University of Pretoria
Department of Economics Working Paper Series

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Working Paper: 2014-04
January 2014

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Primary Education and Fertility Rates in Southern Africa: Evidence from Before the Demographic Transition*

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February 7, 2014

Abstract

We investigate whether primary school completion has played any role on total fertility rates in all fifteen members of the Southern African Development Community (SADC) between 1980 and 2009. The evidence, based on panel time-series analysis, suggests that primary education has indeed reduced fertility rates in the region, or that the community is already trading-off quantity for quality of children. The results are important not only because lower fertility, caused by education, implies more capital per worker, higher productivity and therefore higher growth rates, but also because—in accordance to the unified growth theory—they suggest that southern Africa, like other countries in the past, is experiencing its own transition from the Malthusian epoch into a sustained growth regime.

Keywords: Education, fertility, Africa.

JEL Classification: I20, J13, O55.

*We thank seminar participants at Pretoria for comments.

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1 Introduction

Africa is known for its recent political independence from European rule (mostly in the 1960s), for a number of political regime changes (particularly during the cold war), for civil and military conflicts and for poor macroeconomic performance (the late 1980s and early 1990s saw even negative growth rates taking place in a number of countries). More recently though, the continent has seen some economic structural changes and reforms being implemented, not to mention a certain degree of political stability, that have generally been matched by better economic performance overall, Bates, Coatsworth and Williamson (2007).

Bearing the above context in mind, we investigate the role of primary school completion rates in determining total fertility rates in the Southern African Development Community (SADC), a community of countries that professes the importance of democracy and integration as tools for development and which includes a diverse set of nations, *e.g.*, with Angola and Mozambique presenting positive growth rates since the 1990s and with some double figures from 2004 onwards, with Botswana and Mauritius presenting positive growth for the whole period investigated here, with South Africa presenting positive growth, although modest, since the end of the Apartheid regime in 1994, and with a country like Zimbabwe which has presented negative growth rates since 1999. More specifically, we use data from all fifteen SADC members between 1980 and 2009, and panel time-series analysis to study whether education played any role on fertility in the region.

For the above we rely on unified growth theory models (Galor and Weil 1999, Galor and Weil 2000, and Galor and Moav 2002) to better understand and contextualise the recent development of the southern African region. The underlining theory divides the process of development into three stages. Firstly, the Malthusian regime in which increases in income—usually coming from external shocks, *e.g.,* the Black Death in 14^{th}-century Europe—have the effect of increasing fertility rates. After some time though, given the "preventive checks", this natural economy converges back to its original equilibrium, *i.e.*, shocks have no long-run effects on income per capita, only on population density, Ashraf and Galor (2013). Secondly, there is the Post-Malthusian regime in which income increases and some industrialisation takes place, without too much human capital though. In addition,

during this transitional period, life expectancy as well as fertility tend to increase. Finally, during the sustained growth regime, technological progress and industrialisation take off, human capital formation not only increases, but also takes a central role in the production process, fertility rates see a reduction and eventually the demographic transition takes place.

The evidence we report suggests that, firstly, primary education completion rates have been a robust determinant of total fertility rates in the region. Essentially, education is associated with lower fertility in a region that has not yet gone through its own industrial revolution or demographic transition, Becker, Cinnirella and Woessmann (2010). Secondly, the rise in life expectancy that the region has been experiencing in the last decades is accompanied by higher fertility rates, Galor (2012)[1]. Thirdly, the agricultural sector of those economies is associated with higher fertility rates, Galor, Moav and Vollrath (2009). Fourthly, there is some evidence that economic globalisation reduces fertility, Soares (2007). Lastly, there is evidence suggesting that income increases lower fertility in the community, Becker (1960). All in all, the evidence—particularly the role of education and income in reducing fertility—indicates that southern Africa has already escaped the Malthusian stagnation epoch.

The importance of acquiring a better understanding of the role of education on fertility rates in southern Africa is not only because lower fertility implies more capital per worker, higher productivity and therefore higher growth rates, but also because the take off into the sustained growth regime, usually caused by a shock, requires a critical level of human capital, so that the virtuous circle between human capital and technological progress can take place, Galor and Moav (2002). Given the overall evidence, and always bearing in mind the numerous factors that might have delayed Africa's own demographic transition in the past, it is hard not to emphasize the importance of understanding the interplay between education and fertility in a region which is transitioning from the Malthusian epoch into a more sustained growth regime.

The empirical literature on the role of education on fertility has mostly studied the European trade-off between quantity and quality of children tak-

[1] Alternatively, Soares (2005) and Cervellati and Sunde (2005) propose models which predict that increases in life expectancy will be followed by reductions in fertility rates and sustained growth. In similar vein, Doepke (2005) suggests that lower child mortality is associated with lower fertility.

ing place in the 19^{th} century. Firstly, Dribe (2008) uses Swedish data from 1880 and 1930, at county and national level, to report that the number of teachers per 100 children (aged between 7 and 14) reduces fertility rates. Secondly, Becker, Cinnirella and Woessmann (2010 and 2012) use data from Prussian counties in the 19^{th} century, 1849 and 1816 respectively, to report that school enrolment reduced the child-woman ratio at the time. In similar vein, Becker, Cinnirella and Woessmann (2013) report estimates which suggest that female education reduces fertility rates in 19^{th}-century Prussia. Similarly, but with contemporaneous African data, Bittencourt (2014) presents evidence on the role of secondary education in reducing fertility in a panel of southern African countries.

In essence, the empirical evidence, mostly covering European countries in a time period which they had not yet experienced their own demographic transition, just like Africa now, suggests that school enrolment was already playing an important role in lowering total fertility rates. Hence, this paper is a natural development of the previous literature on the subject. We conduct a case study of an important club of African developing countries that attempts to pinpoint in more detail the effects of primary completion rates on total fertility. We do that by taking advantage of the unified growth theory and panel time-series analysis, which allow us to put the evidence into context and also to deal with particular econometric issues in thin panels, heterogeneity and endogeneity, which enables us to provide—to the best of our knowledge, for the first time—informative and contextual estimates so that our knowledge of a very idiosyncratic, and also diverse within, southern Africa is deepened.

2 The Data and Methodology

The dataset we use covers the period between 1980 and 2009, and fifteen sub-Saharan African countries, which are all members of the SADC, namely Angola, Botswana, the Democratic Republic of the Congo, Lesotho, Madagascar, Mozambique, Mauritius, Malawi, Namibia, South Africa, Swaziland, Seychelles, Tanzania, Zambia and Zimbabwe. To illustrate the importance of these nations in the regional African context, these fifteen countries accounted for approximately 52% of the total GDP in sub-Saharan Africa in 2009.

The variable proxying for total fertility, $FERTIL$, is defined as the number of children per woman—which is the number of children that would be born to each woman with age-specific fertility rates—and the data are from the United Nations. For education we use primary school completion as percentage of the relevant age group, $EDUC$, and the data are provided by the World Bank. It is expected that education leads to more investment in the quality than in the quantity of offspring, or that higher primary completion rates reduces total fertility rates even before a region's demographic transition takes place, Becker, Cinnirella and Woessmann (2012).

In addition, our choice of control variables follows the underlining theory. First, we account for life expectancy, $EXPECT$, which is defined by life expectancy, in terms of number of years, at birth. The data come from the United Nations Population Division and it is predicted that an increase in life expectancy might lead to an increase in fertility, particularly in developing countries where uncertainty regarding survival of offspring is still high, Galor (2012). Moreover, we make use of the importance, in percentage terms, of the agricultural sector on the respective GDPs of those countries, $AGRIC$, and the data are from the World Development Indicators provided by the World Bank. In this case it is predicted that more agrarian societies tend to favour quantity instead of quality of children—because of non-complementarities between agricultural and non-skilled goods and lower fertility—and therefore it is expected that the higher the importance of agriculture, the higher the fertility rates, Galor, Moav and Vollrath (2009).

Furthermore, we use the gross fixed capital formation to GDP, INV, as a proxy for industrialisation and the data are from the World Bank. In this instance, it is predicted that industrialisation is associated with lower total fertility rates not only because of complementarities between industrialised-skilled goods and lower fertility, but also because of higher relative wages for women in the industrial sector, Galor and Weil (1996). We also use a variable for economic globalisation, $GLOBAL$, provided by Dreher (2006) and which takes into account not only trade to GDP, but also, *e.g.*, foreign direct and portfolio investment and import barriers. In this case it is expected that globalisation, at least in non-industrialised developing countries, might negatively affect education because developing countries specialise in non-skilled agricultural goods which do not require human capital, Galor and Mountford (2008).

Lastly, we control for income per capita, GDP, and the data come from the World Development Indicators. It is expected that higher income, in societies that have already escaped the Malthusian stagnation, might lead to a decline in fertility, or to a shift to more quality instead of quantity of children, Becker (1960).

To give a flavour of the main variables of interest, in Figure One we plot the averaged-data on fertility and education in all fifteen countries in our sample, and what we take from this initial eye-ball exercise is that during the whole period investigated, 1980-2009, fertility rates in southern Africa have been decreasing over time, *i.e.*, from roughly six children per woman in 1980 to approximately four in 2009. Moreover, primary education has been on the rise throughout the whole period, from roughly 60% of the corresponding population age group in 1980 to approximately 80% in 2009. In addition, in the third panel we plot the OLS regression line between primary completion and total fertility rates, in logs. The relationship is negative and statistically significant, which indicates that there is an economic relationship between higher primary completion rates and lower fertility taking place in the sample.

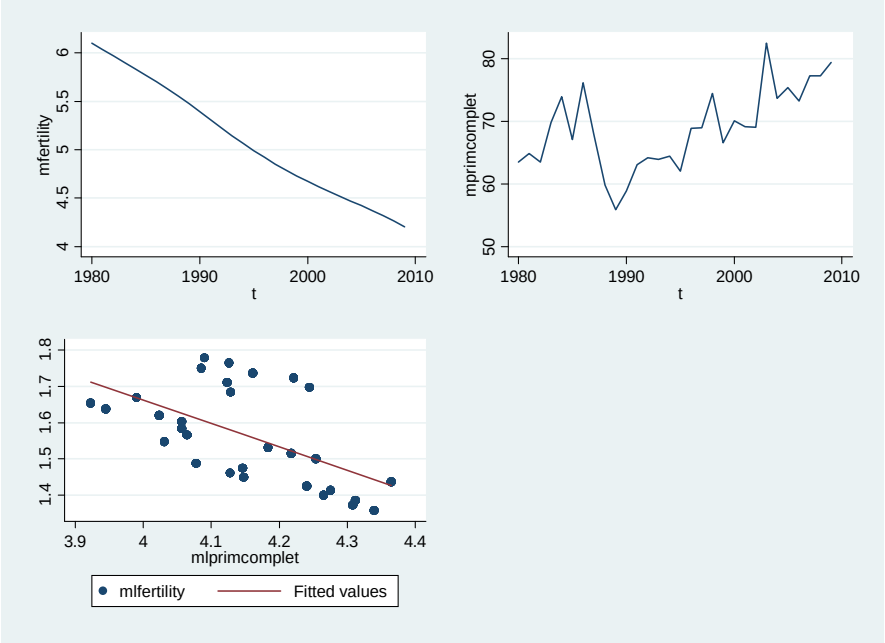

Figure 1: Fertility rates and primary education, SADC, 1980-2009. Sources: United Nations and World Development Indicators.

In Table One we present the correlation matrix of the variables used for the analysis. Initially, our two main variables of interest, fertility rates and secondary education confirm the above eye-ball evidence and present a negative and statistically significant correlation with each other. In addition, life expectancy presents a negative and significant correlation to fertility, which suggests that an increase in life expectancy might reduce uncertainty about survival of offspring, reduce the costs of investment in human capital and hence reduce fertility, Soares (2005).

Furthermore, the ratio of the agricultural sector to GDP presents a positive correlation with fertility. On the other hand, our proxy for industrialisation presents the expected negative correlation with fertility. Contrary to expectation, the negative correlation between globalisation and fertility is probably capturing the role of openness, *e.g.,* via the spreading of better health technologies and information, in lowering fertility, Soares (2007). Finally, income per capita displays a negative correlation with fertility, which indicates that the substitution effect might be at work in the region.

In a nutshell, this initial descriptive inspection of the data, bearing in

mind all caveats with descriptive analyses, suggests that the region is already trading-off quantity for quality of children.

Table 1: The Correlation Matrix: SADC, 1980-2009.

	FERTIL	EDUC	EXPECT	AGRIC	INV	GLOBAL	GDP
FERTIL	1						
EDUC	-0.657*	1					
EXPECT	-0.663*	0.602*	1				
AGRIC	0.709*	-0.731*	-0.491*	1			
INV	-0.282*	0.289*	0.388*	-0.311*	1		
GLOBAL	-0.384*	0.405*	0.133*	-0.663*	0.288*	1	
GDP	-0.234*	0.076	0.158*	-0.231*	0.265*	0.237*	1

Sources: United Nations, World Development Indicators and Dreher (2006). * represents significance at the 5% level.

In terms of the empirical strategy adopted, given that we have a $T > N$ dataset, $T = 30$ and $N = 15$, we make use of panel time-series analysis. Panel time-series allows us not only to deal with important econometric issues in relatively thin panels—heterogeneity and endogeneity—but also to specifically further our knowledge of sub-Saharan Africa without having to incur in the usual removal of African countries (or use of dummies) that takes place in large cross-sectional and panel data analyses. With panel time-series we can specifically analyse the SADC case, with all its idiosyncrasies and differences within, and therefore get a clearer picture of the region.

Firstly, although some of the variables are either ratios or indices, and therefore bounded within closed intervals, we also evoke Phillips and Moon (1999) and their result which suggests that the issue of spurious regressions is less of a problem in panels because of the averaging taking place in panel estimators which reduces the noise coming from such regressions.

Secondly, the issues of statistical endogeneity and heterogeneity of intercepts are dealt with by the one-way Fixed Effects (FE) with robust standard errors estimator, which provides consistent estimates in empirical models when $T \to \infty$, Smith and Fuertes (2010), and Achen (2001). Essentially, although these countries shared some political and economic transitions in their recent history, which makes the homogeneity of slopes a plausible assumption, the FE estimator also accounts for important econometric issues in $T > N$ panels, or for the fact that some of these countries do indeed

present different characteristics in terms of economic and political development (*e.g.*, Botswana, Mauritius and South Africa are relatively richer and more politically stable than most other countries in the community), and these country differences are picked up by the heterogeneous intercepts of the FE estimator.

Thirdly, some would argue that reverse causality is a possibility, or that lower fertility might lead to higher education and not the inverse, Becker, Cinnirella and Woessmann (2010). We therefore use the Fixed Effects with Instrumental Variables (FE-IV) estimator, which provides estimates that are asymptotically consistent and efficient as $T \to \infty$, Arellano (2003).

In terms of instruments utilised, with the assumption ($E(educ_{it-1}v_{it} = 0)$) in mind, firstly we make use of the lag of education as a baseline identifying instrument for contemporaneous primary education. It is expected, because education is persistent over time, a positive effect of lagged education on contemporaneous primary completion. Secondly, we use the normalised, so that it ranges from zero to one, polity2 variable (POL) from the Polity IV files to account for the external (democratic) shock coming with the end of the cold war in the 1990s that the region saw taking place back then and which continues to the day, Bates, Block, Fayad and Hoeffler (2013).

For the sake of clarity, in Figure 3 we plot the above-mentioned external instrumental variable series and we can see the shift to more democratic institutions taking place in 1990 in the region, which coincides with the end of the ideological conflict between the West and the former USSR. In this instance it is expected that democracy should play a positive role on education, via better governance and more efficient allocation of resources towards public goods, in this case, education, Tavares and Wacziarg (2001), and the OLS regression line in the second panel of Figure 3 indeed points towards a positive economic relationship taking place between both variables in the community.

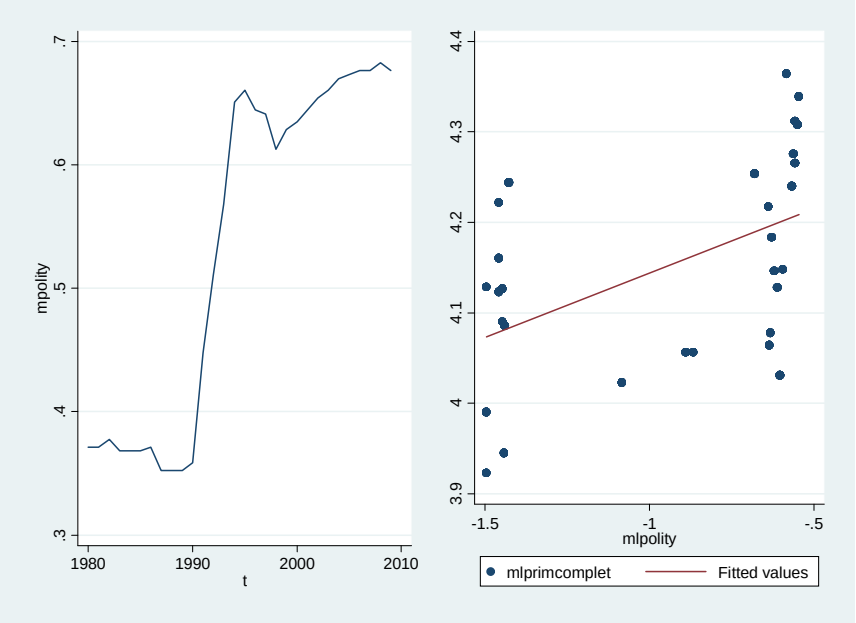

Figure 2: Democracy and primary education, SADC, 1980-2009. Sources: Polity IV and World Development Indicators.

We therefore estimate equations with different pooled estimators, the baseline Pooled OLS (POLS), which assumes homogeneity of intercepts and slopes, the FE and FE-IV estimators, so that different econometric issues are dealt with and more reliable estimates provided. The one-way FE estimated equation is as follows,

$$FERTIL_{it} = \alpha_i + \beta EDUC_{it-1} + \beta EXPECT_{it} + \gamma AGRIC_{it} + \delta INV_{it} + \epsilon GLOBAL_{it} + \varepsilon GDP_{it} + \upsilon_{it} \quad (1)$$

in which $FERTIL$ are the number of children per woman, $EDUC$ is primary completion rates, $EXPECT$ is life expectancy at birth, $AGRIC$ is the share of the agricultural sector to GDP, INV is the share of gross fixed capital formation to GDP, $GLOBAL$ is a proxy for economic globalisation and GDP is income per capita. All variables are in logs.

3 Results and Discussion

In Table Two we report the baseline POLS (first panel) and then the robust FE estimates (lower panel). Most POLS and all FE primary education es-

timates are negative and statistically significant against fertility rates. For instance, the FE estimate in column five suggests that for each percentage point increase in primary education, there will be a .13 percentage point reduction in fertility in the region, a result which is in accordance to the previous efforts which use data from other regions before their own demographic transition, Becker, Cinnirella and Woessmann (2010).

About the control variables, the agricultural sector is associated with significantly higher fertility rates, which highlights the role of non-complementarities between unskilled-agricultural goods and lower fertility in the region, Becker, Cinnirella and Woessmann (2010). In addition, income per capita has the ability of reducing fertility rates in the community, which indicates that the substitution effect is dominating the income effect in southern Africa, or that the region is already trading-off quantity for quality of children, Becker (1960).

Furthermore, the proxy for life expectancy, when using the preferred FE estimator, presents positive and significant estimates on fertility, which suggests that an increase in life expectancy reduces the costs of child rearing and therefore increases fertility in those developing countries, Galor (2012). Lastly, in this instance our proxy for physical capital accumulation does not present clear-cut estimates or does the proxy for economic globalisation.

Table 2: POLS and FE Estimates of Education on Fertility, 1980-2009.

FERTIL	POLS (1)	POLS (2)	POLS (3)	POLS (4)	POLS (5)	POLS (6)
EDUC	-.619 (-14.72)	-.373 (-8.15)	-.076 (-1.53)	-.077 (-1.54)	-.085 (-1.64)	-.097 (-1.85)
EXPECT		-1.10 (-9.06)	-.904 (-8.69)	-.883 (-8.16)	-.919 (-7.51)	-.890 (-7.23)
AGRIC			.237 (10.62)	.236 (10.49)	.265 (9.28)	.262 (9.22)
INV				-.022 (-0.71)	-.035 (-1.01)	-.027 (-0.78)
GLOBAL					.119 (1.68)	.140 (1.96)
GDP						-.004 (-1.71)
F test	216.58	181.12	213.53	159.97	90.23	76.29
R^2	0.43	0.56	0.70	0.70	0.65	0.65
FERTIL	FE (1)	FE (2)	FE (3)	FE (4)	FE (5)	FE (6)
EDUC	-.226 (-2.35)	-.233 (-2.63)	-.131 (-3.38)	-.131 (-4.22)	-.130 (-3.99)	-.045 (-1.79)
EXPECT		.958 (2.77)	.415 (1.97)	.549 (3.02)	.681 (4.08)	.619 (6.11)
AGRIC			.302 (11.74)	.298 (11.76)	.243 (8.39)	.047 (1.04)
INV				-.075 (-2.24)	-.052 (-1.57)	-.023 (-1.63)
GLOBAL					-.178 (-2.27)	-.077 (-0.91)
GDP						-.250 (-3.82)
F test	5.54	5.51	61.31	58.28	46.99	610.66
R^2	0.43	0.09	0.50	0.47	0.32	0.06

T-ratios in parentheses. Number of observations: $NT = 450$. $FERTIL$ is child per woman, $EDUC$ is primary school completion, $EXPECT$ is life expectancy at birth, $AGRIC$ is agriculture ratio to GDP, INV is the gross fixed capital formation ratio to GDP, $GLOBAL$ is a proxy for economic globalisation and GDP is income per capita. POLS is the Pooled OLS and FE the Fixed Effects estimators.

In Table Three we report the FE-IV estimates. In the first panel we instrument education with its own lag, $EDUC_{-2}$, and in the second we use democracy, POL, as our identifying instrument for primary completion rates. Firstly, all $EDUC$ estimates are negative and statistically significant against total fertility rates, irrespective of which instrument we make use of. For example, using column five, second panel, the $EDUC$ estimate suggests that for each percentage point increase in primary education, there will be a reduction in .46 percentage points in total fertility.

Secondly, life expectancy confirms its positive and significant role on fertility as well as the share of the agricultural sector to GDP with positive and significant estimates. On the other hand, physical capital accumulation

and income per capita present negative and significant estimates on fertility, which points to the importance of demand for human capital from the industrial sector and the role of complementarities between skilled goods, higher relative wages for women and lower fertility, Galor and Weil (1996), and of the substitution effect taking place in the region, Becker (1960). Lastly, the proxy for economic globalisation presents negative and mostly significant estimates on fertility, which suggests that openness can reduce fertility, via the spreading of health technologies, flows of knowledge and values across the developing world, Soares (2007).

Moreover, in the first-stage regressions our identifying instruments display the expected signs against primary education, *i.e.*, lagged education (via its persistent effect on itself) and democracy (via its better governance effect, Stasavage 2005) positively influence education. Furthermore, the t-stats of our identifying instruments are all significantly different from zero as well as the F-tests for overall significance, which minimise the issue of weak instruments in our regressions (available on request).

Table 3: POLS and FE Estimates of Education on Fertility, 1980-2009.

FERTIL	FE-IV (1)	FE-IV (2)	FE-IV (3)	FE-IV (4)	FE-IV (5)	FE-IV (6)
EDUC	-.267 (-4.48)	-.249 (-5.05)	-.149 (-4.35)	-.143 (-4.32)	-.140 (-4.50)	-.060 (-2.49)
EXPECT		1.02 (9.98)	.399 (5.35)	.523 (6.72)	.650 (8.30)	.588 (10.36)
AGRIC			.310 (16.99)	.307 (17.45)	.256 (12.76)	.056 (2.68)
INV				-.073 (-4.22)	-.055 (-2.97)	-.034 (-2.54)
GLOBAL					-.144 (-3.78)	-.033 (-1.16)
GDP						-.255 (-12.70)
IV	$EDUC_{-2}$	$EDUC_{-2}$	$EDUC_{-2}$	$EDUC_{-2}$	$EDUC_{-2}$	$EDUC_{-2}$
F* test	60.65	75.36	152.16	165.88	199.73	391.48
R^2	0.45	0.08	0.50	0.47	0.34	0.05
FERTIL	FE-IV (1)	FE-IV (2)	FE-IV (3)	FE-IV (4)	FE-IV (5)	FE-IV (6)
EDUC	-1.04 (-4.02)	-1.03 (-4.18)	-.694 (-4.12)	-.614 (-4.20)	-.462 (-4.11)	-.314 (-2.06)
EXPECT		.843 (4.71)	.523 (3.56)	.655 (4.68)	.707 (6.19)	.657 (6.70)
AGRIC			.191 (4.44)	.196 (5.19)	.170 (5.26)	.105 (3.20)
INV				-.083 (-3.27)	-.059 (-2.61)	-.043 (-2.24)
GLOBAL					-.159 (-3.52)	-.121 (-3.15)
GDP						-.111 (-1.80)
IV	POL	POL	POL	POL	POL	POL
F* test	27.59	24.37	41.90	53.78	91.24	163.31
R^2	0.45	0.28	0.51	0.50	0.38	0.14

T-ratios in parentheses. Number of observations: $NT = 450$. $FERTIL$ is child per woman, $EDUC$ is primary school completion, $EXPECT$ is life expectancy at birth, $AGRIC$ is agriculture ratio to GDP, INV is the gross fixed capital formation ratio to GDP, $GLOBAL$ is a proxy for economic globalisation and GDP is income per capita. FE-IV is the Fixed Effects with Instrumental Variable estimator and the instruments are the lag of contemporaneous primary education $EDUC_{-2}$ and democracy POL.

In a nutshell, primary completion rates have been reducing fertility rates in the SADC, which confirms previous efforts using European historical data from countries which had not experienced their own demographic transition, Dribe (2008) and Becker, Cinnirella and Woessmann (2010). Moreover, the results suggest that the region is already experiencing, before its very own demographic transition, the trade-off between quantity and quality of children, which is an important ingredient of the transition from the Malthusian

stagnation to sustained growth, Becker, Cinnirella and Woessmann (2010).

Furthermore, lower fertility rates are important because that can have a positive effect on capital per worker, productivity and consequently on the much needed economic growth, Galor (2012). Equally important, Galor and Moav (2002) predict that those already with human capital, even during the Malthusian epoch, have higher survival rates and at some point in time, when there is enough human capital in place and usually after a shock, *e.g.*, the implementation of more democratic institutions, a virtuous circle might be created between human capital and technological progress, and consequently sustained growth might take place. All in all, it cannot be emphasized enough, for all sorts of reasons, the importance of having a certain stock of human capital in place in a region like southern Africa.

In addition, life expectancy is a variable which displays consistent results, *i.e.*, positive effects on total fertility rates, results which are in line with the evidence presented by Galor (2012) who suggests that in 18^{th}- and 19^{th}-centuries England, increases in life expectancy were associated with increases in fertility. The results regarding the role of agriculture on fertility rates confirm the prediction that agrarian, and unskilled, goods and quality offspring are not complementary to each other, Galor, Moav and Vollrath (2009). On the contrary, the proxy for industrialisation, with the caveat that the SADC is not a Solow region and its industrial sector is still small, is reducing fertility rates in the community, via skill complementarities and increases in relative wages for women, Galor and Weil (1996).

Income per capita presents results which confirm that southern Africa is not in a Malthusian regime in which higher income would increase fertility. In fact, the evidence indicates that the substitution effect is already dominating the income effect in the region, Becker (1960). In addition, our economic globalisation estimates—although negative and mostly significant in the FE and FE-IV regressions, indicate that openness, via *e.g.*, easier access to health technologies, foreign direct investment and flows of knowledge, can induce lower fertility, Soares (2007)—have to be taken with caution since not all of them are statistically significant. Finally, about the instrumental variables estimates, the first-stage regressions results of the positive effects of democracy on primary education not only confirm that democracy increases efficiency in terms of public spending on education, Stasavage (2005), but also bode well with some of the broad developmental objectives

of the SADC.

All in all, the above are important characteristics that other, now developed, countries displayed in their own past, Galor (2005), and that these southern African countries are already displaying, *i.e.*, the trade-off between quantity and quality of children caused by education and the income substitution effect. Thus, it is fair to say that those southern African countries (some of which have been growing fast, others which have been growing consistently, in the last twenty years or so, *e.g.*, Angola, Botswana, Mauritius, Mozambique and South Africa) are not in the Malthusian stagnation epoch or on a sustained growth path regime. Therefore, it is plausible that those countries are going through the Post-Malthusian regime of development.

4 Conclusion

Using a dataset covering the period between 1980 and 2009, we have investigated the role of primary completion rates in determining total fertility in a panel of fifteen sub-Saharan African countries that are all members of the SADC. The results, based on panel time-series analysis, suggest that education has had a negative and significant effect on fertility in the region. Loosely speaking, education proved to be a robust determinant of reduced fertility, which also highlights its indirect role in determining prosperity in the community via higher capital per worker, increased productivity and economic growth.

In addition, although Bates, Coatsworth and Williamson (2007) argue that Africa right after its independence in the 1960s has shown similar characteristics that Latin America had right after its own independence in the 19^{th} century, *e.g.*, political instability, conflict and economic stagnation, and Acemoglu, Johnson and Robinson (2001) highlight the importance of "extractive" institutions being implemented in Africa during the colonial period, factors that might have delayed Africa's own demographic transition, the evidence suggests that southern Africa has escaped the worst of a Malthusian stagnation and is already showing characteristics of a region in transition. In fact, Young (2012) argues that sub-Saharan Africa has witnessed, since the mid 1990s, a considerable increase in consumption of vital durables such as housing, schooling and health, which is on par with other developing regions.

However, we also have to bear in mind that Galor and Moav (2002) argue that for sustainable growth to take place a higher proportion of educated "quality type" people combined with technological progress must be in place when a shock, *e.g.*, democracy, happens, so that failed takeoffs are minimised. To put it another way, Nelson and Phelps (1966) argue that educated people are not only innovators, but also adaptable to technological change, which emphasizes the role of education on fertility and sustained development in a globalised world.

To conclude, the SADC experience is informative firstly because it encapsulates a number of countries, which no doubt share important characteristics and goals—but which also have their own idiosyncrasies—and the evidence presented suggests that southern Africa, although not yet a Solow industrialised region and with all its known challenges, has already escaped its Malthusian stagnation, which suggests that the southern part of the continent is transitioning to a more sustained growth regime.

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