Trends in Fertility Change by socioeconomic status in Africa: The case of East and Central African countries.

By

Alfred Titus Agwanda, George Odwe, Anne Khasakhala and Hilbert Omamo

Population Studies and Research Institute

University of Nairobi

Introduction

Major questions that arise in fertility transition Africa is why African fertility decline different? And will it stay exceptional in future (Bongaarts, and Casterline 2012)? These questions derive from an earlier widely cited hypothesis by Caldwell et al (1992) who argued that the fertility decline in sub-Saharan Africa represents a new type of transition. This African pattern as described by Caldwell et al (1992) is the one in which fertility declines across all age groups in contrast to the greater declines among older women that characterized the non-African transitions (Bongaarts, and Casterline 2012). In addition, fertility decline in some African countries stalled in mid-transition, a pattern that has rarely been observed in other regions (Bongaarts, and Casterline 2012). The second aspect of fertility transition in Africa is the slow pace of decline. Bongaarts, and Casterline (2012) attribute this to Africa's high ideal family size, and that to fast track further fertility decline, national governments need to reduce preferences by investing in social and economic development. This corroborates Garenne (2012) observation that in a number of countries fertility transition was concentrated first among the most educated groups, and then spread to other groups as well.

Our main motivation of our study is to contribute to understanding of fertility decline in Africa by examining patterns of fertility change among the different socio economic groups. In particular, our focus is on the recent trends in reproductive heterogeneity where reproductive heterogeneity refers to the uneven distribution of births across population subgroups (Giroux et al 2008). Past studies point to the fact that future pace and consequences of African fertility transitions is expected to hinge in part on patterns of reproductive inequality (Shapiro and Tambashe 2001; Bongaarts 2006). Bongaarts (2003) also noted that consequences of recent fertility declines are in part related to reproductive inequality. Although heterogeneity has been long been studied by demographers most were simply based on group differentials without taking into account the compositional changes. Giroux et al (2008) indicate that measures of reproductive inequality are useful in understanding fertility heterogeneity since heterogeneity is shaped both by group differences in behavior and by their representation composition.

We focus on 10 countries in East and Southern Africa because in most of these countries; contraceptive use is increasing and unmet need is falling and fertility is declining (Bongaarts, and Casterline 2012). Despite this trend, the pathways to change have been mixed. For example, Kenya's fertility decline and use of contraception stalled between 1998 and 2003 while Malawi and Rwanda experienced a remarkable increase in use of modern contraception over the last 5 years. Unmet need for contraception in Kenya has remained almost at the same level while it declined substantially in Malawi. In Zimbabwe the fertility decline was similar at all levels of education (Garenne, 2012).

Given these mixed pathways it would important to understand the patterns of change. The persistence differences in fertility by different socio economic groups may continue because of inequality in uptake of family planning services since contraceptive use is the leading driver of the fertility decline in sub-Saharan Africa (Garene 2012). According to demographic and health surveys data in 24 countries taken between 2001 and 2004, the poorest groups constitute less than half of the public sector provision of family planning services (HPI, 2007). In another study by Gakidou and Vayena (2007), the gap between the rich and poor in the use of contraception has persisted despite general global improvements in socioeconomic status and the expansion of family planning Services.

Previous Studies

Many studies have examined fertility differentials in developing countries, typically by urban–rural residence (Kirk and Pillet 1998; Shapiro and Tambashe 2001; Tabutin and Schoumaker 2004) or by education. The rural-urban gap point to the fact that fertility transition is typically stronger in urban areas and that pace of decline is faster in urban compared to rural areas.

In an earlier classic study on differentials by education in 26 developing countries in Africa, Asia, and Latin America and the Caribbean, Castro Martin (1995), found that the largest gaps do not correspond to societies at the earliest stages of the fertility transition. In the case of sub Saharan Africa, countries in the midst of their fertility transition display the largest differentials. Most importantly, the impact of individual schooling on reproductive behavior is weak in poor, mostly illiterate societies but grows stronger as societies improve their overall education and advance in their fertility transition (Castro Martin 1995). A similar perspective is provided by Cleland (2002) who states that as reproductive decline takes root, fertility differentials by schooling initially tend to widen. That is, fertility declines first among the best educated and last among the least well educated (Shapiro and Tambashe 2003; Shapiro and Gebreselassie 2008). However, in the later phase of fertility transition, these differentials begin to narrow until convergence is reached at the end of transition (Cleland, 2002). It is of this view that Shapiro and Gebreselassie (2008) hypothesized that countries with relatively large increases in the share of women with at least some secondary schooling would exhibit larger declines in fertility as compared to countries with smaller increases or with decreases in the proportion of women with secondary or higher education.

In contrast to the view that fertility differentials by education initially widen and then shrink to low levels; other studies show that there are some important differences. Garenne (2012) points out that In Zimbabwe, the fertility decline was similar at all levels of education. Bongaarts (2003) in an examination of data from 57 developing countries from all over the world, noted the tendency for the absolute difference in fertility between the lowest and highest education groups to decline steadily as the transition proceeds. In his conclusion, he stated that differentials in fertility levels by educational attainment remain substantial even in the late and post transitional stages and hence does not anticipate convergence as countries reach the end of their fertility transitions. This view is also held by Shapiro and Gebreselassie (2008) that “there is a greater tendency towards widening of these differentials rather than narrowing as fertility declines”.

Giroux et al (2008) identify other typologies using education differences and taking into account their group composition. In countries where reproductive heterogeneity declined, it is from converging fertility rates across education groups rather than from converging educational levels. In other words, fertility among uneducated women becomes more similar to that among other women as group differences converge. In countries where reproductive heterogeneity increases, the source may be varied but in most cases the increases in reproductive inequality is primarily associated with educational, rather than fertility change. Garene (2012) however, acknowledges that it appears that fertility dynamics vary greatly by country and therefore Identifying a typology would be difficult because the number of different scenarios is the same as the number of countries due to the different dynamics and determinants in each country.

Most of the studies point to the need to examine fertility transition in Africa by examining trends by different groups since a comparison of average fertility levels maybe misleading (Garene 2012). There is also need to examine differentials by not only looking at the changes in the indicators but also taking into account group composition (Giroux et al 2008; Shapiro and Gebreselassie, 2008). While many studies have focused in rural-urban and educational differences, few have examined the trends and differentials in fertility decline by wealth index (perhaps due to the fact that data on wealth index is relatively more recent). This study intends to contribute to this debate by examining pace of fertility decline and relative inequality by wealth index status, educational attainment and place of residence.

Data and Methodology

Data comes from DHS conducted since 1993 for countries in east and central Africa that have had at least 3 surveys because DHS data often provide comparable data and information for most sub Saharan African countries. The countries in the study are; Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. We use the wealth index generated from DHS to measure aspects of poverty.

There are number indicators that can be used to measure inequality raging from simple differentials to concentration ratios. Differentials are the most basic when comparing indicators across groups. Most often use measures are absolute and relative differences in the indicators across groups. However, the use of simple differences ignores group size and changes in the index may either reflect differences in the indicator or group size or both.

Measures that take into account group size integrate information about both group differentials and group size defines the extent of inequality by the generic formulation: Inequality index $I = \Sigma f (ri, wi)$, where ri indicates differentials in the indicator and wi indicates the relative size of groups (Firebaugh

1999). The most commonly used indices are: Gini coefficient; concentration ratio[1]; Theil index; mean logarithmic deviation (MLD) and the coefficient of variation squared[2] (CV)[3].

In this study we use coefficient of variation squared (CV^2) as a measure of inequality (reproductive heterogeneity) simply put:

$CV^2 = \Sigma\, w_j\, (r_j - 1)^2$

Where the summation is taken over j socio economic groups (e.g. wealth quintiles), w_j indicates the relative size of these groups, and r_j indicates the ratio of the group's TFR to the national TFR. The CV is always positive, with higher values reflecting greater concentration.

Finally, a decomposition method is used to partition historical trends in changes in reproductive heterogeneity into components resulting from changing fertility differentials and from changes in the group composition as:

$$\Delta\, CV^2 = [\Sigma w^* \Delta\, (1 - ri\,)^2] + [\Sigma \Delta w\, (1 - r^*\,)^2\,]$$

Where Δ represents change, where r* and w* represent average r and w values between successive surveys. The first term in the bracket [ ] captures the influence of the extent to which reproductive heterogeneity changed as a result of changes in behavior across groups (behavioral differentiation). The second terms captures the change in the index as a result of changes in the relative size of various groups.

Preliminary Results

Annual change in fertility and unmet need for family planning since 2000

Table 1 shows the level of current fertility and the annual rate of change in fertility and unmet need since 2000. Except for Zimbabwe and Mozambique, all the other eight countries experience declining fertility since 2000. Rwanda followed by Madagascar has the highest pace of decline in the decade. Except for Mozambique, all the nine other countries experience decline in unmet need for contraception with Rwanda having the highest rate of decline. Does the same pattern hold when we look at the socioeconomic groups? The results are presented in Table 2.

[1] Concentration ratio is roughly analogous to Gini coefficients.

[2] it can be proved that the square of the coefficient of variation can be thought of as the ratio of the area that lies between the curve of equality and the Lorenz curve in the same way as can the Gini index and, therefore, it can be used as the most natural" measure to discriminate between two distributions when their Gini indices are the same(For technical proof see Gonzalez et al 2010). This form of indicator was firstly proposed as a transfer measure in Shorrocks and Foster (1987) and later by Davies and Hoy (1994),

[3] MLD = $\Sigma\, w_j \log(1/r_j)$; Gini = $\Sigma\, w_j\, r_j\, (q_j - Q_j)$; Theil = $\Sigma\, w_j\, r_j \log r_j$; $CV^2 = \Sigma\, w_j\, \Sigma\, (r_j - 1)^2$, the summation is taken over j groups. wj indicates the share of the total population with a given group trait e.g. level of schooling and rj indicates fertility ratios or unmet need ratio

The annual rate of change is higher for those in the highest socio economic positions for most of the countries. Fertility declined faster in urban areas compared to rural. Most rapid being Rwanda followed by Madagascar. The two countries had again the most rapid decline in the rural areas. Tanzania experienced an increase in fertility in urban areas while Mozambique moderate decline in urban but an increase in rural.

Table 1: Current level and rate of annual change in fertility and unmet need for family planning

Country	Latest survey	Current Total fertility rate TFR	Annual percentage change in TFR since 2000	Current unmet need for family Planning (%)	Annual percentage change in Unmet need since 2000
Ethiopia	2011 DHS	4.8	1.2	26.3	2.6
Kenya	2008-09 DHS	4.6	0.2	25.6	0.9
Madagascar	2008-09 DHS	4.8	1.8	19.0	2.9
Malawi	2010 DHS	5.7	1.0	26.2	1.2
Mozambique	2011 DHS	5.9	-1.0	28.5	-1.0
Rwanda	2010 DHS	4.6	2.1	20.8	4.6
Tanzania	2010 DHS	5.4	0.3	22.3	0.0
Uganda	2011 DHS	6.2	1.0	34.3	0.2
Zambia	2013-14 DHS	5.3	0.8	21.1	1.9
Zimbabwe	2010-11 DHS	4.1	-0.2	14.6	1.0

Rate of annual change increases with wealth index however for some countries the rate of change is mixed. Kenya and Mozambique has a high increase among the highest groups but fertility rate increased among the lower socio economic strata. In Madagascar and Uganda the pace of decline appear higher among the middle groups.

Table 2: Rate of annual change in fertility by different socio economic groups

	Urban	Rural	Lowest	Second	Middle	Fourth	Highest	No education	Primary	Secondary+
Ethiopia	1.2	0.8	0.4	0.7	0.9	1.3	2.0	0.2	0.2	4.5
Kenya	0.6	0.0	-0.8	0.0	-0.6	1.2	0.3	-1.6	-0.4	1.1
Madagascar	2.8	2.0	1.5	0.6	2.3	2.1	1.9	0.5	1.7	2.4
Malawi	1.1	0.9	0.7	0.1	0.2	1.2	2.9	0.5	0.8	-2.0
Mozambique	0.2	-1.9	-3.2	-3.7	-1.4	0.4	1.3	-3.0	-1.2	0.3
Rwanda	3.5	1.9	1.0	1.2	2.4	2.7	3.7	1.3	1.7	3.9
Tanzania	-1.4	0.6	0.9	-0.6	0.0	0.5	0.5	-0.7	-0.7	1.3
Uganda	0.5	0.7	0.7	1.3	0.8	0.3	0.2	1.0	0.6	-2.1
Zambia	1.2	0.4	0.2	0.2	1.0	1.5	1.4	0.2	0.3	0.2
Zimbabwe	-0.3	-0.4	-0.7	-0.9	0.2	0.2	0.0	1.2	-0.8	-1.4

Malawi, Uganda and Zimbabwe similar appear to follow path- the pace of decline higher for lower groups. For other countries, the gap widens with the better off experiencing declining fertility rates and the worse off unchanging or increasing fertility. This implies increase in inequality in reproductive behavior.

Trends in inequality Index

Table 3 shows trends in the extent of inequality in fertility and unmet need by rural urban residence, education and wealth index. The highest extent of inequality in fertility occurs by wealth index differentiation. However patterns differ - Ethiopia, Malawi, Mozambique, Rwanda, Zambia shows increasing gap between rural and urban residence and level of education but declining inequality by wealth index. Kenya and Madagascar appears to follow same (rising inequality by level of education and urban rural residence) but unchanging extent of inequality by wealth index. Tanzania has declining rural urban gap but increasing level of inequality by wealth index and education. In Uganda, the trend is opposite that of Tanzania – increasing rural urban gap but declining differentiation by wealth index and education. In Zimbabwe, there is a declining rural-urban gap and by level of education but unchanging extent of inequality by wealth index.

Table 3: Trends in inequality Index (Total fertility Rate and unmet need for family planning)

		Fertility			Unmet need		
country	Survey year	Urban rural	wealth index	education	Urban rural	wealth index	education
Ethiopia	2011	0.066	0.342	0.072	0.036	0.050	0.027
Ethiopia	2005	0.065	0.343	0.059	0.024	0.018	0.014
Ethiopia	2000	0.044	0.386	0.023	0.014	0.007	0.004
Kenya	2008-09	0.047	0.405	0.065	0.017	0.088	0.057
Kenya	2003	0.035	0.409	0.061	0.024	0.055	0.073
Kenya	1998	0.036	0.400	0.028	0.019	0.094	0.042
Kenya	1993	0.029	0.373	0.020	0.019	0.052	0.019
Kenya	1989	0.022	0.000	0.019			
Madagascar	2008-09	0.033	0.361	0.066	0.002	0.019	0.008
Madagascar	2003-04	0.028	0.331	0.055	0.010	0.029	0.018
Madagascar	1997	0.035	0.361	0.032	0.022	0.038	0.028
Madagascar	1992	0.036	0.000	0.031	0.010	0.000	0.038
Malawi	2010	0.021	0.398	0.035	0.003	0.010	0.008
Malawi	2004	0.020	0.423	0.026	0.003	0.008	0.003
Malawi	2000	0.016	0.519	0.037	0.007	0.009	0.003
Malawi	1992	0.005	0.597	0.009	0.000	0.003	0.003
Mozambique	2011	0.029	0.386	0.041	0.001	0.003	0.000
Mozambique	2003	0.022	0.421	0.027	0.001	0.004	0.006
Mozambique	1997	0.003	0.526	0.006	0.006	0.019	0.002
Rwanda	2010	0.012	0.462	0.026	0.004	0.030	0.022
Rwanda	2007-08	0.005	0.498	0.015			
Rwanda	2005	0.007	0.518	0.012	0.002	0.003	0.006
Rwanda	2000	0.002	0.562	0.004	0.001	0.004	0.007
Rwanda	1992	0.005	0.565	0.016	0.002	0.017	0.012
Tanzania	2010	0.040	0.379	0.050	0.021	0.041	0.011
Tanzania	2004-05	0.053	0.350	0.026	0.013	0.015	0.014

Tanzania	1999	0.070	0.379	0.018	0.004	0.019	0.001
Tanzania	1996	0.026	0.417	0.015	0.007	0.022	0.000
Tanzania	1991-92	0.011	0.000	0.006	0.003	0.000	0.005
Uganda	2011	0.037	0.374	0.021	0.022	0.040	0.026
Uganda	2006 DHS	0.023	0.376	0.033	0.015	0.030	0.018
Uganda	2000-01	0.034	0.367	0.040	0.015	0.017	0.023
Uganda	1995	0.013	0.480	0.009	0.001	0.007	0.005
Uganda	1988-89	0.007	0.000	0.008			
Zambia	2013-14	0.074	0.369	0.063	0.030	0.053	0.019
Zambia	2007	0.065	0.351	0.071	0.009	0.025	0.013
Zambia	2001-02	0.047	0.389	0.048	0.003	0.019	0.010
Zambia	1996	0.022	0.436	0.027	0.002	0.005	0.005
Zambia	1992	0.010	0.000	0.017	0.001	0.000	0.007
Zimbabwe	2010-11	0.041	0.385	0.015	0.005	0.039	0.008
Zimbabwe	2005-06	0.066	0.385	0.039	0.047	0.090	0.106
Zimbabwe	1999	0.038	0.382	0.029	0.027	0.050	0.064
Zimbabwe	1994	0.038	0.406	0.030	0.028	0.061	0.031
Zimbabwe	1988	0.044	0.000	0.047			

Decomposition of change in inequality Index

In this section a decomposition(see Table 4) method is used to partition historical trends changes in reproductive heterogeneity into components resulting from changing fertility differentials and from changes in the group composition using the formula $\Delta CV^2 = [\Sigma w^* \Delta (1 - ri)^2] + [\Sigma \Delta w (1 - r^*)^2]$.

The main cause of group differences by wealth index is behavior for all the countries. In all the countries except Uganda, the effect is to increase the extent of differentiation (increase in inequality).However, differences by education is mixed; the exceptions are Mozambique, Malawi and Tanzania. For Malawi, the compositional effects were the opposite of behavioural effect and the resultant change was minimal. For Mozambique and Tanzania, compositional effects heightened the group differences. In terms of urban-rural gap, the main driver of increased inequality is behavioral except for Ethiopia, and Madagascar. In Ethiopia the affects are same in – increased inequality due to both group composition and differences in group behavior. In Madagascar, nearly the same effects but the direction is opposite and hence the effects tend to cancel out causing decline in inequality overtime.

Most countries exhibit behavioral divergence - reproductive inequality increased, mostly because of growing differentiation in fertility behavior across the groups (wealth index, education and place of residence). However, a few countries such as Ethiopia (place of residence), Mozambique and Tanzania (education) exhibit composition divergence. In Malawi, reproductive inequality decreased mostly due to composition of the different educational groups.

Table 4: change in inequality index since 2000

	wealth			education			rural urban		
country	Behaviour	composition	Total	Behaviour	composition	Total	Behaviour	composition	Total
Ethiopia	0.025	0.002	0.027	0.046	0.004	0.050	0.011	0.011	0.022
Kenya	0.032	-0.002	0.030	0.036	0.001	0.037	0.009	0.002	0.012
Madagascar	0.018	-0.001	0.018	0.031	0.004	0.035	0.010	-0.012	-0.003
Malawi	0.031	0.001	0.032	-0.016	0.014	-0.002	0.002	0.002	0.004
Mozambique	0.042	0.001	0.043	0.015	0.020	0.034	0.022	0.003	0.025
Rwanda	0.015	0.000	0.015	0.008	0.005	0.013	0.005	-0.001	0.004
Tanzania	0.003	-0.001	0.002	0.017	0.014	0.031	-0.030	0.001	-0.029
Uganda	-0.009	0.002	-0.007	-0.028	0.009	-0.019	-0.002	0.005	0.003
Zambia	0.033	0.002	0.035	0.007	0.009	0.015	0.025	0.002	0.028
Zimbabwe	0.014	0.000	0.014	-0.011	-0.002	-0.013	0.003	0.000	0.003

Conclusions

For most of the countries, fertility levels among the poor have not changed much over the last decade. There is an apparent increase in the relative differences in fertility levels among the highest and lowest socioeconomic levels. The poor disproportionately bears the heaviest burden of childbearing. Except for Zimbabwe, most of the countries indicate increase in inequality both in fertility levels as well as unmet need for contraception. This implies that as greater use contraceptive is attained, the success of family planning programmes will increasingly depend upon how well their services are tailored to the unique needs of specific groups of users and how effectively they address equity issues in service. Sustained declines in fertility will not occur in most countries unless the need of poor are met. The extent of inequality might also explain slow decline or stall in some countries like Kenya.

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