The social benefits of widening participation in higher education in sub-Saharan Africa

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Abstract

This paper links endogenous development, externalities, and higher participation in education with issues of student finance and equity in sub-Saharan Africa. The paper is based on new panel data for 43 African countries for 2000-2017, offering new findings for this recent period during which per capita growth in Africa has picked up significantly and about which there is great curiosity. The findings provide evidence that the external effects of lower levels of education lower fertility rates, and that secondary education supports democratization (improvement in political rights).

Together with prior literature the above builds a strong social scientific case about how these external effects of basic education lower the explosive population growth in sub-Saharan Africa through the education of women. This paper goes further to explore the role of government expenditure per student, a powerful driver of lower fertility and more democratization at the primary and secondary levels but not at the higher education level. The problem with inefficiency in financing higher education as large and costly per student room and board grants are provided to the children of the wealthy (who are likely to attend college anyway) with little resource recovery is found to lower its cost effectiveness in achieving per capita growth and development.

Keywords: sub-Saharan Africa; education and social benefits; endogenous growth and development, externalities, higher education participation

1. Introduction

Building on the work of Keller (2006) and the theory of endogenous development set out in McMahon (2018, and in this Special Issue), this paper develops the argument that many of the social benefit effects of basic education continue into the college years, so widening participation in college education under efficient financing conditions is also important for Africa's sustainable development. Otherwise, the current "youth bulge" may not be converted into a "youth dividend" in the years ahead (Oketch, 2016). Failure to realise this youth dividend will have profound negative effects on the life chances of the region's next generation. The effects of widening participation in higher education, particularly on democratization, and on political stability, and hence on per capita growth and development, as well as effects of female education on lower fertility rates are especially important in Africa. However, the problems with emigration of highly talented graduates, and with the high unit cost of higher education due largely to room and board costs need to be addressed.

The purpose of this paper is to consider the effects of education enrollment on democratization, and on political stability, as well as on fertility rates and hence on the population growth rate since 2000 using African panel data. This paper has the advantage of focusing on the social benefit externalities, which are important, based on new panel data for 43 African Countries for 2000-2017. It relates to Keller's data base (which has data for less developed, developed, and worldwide perspectives up to 2000) by obtaining significant and interesting results that serve to confirm and extend to Africa the results she obtains for a few of her key outcomes. It also offers new findings for the more recent 2000-17 period during which per capita growth has picked up significantly in Africa and about which there is great curiosity, more recently framed in terms of harnessing the youth dividend.

The rest of the paper is organised as follows. Section two provides a brief discussion of the wider benefits of higher education, and introduces the issue of fertility rates and political rights in the context of sub-Saharan Africa. This is followed by section three which focuses on higher education finance in sub-Saharan Africa as part of the context for the paper. Section four discusses the theoretical framework for the paper. This is followed by section five which focuses on methodology and panel regression results. Section six discusses the implications of the results, and section seven offers a summary and conclusions.

2. The Wider Benefits of Higher Education

The wider benefits of higher education such as contribution to political and other rights known as externalities are important not only because they benefit others but also because they contribute to productivity growth and benefit future generations. This is the main efficiency rationale for public taxpayer support of higher education (McMahon, 2018). In many parts of sub-Saharan Africa as is the case in the rest of the world, there is the common belief that higher education should lead to immediate employment and better paying jobs. Such belief is not unfounded as those with only secondary or less education often see a decline in their real earnings with a pattern of a widening advantage for those who have completed college education (McMahon and Oketch, 2010, p. 8). However, higher education has far greater effect over the life cycle than just immediate employment. These include nonmonetary effects that tend to be overlooked. Yet overlooking these nonmonetary effects have significant implications for higher education's contribution to individual life chances, the quality of life, and overall development (McMahon, 2018). As pointed out by Leslie and Brinkman (1988, p.69) "Public policymaking must extend beyond private considerations" and this should be true of higher education policymaking in sub-Saharan Africa. Theodore Schultz (1971) said: "It is also true that the price that the student pays for educational services is only remotely connected to the real cost of producing them, and therefore private choices by students, however efficient they are privately, are not necessarily efficient socially" (p. 171).

In sub-Saharan Africa today, with greater demand for higher education but also what is perceived as high rates of graduate unemployment based on looking at only the first few years after graduation or a mismatch between educated graduates and the jobs they do (Oketch, 2016), the social benefits of widening participation in higher education and the contribution of this to sustainable development in the region, in particular, deserves to be taken into account. Furthermore, the manpower requirement approach often fails to take into

account how many times graduates nowadays change their jobs. The existence of nonmonetary private and social benefits of higher education increases the private and social return and it is worth noting the point made by McMahon (1982) that the recognition of these external benefits is mandatory if true economic efficiency is to be maintained, a point that applies in sub-Saharan Africa as well as elsewhere. Today, the effort to estimate these nonmonetary benefits has gone far in developed countries such as USA and UK where reasonable data to do so exist. However, there have also been estimates of the nonmonetary benefits internationally as shown in the work of Keller (2006, p. 28) and by Appiah and McMahon (2002) for sub-Saharan Africa. The latter include an analysis of "Indirect feedback effects" and indicate that they are all externalities since they benefit others and are not normally known or anticipated by individuals as they invest in their own education. Also, "any one individual's impact on these community wide effects is miniscule and often occurs only after considerable time has passed" (p. 28). But these arguments and the evidence base for policymaking, especially for sub-Saharan Africa may be considered preliminary efforts to draw attention to these nonmonetary benefits of higher education in a region where participation rates are so low, where financing schemes tend to favour wealthy students, and where decent basic education is still out of the reach for many children.

In the international literature, the first major attempt to catalogue "nonmarket" effects of schooling and then assign values based on "willingness to pay" was by Haveman and Wolfe (1984). Although there have been many studies of non-monetary contributions of basic education to development, this has not been done as extensively for higher education in sub-Saharan Africa beyond McMahon (2002), Appiah and McMahon (2002), Keller (2006 and this Special Issue) and this paper. McMahon (1984, 2017), Haveman and Wolfe (1984), and others have studied the non-monetary benefits which accrued personally to those with education in developed countries. McMahon (1984) also disaggregated the data he used to provide estimates by occupation and degree level. While commenting on these findings, Leslie and Brinkman (1988 p. 79) observed that McMahon's results were informative, but also confirmed that "excluding nonmonetary returns, private rate of return studies understate the returns for many groups."

3. Higher education finance in sub-Saharan Africa

Currently, sub-Saharan Africa's tertiary gross enrollment rates of under 10%, are comparatively low compared to global average of about 38% in 2017 (UNESCO, UIS, 2019 or in Word Bank Data, 2019b). However, it is also the region of the world that has seen the greatest expansion of its tertiary education participation rate from a mere 1.4% in 1970 to 9.3% in 2017. There was slow growth between 1970 and 2000 when growth increased from 1.4% to 4.1%. The sharpest growth has occurred since 1999 when higher education enrollment grew rapidly from 4.1% to 9.3% in 2017. Table 1 below summarises this rapid growth.

TABLE 1: **Expansion of tertiary education (% gross) in sub-Saharan Africa 1970-2017**

Year	Gross Enrollment Rate (%)
1970	1.409
1980	2.125
1999	4.133
2000	4.505
2010	7.811
2017	9.315

Source: Table based on information obtained from The World Bank; UNESCO Institute of Statistics (uis.unesco.org), License: CCBY.40. School enrolment, tertiary (% gross). https://data.worldbank.org/indicator/SE.TER.ENRR?locations=ZG (accessed on 5/6/2019).

Since the 1990s, the national objective in several countries in sub-Saharan Africa has been to reform higher education financing so as to widen participation (Oketch, 2016; 2003) and to cope with demand arising from a larger number of young people who are seeking entry into higher education. Higher education finance policies have been formulated simultaneously with consideration of removing restriction to the number of places offered based on availability of government funded room and board and to let the demand for tertiary education determine its access and expansion policies. As a result and to respond to demand for places in higher education and not to take the size of existing higher education as given, some countries in sub-Saharan Africa adapted pay-as-you go schemes (known as parallel programmes) for financing higher education, and with a view that means-tested financial aid is a policy option that can better achieve equity objectives (Court, 1999; Oketch, 2003).

Related to widening participation has been equity objectives, especially in systems where students who experience higher education come from relatively wealthy backgrounds while their counterparts from poor backgrounds are not afforded even quality basic education. The equity objectives have been to: 1) reverse the funding situation wherein the higher education system comprises the greater share of the educational budget but enrols an elite group of students. 2) Reconsider higher education financing so that it is not financed through a tax structure whereby the poor end up subsidizing more education for the elite because the children of the majority poor attend poor quality basic education and have extremely limited chance of qualifying to go to a university (Oketch, 2016). For example, analysis by World Bank (2019a, p. vii) presented in a policy report focusing on improving higher education performance in Kenya found that whereas 9.8 percent of the households in the highest quintile had a member attending university education, there were only 0.2 percent for households in the lowest consumption quintile, and that a young person in Kenya who is from the richest income group is 49 times more likely to access higher education than one from the lowest income group.

The literature as well as the public debates on schemes for financing higher education in the recent past have included several examples across the world. The introduction of some of these schemes have led to student protests in some countries, such as in South Africa in recent past, and in the UK when tuition fees hit £9,000 per year. These schemes include pay-as you go systems - whereby one cohort of students from higher income families pay the full costs of their education at the time they are attending university. This was introduced in several African countries in the 1990s (Oketch, 2003; Court, 1999). One cohort was admitted

on a government financing scheme and another cohort (referred to as parallel) were admitted and pay the full economic cost on their own. The second scheme is the fixed-amount-payments scheme, whereby the student repays the total costs of their university education without interest in fixed amount payments over his or her working life. The third scheme is a percentage-of-earnings scheme usually known as income-based repayment loan system or mortgage-type loans (Barr et al. 2019). Under this plan, the student pays a fixed percentage of his or her income. But this means that those who are in low paying jobs, the undiscounted value of this payment would just cover the cost of the loan. The fourth is the income-contingent repayment loan system, whereby "monthly repayments depend on the debtor's future income" (Barr et al. 2019, p. 1).

Barr et al (2019) highlight three elements which make mortgage type repayment undesirable: 1) if interest rates increase this raises monthly nominal repayments; 2) if the duration of repayment is fixed, but the repayment burden for individuals which is the proportion of their income absorbed by repayments stays unaffected, the impact can be huge as the increase in interest raises monthly nominal repayments; 3) if monthly income falls or graduates become unemployed, the repayment burden increases. Mortgage type loan schemes are common in Africa. They have suffered due to these factors but also because there is little or no recovery of costs from wealthy parents who could contribute directly to the cost of their children's higher education. Income contingent repayment loans (ICL) systems are favoured by Barr et (2019,p.2) because: 1) an increase in interest rates has no effect on monthly repayments because "repayments are a fixed per cent of the borrower's current income until he/she has paid the loan"; 2) there is a fixed fraction of the total income of the person to be absorbed by loan repayments; and 3) when a person's income rises, their repayments increase but will not exceed the cap as defined by the policy. In essence, ICL systems imply that those in higher paying occupations would pay more than the average cost, those in low-paying occupations less. This scheme of financing higher education has positive implications for widening participation, hence increases the social benefit externality effects derived from higher education. As Appiah and McMahon (2002) note, these benefits are miniscule for the individual and they also take many years (25 to 40 years) to materialise. Therefore, this effect is more evident when there is greater participation in higher education. This is the central argument also advanced in this paper. It focuses on education's external effects on reducing female fertility rates and increasing democracy through expanding political rights, both of which are increased by higher enrollments. These two themes are introduced briefly in the next sub-sections 3.1 and 3.2.

3.1 Reducing the total fertility rate (TFR)

Reducing the total fertility rate, which is measured by the total births per female is particularly important because it has been a major development problem for the world. It is also an important factor in expanding access. This is because high population growth rates due to higher fertility rates increase poverty and are also a burden to governments with limited resources, as it inhibits the ability of such governments to establish and support high quality higher education to cope with increased demand. Bongaarts, et al. (2017) have emphasised that fertility will differ between more educated and less educated women in almost all countries. Figure 1 below shows that fertility has declined steadily in sub-Saharan Africa in recent years, and increased education of girls and women is thought to have contributed to this declining fertility. It is known that education can change the way family

relations and decisions about childbearing are made, which have impact on the total fertility rate (TFR). When girls and women have more education, including participation in higher education, this can bring about postponement of marriage to a later date, which also leads to later onset of childbearing and ultimately small family size due to reduced TFR (Colleran, H et al, 2014; KC & Lutz, 2017). The problems caused by higher TFR, hence rapid population growth in sub-Saharan Africa is also the theme in the major work by McMahon with Arifa in McMahon (2002, p. 75, Table 5.4) in which they traced the effects on economic growth of expanding access to education via effects on population growth, among other factors. What is new in this paper is that it considers this relationship through the effects of enrollment ratio, effects of government expenditure per student as percentage of GDP per capita and effects of percentage of government expenditure on education. These are all considered for primary, secondary, and higher education using more recent data for 2000-2017. This also happens to be the period of 2015 Millennium Development Goals (MDGs) and Education for All (EFA), during which many countries in sub-Saharan Africa witnessed improved participation in all levels of education, and particularly emphasis on universal access to primary education.

Figure 1: Fertility rates in sub-Saharan Africa: 1960-2015
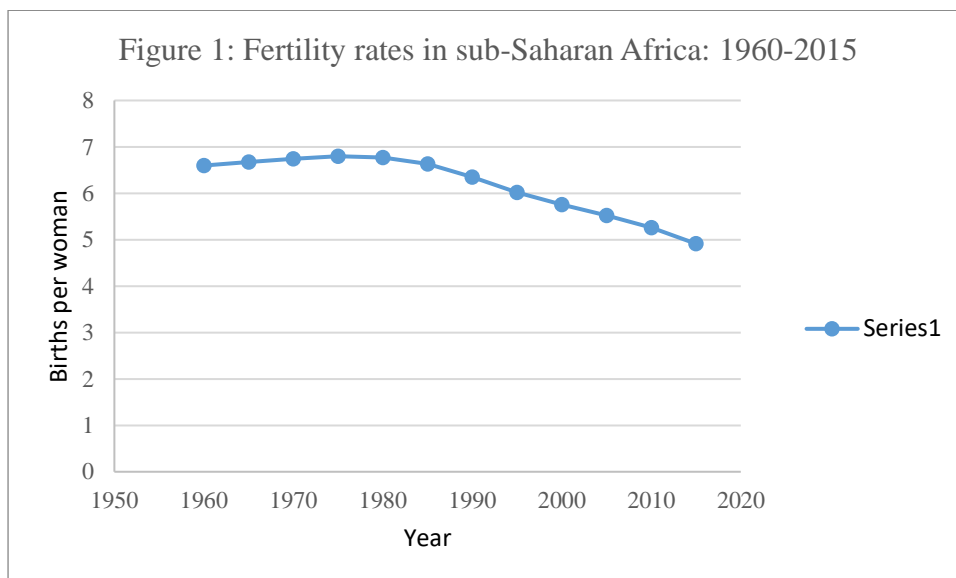
Source: Constructed by author based on data from World Development Indicators, World Bank.

3.2 Political participation

There is a widely held view that education positively correlates with political participation. In theory education is thought to confer participation-enhancing benefits and these in and of themselves cause political participation (Kam and Palmer, 2007). Therefore, it follows based on this logic that expanding education participation should positively be associated with the degree of political participation. Enrollment in higher education should be expected to also confer participation-enhancing benefits, making it more likely that those individuals who have attended college will be active in political campaigns and civic engagement. After optimism following political independence in several countries in sub-Saharan Africa in the early 1960s, coups and domination by military rule soon took over and many governments in the region were regarded as mainly authoritarian or military regimes. This began to change in the early 1990s, after calls for democracy grew stronger, helped by the end of the cold-war.

Since then, elections have been held regularly in five-year cycles in most countries and military coups have become increasingly very rare and are shunned by the African Union. While authoritarianism has remained common even when elections are held, the trend has shifted away from domination by the military as was the case before the 1990s across the region. Coincidentally, in 2000, the MDGs also rallied countries to provide universal basic education, and this has spilled over to expanding secondary education. There has been increased demand for expansion of opportunities for tertiary education and this demand is thought to be arising from greater participation in secondary education in the region. Using the new data from 2000-2017 this paper, therefore examines the effects of education enrollment on democratization (improvement in political rights) controlling for the impacts on per capita income in sub-Saharan Africa. The next section develops the theoretical and conceptual arguments for this relationship between education, including higher education and social benefit externalities.

4. Theoretical framework for social benefit externalities
4.1 The theory of endogenous development
The conceptual framework for the effects of social benefit externalities on the rates of growth and of per capita development are worked out in the first article in this Special Issue by McMahon. In this framework, McMahon notes that endogenous development which builds on endogenous growth theory can be applied to explain the effects of social benefit externalities arising from wider participation in higher education. Hence, the starting point of the theory of endogenous development is to understand the theory of endogenous growth. A starting point to the theory of endogenous growth was the dissatisfaction with the neoclassical approach, and this gained momentum in the 1980s and entered mainstream growth economics through the work of Romer (1986) and Lucas (1988). An objective driving this new growth theory in the 1980s was the desire to replace Solow's long run steady state of zero per capita growth. This, and the endogeneity of the growth process, brought long-run growth back into the mainstream of economic analysis, by explaining it within the model (Oketch, 2006, p. 555-556). Therefore, endogenous growth theory is really about explaining the process of human capital formation and how this with its externalities determines per capita economic growth by offsetting diminishing returns to investment in physical capital. Romer's (1990) model argues in favor of an adequate stock of human capital and he finds that "what is important for growth is integration not into an economy with a larger number of people but rather into one with a large amount of human capital" (Romer, 1990, p. 98). Lucas (1988) can be said to have been the one who fully spearheaded the development of the endogenous growth theory in a manner that is relevant to the study of social benefit externalities. In Lucas' (1988) model, which offers the building blocks for endogenous development, investments in human capital has spillover effects through the external effects of human capital (Oketch, 2006, p. 557). Lucas (1988) specified that increasing returns would occur as human capital is used in production over the life cycle. This effect in turn gives rise to endogenous growth.

Lucas' model assumes that a typical firm i takes the form (i) $Y_i = F(\mu h L_i, K_i) H_a^\gamma$ where L_i is the number of workers, μ is the proportion of the time that each worker devotes to production, h is the human capital per worker employed by the firm i, H_a is the average human capital in the economy, and γ is a positive exponent. Note that in this formulation, effective labor input $\mu h L_i$, replaces the simple labor input L, specified in the standard neoclassical Solow growth model. The H_a^γ term in Lucas' model is the externality effects of human capital. Therefore, it is important to note that, endogenous growth as well as

endogenous development is really concerned with human capital formation and hence its financing by households and by government. A country with a well-educated population develops better. An increase in education tends to lead to an increase in human welfare (Oketch, 2006). Building on endogenous growth theory, particularly the production function in Lucas (1988; 2011), McMahon (2018, p. 3) develops a new model which incorporates household production of non-monetary development outcomes and the endogeneity of new ideas, and further develops the role of externalities, and how they and public support relate to both monetary and additional non-monetary development outcomes. McMahon's (2018, p. 3) model provides the key building blocks for the new model of endogenous development. Hence, endogenous growth theory has been extended through the work of McMahon (2018) into the theory of endogenous development. In the model endogenous development includes the non-monetary returns to investment in education.

For most externalities to occur, it is necessary that there are public subsidies or in the case of private institutions, some funding by endowments, since private incentives for individuals to invest in outcomes that benefit others are usually insufficient to invest enough (McMahon, 2018, p.3). Externality benefits, such as reduced population growth as a result of education's effect on the total fertility rate via increased school years for girls and women, do not accrue to the decision maker or the decision-maker alone but to the wider society. Although the decision-maker might capture the benefits of earnings and private non-market returns, he or she cannot capture (all) the external benefits or externalities (Oketch, 2006, p. 559). This is particularly important in sub-Saharan Africa where there is probably not even tacit awareness of these externalities associated with higher education. Specific external benefits of higher education that is relevant to sub-Saharan Africa today include contributions to building a society with functioning democratic institutions and their related freedoms, often enjoyed by future generations, easier access for those with more education to the internet which is now quite widespread in the major cities of the African countries, more newspapers, and a free press which can hold politicians and key government officials accountable for their actions and decisions in governance. As Oketch (2006, p. 5559) noted "The economy and the markets on which it depends function better when there is literacy, adaptability, and understanding." Recent riots in Sudan are an example of where educated youth with the support of the internet have demonstrated peacefully leading to the fall of a dictatorship. They are continuing to demand more freedom and this could be said to be partly as a result of the externalities associated with higher education because the majority of the young people who have led the demonstrations tend to be college educated. Their articulate views and the fact that they have also been joined by professionals has been portrayed in television news.

5. Methodology and Results

So, widening access via cost sharing in Africa is important. As access is widened, then additional social benefits (benefits that accrue to others, like civic engagement, trust, social capital, political stability, lower crime, more tax revenue used to finance public goods, etc.) are generated. However, not all social benefit externalities are linear extrapolations based on years of education. Yet higher education effects on technology transfer, adaptation, and its application, for example, and the effects of these on democratization, and on political stability, and hence on growth, as well as the effects of female education on lower fertility rates and hence on per capita growth are especially important for sub-Saharan Africa.

The research method of this paper involves the formulation of an empirical model based on this endogenous development theory and extends the work of Keller (2006) into the later

period. It also develops other aspects highly relevant to sub-Saharan Africa such as lowering fertility rates and hence population growth rates and hence increasing per capita income when GDP is expressed on a per capita basis. This whole process is very important for the world, worried about population growth, as well as for Africa because falling per capita income if population growth does not slow raises the real threat of the Malthusian solution of starvation. Keller's article does not focus on Africa, so also in this regard this piece makes a unique contribution to the literature.

Model Specification

The regression equations for the two dependent variables, fertility (FRTY), and political rights (PR), depend on higher education enrollment rates, other levels of education; government expenditure on education, expenditure per student as percentage of GDP per capita, all lagged ten years, and other control variables:

(2) $\mathbf{FRTY}_{it} = \alpha_i + \beta_1 \mathbf{(ly)}_{i(t-10)} + \boldsymbol{\beta_2 e_3}_{i(t-10)} + \boldsymbol{\beta_3 e_2}_{i(t-10)} + \boldsymbol{\beta_4 e_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

(3) $\mathbf{PR}_{it} = \alpha_i + \boldsymbol{\beta_1 (ly)}_{i(t-10)} + \boldsymbol{\beta_2 e_3}_{i(t-10)} + \boldsymbol{\beta_3 e_2}_{i(t-10)} + \boldsymbol{\beta_4 e_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

(4) $\mathbf{FRTY}_{it} = \alpha_i + \boldsymbol{\beta_1 (ly)}_{i(t-10)} + \boldsymbol{\beta_2 p_3}_{i(t-10)} + \boldsymbol{\beta_3 p_2}_{i(t-10)} + \boldsymbol{\beta_4 p_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

(5) $\mathbf{PR}_{it} = \alpha_i + \boldsymbol{\beta_1 (ly)}_{i(t-10)} + \boldsymbol{\beta_2 p_3}_{i(t-10)} + \boldsymbol{\beta_3 p_2}_{i(t-10)} + \boldsymbol{\beta_4 p_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

(6) $\mathbf{FRTY}_{it} = \alpha_i + \boldsymbol{\beta_1 (ly)}_{i(t-10)} + \boldsymbol{\beta_2 S_3}_{i(t-10)} + \boldsymbol{\beta_3 S_2}_{i(t-10)} + \boldsymbol{\beta_4 S_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

(7) $\mathbf{PR}_{it} = \alpha_i + \boldsymbol{\beta_1 (ly)}_{i(t-10)} + \boldsymbol{\beta_2 S_3}_{i(t-10)} + \boldsymbol{\beta_3 S_2}_{i(t-10)} + \boldsymbol{\beta_4 S_1}_{i(t-10)} + \mathbf{X} + \varepsilon_i$

Where $\mathbf{X} = \boldsymbol{\beta_5 (I/Y)}_{it} + \boldsymbol{\beta_6 (T/Y)}_{it} + \boldsymbol{\beta_7 (G/Y)}_{it}$

By controlling for GDP per capita, the net effects of higher education are development outcomes above and beyond earnings.

The panel data are measured in actual years (not averages as in Keller, 2006) for 43 African countries, 2000-2017 (see appendices). The dependent variables are fertility rates, and political rights. Enrollment rates are ($\mathbf{e}_{i)}$, (i= 1, 2, 3), for primary, secondary, and higher education; public education expenditure as a share of GDP ($\mathbf{p}_{i)}$; and public education expenditures per student in higher education as a share of GDP per capita ($\mathbf{s_i}$). They are not averaged although they are lagged by ten years as in Keller (2006p. 20). Following Keller (2006) and McMahon (1998) the education variables for enrollment rates and public expenditure are not included in the same regression in the tables below because they are observed to be collinear. As Keller (2006, p. 20) notes, moreover, public expenditure per student as a share of GDP per capita accounts for expenditures per student. The specification of the regressions to a large extent reproduce the earlier work of Keller (2006, and in this Special Issue) but are applied to Africa and without using averages. In her work, she uses data from 1971-2000. This paper uses the same data sources but from 2000-2017 and will focus on the results for political rights and fertility.

Using many countries lessens self-selection bias, and enrollment rates lagged by ten years lessens bias due to simultaneity in the regressions on fertility and political rights. There are 43 countries when estimating the effects of enrollment rates (Table 2); there are 39 countries when estimating the effects of the percentage of government expenditure on education (Table 3); and there are 24 countries when estimating the effects of government expenditures per student in higher education (% GDP per capita) (Table 4) all lagged by 10 years. World Bank Data from the World Development Indicators (WDI) 2000-2017 are used for enrolment rates at all levels, fertility rates, public expenditure on education, and GDP per capita growth.[1] Data from 2000-2017 was used because data for 2018 was only available for Gambia, Ghana & Lesotho for a few variables, so 2018 was excluded. There are 46 sub-Saharan African countries: There was no data on Swaziland, but Sudan as well as South Sudan were included so in total 43 countries. GDP per capita measures are in constant 2010 dollars (in line with Keller 2006, 20 footnote). Political stability is from Freedom House (2017) as is Political Rights (PR) which is measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest.[2] The panel data are for 18 years. The dependent variable is fertility rate and democratization/political rights. Enrollment rates in primary, secondary, and higher education (i= 1, 2, 3) are similar to Keller (2006), not averaged but lagged by ten years. Only gross enrollment rates are used as these are available for all stages- primary, secondary and tertiary education. The control variable added is GDP per capita. Otherwise the model follows the procedure set out in Keller (2006) for the regression equation.

Panel Regression Results

TABLE 2: **Effects of enrolment ratio (lagged by 10 years) on fertility and democratization**

	fertility	fertility	political rights	political rights
e1	-.010 [-6.17]***	-.010 [-6.06]***	-.005 [-1.10]	-.005 [-1.19]
e2	-.044 [-13.91]***	-.047 [-11.94]***	.060 [7.53]***	.064 [6.53]***
e3	-.018 [-1.17]	-.022 [-1.45]'	-.087 [-2.33]**	-.087 [-2.24]**
gdp per capita		-.000 [1.16]		-.000 [-0.60]
Adj R-sq	0.77	0.78	0.26	0.26
F-statistics	326.88***	245.61***	35.21***	26.49***
Countries	43	43	43	43
Observations	286	285	286	284

Note: Absolute values of the t-statistic is in the brackets. Statistical significance is indicated by ***, **, * and ' for the 1-, 5-, 10-, and 20-percent levels, respectively. 1, 2, 3 represents primary, secondary, and tertiary education.

Results shown in Table 2 show that similar to earlier findings by Keller (2006) primary and secondary enrollment rates significantly lower fertility rates. Secondary education is highly

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[1] Data downloaded on 27/05/2019

[2] Data downloaded on 27/05/2019

significant at the 1-percent level as in Keller's findings. However, while the coefficient is smaller, the size of the t-statistics here is higher. Thus, this would be due to the even smaller standard error, an estimate of the standard deviation of the coefficient, the amount it varies across these African countries included compared to Keller's global sample. There has been a greater participation in secondary education in sub-Saharan Africa in recent data of 2000-2017 compared to Keller's data covering 1971-2000. During these same years fertility rates have fallen in sub-Saharan Africa as shown in Figure 1. So, the impact of increased enrollment on fertility rates has diminished, but the precision of measuring this coefficient is better among this smaller more similar group of African countries than among a global sample as in Keller (2006). It should be noted that the focus of this paper is on higher education, therefore as more women join tertiary education, this should boost the significance of higher education in augmenting the already highly significant effects from secondary education in lowering fertility rates. The size of the population in the next generation may even begin to decline with significant improvements in the quality of the population.

Political rights are significantly increased by higher primary and secondary enrollment rates, a reflection of the greater expansion of primary and secondary education in the region between 2000-2017, the period covered by this paper. But they are decreased significantly by higher education enrollment rates, possibly because few are enrolled. It may also be likely because the transition 'democracies' in Africa clamp down 'heavily' on university students who are demanding political freedoms, and also urge them to vote for the government on whom they depend for room and board in authoritarian countries. This has happened in many countries where university or tertiary education students have clashed with political regimes that are still largely repressive and attempting by all means, including brutal crackdown, to suppress the political freedom spearheaded by college educated youth. The example of Sudan was given in the earlier section of this paper.

TABLE 3: **Effects of % of government expenditure on education (lagged by 10 years) on fertility and democratization**

	fertility	fertility	political rights	political rights
p1	.034 [2.37]**	.004 [0.36]	-.009 [-0.44]	.011 [0.58]
p2	-.010 [-0.67]	.001 [0.07]	.008 [0.37]	.000 [0.02]
p3	.003 [0.18]	-.032 [-2.37]**	-.031 [-1.30]'	-.007 [-0.32]
gdp per capita		-.000 [-11.55]***		.000 [4.48]***
Adj R-sq	0.08	0.47	0.004	0.098
F-statistics	6.60***	41.90***	1.24	6.04***
Countries	39	39	39	39
Observations	186	186	186	186

Note: Absolute values of the t-statistic is in the brackets. Statistical significance is indicated by ***, **, * and ' for the 1-, 5-, 10-, and 20-percent levels, respectively. 1, 2, 3 represents primary, secondary, and tertiary education.

Government expenditure on primary education as % of expenditure does not have a negative effect on lowering fertility when income effects are controlled for at the primary education level, which is likely because what matters for fertility here is not the quality of education, usually associated with expenditure but enrollment. It is known that while enrollment has improved significantly to near universal attendance in several countries, quality has declined.

Tertiary education expenditures significantly lower fertility (Table 3) after controlling for per capita income. This may be because it augments secondary education's effects in lowering fertility for females, or because females delay having children to increase their opportunity to attend college.

TABLE 4: **Effects of government expenditure per student (% of GDP per capita) (lagged by 10 years) on fertility and democratization**

	fertility	fertility	political rights	political rights
s1	-.043 [-1.45]'	-.033 [-1.72]*	.095 [2.27]**	.086 [2.31]**
s2	.036 [3.03]***	.016 [2.02]**	-.037 [-2.22]**	-.020 [-1.30]'
s3	.001 [1.58]'	-.000 [-0.49]	-.000 [-0.61]	.000 [0.59]
gdp per capita		-.001 [-9.25]***		.000 [4.05]***
Adj R-sq	0.14	0.64	0.09	0.28
F-statistics	4.58***	29.58***	3.23**	7.13***
Countries	24	24	24	24
Observations	65	65	65	65

Note: Absolute values of the t-statistic is in the brackets. Statistical significance is indicated by ***, **, * and ' for the 1-, 5-, 10-, and 20-percent levels, respectively. 1, 2, 3 represents primary, secondary, and tertiary education.

Table 4 goes further to explore the role of government expenditure per student. This is a powerful driver of lower fertility rates and more democratization at the primary and secondary levels but not at the higher education level. Here the effects of the inefficiency in financing of higher education by providing large and costly per student room and board grants to the children of the wealthy (who are likely to attend college anyway) with little resource recovery shows up. This, as noted earlier is likely because too much public tax money is spent per student in ways that do not increase learning, as is also found in Keller (2006, Table 12) globally. She also does not find significant effects from higher expenditure per student in higher education in developing countries (in her Table 9 and in this Special Issue).

6. Implications

The paper has estimated the individual effects of primary, secondary and higher education enrollment rates, public expenditure, and public expenditures per student lower female fertility rates and increase political rights in sub-Saharan Africa countries using new data covering the period 2000-2017. Primary and secondary education enrollment rates in sub-Saharan Africa do lower fertility and increase political rights. Public resources would be

better utilised if sufficient amounts are allocated first toward basic education rather than higher education in sub-Saharan Africa. It is probably possible to encourage more private financing of higher education through tuition and fees for resource recovery from wealthier families and to use public resources to support means tested financial aids for students from poor families as is done elsewhere as well as use government loans with cost-sharing to finance expansion of higher education. At present, higher education enrollment does not show significant direct benefits to lowering fertility rates and increasing political rights, perhaps because there are few enrolled. However, higher education expenditures significantly lower fertility (Table 3), possibly in part because it augments secondary education for females who then have greater opportunity to attend college and delay children.

Higher education enrollment rates also do not increase political rights later in the life cycle in spite of greater awareness and clamour for political freedom by college educated youth while in college. Governments have subsidized college students and responded by cracking down on these demands. However, it is clear that in sub-Saharan Africa secondary education enrollment rates are vital to both reducing fertility and increasing political rights (Table 2, e2). This is also found in Keller's (2006) results for developing countries. Nonetheless, the education stages are interlinked. Lower stages benefit higher stages, such that increased secondary enrollment will lead to greater demand for higher education which in turn will lead to increased higher education enrolment by females resulting in some social benefit effects in further lowering fertility rates as captured by the effects of higher education expenditure in Table 3. These results appear to reflect the transitionary development stage that several countries in sub-Saharan Africa are in at the moment. Elections are held in authoritarian countries but that does not mean that these countries are democratic. As secondary schooling has expanded there is growing demand for political freedoms, some of which have led to reforms and some to government crackdowns on those demanding these reforms, including the college educated. Hence the negative effect of tertiary education enrollment rates on political rights (Table 2).

7. Summary and Conclusion

This paper has considered the coefficients of the effects of education enrollment rates and public expenditure on lower fertility rates and increasing political rights in sub-Saharan Africa using WDI panel data from the year 2000-2017 and Freedom House data for 2017. Both lower fertility and increased political rights are important for the region's development, lowering population growth rates which has been an issue of concern and raising income on a per capita basis. Democratization also has been on the rise in the region through calls for greater political freedoms and free and fair democratic elections, especially since 1990s. Many countries in the region are in a 'transitional' zone of democracy: elections are held in authoritarian countries but that does not mean that these countries are democratic. The results in these transitions indicate a negative relationship between higher education enrollment rates and political rights, perhaps because as secondary education expands, more college students have demanded greater political freedoms, some of which they have won, but not without crackdowns on these demands by government regimes not ready to engage democratically. These results also show that secondary enrollment has the greatest effect in lowering fertility and increasing political rights in sub-Saharan Africa. Increased participation in secondary education is going to lead to greater demand for higher education, which at the moment has a negative relation to political rights but also will be necessary to establish a lasting political transition to stable and mature democracies in the region. This will happen as population

growth stabilizes with more female participation in secondary education leading to reduction in population growth as well as democratization. Clearly scarce public resources appear better allocated to secondary education, after universal primary education has been achieved, rather than heavily toward higher education for the benefit of the children of the wealthy and with little resource recovery.

Table 3 shows important connections between slowing fertility rates and hence net population growth rates that has the effect of raising per capita income and development outcomes. But expansion of higher education, particularly at 2-year Associate Degree levels which is less costly and where graduates do not tend to emigrate is also necessary and important because currently participation levels for 4-year bachelors' degrees are low. Otherwise, the social benefit externalities associated with improved secondary education, followed by opportunities for higher education and adaptation to new technologies will not be realized. This will put sub-Saharan Africa in a weaker path toward establishing mature and sustainable democracy conducive to economic development. A further danger is that this may generate discontentment among the youth and a loss of a generations inability to invest in higher education that otherwise would lead to conversion of the present youth bulge into a youth dividend. So, together with Keller (2006, and this Special Issue) this paper builds a stronger social scientific case about the external effects of education at the different levels, but also about lowering the explosive population growth in sub-Saharan Africa including humane and acceptable ways to reduce it, (namely by the education of women that lowers fertility rates). The analysis goes further to consider government expenditure per student as a powerful driver of lower fertility rates and more democratization at the primary and secondary levels but not at higher education level. The effects of the inefficiency in financing of higher education by providing large and costly per student room and board grants to the children of the wealthy who are likely to attend college anyway, and largely at the expense of the poor, with little resource recovery shows up, another result that has policy implications. At the same time the practical steps for implementing more effective forms of higher education finance, including income contingency loans, tuition fees, and means testing for public grant support in Africa are suggested.

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Appendices

Countries in Table 2, 3 and 4

Effects of enrolment ratio (lagged by 10 years): Table 2	Effects of % of government expenditure on education (lagged by 10 years): Table 3	Effects of government expenditure per student (% of GDP per capita) (lagged by 10 years): Table 4
Angola	Angola	Benin
Benin	Benin	Botswana
Botswana	Botswana	Burkina Faso
Burkina Faso	Burkina Faso	Burundi
Burundi	Burundi	Cameroon
Cameroon	Cameroon	Cape Verde
Cape Verde	Cape Verde	Chad
Central African Republic	Central African Republic	Congo, Rep.
Chad	Chad	Cote d'Ivoire
Comoros	Comoros	Eritrea
Congo, Dem. Rep.	Congo, Rep.	Ghana
Congo, Rep.	Cote d'Ivoire	Kenya
Cote d'Ivoire	Equatorial Guinea	Lesotho
Equatorial Guinea	Eritrea	Madagascar
Eritrea	Ethiopia	Malawi
Ethiopia	Gabon	Mali
Gabon	Gambia	Mauritania
Gambia	Ghana	Mauritius
Ghana	Guinea	Mozambique
Guinea	Kenya	Namibia
Guinea-Bissau	Lesotho	Niger
Kenya	Madagascar	Rwanda
Lesotho	Malawi	Senegal
Liberia	Mali	Togo
Madagascar	Mauritania	
Malawi	Mauritius	
Mali	Mozambique	
Mauritania	Namibia	
Mauritius	Niger	
Mozambique	Rwanda	
Namibia	Senegal	
Niger	Sierra Leone	
Nigeria	South Africa	
Rwanda	Tanzania	
Senegal	Togo	
Sierra Leone	Uganda	
South Africa	Zambia	
Sudan	Zimbabwe	
Tanzania		
Togo		
Uganda		
Zambia		
Zimbabwe		

Correlation

Correlation between enrolment ratio (e1, e2, e3) and public expenditure (p1, p2, p3)

	e1	e2	e3	p1	p2	p3
e1	1					
e2	0.4788*	1				
	0					
e3	0.2594*	0.8182*	1			
	0.013	0				
p1	0.025	-0.3352*	-0.4355*	1		
	0.814	0.0012	0			
p2	-0.0778	0.3969*	0.5433*	-0.6207*	1	
	0.4633	0.0001	0	0		
p3	0.1633	-0.0656	-0.0944	-0.3911*	-0.1182	1
	0.122	0.537	0.3734	0.0001	0.2644	

Collinearity between GDP per capita and fertility in Table 2

Variable	VIF	1/VIF
p1	2.76	0.362013
p2	2.35	0.425204
p3	1.85	0.539627
GDP	1.24	0.80575
Mean VIF	2.05	

Data summary

variable	variation	observation	mean	sd	min	max
Country ID	overall				1	43
Year	overall				2000	2017
Fertility	overall	828	4.8	1.22	1.36	7.68
	between			1.18	1.67	7.49
	within			0.36	3.85	6.3
GDP per capita (US dollars)	overall	803	2180.77	3211.92	193.87	20333.94
	between			3150.71	227.91	14579.66
	within			731.25	-6914.59	7935.05
e1	overall	671	98.16	21.96	32.32	149.31
	between			18.98	56.5	139.23
	within			10.87	46.54	131.25
e2	overall	508	41.9	23.02	6.11	102.75
	between			19.84	9.48	92
	within			8.57	20.75	73.39
e3	overall	458	7.5	6.89	0.34	40.04
	between			5.35	0.49	27.7
	within			3.82	-9.17	19.97
p1	overall	334	45.03	11.56	16.87	72.65
	between			10.37	25.13	63.52
	within			6.18	11.13	63.65
p2	overall	329	29.16	10.23	8.93	64.14
	between			8.82	14.6	52.17
	within			5.23	12.13	48.28
p3	overall	337	19.59	9.38	1.13	59.02
	between			8.45	5.26	44.47
	within			5.18	7.3	52.89
s1	overall	304	12.27	5.42	2.79	33.32
	between			5.14	2.79	22.45
	within			2.97	1.23	24.66
s2	overall	224	24.45	12.72	4	73.26
	between			12.03	7.11	56.98
	within			6.24	-7.07	49.42
s3	overall	234	207.35	283.52	8.39	2530.69
	between			312.57	20.09	1772.51
	within			116.61	-373.49	1137.7

*Note:*1, 2, 3 represents primary, secondary, and tertiary education.