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The link between Structural Adjustment Programs, education discontinuities and stalled fertility in Africa

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Abstract

Countries in Sub-African countries that are classified as having experienced stalled fertility declines after 2000 also experienced a discontinuity in the progress of educational improvement for cohorts of women that during the 1980 were in their primary school ages. While the proportion of young women without any formal education had been gradually declining over the previous decades the Structural Adjustment Programs of the early 1980s where associated with a stall or reversal of this improvement. After that in most countries the improving trend picked up again for the subsequent cohorts, but some cohorts of less educated women entered the prime childbearing ages around 2000. Given the strong fertility differentials by education in the countries concerned these education discontinuities provide a plausible explanation for the fertility stalls over the period. Since younger cohorts are again much better educated this also implies a likely end of the fertility stall.

Acknowledgments

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1 Introduction

This research note studies the timing and magnitude of possible effects of the Structural Adjustment Programs (SAP) that were enforced in the early 1980s by the International Monetary Fund (IMF) and World Bank in many developing countries on the recent stall in fertility declines in several African countries as mediated by discontinuities in the educational attainment of subsequent cohorts of young women in the countries affected.

While over the 1990s there has been a body of literature on the possible implications of the Structural Adjustment Programs on social and economic development in the affected countries, and over the last decade there has been a body of literature on stalled fertility declines in Africa, the two have hardly been linked. This may have to do with the fact that the two phenomena are almost twenty years apart which may have seemed too long for any direct causal effect from e.g. reduced spending on reproductive health services on fertility. This 20-year lag is, however, precisely the timing that would be expected for an effect operating through female education: Declining primary school enrollment rates for girls during the 1980s would result in lower education and hence higher fertility for women in their prime childbearing ages after 2000.

Another reason why this possible link has not been studied before may have been the difficulty to find consistent time series of changes in the proportions of women in different educational attainment categories by age for all African countries. These data now exist and do indeed show clear discontinuities in the progress of education for the cohorts concerned. Hence, a description and analysis of these education discontinuities will be our empirical starting point for this paper. From there we will go back and study the link between the discontinuities and information about the nature and timing of the Structural Adjustment Programs affecting education in the respective countries. Then we will go forward and study the possible effects of these discontinuities on the aggregate fertility trends and possible stalls in their decline. We will end with a discussion about what the existence of these links implies for likely future fertility trends in the countries affected. This will be done with the example of Nigeria which not only shows stalled fertility at a high level but also is by far the most populous country of Africa.

2 Discontinuities in the progress of educational attainment of young women in certain African countries

Consistent long time series of progress in educational attainment by age and sex for all countries in the world are not provided by statistical agencies or the UN System. For decades the United Nations Educational, Scientific and Cultural Organization (UNESCO) has collected series of school enrollment numbers at different levels of education for a large number of countries in the world. These data have typically been collected from administrative records of individual schools that were then aggregated to the municipal, district, provincial and national levels. But these data suffer from several shortcomings that make them difficult for use in cross-national time series analyses. First, these enrollment data do not exist for all countries for continuous annual time series going back to at least 1970. Secondly, the absolute enrollment numbers need to be related to the cohort sizes of young people in order to produce internationally comparable enrollment rates. But often the source data is only given by grade level and not by age of all children attending these grades which in Africa tend to show a great spread and often teenagers are found to attend schools at low grades. Hence, efforts to estimate net enrollment rates for different levels are often based on many assumptions. Finally, there is reason to assume a bias towards over reporting enrollment, if the funding of schools depends on the number of students enrolled. All these reasons make the direct use of reported enrollment rates problematic.

A more consistent and typically less biased source of information can be found in age- and sex-specific educational attainment proportion as they are collected in censuses and representative surveys in most countries. Looking at the times series of the distribution of highest educational attainment for young adults can then be either directly used as an indicator of changes in education over time or they can be converted back into educational transition rates that should be directly comparable to graduation rates derived from enrollment data – assuming standard ages at transition. Unfortunately, the data provided by UNESCO, who has been since its creation the prime receiver of data on educational attainment from national statistical offices, are fragmentary at best with large gaps for many countries. The data also suffer from the lack of harmonization of education categories which makes them difficult to compare over time (Bauer et al. 2012; Riosmena et al. 2008). While in the case of population distributions by age and sex the United Nations Population Division has used the raw data provided by countries and converted them into consistent time series for all countries, a similar data adjustment for educational attainment has not yet been implemented by UNESCO, particularly not for historical time series.

For these reasons several groups of economists who needed such data for estimating the effect of human capital on economic growth have made efforts to estimate consistent time series for most countries. The best known of these are Barro and Lee (1993; 2001; 2013), Cohen and Soto (2001; 2007) and De la Fuente and Domenech (2000; 2006; 2012). The methodology that they used for the reconstruction has been changing over time. Earlier datasets were based on a method from the standard tool kit of economists for cumulating investments over time, the so-called perpetual inventory method, which essentially cumulates enrollment rates along cohort lines and in some cases adjusts them to correspond to given data points on attainment. The latest datasets (Barro & Lee 2013; de la Fuente & Doménech 2012) are using a methodology closer to the one developed by Lutz et al. (2007) who published the first systematic

reconstruction of educational attainment distributions by age and sex for all countries in the world using multi-dimensional demographic back projection methods. Unlike the above cited earlier efforts Lutz et al. produced the first full set for 5-year age-groups, sex and four educational attainment categories back to 1970 also adjusting for different survival probabilities by level of education. They started for each country from data points around 2000 that came from censuses or in some cases Demographic and Health Surveys (DHS) and reconstructed backwards along cohort lines until 1970. Hence the observed educational attainment distribution of e.g. 50-54 year old women in 2000 was the basis for estimating the distribution of 20-24 year old women in 1970 after adjusting for differential mortality and in some cases migration. Since the age- and sex-structure for every country had been estimated by the UN back to 1950 this reconstruction was only a matter of estimating the proportions with different education levels in each age cohort. These reconstructions were then validated against the existing data from different sources e.g. UNESCO, National Statistical Offices, DHS, and adjusted where necessary. More recently a new exercise of this sort has been conducted using six instead of age education categories (Speringer et al. 2015; WIC 2015). The data used here are taken from this more detailed reconstruction (WIC 2015).

Even before drawing any possible links to the SAPs of the 1980s or the stalled fertility trends after 2000 this review of education trends resulting from the reconstruction of human capital by age and sex revealed some curious discontinuities for some African countries but not for others. In the following we look at the number of women in the age group 15-19 who have some schooling, even if it is only incomplete primary in some of the larger Sub-Saharan African countries. We chose the 15-19 age group because it is still rather close to the age at which these women went to primary school and on the other hand it can be assumed that if a girl has not received any schooling by age 15 she is unlikely to receive any formal schooling at all.

Figure 1a shows the trends from 1970 to 2010 for Nigeria which is with currently over 170 million inhabitants the most populated African country. While in 1970 only around 30 percent of Nigerian women aged 15-19 had ever attended any formal schooling this proportion doubled to around 60 percent by 1990 but then saw an abrupt interruption of this increasing trend and over the 5-year period 1990-95 the proportion of 15-19 year old women remained virtually unchanged. Only after 1995 the increasing trend started again although at a somewhat slower speed. In 2010 76 percent of young Nigerian women of this age group had experienced some formal schooling. As will be discussed in more detail in the following section this discontinuity in the improving education trends for the cohort born 1975-80 directly corresponds to the timing of a major crisis of the Nigerian education system in the context of the SAPs for that country. As Fadayomi (1993) shows, during the course of this crisis the officially reported primary enrollment rate for 6-11 year olds declined from 93 percent in 1982-83 to only 64 percent in 1986-87. After that it only recovered slowly.

Figure 1b shows a similar pattern for Kenya but at an already higher level of primary enrollment. During 1970 and 1990 the proportion of women aged 15-19 who had ever received any schooling had increased from 54 to 87 percent. Between 1990 and 1995 this improvement slowed and then even declined between 1995 and 2000. Only after 2000 the improvement picked up speed again. This pattern is almost identical to that in Zambia (Figure 1c) where the discontinuity happened five years earlier. The pattern of Niger (Figure 1d) again closely resembles that described above for Nigeria.

All 33 Sub-Saharan African countries show some sort of discontinuity in educational improvement for the cohorts that were of primary school age in the 1980s.

Figure 1: Trends in the proportion of women aged 15-19 who have received at least some schooling for Nigeria, Kenya, Zambia and Niger. The dotted lines show the extrapolation of the trend from 1970 to 1990 based on cubic spline.
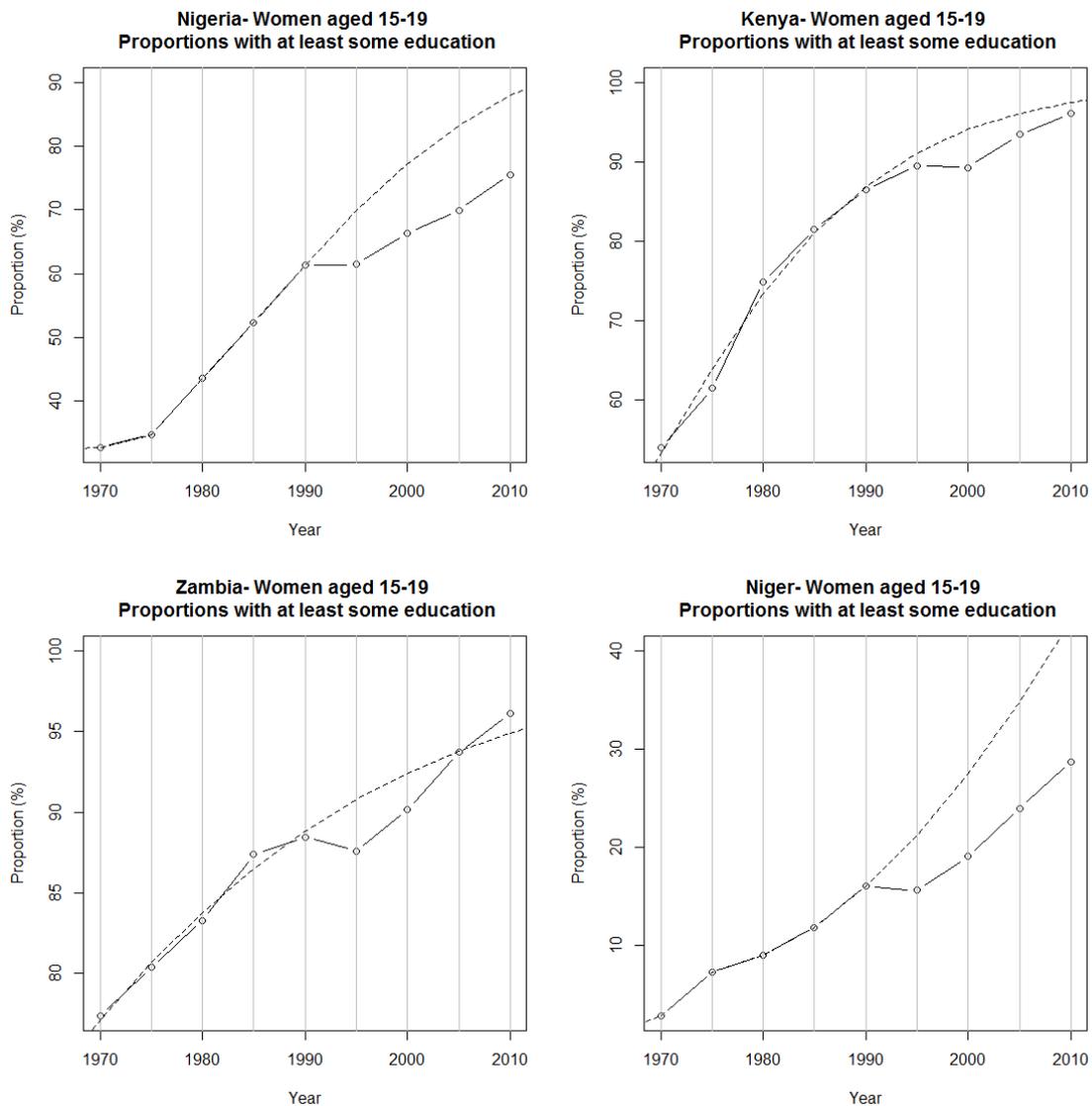
But there are also large African countries that do not show such discontinuities or even experienced an acceleration of education improvements for these cohorts. Figure 2a shows the trends for subsequent cohorts in Senegal where the improvement in the proportion of women aged 15-19 who had ever attended school shows almost a straight line after 1980 with only a very minor dent between 1995 and 2000. In Ghana after a period of little improvement in 1980-85 the rate of improvement even accelerated up until the year 2000 after which it slowed again. A particularly interesting case is Ethiopia where a slowing of the improving trend between 1990 and 1995 was followed by an acceleration that was even faster than the original increase and by 2010 brought the proportion of 15-19 year old women with some schooling to a level that with close to 80 percent is even higher than the trend line based on the 1970-90 trend.

Figure 2: Trends in the proportion of women aged 15-19 with at least some primary schooling experience: Senegal, Ghana and Ethiopia. The dotted lines show the extrapolation of the trend from 1970 to 1990 based on cubic spline.
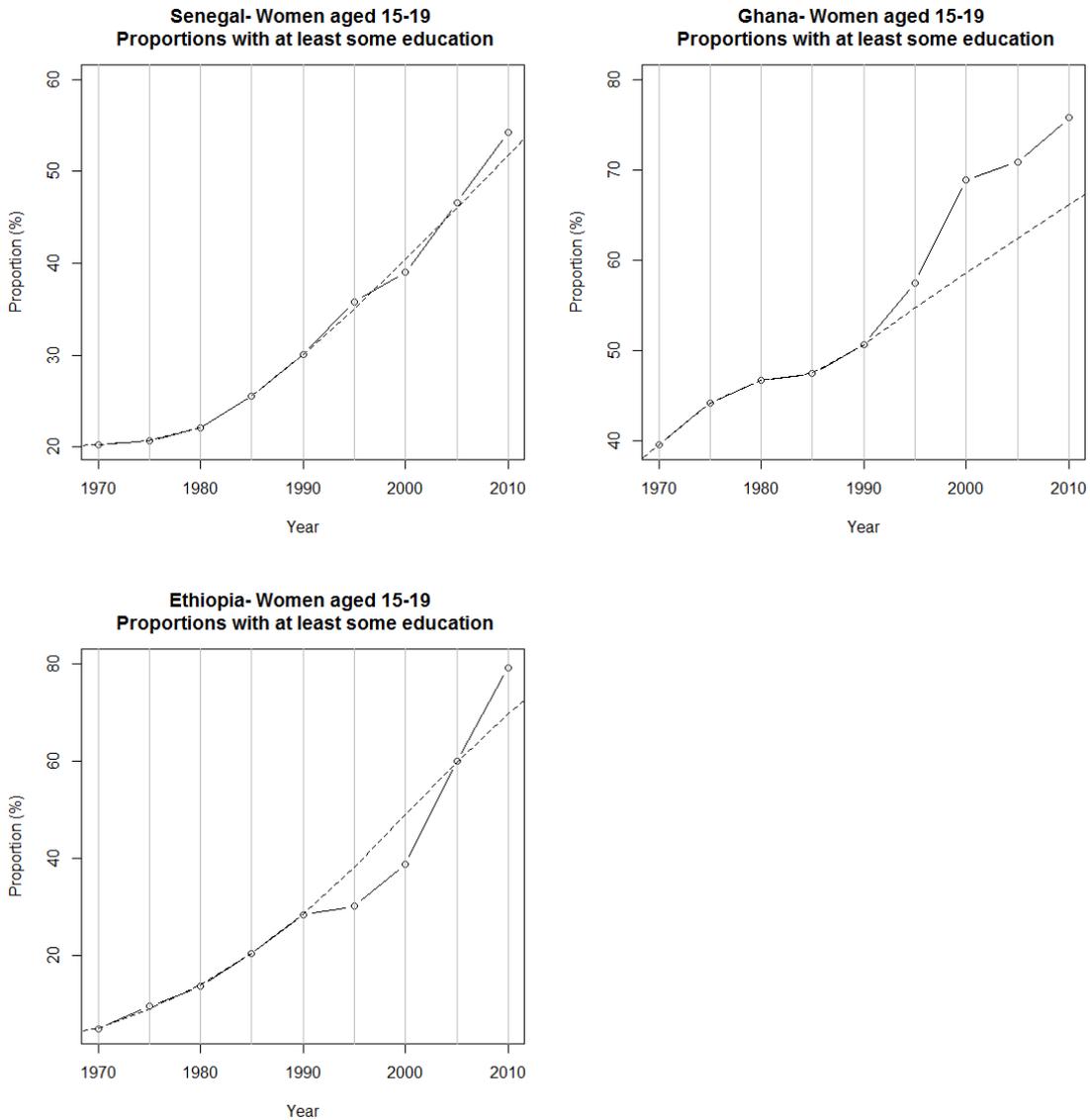
While the described discontinuities in the improvement of education levels of subsequent cohorts is most clearly visible for the difference between no schooling or some schooling it does also show up at higher levels of education. For this it is worth looking at countries that by 1990 already had sizeable proportions of the female population with at least junior secondary education. Figure 3 shows the changing proportion of young women that have completed junior secondary or higher education in Zimbabwe and Kenya. For both countries a discontinuity is visible that is comparable to those described for some primary education above. Since in the African context junior secondary education can still be completed after the age of 15, partly due to delayed entries in the school system and grade repetition, these figures depict the proportions among women aged 20-24. Therefore the expected possible effects of the

education crisis of the 1980s can be expected to show up five years later than shown in Figures 1 and 2. Generally, for most African countries the pattern of possible discontinuities with respect to higher levels of education is less clearly pronounced than in the above described cases of the transition to any schooling. This is likely due to the fact that the strong annual fluctuations in school enrollment that happened in some countries over time become blurred in terms of their effects on the educational attainment of 5-year cohorts due to the rather broad age range in which young women in Africa enroll in different school grades that in other parts of the world are very closely associated with specific ages. For this reason our analysis focuses primarily on the transition from no schooling to any formal education.

Figure 3: Trends in the proportion of women aged 20-24 with at least completed lower secondary education in Zimbabwe and Kenya. The dotted lines show the extrapolation of the trend from 1970 to 1990 based on cubic spline.
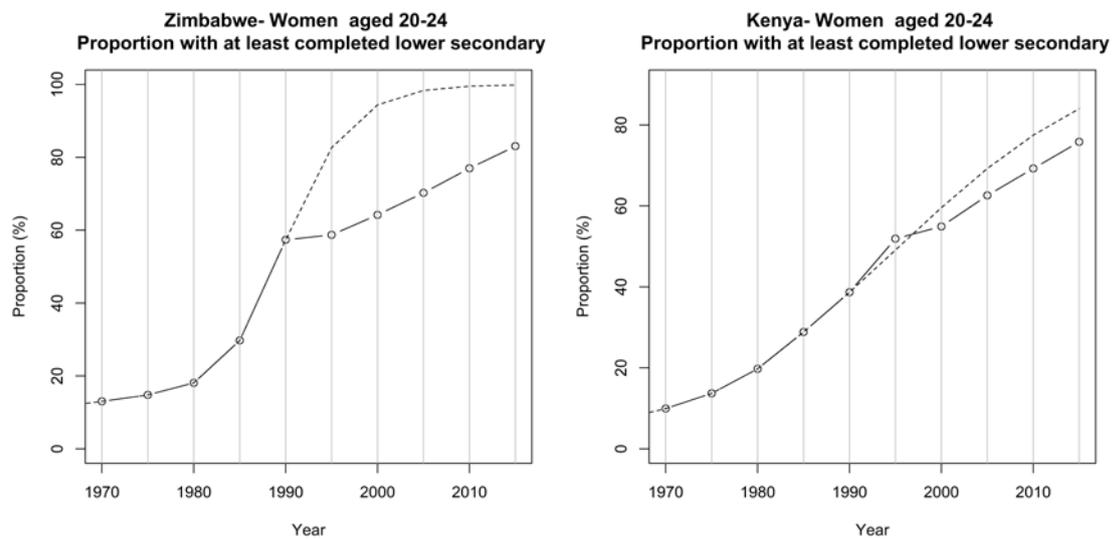
3 The Structural Adjustment Programs of the 1980s

For many countries particularly in Latin America and Sub-Saharan Africa the 1980s saw a contradictory international discourse on education and economic reform. On the one hand, a process lead by UNESCO highlighted the overriding importance of education for national development and organized a series of regional conferences that finally culminated in the World Conference on Education for All in Jomtien (Thailand) in 1990. On the other hand a process lead by the World Bank and the IMF emphasized the need to restructure economies, reduce the role and the size of government spending, and enforce fiscal discipline. In particular, the 1982 announcement by the Mexican State that it could no longer service its debt obligations was widely seen as a wakeup call reminding the world community that a restructuring and stabilization of public finances was a prerequisite for subsequent sustainable economic growth. And since many countries in Africa and Latin America greatly depended on the World Bank and IMF for credit those institutions had a strong leverage to impose onto these countries structural adjustment policies that were considered necessary and appropriate.

While the World Bank was even one of the key sponsors of the World Conference on Education for All (Reimers 1997) it at the same time forced countries to

significantly cut government expenditures which in most cases translated into strong reductions in education, health and social expenditures. The strong negative actual effects of the SAPs on school enrollment and educational attainment in a number of countries was probably not intended by the World Bank and IMF. In the words of Reimers (1997, p.4) "Adjustment was not attempting to 'worsen' education conditions, nor was it trying simply to mitigate the deterioration in economic conditions which preceded adjustment in most countries. The purpose of adjustment was to restore the conditions that would enable countries to recover rates of economic growth that would allow them to increase the quality of life of their populations, to reduce poverty and to sustain development." The effect of SAPs on education was discussed passionately among scholars because of the difficulty to disentangle the outcome of SAPs from that of other strains on the education systems due to e.g. civil wars, droughts, epidemics (Stromquist 1999). However, since SAPs were introduced to induce development, the mere fact that they resulted in declining education spending and attainments particularly for girls is a strong argument in their disfavor.

In a global comparative perspective trends on spending for primary education diverged strongly between 1980 and 1990. Relative to per capita income, Asian countries increased their spending by 7 percent and European countries by 16 percent, while in Sub-Saharan Africa it decreased by 12 percent (Reimers 1997).Considering that in some of the African countries per capita income did not increase over this decade while population size and therefore the number of children needing education strongly increased, makes these declines in Africa even more significant.

It is hard to find comparable data on changes in government education expenditure for the countries discussed in this paper. We focus on changes between 1980 and 1990 as a percentage of GDP. For the countries with strong discontinuities listed in Figure 1 the following information on education spending could be found: In Nigeria the total educational spending by the Federal Government dropped from 16.2 percent of the budget in 1979 to only 10 percent of the budget in 1986-89 (Fadayomi 1993). Capital spending on education as a percentage of the budget declined from 9.7 percent in 1979 to 4.4 percent in 1980-85 and to only 3.1 per cent in 1986-89. Since over the same period the population of Nigeria was growing at a record rate of almost three percent a year it is still surprising that this significant cut in education funding in Nigeria did not result in a stronger decline in educational attainment rates. This can be partly explained by the fact that the salaries of teachers were also cut significantly. What were the effects on the quality of education cannot be assessed on the basis of the available data but it seems likely that it did not improve.

Kenya was an intensive adjustment country and the funding for education as a percentage of GDP declined strongly from 5.9 percent in 1981 to 4.6 percent in 1984 after which it recovered again (UNESCO 2015). It is not well documented what this shock actually did to the education systems under conditions of a simultaneous dramatic increase in the number of children. The number of children aged 5-14 increased during that period from 4.8 million in 1980 to 5.9 million in 1985. For Niger we could not find information about changes in the education budget before 1990, but it was among the adjustment lending countries. Zambia which also was an intensive adjustment lending country had a massive decrease of education spending from 6.3 percent of GDP in 1976 to 5.4 percent in 1983 down to a low of 2.7 in 1987 and even below 2.0 in the early 1990s (UNESCO 2015).

While Ethiopia was not among the structural adjustment countries, both Ghana and Senegal were such countries. But Ghana, despite of being in this category managed to still increase its education spending as part of GDP, after experiencing an initial decline from 2.7 percent in 1980 to 1.8 percent in 1981 to above 3.0 percent in the mid- and late 1980s (UNESCO 2015), in 1990 while Senegal saw a slight decline (Reimers 1997). On average, for all the bigger African countries for which we could find data on their exposure to SAPs and the resulting changes in education spending the pattern is very clear: Those countries that were heavily exposed to SAP saw significant declines in their education spending as a fraction of GDP which under conditions of rapid population growth resulted in declines in school enrollment rates and most likely also in the quality of education. Countries that were not affected by those SAP policies or otherwise managed to maintain or even increase their education spending despite of SAP (such as Ghana) had no discontinuities in their improvement of education of subsequent cohorts during the 1980s.

A 1990 Word Bank Study on the consequences of SAP concludes that over the 1980s expenditures on health and education have increased in non-adjusting countries while in the adjusting countries they have declined. The study concludes that greater emphasis needs to be given to the protection of the social sectors because providing health and education services was an investment in human capital (Kakwani et al. 1990). This resulted in the creation of safety nets for the poor and increases in the funding allocated to education. But in 1990 the damage was already done and despite of significant subsequent efforts to again increase education investments, there was a cohort that in several big African countries on average was less educated than both the preceding cohorts and the subsequent cohorts. And it were girls in rural Africa that seem to have suffered most because in the crisis they were the first to be asked to contribute to household income rather than go to school. This was the cohort born in the mid-1970s. In the following section we will discuss how the lower education of this cohort of women could be one of the reasons for the stalled fertility decline that was observed in many of the same countries during the first decade of the 21st century.

4 Possible effects on stalled fertility

For many countries in Sub-Saharan Africa there seems to be evidence that earlier declines in the total fertility rate have significantly slowed or even stopped altogether around the year 2000 and over the first decade of this century (Fuchs & Goujon 2014). Bongaarts (2008) based on subsequent DHS observed that as many as two thirds of the countries in Sub-Saharan Africa had experienced no significant decline in fertility over this period and more than half were classified as having a "fertility stall". But there is significant disagreement about what should be the precise criteria for classifying a fertility trajectory as stalled. Schoumaker (2009) comes to the conclusion that there is only one country, Kenya, that should be classified in this way – and that the others are spurious and attributable to problems in the collected data – and Machiyama (2010) adds to this Benin, Rwanda and Zambia. Finally, a recent factsheet by Howse (2014) also includes Burkina Faso, Cameroon, Mozambique, Nigeria, Zimbabwe, Gabon and Cote d'Ivoire in the list by studying all countries with more than one DHS where the most recent one is no earlier than 2004. None of these studies could find one common factor that could explain these fertility stalls. Bongaarts claims that it could be explained

by a combination of three factors: The impact of HIV/AIDS on mortality, poorly performing economies and lower priority given to family planning.

Another way of studying recent trends that does not exclusively rely on DHS data is by looking at the estimated fertility levels produced by the UN for 5-year periods for all countries. These estimates are based on multiple sources of information and updated every 2-3 years. The most recent estimates available are from the 2012 assessment (United Nations 2013). Looking at all countries in Sub-Saharan Africa (leaving out island states) and building ratios of the fertility rates for the period (a) 2000-05/1995-2000 as well as (b) 2005-10/2000-05 we consider as stalled a country in which either of these two ratios is at or above 0.98, i.e. if fertility declined by two percentage points or less. The following countries qualify: Congo, Gambia, Kenya, Mali, Mozambique, Niger, Nigeria, Tanzania and Zambia.

Of those nine countries, four (Kenya, Nigeria, Niger and Zambia) have already been identified and depicted earlier in the paper as having strong discontinuities in the improvements of educational attainment over the 1980s. An inspection of the education trends of the other five countries shows that all of them also experienced similar discontinuities after 1980 in the improvements of the proportions of women aged 15-19 with at least some formal education. In Congo the improvement slows in 1985-90 followed by a real decline until 2000. In Gambia there is a significant drop in the proportion with some schooling around 1980 and in Mali the earlier improvements – still at a low level of around only 15 percent - also started to slow around 1980. Similarly, in Mozambique a phase of expansion up to around 20 percent of young women receiving any formal education was followed after 1980 by stagnation. In Tanzania earlier rapid improvements from around 40 to 75 percent come to halt in 1985 and there was no further increase in the proportion for the following 15 years.

This analysis shows that for all of the countries that were classified as having stalled fertility this has been associated with an identifiable discontinuity in the improvement of the educational attainment of young women as a likely consequence of the SAPs in the 1980s. Conversely, the other countries in Sub-Saharan Africa that did not show such education discontinuities also showed rather smooth and continuous fertility declines, forming a clear contrast to the ones experiencing fertility stall. Hence, unlike earlier unsuccessful attempts to identify a common cause for the stalled fertility of the countries affected, this study seems to have identified such a common cause in the form of slowed improvements or even declines in the education of young women.

The final missing piece in our chain of arguments from structural adjustment to stalled fertility is the link between female education and fertility which has been convincingly established in several major studies (Castro Martin 1995; Castro Martin & Juarez 1995; Cochrane 1979; Jejeebhoy 1995). More educated women in high fertility countries want significantly fewer children and have a significantly lower numbers of unwanted births. The resulting strong fertility differentials by level of female education can be observed for all countries in Sub-Saharan including the ones that have been classified as having stalled fertility. In many cases the relationship between level of education and fertility is almost linear with women without any formal education having the highest fertility and those with post-secondary the lowest. Since in this paper we mostly focus on the changes in the proportions of women without education as compared to those with at least some formal schooling, in Table 1 we also present the

fertility rates derived from the most recent DHS for these two categories for the countries identified as having stalled fertility as well as for the three large comparison countries Ghana, Senegal and Ethiopia.

Table 1: Fertility rates by mothers' education, Source (Measure DHS n.d.) (For the 2013 DHS for Gambia the data are not yet available)

Country	No education	Some education
Congo (2011)	6.8	5.5
Ethiopia (2011)	5.8	4.2
Ghana (2008)	6.0	3.8
Kenya (2008)	6.7	4.7
Mali (2012)	6.5	5.3
Mozambique (2011)	6.8	5.7
Niger (2012)	8.0	6.6
Nigeria (2013)	6.9	5.1
Senegal (2010)	5.8	4.0
Tanzania (2010)	7.0	5.3
Zambia (2007)	8.2	6.3

Much has been written about the reasons for these strong educational fertility differentials. In terms of their desired family sizes more educated women tend to shift from quantity to quality: They want fewer children with better life chances (including education) for them. And they consistently have higher rates of contraceptive use. A recent comprehensive study on Africa (Bongaarts 2010) explains this by pointing out that more educated women have more knowledge about and more access to contraception as well as greater autonomy in reproductive decision making. Lutz and Skirbekk (2014) assess this massive empirical association between female education and fertility to be "functionally causal" based on the evaluation of three distinct criteria: (a) the association holds for different cultural contexts and different points in time, (b) there is a plausible narrative about the mechanisms by which education influences fertility and (c) other obvious competing explanations such as selectivity and reverse causality can be ruled out. While in the social sciences true and everlasting causality is hard if not impossible to assess, functional causality has the more modest aim of establishing a consistent causal relationship for the countries and time horizons that are under consideration for the specific phenomenon studied. Based on the presented evidence as well as the extensive discussions of the literature given in Lutz and Skirbekk (2014) this assumptions seems to be safe for the issue under consideration namely education and fertility trends in continental Sub-Saharan Africa in the period ranging from 1980 to around 2020.

For this period there seem to be strong indications that discontinuities in the progress of education of successive cohorts of young women that were associated with the SAPs of IMF and World Bank in the early 1980s resulted in the fact that in the most effected countries less educated or at least not better educated cohorts of women entered the main childbearing ages which, given the strong associating between female education and fertility, in turn resulted in stalled fertility declines in the first decade of the 21st century.

If this explanation of the stalled fertility does indeed hold then this also has far reaching consequences for the future prospects of fertility and population growth in the countries affected. Given that the described education discontinuity in many countries was a temporary phenomenon that only affected some cohorts and the subsequent cohorts of young women again benefitted from continued education improvements this will likely result in near term aggregate level fertility declines in the countries affected. But this also implies that population projections that are only based on extrapolative approaches of the aggregate levels of TFRs without taking account of the changing educational composition will likely overestimate fertility levels over the coming decades. For one such country that according to the UN assessment (United Nations 2013) had stagnant TFRs around 6.0 for the past 15 years the projections that do not explicitly take education into account result in only a very slow fertility decline over the coming decades and thus a population increase from currently around 170 million to an incredible 914 million by the end of the century. This country is Nigeria and in the following we will have a closer look at this heavyweight in future world population growth.

5 A closer look at the case of Nigeria

Empirical data on Nigeria are chronically unreliable and highly problematic. Different surveys often show contradictory results and some surveys such as the Nigeria DHS of 1999 has been judged as being so problematic that it has recently been withdrawn from the DHS website. But here we do not want to enter the controversial discussion about what are the more reliable surveys and what exactly is the absolute level of fertility. The most recent DHS for Nigeria conducted in 2013 gives a TFR of 5.5 for the three years preceding the survey, i.e. 2010-13. The UN (2013) assumes constant fertility at 6.0 for 2010-15. Here we will use the DHS 2013 only to assess the relative level of fertility by level of education and in particular the educational structure of the female population which has been the key empirical input to the assessment of population and human capital trends for all countries in the world by Lutz et al (2014).

Figure 4 gives the age and education pyramid for Nigeria for 2010 as derived from this study. It clearly shows that Nigeria has a very young population with more than half of the population below the age of 20 and only 3 percent above the age of 65. It also shows that the vast majority of women above the age of 50 had never experienced any formal schooling. Only for the younger cohorts schooling has improved substantially. For women aged 20-39 in 2010 only around a third was without education. But since the young population is much more numerous than the older one the red area indicating women without any schooling is actually larger for the younger cohorts despite of smaller proportions.

Figure 4: Age and education pyramid for Nigeria in 2010.
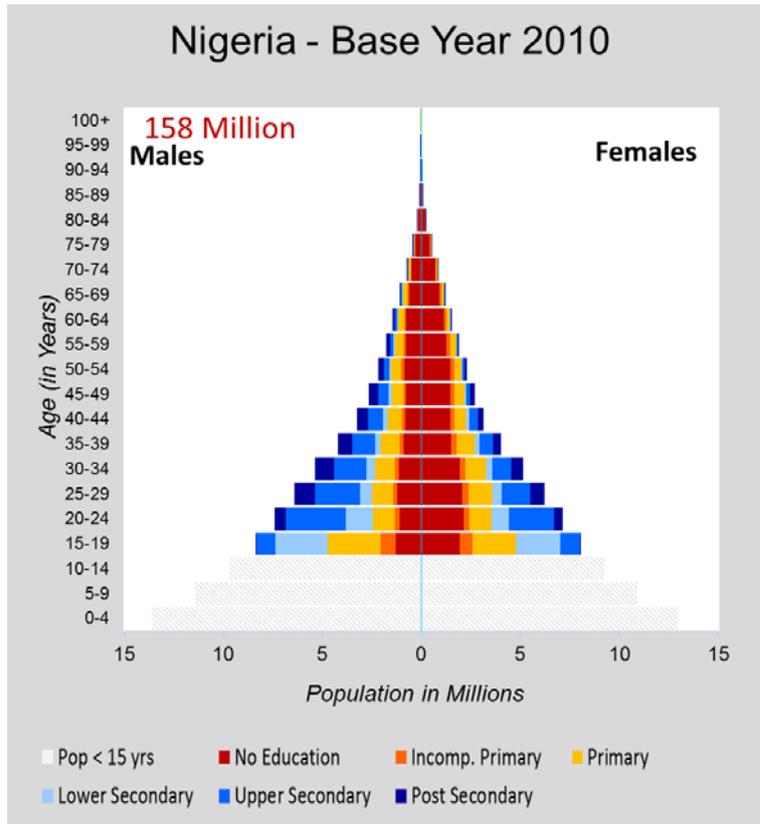
Table 2 has a closer look at the proportions of women with different levels of education as estimated for 2010 and projected under the medium scenario derived from the education attainment projections in Lutz et al. (2014) to 2020. It gives the full range of six education categories as they were used in Lutz et al (2014) for 5-year age groups. The first column for women with different levels of education in 2010 by age groups shows essentially the same pattern as depicted in Figure 1: The proportion without any formal education for women aged 15-19 is only 24 percent which is less than half of the 55 percent among women aged 45-49. The increase from one cohort to the next is continuous except for the above mentioned discontinuity of no improvement from age group 35-39 to 30-34 with both groups constant at 0.38 percent. The inter-cohort differences of the intermediate education groups are harder to interpret because their proportions increase as women move up from lower categories but at the same time decrease as women move on to yet higher education groups. The highest education category – that of women with completed post-secondary education – increases from 8 percent for women aged 45-49 in 2010 to 12 percent for those aged 30-34. For younger women the proportions are somewhat lower again because at those ages the transitions to this highest category are not yet completed.

Table 2: Proportions of women in different educational attainment categories, Nigeria 2010 and 2020 (according to medium scenario projections)

Year	Age group	Educational attainment:					
		No education	Incomplete primary	Completed primary	Lower secondary	Upper secondary	Post-secondary
2010	15--19	0.24	0.08	0.27	0.28	0.12	0.00
	20--24	0.30	0.04	0.16	0.12	0.32	0.06
	25--29	0.33	0.05	0.19	0.08	0.23	0.11
	30--34	0.38	0.05	0.20	0.06	0.18	0.12
	35--39	0.38	0.06	0.23	0.06	0.16	0.10
	40--44	0.47	0.06	0.20	0.05	0.13	0.09
	45--49	0.55	0.07	0.18	0.03	0.08	0.08
2020	15--19	0.11	0.04	0.30	0.38	0.16	0.00
	20--24	0.15	0.04	0.16	0.13	0.43	0.09
	25--29	0.19	0.04	0.18	0.07	0.34	0.17
	30--34	0.23	0.03	0.14	0.12	0.29	0.19
	35--39	0.30	0.04	0.15	0.12	0.24	0.15
	40--44	0.37	0.05	0.20	0.07	0.19	0.12
	45--49	0.37	0.06	0.23	0.06	0.17	0.10

The Data presented in Table 2 do not only give testimony of the stalled educational improvement for the cohorts that were in their formative ages during the 1980s, it also shows the impressive improvements in educational attainment that was achieved since the 1970s for the younger cohorts. Summing up the last three columns in Table 2 yields the proportion of women that have at least completed lower secondary education. For the cohort of women aged 20-24 in 2010 this group comprises already 50 percent of the entire cohort. For women that were 20 years older – i.e. 40-45 in 2010 – the corresponding proportion was only 24 percent which is less than half. This indicates that over the two decades that followed the education discontinuity in Nigeria, improvements did not only happen in the above described proportion of women that ever had attended any school but also at the higher levels of education, in particular in the category of completed upper secondary education to which in 2010 belonged one third of the women aged 20-24. Given the fact that fertility rates for women with more than secondary or higher education currently are around 3.1 (DHS Nigeria 2013) as compared to 6.6 for women belonging to the lower three education categories (no education to completed primary) these significant improvements in the education of younger women in Nigeria is bound to have some impact in form of a downward pressure of future overall fertility rates.

And as the lower part of Table 2 indicates this trend is likely to continue and already in 2020 almost two thirds of women aged 20-24 are likely to have completed lower secondary or higher education. Given the much lower average fertility of this group this compositional change in the population implies significantly lower future fertility as compared to approaches that disregard the changing education structure on extrapolate from the recently stalled trends in overall TFRs.

6 Discussion

The main purpose of this brief research note is to point at a possible explanation of the recently stalled fertility decline in a number of countries in continental Sub-Saharan Africa linking it to an evident discontinuity in the progress of educational improvement for cohorts of women that during the 1980 were in their primary school ages. We also showed evidence that this discontinuity is likely the consequence of SAPs implemented in many African countries over the same period which often resulted in drastic cuts of education budgets. Further we showed that all countries that have been classified as experiencing stalled fertility during the first half of the 21st century had experienced such discontinuities in educational improvements. Thus, given the strong association between women's education and fertility this offers a very plausible explanation of the appearing pattern of stalled fertility. Furthermore we also looked at countries such as Ghana and Senegal that did not experience such education discontinuities and found that they also did not experience stalls in their fertility declines but showed patterns of a smooth and continuous decline.

Why has this not been identified before in the extensive literature on stalled fertility in Africa? Previous studies have tried unsuccessfully to link it to mortality trends, changes in family planning programs or rates of economic growth. To our knowledge the education discontinuity hypothesis put forward in this paper has not been studied in the literature before. This also may have been due to the lack of consistent time series data for trends in educational attainment by sex and 5-year age groups that is necessary to identify the described discontinuities for specific cohorts of women. Only with such data recently becoming available the discontinuities as presented in the first section of the paper become apparent. Once they were identified it was only a logical next step to try to look for their reasons in terms of the crisis of many education systems in the 1980s in the context of structural adjustment and for the consequences in terms of explaining stalls in fertility in the countries affected.

This paper does not yet offer a full test of the hypothesis that structural adjustment via discontinuities in female education is the main reason for stalled fertility declines. It rather is an attempt to formulate a plausible narrative that puts together the different pieces of the puzzle that were rather easily available. All the evidence that we found, however, supported the hypothesis and we found no evidence that was inconsistent with the hypothesis. But to do a more thorough testing one would need to construct time-series of age and education-specific fertility rates which is not a trivial task given the difficult data situation in many of the countries concerned. One might also consider moving from the study of 5-year age groups to that of single years of time and age because some of the education systems during crisis showed sharp discontinuities in terms of enrollment from one year to another and in some cases recovered quite quickly. On the other hand, in many African countries the attendance of school of one particular grade is less clearly associated with a particular age and often young adults can still be found visiting primary schools. This makes the identification of the precise links between short-term fluctuations in the funding of schools, their longer term consequences in terms of enrollment and completion rates and subsequent effect of different attainment levels on desired family size, use of contraception and ultimately fertility a difficult task which requires much more research effort that could not be done in this research note which only wants to put the issue on the table.

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8 Appendix

Appendix Table 1: Data for Figure 1 and 2: Proportion with at least some education for women aged 15-19

Year	Ethiopia	Ghana	Kenya	Niger	Nigeria	Senegal	Zambia
1970	5%	40%	54%	3%	33%	20%	77%
1975	10%	44%	61%	7%	35%	21%	80%
1980	14%	47%	75%	9%	44%	22%	83%
1985	20%	47%	81%	12%	52%	26%	87%
1990	28%	51%	87%	16%	61%	30%	88%
1995	30%	57%	90%	16%	61%	36%	88%
2000	39%	69%	89%	19%	66%	39%	90%
2005	60%	71%	93%	24%	70%	47%	94%
2010	79%	76%	96%	29%	76%	54%	96%

Appendix Table 2: Data for Figure 3: Proportion with at least some completed lower secondary education for women aged 20-24

Year	Kenya	Zimbabwe
1970	10%	13%
1975	14%	15%
1980	20%	18%
1985	29%	30%
1990	39%	57%
1995	52%	59%
2000	55%	64%
2005	63%	70%
2010	69%	77%