bias and the results indicate that we fails to reject the null hypothesis that there is no omitted bias at 5% significance (p=0.15). This implies there might not be any form of omitted bias. In regards to measurement error, Wooldrige (2009) recommends that whether they may be present or not are for empirical analysis, it is assumed to be uncorrelated with all predictor variables.

However it could be that endogeneity is present and the error term is correlated with predictor variable in other possible ways. Furthermore there is significant amount of empirical and theoretical literature suggesting the endogeneity on the gender equality variable. Gender disparity in education may be to some degree a result of a socio economic context, whether it is intend or not (Seguino & Were 2013). Based on these arguments OLS is abandoned as it could no longer be the unbiased estimator to properly address endogeneity. Therefore analysis is conducted using Instrumental Variable (IV) techniques, to account for the possible endogeneity of the gender equality variable. Gender equality in education is instrumented by religion as in Dollar and Gatti (1999), Klasen and Lamanna (2009), and Baliamoune-Lutz and McGillivray (2009). The argument is that explain that it is more likely to observe significant gender inequalities in education in Muslim countries. This can be reflected in the form of lower female labour participating rate as well as literacy rates.

We test whether religion can be used as an instrument for gender equality. The results indicate religion as a

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powerful instrument for gender equality at 5% percent significance level (p=0.028). We fail to reject the null hypothesis that variables are exogenous at p=0.4747. No over identification test was performed given that the data it is just identified, that is there is one instrument for one variable

Additional data diagnostics were performed. The homoskedascity assumption was tested using the Breusch-Pagan / Cook-Weisberg test and results indicate the study reject the null hypothesis that variance of error term is constant at 5% significance (p=0.0000). That means error variance is not constant and heteroskidascity is present. This will not bias the coefficients but the T and F tests as well as standard errors. However in order to address heteroskidascity the heteroskidascity -robust standard errors option was employed as suggested by Wooldrige (2009). The serial correlation test indicates that the study rejects the null hypothesis that there is no first-order correlation at 5% significance level (p=.0008). The conclusion is that errors associated of one observation are correlated with the error of any observation in the sample that is there is autocorrelation. The Levin-Liu-Chu test was employed for unit root test as the data is balanced and contains five panels. The results indicate that the study rejects the null hypothesis that panels contains unit root at 5% significance level (*adjusted* t=-3.9 and p=0.000) and conclude that series do not contain unit root and therefore are stationary and/or weakly dependent. The normality of residual distribution is tested with the Sapiro-Wilk test and results indicate the residual to follow a normal distribution. No significant outliers were observed in the model.

RESULTS

The study has adopted the Instrumental Variable Estimator based on data diagnostics test; and the results are displayed in Table 3 where gender equality in education is defined by a ratio of girls to boys in primary education. All models have a high explanatory power with good R square values which imply better predictive ability. Equation 1 to 3 displays the coefficients for the whole sample. From equation 4 to 7 we include some country dummies variables depending on their collinearity with other countries.

In equation (1), the coefficient on fertility is negative and democracy positive and both are significants. Gender equality in education is positive but not significant. Trade dependency ratio is negative and not significant. However from equation 2 gender equality in education becomes positive, robust and significant for 1 and 10 % significance levels. Fertility has an expected negative, robust and significant impact on economic growth as well. Trade dependency ratio is positive, robust and very significant from equation 2. Investment rate is also positive and significant to economic growth. The democracy variable remains positive and significant exceptionally in equation 6. One important finding is that human capital which is lagged two years is negative and not significant for growth in most of these countries. The coefficient on Botswana dummy is positive and robust while Lesotho Mauritius and Mozambique have a negative and significant coefficient.

The study also tested the sensitivity of our results to changes in the model specification. The dependent variable was re-specified to per capita GDP at purchasing power parity as opposed to real GDP per capita. In addition a time tend variables was added to the existing explanatory variable. The results are displayed in Table 4.

Majority of variables in Table 4 display similar results to the previous model. Gender equality in education remains positive and significant at 1% significance level. Democracy remains positive and significant economic growth and fertility remains negative and very significant for economic growth which goes well with the theoretical predictions. Again human capital remains negative and significant to economic growth for these countries. The additional time trend or year effect variable displayed a significant effect on economic growth.

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TABLE 3 RESULTS OF PANEL REGRESSION

	(1) lnrgdpl	(2) lnrgdpl	(3) lnrgdpl	(4) lnrgdpl	(5) lnrgdpl	(6) lnrgdpl	(7) lnrgdpl
ratiop	0.0256	0.0168*	0.0397***	0.0378***	0.0393***	0.00176	0.0187***
	(0.0191)	(0.00656)	(0.0107)	(0.00801)	(0.00691)	(0.00242)	(0.00332)
openk	-0.0102	0.0121***	0.0160***	0.0140***	0.000584	0.00357***	0.00337***
	(0.00613)	(0.00154)	(0.00265)	(0.00251)	(0.00173)	(0.000790)	(0.000754)
democ	0.211***	0.160***	0.242***	0.148***	0.0276	-0.0215*	0.00948
	(0.0388)	(0.0253)	(0.0387)	(0.0325)	(0.0202)	(0.00872)	(0.00880)
fert	-0.239***	-0.274***	-0.219***	-0.453***	-0.472***	-0.434***	-0.540***
	(0.0467)	(0.0484)	(0.0447)	(0.0410)	(0.0324)	(0.0139)	(0.0213)
ki	—	0.0229***	—	0.00784	0.0118**	0.00188	0.00662**
		(0.00379)		(0.00518)	(0.00392)	(0.00156)	(0.00224)
laglntenrolp	—	-0.115*	-0.0658	0.0988	0.158**	-0.0354	-0.175***
		(0.0506)	(0.0970)	(0.0670)	(0.0583)	(0.0230)	(0.0364)
Botswana	—	—	—	0.902***	0.649***	1.093***	—
				(0.155)	(0.152)	(0.0419)	
Lesotho	—	—	—	—	-1.654***	-0.943***	-2.088***
					(0.204)	(0.0713)	(0.0750)
Mozambique	—	—	—	—	—	-0.636***	-0.499***
						(0.0787)	(0.0967)
Mauritius	—	—	—	—	—	—	-1.272***
							(0.0719)
_cons	5.817***	8.110***	5.545*	4.514**	3.203*	9.499***	10.57***
	(1.550)	(1.258)	(2.300)	(1.591)	(1.408)	(0.543)	(0.831)
N	188	178	178	178	178	178	178
R^2	0.771	0.850	0.716	0.818	0.883	0.977	0.970
adj. R^2	0.766	0.845	0.708	0.810	0.877	0.976	0.968
F							
df_m	4	6	5	7	8	9	9
df_r							
rmse	0.523	0.422	0.580	0.465	0.373	0.165	0.190

Source: Authors calculations.

*Notes: The term rmse is the root mean square error; df_r the degrees of freedom of the residuals; df_m the degrees of freedom of the model and N is the sample size.*Significance level at 90 percent, ** Significance level at 95 percent and ***Significance level at 99 percent. The standard error are in parentheses*

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TABLE .4.1 ROBUSTNESS CHECK

	(1) lncapgdppp	(2) lncapgdppp	(3) lncapgdppp	(4) lncapgdppp	(5) lncapgdppp
ratiop	0.0326***	0.0103***	0.0237***	0.0469***	0.0809***
	(0.00553)	(0.00313)	(0.00242)	(0.00370)	(0.0104)
ki	-0.00865	0.00920***	0.000899	-0.00615***	-0.0108***
	(0.00524)	(0.00245)	(0.00175)	(0.00149)	(0.00272)
openk	-0.0159***	0.00645***	0.00489***	0.00579***	0.0108***
	(0.00102)	(0.00138)	(0.000976)	(0.00120)	(0.00258)
democ	0.0535*	0.0102	0.00939	0.0200*	0.0377*
	(0.0213)	(0.0110)	(0.00594)	(0.00993)	(0.0170)
fert	-0.756***	-0.386***	-0.432***	-0.397***	-0.750***
	(0.0697)	(0.0487)	(0.0267)	(0.0240)	(0.0560)
laglntenrolp	0.0831	-0.474***	-0.281***	-0.581***	-1.065***
	(0.0551)	(0.0531)	(0.0403)	(0.0611)	(0.181)
Time trend (t)	-0.00776***	0.0210***	0.0118***	0.0251***	0.0187***
	(0.000929)	(0.00180)	(0.00168)	(0.00301)	(0.00424)
Botswana		2.900***	2.052***	3.478***	
		(0.187)	(0.166)	(0.310)	
Lesotho			-0.542***	0.0926	-3.524***
			(0.0822)	(0.128)	(0.371)
Mozambique				0.637***	0.455*
				(0.131)	(0.200)
Mauritius					-4.226***
					(0.648)
_cons	9.122***	10.98***	8.992***	8.644***	15.91***
	(0.548)	(0.367)	(0.335)	(0.373)	(1.355)
N	91	91	91	91	91
R^2	0.965	0.990	0.995	0.993	0.978
adj. R^2	0.962	0.989	0.995	0.992	0.976
F					
df_m	7	8	9	10	10
df_r					
rmse	0.219	0.118	0.0794	0.102	0.172

Source: Authors calculations

Note: lncapgdppp refers to per capita GDP in PPP The term rmse is the root mean square error; df_r the degrees of freedom of the residuals;

*df_m the degrees of freedom the model and N is the sample size.*Significance level at 90 percent (p < 0.01),*

*** Significance level at 95 percent (* p < 0.05) and ***Significance level at 99 percent (p < 0.001). Standard errors in parentheses.*

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DISCUSSION

This study has found that over the long run that the effect of gender equality on economic growth to be positive, very significant and robust. This is consistent with the results found by Klasen and Lamanna (2009); Klasen (2002) who obtained similar results using a ratio of years of schooling data. It is also consistent with Brummet (2008) who used both primary enrolment rates and years of schooling ratio measures. However Brummet found that the impact of ratio of primary enrolment to be much stronger and relevant compared to the impact of years of schooling ratio. Similar results were found by Baliamoune-Lutz and McGillivray (2009) using youth literacy ratio on a much larger panel. They are not consistent with Barro and Lee (1994) who employed separate female and male education variables. The sizes of coefficients cannot be directly compared because each study uses different model specification, some use log-log level others level-level and others log-level.

When we account for country specific effect Botswana country dummy is positive and significance which indicates a deviation from the baseline intercept while others derived a negative coefficient. It could reflect the advantaged position Botswana holds compared to the rest of the countries in the sample. Although all countries are in the middle income range except for Mozambique which is in a low income range, Botswana is the only country in the region considered as upper middle income country. Mozambique despite being low income seems to have a smaller deviation compared to better income groups' countries such as Lesotho and Mauritius.

Human capital measure indicated by enrolment in primary schools is not significant over the long term which is different from Keller (2006) who suggests that raising enrolment rates and expenditure in lower stages of education is good for growth. On the other hand Chatterji (1998) emphasises the need to target tertiary over secondary levels for economic growth. It could be that our measure is inappropriate for the level of education required to enhance growth. Also it could be that our measure of education may reflect the low quality of education in this region. The quality of education also matters to create a more prepared skilled force (Logerlly & Owen 1999). This is an issue that may require further studies.

The positive and significant effect of investment is consistent with the findings observed by Klasen (2002); Klasen and Lamanna (2009); Baliamoune-Lutz and McGillivray (2009). Fertility coefficient is consistent with Lagerlof (2003) and has a negative and significant effect on growth. However, Baliamoune-Lutz and McGillivray (2009) did found fertility to be insignificant for growth. The positive effect of trade dependency ratio over the long run is consistent with Brummet (2008); Klasen (2002) and Baliamoune-Lutz and McGillivray (2009).

CONCLUSION AND POLICY IMPLICATIONS

This study has examined the extent to which equality in education reduces economic performance in five SADC countries during 1970-2010. Measuring gender equality in education by a ratio of girls to boys in primary enrolment and economic growth by real GDP per capita, and using Instrumental Variable Technique, the result presented in this analysis suggests that there is a positive, robust and significant effect of gender equality in education on economic growth in this region. These results imply that some adjustment in education planning within SADC may be required to ensure retention of girl students as well as raising the quality of education. In practice this positive significant and robust relationship between equality in education and economic growth supports the emphasising policies placed by SADC and other international agencies on increasing female participation in education.

Therefore a more realistic policy recommendation from this study is that there is a need to develop strategies to commit to the implementation of the existing SADC protocol on Gender. The current SPG provides a platform for equal access for both men and women of quality education and training, while addressing retention issues for all levels of education. Since not all country members ratify to the current SPG, for those who have ratified it is only in recent years that their countries education policies are being changed in order to account for gender diversity issues. These changes aim to foster an environment that both man and women should have an equal opportunity to learn. There should be some changes of policy and priorities in education planning in all SADC countries. This implies that attention needs to be paid to ensure retention of girl students and improve education quality.

On the other hand it is known that gender equality in education also have a significant impact on other development goals such as reductions in fertility, child mortality, and under-nutrition. Thus, reducing existing gender inequality in education will not only promote growth but also helping to achieve these valuable development goals.

A shortcoming of the study is that it uses student enrolment data, as a form of gender equality in education given that other possible forms, such as literacy and years of schooling are not available for this region. The analysis result could be greatly improved when more relevant data of these forms becomes available. Similar analysis would

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be undertaken for other levels of education such as secondary, tertiary and vocational education as well. This would be extremely elucidative for the current research for this region. We have tried to control for problems on the research design such as endogeneity in the panel regressions, and expect further research to be undertaken when the required data are available in the future.

ENDNOTE

[1] These areas are: the SADC gender Unit indicates Policy Development and Harmonisation; Gender Mainstreaming; Institutional Strengthening and Capacity Building; Women's Empowerment; Communication, Information Sharing and Networking; and Research, Monitoring & Evaluation

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