Fertility transitions in sub-Saharan Africa. A Male perspective

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1. Introduction

Male fertility has been neglected in demographic research (Bledsoe, Guyer, & Lerner, 2000; Coleman, 2000; Greene & Biddlecom, 2000; Tragaki & Bagavos, 2014; Zhang, 2011). Theoretical approaches of fertility transitions have long acknowledged the role of males in fertility behavior, but these theories have to large extent remained "in search of evidence" (Coleman, 2000). This is especially striking in the context of sub-Saharan Africa, where very little research on male fertility exists, while males are considered to be major actors in fertility behavior (J. Caldwell, 1982; J. C. Caldwell, Orubuloye, & Caldwell, 1992; DeRose & Ezeh, 2005; Oppenheim Mason & Taj, 1987; Ratcliffe, Hill, & Walraven, 2000).

The lack of research on male fertility has been traced to several causes. According to Greene and Biddlecom (2000), fertility research was first formulated in a Western context, with a somewhat idealized view about couples and an implicit assumption of identical interests (and fertility) of spouses. "Family structures differing from Western norms may have challenged the way research was formulated […]" (Greene & Biddlecom, 2000, p. 83). The lack of data, data quality issues, and the larger and less clearly defined age range of reproduction among males (Andro & Loû, 2009; Coleman, 2000; Estee, 2004; Greene & Biddlecom, 2000; Ratcliffe et al., 2000; Zhang, 2011) are other reasons for the lack of studies on male fertility.,

The importance of research on male fertility – including by better documenting their patterns and changes of fertility – has been advocated by several researchers (Andro & Loû, 2009; Coleman, 2000; Greene & Biddlecom, 2000; Ratcliffe et al., 2000; Zhang, 2011). While coincident interests and experiences in fertility are often assumed implicitly, studying male fertility acknowledges that this may not be the case (Greene & Biddlecom, 2000). Taking into account the varied experiences, interests and roles of males and females in reproduction may also improve explanations of fertility transitions in contexts where family forms differ from the Western context (Greene & Biddlecom, 2000, p. 88). In summary, working on both males and females, "as individuals, not just as members of current sexual unions" (Greene & Biddlecom, 2000, p. 104) may open new perspectives in fertility research.

The few studies on male fertility in sub-Saharan Africa have established that the fertility levels and age patterns of fertility are usually very different among males and females – highlighting the contrasted reproductive experiences of males and females (Ratcliffe et al., 2000, p. 570). Males start their reproductive careers later, and also continue having children much later in their lives (Donadjé, 1992; Paget & Timæus, 1994; Pison, 1986; Ratcliffe et al., 2000). In polygynous societies, as in many sub-Saharan African countries, age-specific fertility rates and total fertility rates tend to be much higher among males than among females (Pison, 1986; Ratcliffe et al., 2000). Pison (1986) found a total fertility rate of 11.2 children among male Bande Fulani in Senegal (6.7 among females) and Ratcliffe et al. (2000) found a TFR of 12.0 in Rural Gambia (6.8 among females).

However, most studies on male fertility have been conducted at the local level or at the sub-national level (Donadjé, 1992; Pison, 1982, 1986; Ratcliffe et al., 2000), and little work is available at the country-level, let alone in a comparative perspective. Recent studies are also lacking. Male fertility *changes* are even less documented than levels and age patterns. While fertility changes are fairly well documented among females, this is not the case among males. The pace of fertility declines, the changing age patterns of fertility, and the drivers of these changes have not been studied.

The general objective of this paper is to describe male fertility transitions since the 1970s in 28 sub-Saharan Africa, and to contrast these changes with female fertility. Two types of analyses are performed: (1) male total fertility rates are reconstructed since the late 1970s in around thirty sub-Saharan African countries; (2) Age patterns of male fertility and their changes in the course of the fertility transition are described in the same countries. These changes among males are compared to changes among females. This paper is descriptive; preliminary results aims at showing the extent to which male and female reproductive experiences diverge, and to what extent fertility transitions differ among males and females.

Three broad hypotheses are explored. First, we expect the speed of fertility transitions to differ between males and females. Research in Western countries has shown that fertility usually changes in the same way among males and females, but this needs not be the case (Brouard, 1977). In context where polygyny declines rapidly, and where age differences between spouses decreases, we expect fertility to decline faster among males, and fertility levels and patterns of both sexes to converge. Secondly, we also expect gender differences in changes in age patterns of fertility. The deteriorating economic conditions that many African countries have experienced over the last decades may have pushed males to delay marriage and fertility in a more pronounced way than females, leading to a decrease in fertility rates at young ages. In contrast, males may stop having children at higher ages for a variety of reasons, including decreasing polygyny and the costs of large families.

2. Data and Methods

Analyses are performed using data from the household questionnaire of the Demographic and Health Survey (DHS). In total, 88 household surveys from 28 sub-Saharan African countries are used. The number of surveys per country varies from 2 to 5 (see Table annex 1).

In the DHS household questionnaire, children living in the household are listed in the household schedule and linked to their biological parents if they live in the same household. Such data are available in most DHS surveys and can be used to compute fertility rates with the own-children method (Schoumaker, 2013). The procedure used in the standard own-children method (when applied to female fertility) is (1) to link the surviving children with their mother, (2) to classify the children by single-year-of-age and single-year-of-age of the mother, (3) to redistribute unmatched children by age of the mother, (4) to reverse survive the children to estimate the number of births by year and age of the mother, and (5) to reverse survive the female population in the years preceding the survey to estimate the denominator of the rates (Cho, Retherford, & Choe, 1986; United Nations Population Division, 1983). Rates can be computed by calendar year for each age group of women.

Adaptation of the own-children method to measure male fertility rates with DHS household data is described in Schoumaker (2013). As in the standard own-children method, surviving children are linked with their father to obtain the age of the father at birth of the child. This is straightforward when the child lives in the same household as the father because the line number of the father is included in DHS data. The three major differences compared to the standard own-children method are that (1) children whose father are deceased are dropped from the list of surviving children, making it unnecessary to reverse survive the adult male population; (2) random hot deck imputation (Allison, 2001) is used to estimate the age of surviving fathers who do not live in the household of the children , and to redistributed children to fathers of the same age as the imputed age[1]; and (3) children are reverse survived using observed survival probabilities from female birth histories. From these data, one can compute the number of births per age group per year, and the exposure per age group and per year. Rates are computed by dividing the number of births by exposure. The total fertility rate is computed between ages 15 and 79.

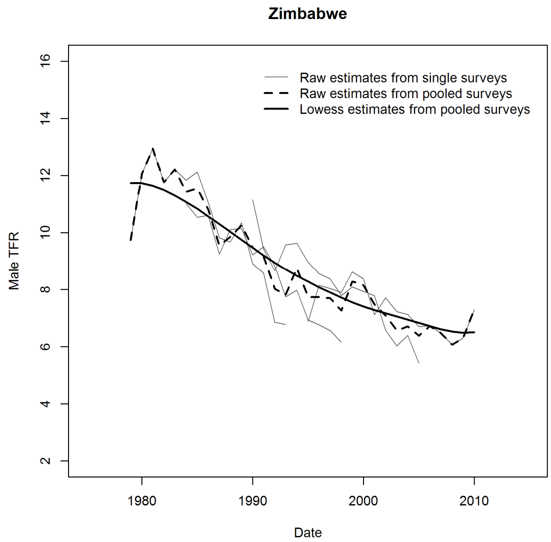
In this paper, we combine data from several surveys to cover a long period (around 30 years in most countries), to limit fluctuations due to small numbers and - to some extent – to attenuate data quality issues. The procedure is illustrated below with data from Zimbabwe. Using the method described above, retrospective estimates can be computed from single surveys. Solid light grey lines show retrospective estimates of the total fertility rate from four surveys in Zimbabwe (1994, 1999, 2005 and 2010). Data on births and exposure can be pooled[2] and retrospective estimates are computed from 1979 to 2010; these estimates are

[1] Contrary to the standard approach, this does not rely on the assumption the age distribution of fathers of matched children and unmatched children of age *x* to be the same. Using mother's age in the imputation process leads to a lower age at birth (one year on average) for fathers of unmatched children, compared with fathers of matched children.

[2] Births and exposure by year and by age from several surveys group are summed, and rates by age groups and by year are based on data from several surveys.

represented by the black dotted line. Locally weighted regression (lowess) is used to smooth the trend in the male total fertility rate (black thick line)[3].

Figure 1: Trends in male total fertility rate (15-79) from four surveys in Zimbabwe

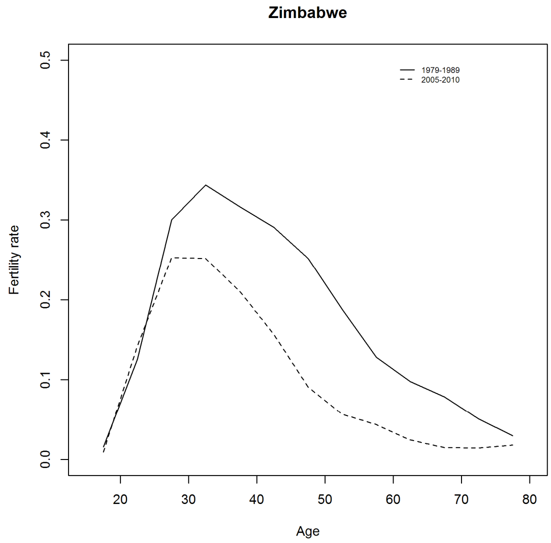


Changes in age patterns are also documented with these data. Age-specific fertility rates are computed for 5-year age groups. Trends in mean age at fatherhood (males) and mean age at childbearing (females) are computed from these rates (based on pooled data), and smoothed in the same way as the total fertility rates. In order to describe changes in age patterns, age-specific fertility rates are computed for the earliest 10-year period and the most recent 5-year period[4]. Figure 2 illustrates changes in age-specific male fertility rates in Zimbabwe between the 1979-1989 period and the 2005-2010 period. For comparisons across countries, annual changes in fertility rates are estimated (see section 3.3).

Figure 2: Age-specific male fertility rates (15-79) in Zimbabwe for two periods (1979-1989, 2005-2010).

[3] A smoothing parameter equal to 1 is selected, to limit fluctuations due random variations and data quality issues.

[4] Data are aggregated for 10-year periods and 5-year periods to limit random fluctuations.



The quality of male fertility estimates depends primarily on two factors: (1) the assumptions of the own-children method, and (2) the quality of the data. Regarding data quality, underreporting of children would lead to underestimation of recent fertility, artificial aging of young children on the household schedule would lead to overestimating fertility declines, and heaping on specific ages may also lead to erratic fertility trends. Slight overestimation of fertility may occur if orphans are reported as own-children by non-biological fathers. However, a strength of the Own children method is that children can be reported even if their fathers are not aware of their existence, which limits downward bias due to fathers' lack of awareness of progeny. Another advantage of the own-children method is that fertility rates can be computed over a large age range, since data is collected on all the members of the households, regardless of their age. While data quality is potentially a serious issue, we expect the own children to provide very close estimates to those one would obtain with direct estimates. Comparisons of own children estimates and direct estimates for female fertility indeed show that results are very close (Avery, St. Clair, Levin, & Hill, 2013),

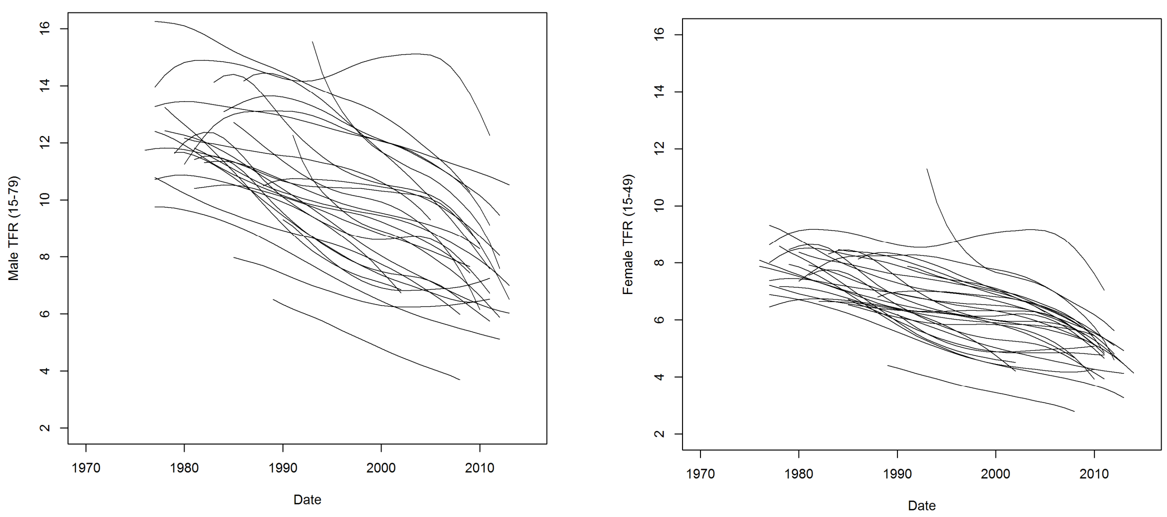
3. Male and female fertility changes compared

3.1. Changes in total fertility

Figure 3(a) show reconstructed estimates of male total fertility (15-79); these are compared to fertility trends among females (Figure 3(b)). These trends are somewhat erratic, reflecting potential data quality issues. However, three clear features emerge. (1) First, male fertility is on average much higher than female fertility. Total fertility rates (15-79) well above 12 children are not unusual, while they rarely exceed 8 children among women. These Large differences are in line with previous research on male fertility in sub-Saharan Africa, and reflect the very different age patterns of fertility by gender (Donadjé, 1992; Pison, 1986; Ratcliffe et al., 2000). Males start their reproductive lives later, but continue having children much later. (2) Secondly, heterogeneity across countries is greater for male fertility than for female fertility[5]. (3) Thirdly, male fertility has declined, as has female fertility. In the 1980s, male total fertility was above ten children in most of the 28 countries; in contrast, it is below ten children in almost all the countries around 2010. Around a quarter of the countries had fertility levels above 12 children per man in the early 1990s; only Niger still shows such a high level of male fertility.

Figure 3. Trends in total fertility rates among males and females, 28 sub-Saharan African countries

Males (b) Females



3.2. Speed of fertility decline among males and females

Does the speed of fertility decline differ among males and females? As mentioned earlier, male and female fertility need not decline at the same pace, as a result of differences in fertility changes by age. While one may expect some convergence between males and female experiences, as a result of faster declines among males, other trajectories are possible.

Figure 4 evaluates this possible convergence through trends in the ratio of the male TFR to the female TFR. Decreasing ratios show a faster fertility decline among males than among females, and some convergence in fertility among males and females. In contrast, increasing trends indicate that the relative decline in the male TFR has been slower than the relative decline in the female TFR. Table 1 classifies the 28 countries according to the trends in the ratio of male to female TFR.

[5]Absolute heterogeneity (standard deviation) is much greater, and relative heterogeneity (relative standard deviation) is also greater among males.

As shown on Figure 4 and Figure 5, situations vary widely across countries. In ten countries, as in Ghana and Madagascar, fertility has decreased faster among males than among females. In another eleven countries, as in Namibia, the ratio has been fairly stable, indicating a similar pace of decline among males and females. In six countries, all located in Western and Central Africa, male fertility has decreased more slowly than female fertility (in relative terms). The difference in total fertility between males and females fertility has remained very large, as illustrated by the case of Senegal (Figure 5). Finally, in one country (Zimbabwe), fertility first decreased faster among females than among males, and the situation reversed in the course of the transition. In summary, male fertility declines tends to change faster or at the same pace as female fertility, but the opposite situation is found in a number of countries.

Figure 4. Trends in the ratio of male TFR (15-79) to female TFR(15-49) in 28 sub-Saharan African countries.

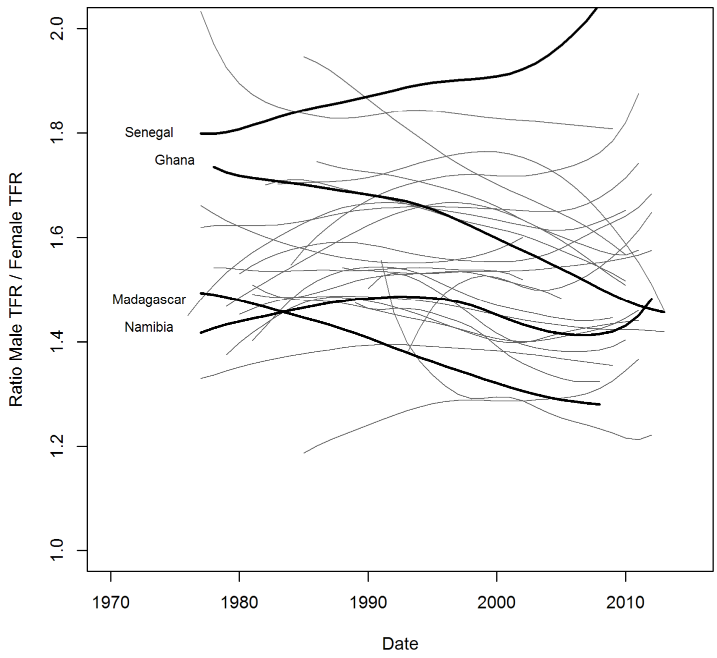
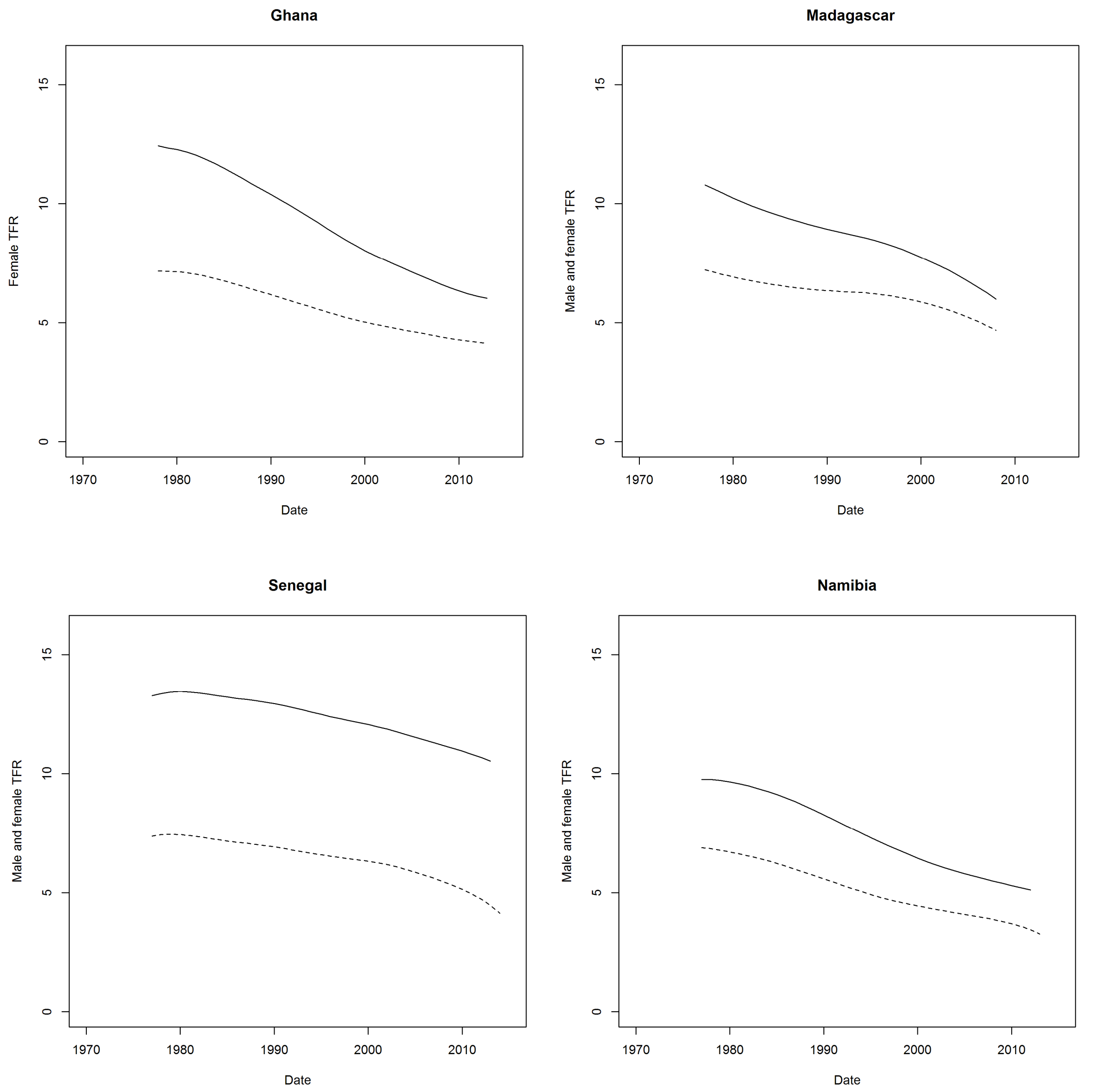


Table 1: Countries classified according to the trend in the ratio of male to female fertility

Decreasing ratio	Stable	Increasing	Increasing/decreasing
Ghana	Tanzania	Senegal	Zimbabwe
Madagascar	Uganda	Guinea	
Mozambique	Zambia	Mali	
Rwanda	Kenya	Sierra Leone	
Benin	Malawi	Cameroon	
Congo	Nigeria	Gabon	
Comoros	Niger		
Liberia	Namibia		
Lesotho	Burkina Faso		
Togo	Côte d'Ivoire		
	Ethiopia		

Figure 5. Comparisons of male (solid line) and female (dotted line) fertility trends in 4 sub-Saharan African countries



The reasons for these differences in the speed of fertility changes by gender across countries are not entirely clear. From a demographic point of view, differences in speeds of decline depend on differences in the ages at which fertility changes, but the drivers of these differential changes, and what they mean, need to be further investigated. What they suggest, however, is that convergence or divergence of fertility changes among males and females might be of interest to characterize fertility transitions in addition to classical indicators (change in TFR, change in age at childbearing).

3.3. Changing age patterns

Males have their children much later than females, and we also find a much greater heterogeneity among males than among females (Figure 6). Decreases in total fertility among males have also been accompanied by decreases in ages at fatherhood in most countries (Figure 6), whereas the mean age at childbearing among females tends to remain stable or slightly decrease. As a result, the difference between these two indicators has decreased in many countries (Figure 7). It currently lies between 8 and 15 years in most countries. The difference between age at fatherhood and mean age at childbearing has increased in some countries – as in Senegal (Figure 7).

Figure 6. Trends in mean age at fatherhood and mean age at childbearing, 28 sub-Saharan African countries

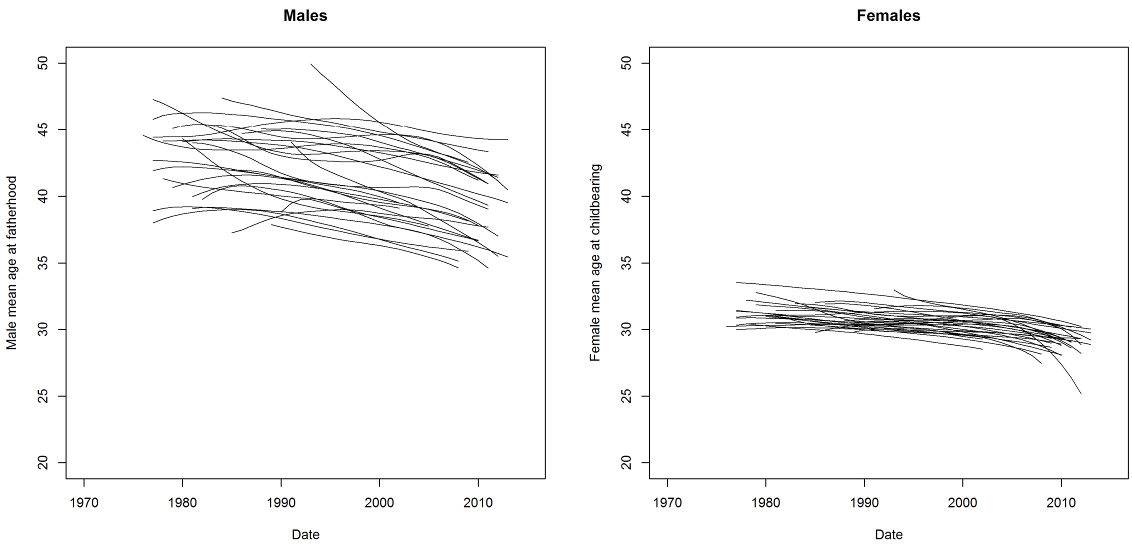
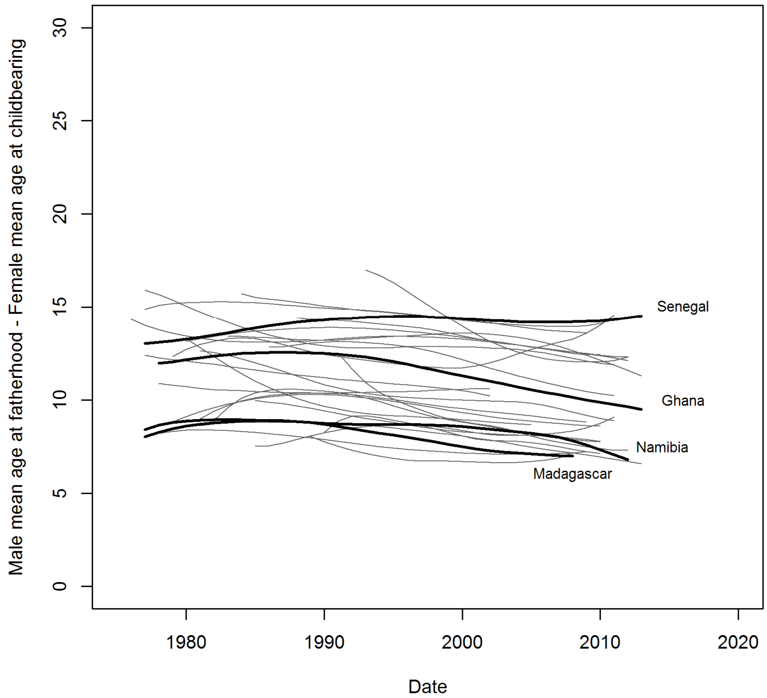


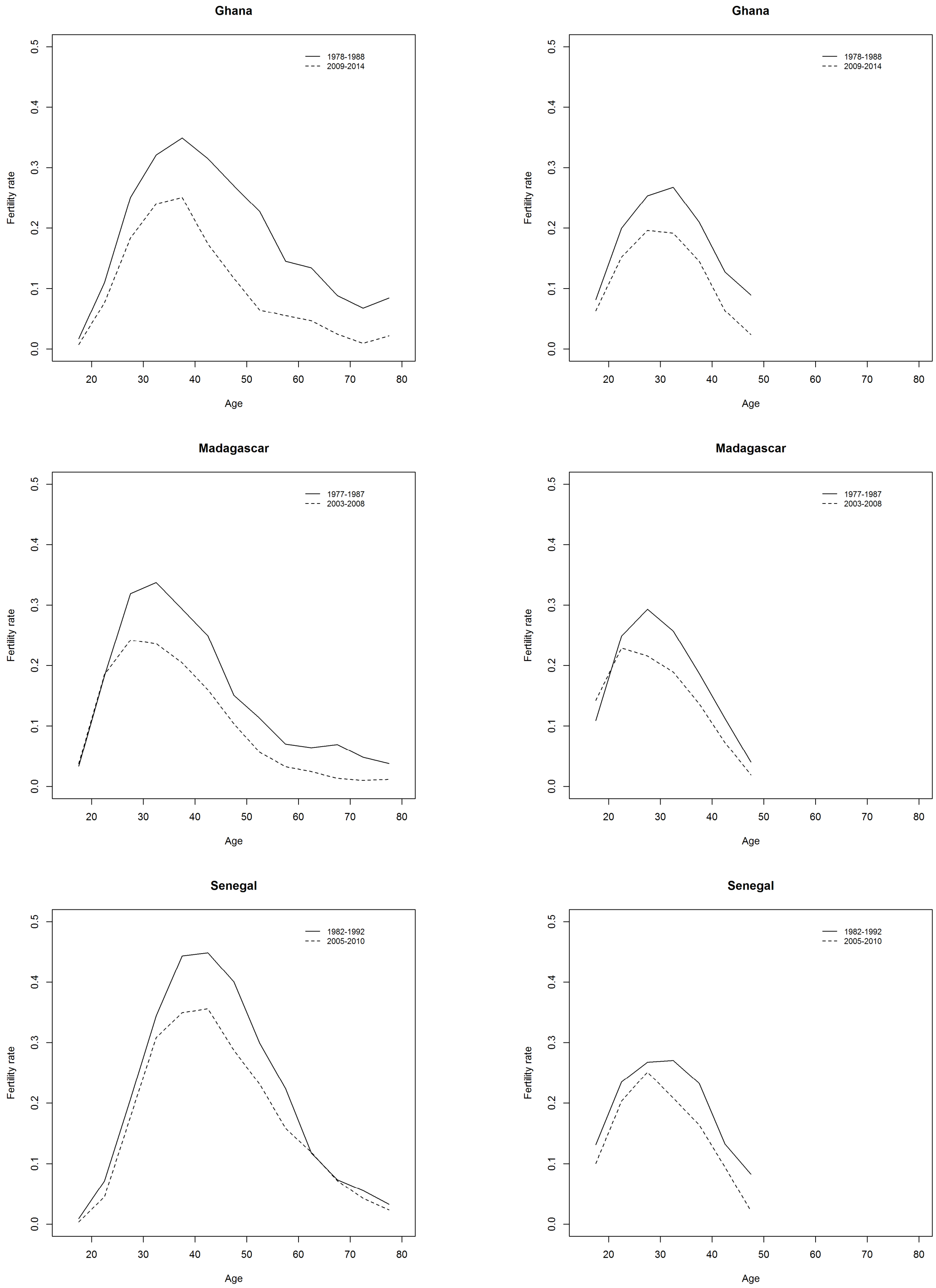
Figure 7. trends in difference between the mean age at fatherhood and the mean age at childbearing in 28 sub-Saharan African countries.

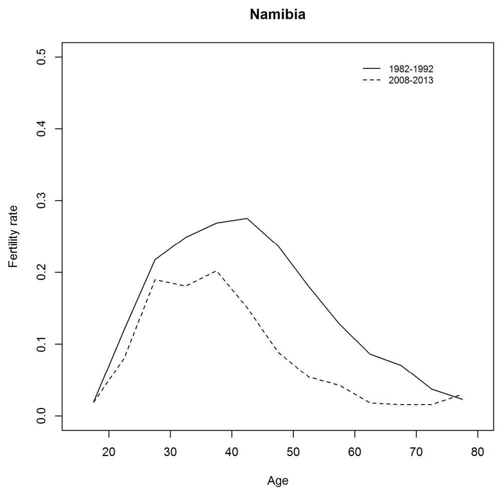


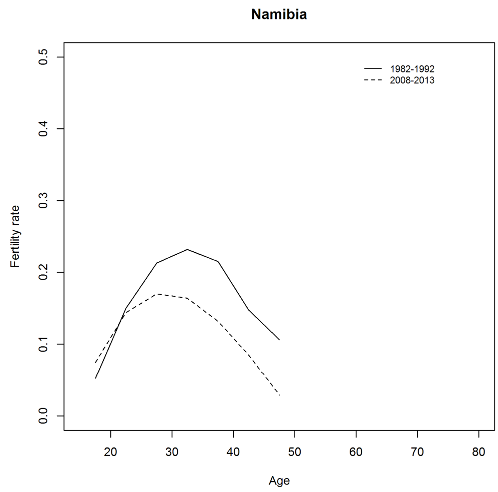
These declines in age at fatherhood reflect the much stronger declines in fertility rates at older ages than at young ages. Overall, male fertility rates have changed little before age 30; in contrast, changes beyond age 45 have been very pronounced in most countries (See figure annex 1 and figure annex 2). Figure 8 illustrate changes in age patterns in the same four countries as in the previous section. Changes in Ghana, Madagascar and Namibia illustrate well the larger decrease in fertility rates at higher ages among males. As a result, the mean age at fatherhood has decreased substantially in these countries (from 44 to 39 years in Ghana; 38 to 35 years in Madagascar; 42 to 38 in Namibia). In contrast, changes in Senegal have been more concentrated in central ages (35 to 60), and the mean age at fatherhood has remained stable at around 44-45 years. Overall, countries where age at fatherhood and age at childbearing converge also show converging fertility levels. These results indicate that the start of the reproductive careers has been little affected among males; in contrast, changes are mainly visible at high ages – reflecting partly the downward trend in polygyny (not shown) and a decrease in preferences for large families. This pattern among males also contrasts with the hypothesis of a specific type of African transitions, where fertility declines would be similar at all ages (J. C. Caldwell et al., 1992). While this question has been debated for female transitions (Bongaarts, 2013; Timæus & Moultrie, 2008), using male data provides another perspective.

Figure 8. Changing age patterns of male and female fertility in four sub-Saharan African countries

Males | Females







4. Conclusion

This paper shows a few preliminary results about male fertility transitions. First, they confirm that male fertility rates are widely different from female fertility rates, illustrating that reproductive experiences of men are "distinct of those of women" (Ratcliffe et al., 2000, p. 570). Men can expect to have a much larger number of children than women, and they also build their families at very different ages. Using male fertility rates – in addition to female fertility rates – gives a more complete picture of the reproductive patterns of a population. Acknowledging and showing that male and females have very different reproductive patterns highlights that their experiences and interests with reproduction may differ widely.

Secondly, male fertility has decreased in the majority of countries studied. While the rhythms of changes vary across countries, the overall decrease is clearly visible. Male total fertility rates well above 10 children that were the rule in the 1980s appear now as the exception[6]. In absolute terms, decreases have been stronger among males than among females, and relative changes have also been stronger among males than among females in a third of the countries. In these countries, age patterns of male fertility have changed drastically, with strong decreases in fertility rates at high ages and in the mean age at fatherhood. Convergence between male and female fertility is on its way. In a little over a third of the countries, relative fertility declines have been similar among males and females; in a few countries, total fertility among males has decreased more slowly than among females, male and female reproductive experiences (total number of children and age at which they have their children) appear as increasingly diverging.

These results are preliminary. At the very least, they show that reproductive experiences between males and females differ largely; this may have implications for instance for

[6] Recent estimates may be somewhat underestimated – and there may be a few more countries with recent male TFRs above 10 children.

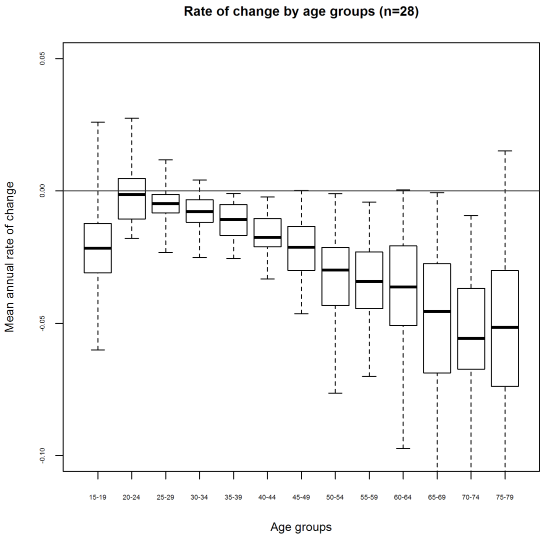
population policies, as both the number of children and the age at which they have them is very different for males and females. Using male data for examining theories of fertility changes may also bring new perspectives in understanding fertility changes. Male and female data indicates that transitions do not occur at the same speed and in the same way for both sexes in all the countries. Combining data on male and female transitions may be used to describe transitions in a more complete way than with only female data. Further analyses may also include analysis of fertility differentials (e.g. by education, wealth) for males, or identifying the macro determinants of fertility differentials and changes from a male fertility perspective. Whether this will improve the understanding of fertility changes remains open, but the data - to some extent- allow exploring these questions.

Table annex 1. Countries and survey files used

Country	**List of survey files used**
Benin	BJ41 BJ51 BJ61
Burkina Faso	BF21 BF43 BF62
Cameroon	CM22 CM31 CM60
Comores	KM32 KM61
Congo	CG51 CG60
Côte d'Ivoire	CI35 CI61
Ethiopia	ET41 ET51 ET61
Gabon	GA41 GA60
Ghana	GH31 GH41 GH4B GH5H GH70
Guinea	GN41 GN52 GN61
Kenya	KE33 KE3A KE42
Lesotho	LS41 LS60
Liberia	LB51 LB6A
Madagascar	MD21 MD31 MD41 MD51
Malawi	MW22 MW41 MW4D MW61
Mali	ML32 ML52 ML6H
Mozambique	MZ31 MZ41 MZ62
Namibia	NM21 NM41 NM51 NM61
Niger	NI22 NI31 NI61
Nigeria	NG4B NG53 NG6A
Rwanda	RW41 RW53 RW61
Senegal	SN21 SN4H SN61 SN70
Sierra Leone	SL51 SL61
Tanzania	TZ3A TZ41 TZ4I TZ63
Togo	TG31 TG61
Uganda	UG33 UG41 UG52
Zambia	ZM31 ZM51 ZM61
Zimbabwe	ZW31 ZW42 ZW51 ZW62

Figure annex 1. Boxplots of the mean annual rate of change of fertility rates by age groups in 28 countries

(a) Males, relative changes



(b) Females, relative changes

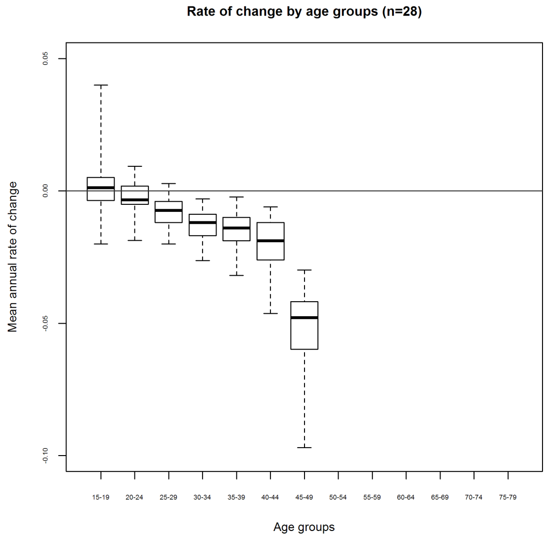
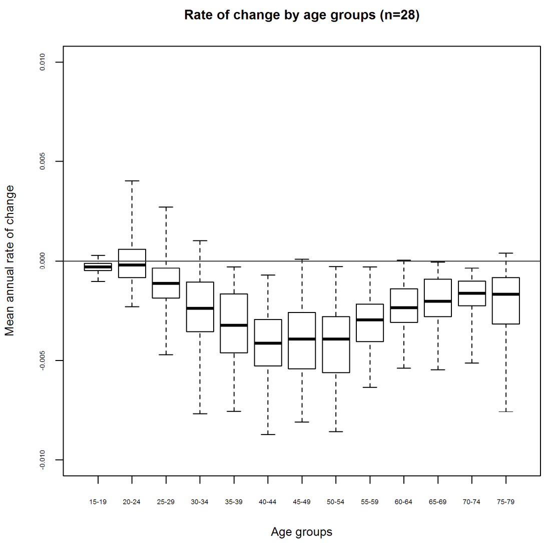
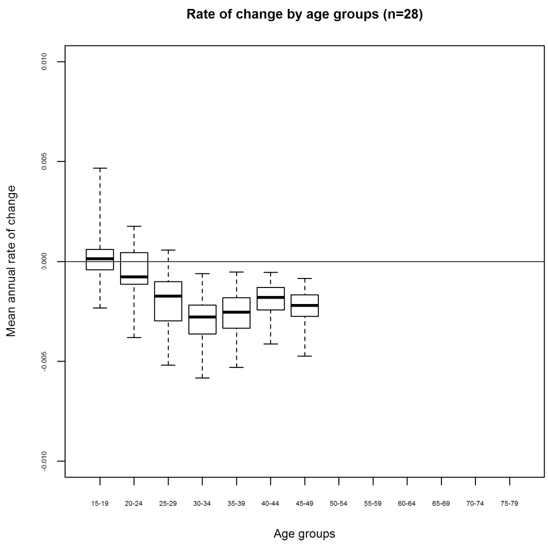


Figure annex 2. Boxplots of the mean annual absolute change of fertility rates by age groups in 28 countries

(a) Males, absolute changes



(b) Females, absolute changes



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