LIFE EXPECTANCY AND ECONOMIC GROWTH: EVIDENCE FROM THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

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ABSTRACT

This paper examines the association between life expectancy and economic growth in a sample of 10 Southern African Development Community members for the period 1985 to 2017. To account for unobserved country-level heterogeneity we employ the fixed effect estimator. We also use fixed effects two-stage least squares (FE-2SLS) estimator to account for a possible endogeneity bias due to reverse causation between life expectancy and economic growth. The results suggest that life expectancy have a robust positive impact on economic growth. This result holds over a large battery of robustness checks: controlling for additional variables (such as inflation, trade openness, population and government expenditure), and altering the sample of countries (i.e. excluding South Africa from the sample) in the estimation.

Keywords: SADC, endogeneity, economic growth, fixed effect, life expectancy.

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1 Introduction

Southern African Development Community member countries have experienced a substantial increase in life expectancy over the past decade – increased from about 52 in 2007 to about 60 in 2016. This trend follows several years of decline in life expectancy owing to HIV and AIDS epidemic. According to UNAIDS, (2008: 13) "HIV has reduced life expectancy by more than 20 years, slowed economic growth, and deepened household poverty. In 2007, the 15 countries of the Southern Africa Development Community (SADC) comprised two thirds of the global HIV population and accounted for nearly three fourths of those who had died from AIDS".

This raises an important question: Does increasing life expectancy matter for economic development? Many scholars in this field take the view that it does (Gallup and Sachs (2000), Alleyne and Cohen (2002)). Notwithstanding research evidence on the effect of life expectancy on economic growth, it has not yielded consistent results. Some support the idea that a rise in life expectancy is accompanied by an increase in economic growth (Gallup and Sachs (2000); Barro and Sala-I-Martin 1995; Mayer, 2001; Bloom et al., 2001; Bloom et al., 2003; Akram et al, 2008; Cervellati & Sunde, 2011; Ngangue and Kouty, 2015)); other studies find evidence to suggest that life expectancy is negatively associated with economic growth (Acemoglu and Johnson (2006 and 2007).

Surprisingly, empirical evidence on the effect of life expectancy on economic growth in SADC countries (i) remains very thin (ii) Some of the above-mentioned studies (Jamison, Lau and Wang 2005; Bloom, Canning and Sevilla 2004; Bhargava, Jamison, Lau, and Murray 2001; Bloom, Canning and Malaney 1999; Bloom and Malaney 1998; Bloom and Williamson 1998; Sachs and Warner 1997; Barro and Sala-I-Martin 1995) don't account for reverse causality bias — potential reverse causality from the dependent variable (such as economic growth) to the explanatory variables (such as life expectancy)

Thus, this paper contributes and improves upon the existing literature by first investigating the effect of life expectancy on economic growth in SADC context. Secondly, it makes use of appropriate panel data models (such as fixed effects two-stage least squares) to provide more robust estimates and address the potential bias stemming from problems such as endogeneity, heterogeneity that may have affected previous empirical work on the effect of life expectancy on economic growth. Finally, it checks the strengths of the results by altering the sample of

countries (i.e. exclude South Africa from the sample). The rest of the paper is structured as follows. Section 2 reviews the literature on the life expectancy and economic growth nexus. The methodology and data are discussed in Section 3. The results are discussed in Section 5. Section 6 concludes.

2 Literature review

There is now a considerable literature devoted to estimating the impact of life expectancy on economic growth (Acemoglu and Johnson, (2007) for 75 countries from western Europe, Oceania, the Americas, and Asia; Lorentzen *et al.*, (2008) for 98 countries; Mayer (2001) for Mexico; Akram *et al.*, (2008) for Pakistan; Ngangue and Kouty, (2015) for 141 developing countries; Hansen *et al.*, (2013) for a sample of 47 countries; Bloom, Canning, and Sevilla, (2004) for a panel of countries; Zhang and Zhang, (2005) for 76 countries; Desbordes, (2011) for 47 countries at various levels of development; Barro, (1996) for a panel of around 100 countries and Cervellati and Sunde, (2011) for 47 countries.

Notwithstanding the research evidence on the effect of life expectancy on economic growth, it has not yielded consistent results. Some studies find that life expectancy is positively related to economic growth (Bloom, Canning, and Sevilla, 2004; Zhang and Zhang, (2005); Lorentzen et al., (2008); while other studies suggest a negative association between life expectancy and economic growth (Acemoglu and Johnson (2007)); others find that life expectancy has a positive but negligible impact on economic growth (Shastry and Weil (2003), Weil (2007) and Ashraf et al. (2008)); yet others suggest a U-shaped relationship between life expectancy and economic growth (Hansen (2013) Cervellati & Sunde, (2011) and Desbordes (2011)).

Using two stage least squares method, Bloom, Canning, and Sevilla, (2004) considered the relationship between life expectancy and economic growth and found that life expectancy has a positive, substantial, and statistically significant effect on economic growth, after control for other important variables -- “a one-year improvement in a population’s life expectancy contributes to a 4% increase in output” They maintain that the effect of life expectancy should be interpreted as a real labour productivity effect, rather than a proxy for worker experience.

Using two stage least square approach, Acemoglu and Johnson (2007) come to opposite finding: life expectancy brings about a decrease in economic growth. Moreover, they find the estimates to be strongly negative and significant for low- and middle-income countries

Cervellati & Sunde, 2011 examined the life expectancy and economic growth nexus for the period 1940–2000 and found that the effects of changes life expectancy differ across stages of the demographic transition. Ngangu and Kouty (2015) investigated the impact of life expectancy on the growth of Gross National Income per capita in developing countries. They used a dynamic panel of 141 developing countries over the period 2000-2013. The study found that the positive relationship exists between life expectancy and economic growth. The improvement in life expectancy positively affects economic growth in developing countries. However the results are mixed when classifying Developing countries according to their level of income as the effect is not significant in the middle-income countries.

3 Methodology

Guided by the empirical literature, especially Acemoglu and Johnson (2007), we employ a standard empirical neoclassical growth specification. Thus, we specify a growth equation of the following general form:

$$Y_{1^{it}} = \varphi_{1i} + \delta_{1t} + \beta_1 LifeExp + \beta_2 Demo + \sum_{m=8}^{m} \beta_3 \left(\varphi_{1^{it}}\right) + \mu_{1^{it}}$$

Where our outcome variable (Y) represent the growth rate of real GDP per capita; $Demo$ is the level of democracy. φ consists of control variables such as trade openness – expressed as the sum of total imports and exports in relation to GDP, and inflation rate and μ is the error term. Estimating the influence of life expectancy on economic growth presents some challenges. One of the challenges is that it ignores the fact that unobserved factors might be correlated with the outcome variables and some of the explanatory variables. Such correlation can produce biased estimates of the life expectancy change. We use fixed effects model (δ_{1t} in above equation) to account for unobserved factors – countries specific effects. Apart from the unobserved heterogeneity bias, this study might suffer from reverse causality bias – feedback relationship between life expectancy and economic growth. As Acemoglu and Johnson (2007:14) put it, "the most serious challenge in estimating the causal effect of life expectancy on income per capita or population is potential omitted variable bias and reverse causality". Thus, though we have hypothesised a direct effect stemming from life expectancy to economic growth, we

recognise that the reverse is also possible. Our preferred choice of estimator to deal with the possibility of endogeneity is fixed effects two-stage least squares (FE-2SLS) estimator. We account for endogeneity issue by using the lagged value of life expectancy as an instrument. The data used in this study consists of yearly observations from 1980 to 2010 for Angola, Mauritius, Botswana, Namibia, Malawi, Zambia, Swaziland, Mozambique, Tanzania and South Africa. The other SADC countries were left out due to lack of data. Most of the variables used in this paper were obtained from World Development Indicators of World Bank.

4 Empirical analysis

The idea that life expectancy promotes economic growth has gained a great deal of currency among many scholars in this field (see Bloom and Sachs (1998), Gallup and Sachs (2000), Alleyne and Cohen (2002), and Bloom and Canning (2005)). Our descriptive analysis — plotting (Figure 1) the link between life expectancy and economic growth in SADC countries, confirms this claim. In line with empirical and theoretical literature, the scatter plot suggests a positive relationship between economic growth and life expactancy.

Figure 1: Life expectancy and economic growth in SADC, 1986-2017

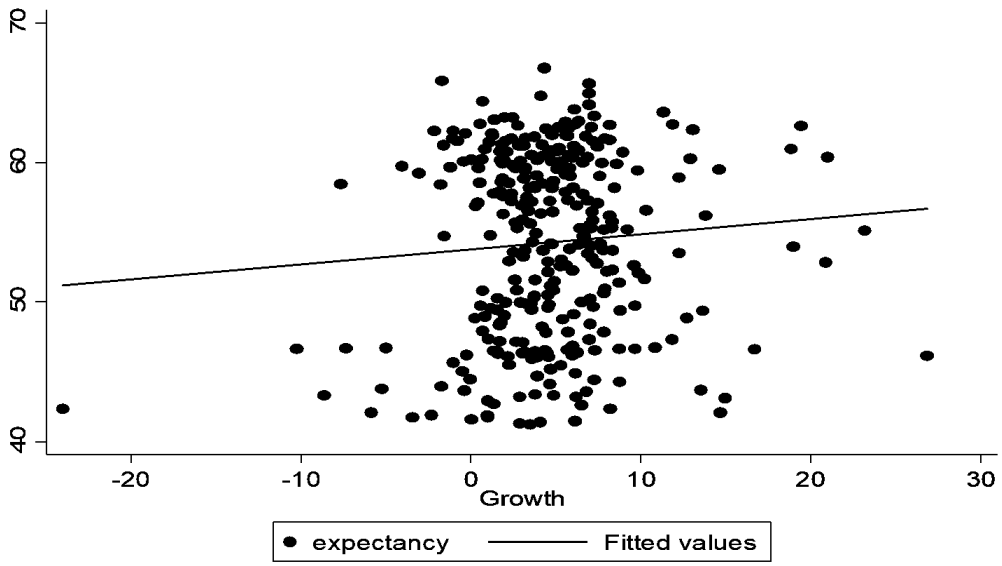


Figure 2, plots GDP per capita against life expectancy at birth. It reveals that some countries had relatively low life expectancy and relatively low levels of GDP per capita (Malawi, Zambia and Mozambique); while others had high life expectancy and medium levels of GDP per capita (Namibia, Mauritius, Botswana, etc). Figure 3 indicate that there was a substantial

improvements in life expectancy in most countries (Mozambique, Malawi, Angola, Zambia, etc) and that this was mostly associated with faster growth in income per capita.

Figure 2: Life expectancy and economic growth in SADC, 1986

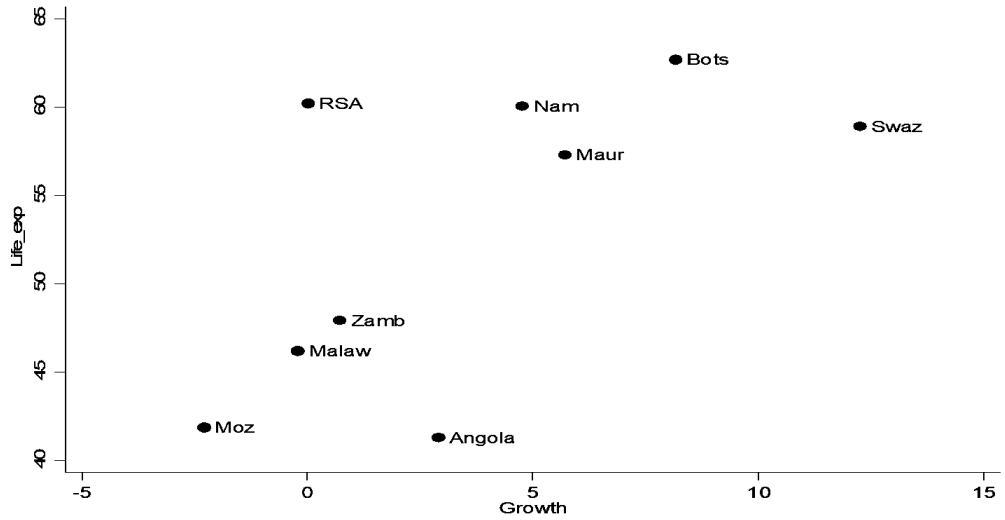
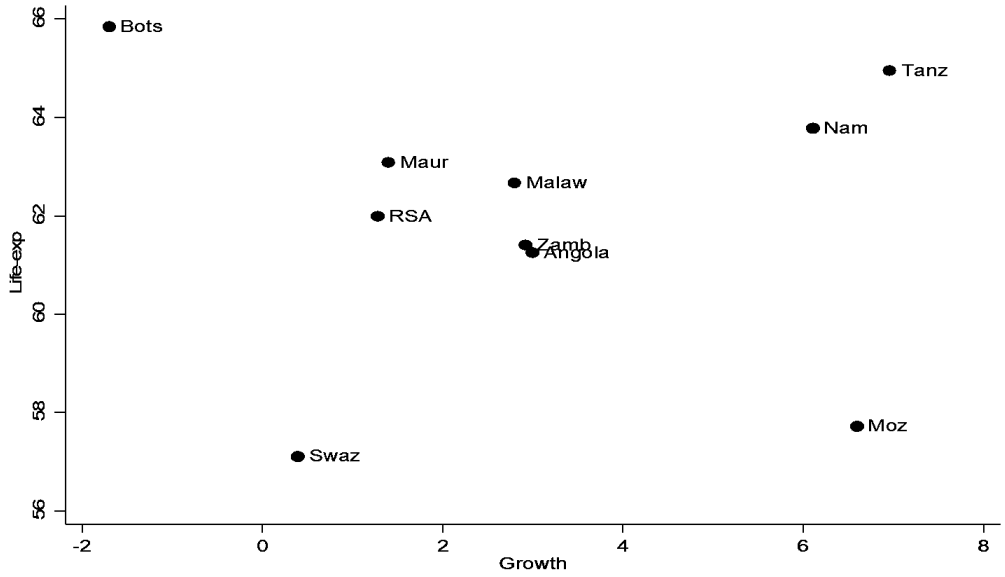


Figure 3: Life expectancy and economic growth in SADC, 2015



While the descriptive analysis sheds some light on the degree to which life expectancy might influence economic growth in the SADC region, it does not imply any causal relationship. Many studies have shown that there are a number of other factors that need to be taken into consideration when estimating the link between these variables. Thus, in what follows we verify the descriptive results (check if the descriptive results continues to hold) by employing appropriate econometric methods.

5. Regression results

5.1. Baseline estimates

This section will first present the baseline estimates and then incorporate a number of robustness checks. Table 1 presents the results of fixed effect regression, used in this study. The results are presented in a stepwise manner for robustness check. The first specification fixed effect (1) contains life expectancy. The second specification fixed effect (2) adds population variable, fixed effect (3) include democracy variable, fixed effect (4) adds inflation fixed effect (5) trade openness and the last specification fixed effect (6) military expenditure. The table presents some interesting findings. For example, our variable of interest (life expectancy) presents positive and significant estimates on economic growth. These results are consistent with the findings of Mayer (2001); Bloom et al. (2001, 2003); Akram et al.(2008); Cervellati & Sunde (2011) and Ngangue and Kouty (2015).

Table 1 Fixed effect and 2SLS estimates of the effects of life expectancy on economic growth in SADC(full sample), 1985-2017

ECONOMIC GROWTH	FE(1)	FE(2)	FE(3)	FE(4)	FE(5)	FE(6)	FE(2SLS)
LIFE-EXP	0.033***	0.016***	0.123***	0.014***	0.012***	0.123***	0.009**
	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
POP		0.676*	0.695*	0.555*	0.616*	0.688*	0.736***
		[0.107]	[0.115]	[0.100]	[0.0115]	[0.137]	[0.134]
DEMOCRACY			0.255*	0.305*	0.284*	0.302*	0.242**
			[0.125]	[0.121]	[0.118]	[0.123]	[0.116]
INFLATION				0.036**	0.053*	0.045**	0.036*
				[0.022]	[0.218]	[0.024]	[0.022]
OPEN					-2.830***	-2.580***	-2.650***
					[5178]	[580]	[534]
MIL-EXP						0.008**	0.008**
						[0.012]	[0.011]
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hausman test (RE vs. FE)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Poolability test[1], Pval:	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Cragg-Donald Wald F statistic							37.010

Notes: clustered standard errors are reported in parentheses with ***, **, and *, denoting significance at the 1%, 5%, and 10% levels, respectively.

The estimated coefficients for the control variables mostly confirm our a priori expectations. The population estimate is consistent with Biyase and Zwane (2016),'s findings that the increases in population leads to economic growth; but inconsistent with Herrin and Pernia (2003) and Canlas (2004)'s finding – opposite results. Consistent with empirical findings of Malefane and Odhiambo (2018), we find that more openness has a negative effect on economic growth. Inflation is consistent with the findings from Datta & Mukhapadhyay (2011); Munyeka (2014) Biyase and Zwane (2016) where there is a negative association between inflation and economic growth. Munyeka (2014) argue that, inflation imposes costs on an economy thereby reducing economic growth. Military expenditure collaborates the findings from Yang et al. (2011); Cappelen et al. (1984) and Dunne et al. (2002); that it has a negative and significant impact on economic growth.

5.2. Robustness

Next we check for the firmness of the life expectancy-growth nexus by altering the sample of SADC countries (i.e. by excluding South Africa). This is important because South Africa is often regarded as an outlier in the SADC sample. As one of the reports puts it "South Africa is the unchallenged economic heavy weight of the region. Its share of the region's total GDP stands at 55.5%... Angola comes in second with a share of 13.6%. On the other end of the spectrum, Lesotho and Seychelles, have shares of regional GDP adding to 0.4% and 0.2% respectively". Reassuringly, the estimates of the subsample (excluding SA) are remarkably robust to the full sample – life expectancy has a positive and significant effect on growth in sub-sample of SADC countries. We also found that a number of control variables: population, trade openness, and inflation are preserved relative to the full sample. However, the democracy effect is reduced – in all specifications it completely loses its statistical significance.

Next, given the potential endogeneity bias between economic growth and life expectancy, the benchmark model (fixed effect) was re-estimated using the fixed effects two-stage least squares estimates (see column 8 of Table 1) with an instrument as discussed earlier. Relevant specification tests were carried out to check if certain statistical conditions are met: serial correlation and to check if the instruments use are valid i.e. not correlated with the error term respectively. The results suggest rules out the serial correlation, while Cragg-Donald F-test rules out the concern of weak instruments (above the value of 20, see bottom of Table 1). We also run an endogeneity test to check if we need to use fixed effects two-stage least squares

regression or if a fixed effect model will suffice. The results indicate that a fixed effects two-stage least squares model is in fact the model we need to use. The two-stage least square estimates (which accounts for the feedback relationship between life expectancy and growth) are presented in the last column 8 of Table 1 above. Life expectancy still enters positively and significantly similar to those of the benchmark model (Table 1). The control variables are also similar to the benchmark estimates (see Table 1). For instance, consistent with the benchmark estimate, trade openness still enters negatively and significantly in the model. Thus the estimates fixed effects two-stage least squares estimation seem robust the benchmark estimates.

Table 2 Fixed effect estimates of the effects of life expectancy on economic growth in SADC(sub-sample), 1985-2017

ECONOMIC GROWTH	FE(1)	FE(2)	FE(3)	FE(4)	FE(5)	FE(6)
LIFE-EXP	0.035***	0.234***	0.019***	0.019***	0.0188***	0.020***
	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
POP		0.437***	0.532***	0.500***	0.469***	0.589***
		[0.108]	[0.109]	[0.115]	[0.108]	[0.125]
DEMOCRACY			0.111	0.114	0.171	0.160
			[0.128]	[0.128]	[0.119]	[0.217]
INFLATION				-0.021*	-0.039*	-0.023
				[0.021]	[0.019]	[0.217]
OPEN					2.58e+07***	2.27e+07***
					[4658652]	[5123581]
MIL-EXP						0.019
						[0.011]
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Hausman test (RE vs. FE)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Poolability test[1], Pval:	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: clustered standard errors are reported in parentheses with ***, **, and *, denoting significance at the 1%, 5%, and 10% levels, respectively.

Conclusion

In this paper the relationship between life expectancy and economic growth was investigated, using data spanning from the 1985 to the 2017 and covering 10 Southern African Development Community (SADC) countries. We applied a fixed effect estimator to account for unobserved heterogeneity. While the endogeneity bias was accounted for using a FE-2SLS estimator. The results suggest that life expectancy has a positive effect on economic growth, consistent with the findings of Mayer (2001); Bloom et al. (2001, 2003); Akram et al.(2008); Cervellati & Sunde (2011) and Ngangue and Kouty (2015). The results are robust to addressing the potential reverse causality between life expectancy and economic growth, controlling for additional variables (such as inflation, trade openness, population and government expenditure), and altering the sample of countries (i.e. excluding South Africa from the sample) in the estimation. Our findings suggest a possibility of enhancing economic growth by investing in healthcare systems-improvement in life expectancy is likely to yield significant returns in terms of economic growth and development in general. Thus estimates from this paper suggest that improving health conditions in the SADC can be effective and should continue to be a major focus of policy makers in this region and other developing region.

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