

Stalls in Fertility Transitions in Sub-Saharan Africa: Revisiting the Evidence

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1. INTRODUCTION & OBJECTIVES

Fertility in Sub-Saharan has decreased little over the last decades. As of 2010, African women had on average around 5.5 children (United Nations Population Division, 2015). While fertility has decreased in most sub-Saharan African countries (Schoumaker, 2016), it started much later than in other regions of the world, and the pace of fertility decline has also been overall slower in sub-Saharan Africa (Bongaarts, 2013; Bongaarts & Casterline, 2013). There is also considerable uncertainty about sub-Saharan Africa's future fertility. In many countries, changes have been limited and hesitant, and several countries have also followed unexpected paths with slowing or stalling fertility transitions (Bongaarts & Casterline, 2013; Goujon, Lutz, & KC, 2015).

Fertility stalls in sub-Saharan Africa have received sustained attention from around 2005, when they were first identified in Ghana and Kenya. Bongaarts' early study (2006) on the causes of stalling fertility transitions in developing countries included these two African countries. Westoff and Cross (2006) provided a detailed analysis of the stall in Kenya between 1998 and 2003 with DHS data, and Agyei-Mensah (2007) analysed the stall in Ghana between 1998 and 2003. Later, Shapiro and Gebreselassie (2008) documented stalls in three midtransition countries (Ghana, Kenya and Cameroon) and in five other countries (Guinea, Mozambique, Rwanda, Senegal, and Tanzania); Bongaarts' (2008) study on the progress of fertility transition in developing countries concluded that 12 sub-Saharan African countries had experienced a stall; Ezeh et al. (2009) mentioned 15 countries experiencing a stall and focused on stalls in four countries (Tanzanie, Kenya, Zimbabwe, Uganda). Garenne (Garenne, 2011) used DHS data and found stalls in urban Ghana, Kenya, Madagascar, rural

Nigeria, Rwanda, urban Senegal, rural Tanzania and rural Zambia, but not in several countries studied by other authors (e.g. Cameroon, Mozambique, Zimbabwe). Machiyama (2010a) found a stall in Kenya, and possibly in Benin, Rwanda, and Zambia. Finally, Goujon et al. (2015), using United Nations Population Division Data, identified 10 stalls in sub-Saharan Africa, including in countries that were not identified with stalled transitions before (e.g. Congo, Gambia, Mali, Niger). Combining all these studies, as many as 20 African countries have been classified in the “stall” category at some point. However, a variety of definitions have been used. The quality of the data (mainly the DHS) for identifying the stalls data has also been questioned (Machiyama, 2010b; Schoumaker, 2009, 2014). As a result, whether stalls in sub-Saharan Africa are pervasive or not is an open question. Moreover, while the demographic dynamics of the stall was well described in Kenya, using both DHS and Census data (Garenne, McCaa, Odimegwu, Adedini, & Chemhaka, 2015; Westoff & Cross, 2006), this has not been done in most countries. In other words, we lack systematic demographic descriptions of the stalls in sub-Saharan Africa.

The causes of these stalls have also been addressed in several papers, but with mixed results (Bongaarts, 2006; Ezeh et al., 2009; Garenne, 2008; Goujon et al., 2015; Moultrie et al., 2008; Sandron, 2010; Shapiro & Gebreselassie, 2008; Westoff & Cross, 2006). Among the proximate determinants of fertility, contraceptive use has received the most attention, and several authors have suggested that declining investments in family planning programs may explain fertility stalls through stalls in contraceptive use (Agyei-Mensah, 2005; Bongaarts, 2008; Ezeh et al., 2009; Gillespie, Ahmed, Tsui, & Radloff, 2007). In Kenya, Westoff and Cross (2006) found a plateauing of contraceptive use during the stall. Shortages of contraceptive supplies were mentioned as a possible factor for this (Westoff & Cross, 2006). Askew et al. (2016) showed the share of the public sector in the supply of contraceptives decreased during the stalls in the late 1990s in Kenya and Ghana, maybe as a result of reduced investments. However, no stall in contraceptive use was found in Ghana in the late 1990s, but rather between 2003 and 2008 (Askew et al., 2016). Shapiro and Gebreselassie (2008) also found no correlation between fertility trends and changes in contraceptive use in their study on 24 sub-Saharan African countries. In contrast, Ezeh et al. (2009, p. 3001) found that decreases in contraceptive use was among the “the most consistent variables associated with stall in fertility at the regional level in Eastern Africa”.

Changes in reproductive preferences were also analysed in a few countries. In Kenya, Westoff and Cross (2006) found that the percentage of women wanting no more children stalled in the late 1990s (Charles Westoff & Cross, 2006). A possible driver of the stall in reproductive preferences (and fertility) in Kenya was the increase of child mortality, as a result of HIV/AIDS and deterioration of health services (Charles Westoff & Cross, 2006)¹. Ezeh et al. (2009, p. 3003) also found some support for an effect changing reproductive preferences in explaining stalls. In contrast, Shapiro and Gebreselassie (2008) found no correlation between fertility trends and changes in ideal family size in the 24 countries of their study.

The role of education in fertility stalls was studied in several papers. Analyses by educational levels in Kenya found stalls among women with little education, but not among the highly educated (Charles Westoff & Cross, 2006). In four Eastern African countries (Kenya, Tanzania, Uganda, Zimbabwe), Ezeh et al. (2009) also showed diverging trends by level of education, with stalls more common among the less educated. Stalls in education – reflecting composition effects – were also mentioned as a possible explanation for stalls in sub-Saharan Africa (Goujon et al., 2015). Eloundou-Enyegue et al. (2017) also insist on examining fertility declines within subgroups, suggesting that stalls are more likely when the fertility decline is limited to a small group (e.g. the better educated), and that the rest of the population does not experience the same decline. As far as other socioeconomic determinants are concerned, Bongaarts' early study (2006) showed no significant link between trends in socio-economic development and the presence of a stall, and Shapiro and Gebreselassie (2008) also found that trends in GDP per capita could not account for stalling fertility. We argue that part of the explanation for these mixed results is that some of these stalls are spurious. Focusing on stalls that appear robust is expected to provide firmer conclusions about the causes of the stalls.

The objective of this paper is to revisit fertility stalls in sub-Saharan Africa with new data and methods that have not been used so far. Over the last few years, new Demographic and Health Surveys have been conducted in many sub-Saharan African countries. These surveys both allow covering a larger set of countries than in previous studies, and allow combining

¹ HIV/AIDS, through its effect on child mortality, has also been discussed as a possible cause of fertility stalls in South Africa (Moultrie et al., 2008).

data from several survey to reconstruct fertility trends (Schoumaker, 2013b, 2014). Census data have also become more widely available, especially through IPUMS (Minnesota Population Center, 2015), and allow reconstructing fertility trends in a dozen of African countries.

In the first part of the paper, we identify different types of stalls using published total fertility rates from demographic and health surveys. We show that – depending on the criteria used to identify stalls - their number ranges from 8 (in 6 countries) to 41 (in 24 countries). Their pervasive character is thus to a large extent a question of definition. Next, we evaluate the validity of stalls by combining different methods and data sources. Fertility trends from published data are compared to reconstructed trends from individual birth histories to evaluate the consistency of these trends. Where available, census data are used to evaluate fertility trends using an independent data source. We also use Bongaart's (2015) revised model of proximate determinants of fertility with DHS data to check the consistency between observed fertility trends and trends in fertility expected from proximate determinants. Based on these various methods and data, we find strong support for stalls in a limited number of countries. We focus on four countries where stalls appear genuine to describe trends in proximate determinants and demand for children.

2. DATA AND METHODS

Demographic and Health Surveys conducted in Sub-Saharan Africa since the 1980s are used. All the countries where at least two comparable surveys have been conducted since the 1980s, and for which individual data files are available, are included in this study (145 surveys from 31 countries). The analyses mainly rely on individual women recode data files. Published data are taken from the STATcompiler website and from DHS country reports (www.measuredhs.com). Census data come from IPUMS (Minnesota Population Center, 2015) and from published census reports.

TFRs and their standard errors are computed for the three years preceding the survey using the `tfr2` Stata command (Schoumaker, 2013a, p. 2)². Data for measuring the proximate

² These are identical to the TFRs published on the published on STATcompiler and in DHS reports. However, TFRS are computed over the last five years in some survey reports; in addition, standard errors of TFRs are not always available in DHS reports. Using the `tfr2` command allows using comparable time periods and computing standard errors for all the surveys.

determinants of fertility and applying the revised Boongaarts' model (2015) and data on fertility preferences also come from the individual recode data files. Fertility trends are reconstructed from birth history data by pooling surveys together (Schoumaker, 2013b, 2014). Age sex structures from census data are used in selected countries to reconstruct fertility trends using reverse survival methods (Spoorenberg, 2014; Timaeus & Moultrie, 2013). The spreadsheet provided by Timaeus and Moultrie (2013) are used to apply the reverse survival method, using the survival probabilities from the United Nations available in the spreadsheet.

3. DEFINING AND IDENTIFYING STALLS

The first objective of this paper is to identify stalls by observing trends in TFRs for the three years preceding the surveys (as published in DHS reports). As discussed by Bongaarts (2008, p.109), “a stall implies that an ongoing fertility transition is interrupted by a period of no significant change in fertility before the country reaches the end of the transition”. Two steps are thus necessary to identify countries where fertility has been stalling. First, a criterion must be used to consider that a fertility transition is underway. Secondly, one needs to measure the interruption of the decline in fertility.

In this paper, we consider that fertility transition is underway if the TFR is at least 10% lower than it was in a previous survey, or than the average number of children ever born (CEB) among women aged 40-49 in any preceding DHS. With that definition, all but four African countries (DR Congo, Congo, Burundi and Uganda) have been in transition since the 1990s³. To further refine the classification, we also distinguish early transitions from mid-transitions; mid-transition is reached when fertility has decreased below five children per woman (National Research Council, 2000; Shapiro & Gebreselassie, 2008). Some countries can be classified in early transition at some point and in mid-transition later. In this paper, 17 countries are in the mid-transition situation at some point.

We also distinguish different types of fertility changes by comparing total fertility rates in two successive surveys. The first type corresponds to stagnating or increasing fertility

³ Bongaarts (2008) considers a fertility transition is underway if the TFR has decreased by at least 10 percent compared to a previous survey, or if contraceptive prevalence among married women is over 10 percent. The use of contraceptive prevalence is justified when only two surveys are available on the ground that a 10 percent increase in contraceptive prevalence corresponds approximately to a 10 percent decrease in fertility.

between two successive surveys. This approach is both intuitive and simple to implement (Schoumaker, 2009; Shapiro & Gebreselassie, 2008), and is a conservative way to identify fertility stalls. The second type of fertility changes includes fertility decreases that are not statistically significant (Bongaarts, 2008)⁴. The third type corresponds to situation of fertility decreases that are statistically significant.

TABLE 1. CLASSIFICATION OF FERTILITY CHANGES, 31 COUNTRIES, 89 CASES OF FERTILITY CHANGES

	No stall – significant decline or no 48 cases, 24 countries	Slight stall-No significant decline 20 cases, 14 countries	Stall – stagnation or increase 21 cases, 17 countries
No transition	5 cases, 4 countries Burundi (1987-2010), Congo (2005-2011), DR Congo (2007-2013), Uganda (1988-1995, 2006-2011) Average yearly change=0.00		
		26 cases, 15 countries	
Early Transition	23 cases, 15 countries Benin (1996-2001), Burkina Faso (1999-2003), Ghana (1988-1993), Guinea (2005-2012), Kenya (1989-1993), Liberia (1986-2007), Madagascar (1997-2004), Malawi (1992-2000, 2000-2004, 2004-2010), Mali (1987-1996, 2006-2013), Nigeria (1990-2003; 2008-2013), Rwanda (1992-2000, 2005-2008), Senegal (1986-1993, 1993-1997, 1997-2005), Tanzania (1992-1996), Togo (1988-1998), Zambia (1992-1996, 2007-2013). Average yearly change= -0.09	13 cases, 10 countries Burkina Faso (1993-1999), Chad (1997-2004), Cote d'Ivoire (1994-1999), Ethiopia (1992-1997), Madagascar (1992-1997), Mali (2001-2006), Niger (1998-2006), Tanzania (1996-1999, 2004-2010, 2010-2015), Uganda (1995-2001, 2001-2006), Zambia (1996-2002). Average yearly change= -0.03	13 cases, 11 countries Benin (2001-2006), Burkina Faso (2003-2010), Chad (2004-2015), Guinea (1999-2005), Mali (1996-2001), Mozambique (1997-2003, 2003-2011), Niger (1992-1998, 2006-2012), Nigeria (2003-2008), Rwanda (2000-2005), Tanzania (1999-2004), Zambia (2002-2007) Average yearly change= +0.04
		15 cases, 10 countries	
Mid Transition (17 countries)	20 cases, 13 countries Benin (2006-2012), Cameroon (1991-1998), Comoros (1996-2012), Ethiopia (1997-2003), Ghana (1993-1999, 2003-2008), Kenya (1993-1998, 2003-2009, 2009-2014), Liberia (2007-2013), Madagascar (2004-2009), Namibia (1992-2000, 2000-2007), Rwanda (2008-2011, 2011-2015), Senegal (2005-2011, 2013-2015), Togo (1998-2014), Zimbabwe (1988-1994, 1994-1999) Average yearly change= -0.11	7 cases, 5 countries Côte d'Ivoire (1999-2012), Gabon (2000-2012), Lesotho (2004-2009, 2009-2014), Sierra Leone (2008-2013), Zimbabwe (1999-2005, 2011-2015) Average yearly change= -0.02	8 cases, 6 countries Cameroon (2004-2011, 1998-2004), Ghana (1999-2003, 2008-2014), Kenya (1998-2003), Namibia (2007-2013), Senegal (2011-2013), Zimbabwe (2005-2011). Average yearly change= +0.04

⁴ Standard errors of total fertility rates are computed taking account of clustering using the jackknife method (Schoumaker, 2013a). A one-tailed t-test is used to test the significance of fertility decrease ($p < 0.10$).

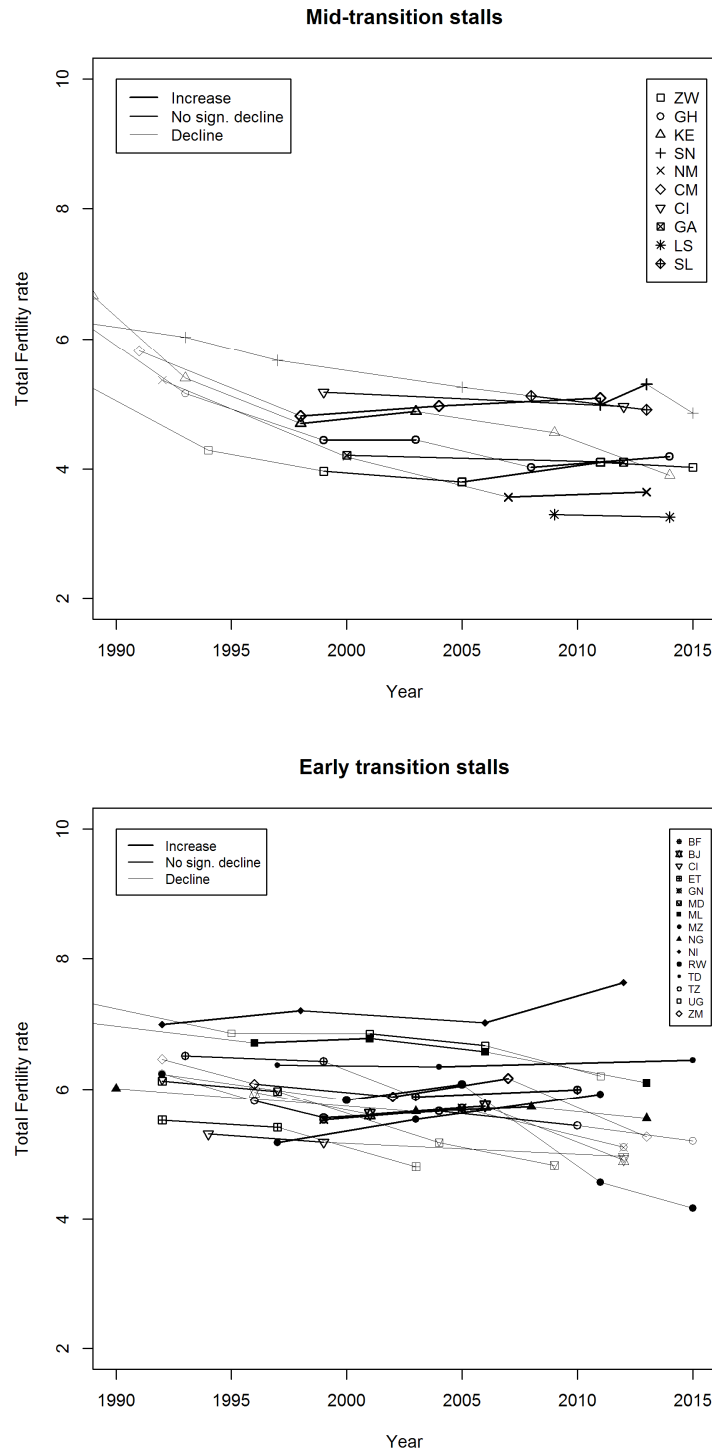
Combining these criteria leads to seven categories (Table 1): one category corresponds to pre-transitional situations (no transition), three categories for early transition countries (no stall, slight stall, stall), and the same three categories for mid transition countries. Depending on the criteria used to identify stalls, and whether we focus on mid-transition countries or also include early transition countries, the number of cases varies from 8 stalls in 6 countries, to more than 41 stalls in 24 countries (out of 89 cases in 31 countries, Table 1). The 8 cases of stalls among mid-transition countries include stalls in the late 1990s in Kenya, Ghana and Cameroon, that were identified in the early analyses of fertility stalls in sub-Saharan Africa (Bongaarts, 2008; Charles Westoff & Cross, 2006; Shapiro & Gebreselassie, 2008). More recent stalls are also found in Ghana, Zimbabwe, Namibia and Senegal⁵. Using a less conservative definition of stalls in mid-transition countries brings 7 additional cases of slight stalls (4 additional countries: Côte d'Ivoire, Gabon, Lesotho, Sierra Leone; Figure 1), that have less often been discussed in the literature. Taking into account early transition countries with either fertility increases or non-significant decreases, the number of stalls reaches 41 cases in 24 countries (Table 2, Figure 2), that is almost half of the cases and eight out of ten countries. This clearly shows that the number of stalls clearly depends on the way transition and fertility changes are measured.

TABLE 2. NUMBER OF CASES OF STALLS AND COUNTRIES EXPERIENCING STALLS USING VARIOUS DEFINITIONS OF STALLS

Types of stalls	Cumulated number of countries	Cumulated number of cases
Mid transition stalls	6 countries	8 cases
+ Mid-transition slight stalls	10 countries	15 cases
+ Early transition stalls	21 countries	28 cases
+ Early transition slight stalls	24 countries	41 cases

⁵ These stalls have received less attention. For the stall in Zimbabwe, see Sayi (2015), Goujon et al. (2015) and Ezeh et al. (2009); for the stall in Namibia, see Palamuleni (2015)

FIGURE 1. MID-TRANSITION STALLS AND EARLY TRANSITION STALLS IN SUB-SAHARAN AFRICA



4. ARE THE STALLS REAL OR SPURIOUS?

The preceding section suggests that fertility stalls are pervasive in sub-Saharan Africa (Bongaarts, 2008), when early transition situations are included, and when stalls includes non-significant fertility declines. Whether we should include early transition stalls is

debatable, as the transition has rarely been going on for a long time in these countries, and whether the transition has really started is not always clear. Actually, some of the countries included in the early transition countries might as well be classified in the pre-transitional category, such as Chad or Niger (Figure 1). We will come back to this issue. Restricting analyses to mid-transition countries markedly decreases the number of stalls, but their number (15 stalls in 10 countries, Figure 1) remains impressive. Yet, the stalls may not be as pervasive as it seems. As discussed before, the quality of fertility data varies greatly from one place to another, and may also vary from one survey to the other in the same country (Blacker, 1994; Gerland, Biddlecom, & Kantorová, 2017; Schoumaker, 2014). As a result, some of these stalls may be spurious, reflecting differential data quality across surveys (Machiyama, 2010a; Schoumaker, 2009). In this section, we evaluate the genuineness of stalls, using a variety of data and methods.

First, fertility trends are reconstructed using birth histories. The method for reconstructing fertility trends relies on pooling all the surveys together, and smoothing fertility trends using Poisson regression and restricted cubic splines (Schoumaker, 2013b)⁶. Simulations show that the method performs very well with good quality data to reconstruct the underlying trends (Schoumaker, 2013b)⁷. When the quality of birth history data is affected by displacements of births, omissions of births, or differences in sample implementation, it is not possible to recover the real fertility levels and trends, but this approach provides alternative estimates that tend to be closer to the real values. In summary, with good quality data, both published estimates and reconstructed estimates will be consistent, and a real stall is expected to be visible with both approaches. With data affected by data quality problems, fertility levels and trends may differ across methods, and stalls that are visible with published estimates may not be visible in reconstructed trends.

Next, we use census data where available to evaluate the consistency in fertility trends across data sources. Again, we expect real stalls to be visible, regardless of the data that are used. In contrast, inconsistencies across data sources suggest stalls may be spurious. Two approaches are used. When the age distribution of children (<15) is available by single years

⁶ Restricted cubic splines are piecewise polynomial functions constrained to join at predefined years (knots) (Andersen, 2009). Cubic splines are flexible and allow fitting a large variety of shapes with relatively few parameters (Harrell, 2001). In this case, 5 knots were selected and located according to Harrell's (2001) recommendation.

⁷ Penalized splines and lowess were also tested and provide similar estimates.

of age, and when numbers of women by five year age groups are available, fertility trends are reconstructed with reverse survival methods (Spoorenberg, 2014; Timaeus & Moultrie, 2013)⁸. Lowess is used to smooth fertility trends obtained with the reverse survival method. In a few cases (Zimbabwe, Gabon, Senegal), we use published estimates of the TFR for the year preceding the census – as the age distribution by single year of age was not found. The period covered by the censuses does not necessarily perfectly match the period covered by DHS, but the overlap is usually sufficient for our purpose.

Finally, we also use the revised Bongaart's model to estimate expected fertility levels and trends from the values of three proximate determinants measured in DHS: percentages of women in union (by age), contraceptive use and postpartum insusceptibility. These proximate determinants are transformed into indices that measure their fertility-reducing effect (Bongaarts, 2015), and the expected fertility level is estimated by multiplying 15.4 by each of these three indices⁹. No information is available on abortion, and trends in expected fertility are interpreted accordingly. Again, trends in Bongaarts' expected fertility should be fairly consistent with trends in observed fertility with good quality data.

MID TRANSITION STALLS

We first concentrate on the 10 countries where 15 cases of mid-transition stalls are found (Cameroon, Côte d'Ivoire, Gabon, Ghana, Kenya, Lesotho, Namibia, Senegal, Sierra Leone and Zimbabwe). We illustrate the method with the case of Kenya, and next discuss the 9 other countries.

Figure 2a shows fertility trends in Kenya obtained from published fertility (3 years preceding the survey, red dots) in the six successive Demographic and Health Surveys. A stall in fertility at about 5 children starts between 1995 and 2000, and lasts around 10 years. On Figure 2b, trends over the fifteen years preceding each of the six surveys separately (Schoumaker, 2013a). The trend reconstructed with pooled birth histories is represented by the black smooth line. The orange section of the line indicates the period during which the decline was

⁸ The data either come from IPUMS (international.ipums.org/international), where samples of microdata are available for a number of censuses in Africa (e.g. Ghana, Cameroon, Kenya, Rwanda, Sierra Leone). In some cases, the data come from census reports (e.g. Namibia, Lesotho).

⁹ 15.4 is the average value of the total fecundity rate found in the revised version of the Bongaarts model (Bongaarts, 2015).

not statistically significant ($p < 0.10$)¹⁰, corresponding to a stall in fertility if the transition was underway. Reconstructed fertility is a little higher than published fertility in the late 1990s-early 2000s, but the stalls is also clearly visible with the reconstructed trend, roughly corresponding to the period between the 1998 and 2003 survey. On figure 2c, we add fertility trends reconstructed from census data using the reverse-survival method¹¹. Although census estimates are not perfectly equal to survey estimates, the consistency is quite good up to 2005. The stall in Kenya is clearly visible also with census data, as already shown by Garenne et al. (2015). The last step consists in comparing fertility trends with trends that are expected from proximate determinants of fertility. The green line on figure 2d suggests that trends in proximate determinants are fairly consistent with fertility trends. No real stall is visible in proximate determinants, but there seems to be a slowdown in the late 1990s. Given the measurement errors in proximate determinants of fertility, and the fact that other proximate determinants (e.g. abortion) are not included in this trend, the consistency with fertility trends is actually quite good. In summary, using these varied sources and methods, we can reasonably conclude that there was a stall in fertility in Kenya that started in the late 1990s and lasted for a few years. The exact timing and length of the stall is of course difficult to ascertain, but its existence is pretty clear.

¹⁰ Marginal effects are computed with the Stata user-written command *mfrcspline* (Buis, 2009). A one-tailed test is performed by constructing 80% confidence intervals around the marginal effects. If 0 is not included in the 80% confidence interval, the slope is significantly negative with a 90% confidence level.

¹¹ Data from the 2009 and 1999 censuses are used, covering the period from 1985 to 2009. Annual estimates are smoothed with lowess regression.

FIGURE 2. COMPARISONS OF METHODS AND SOURCES FOR IDENTIFYING STALLS, ILLUSTRATION IN KENYA

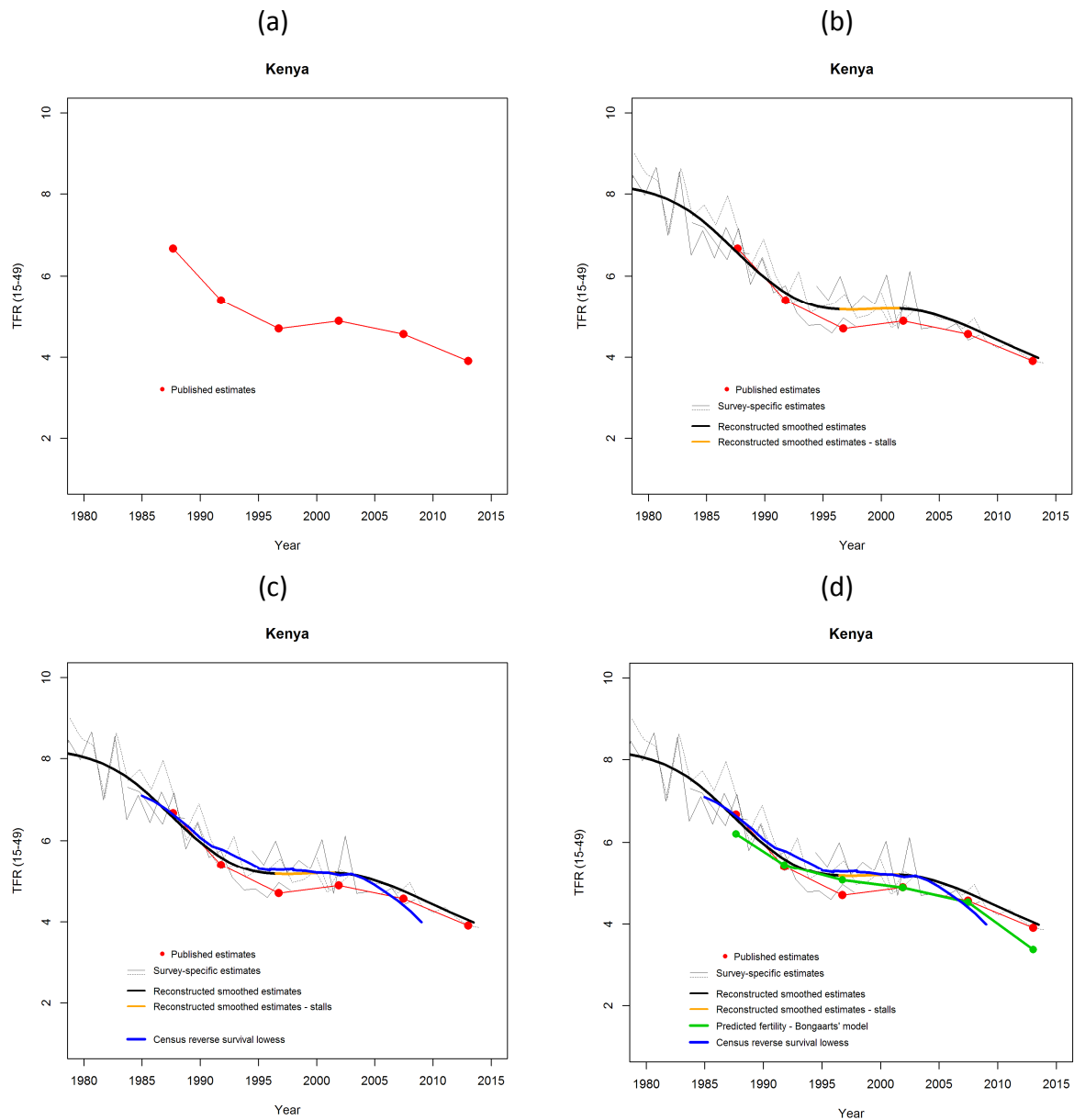


Figure 3 compares these different methods and sources in the 10 countries (including Kenya) that are thought to have experience mid-transition stalls. The consistency across all methods and sources is especially striking in Zimbabwe and Namibia, where the existence of a stall leaves little doubt. In Gabon, the reconstructed trends from DHS indicates a stall; estimates from the 1993 and 2013 censuses suggest fertility has only slightly decreased over that period¹². Trends in proximate determinants also indicate that fertility was expected to increase. As mentioned earlier, data on abortion is not included, and may explain the

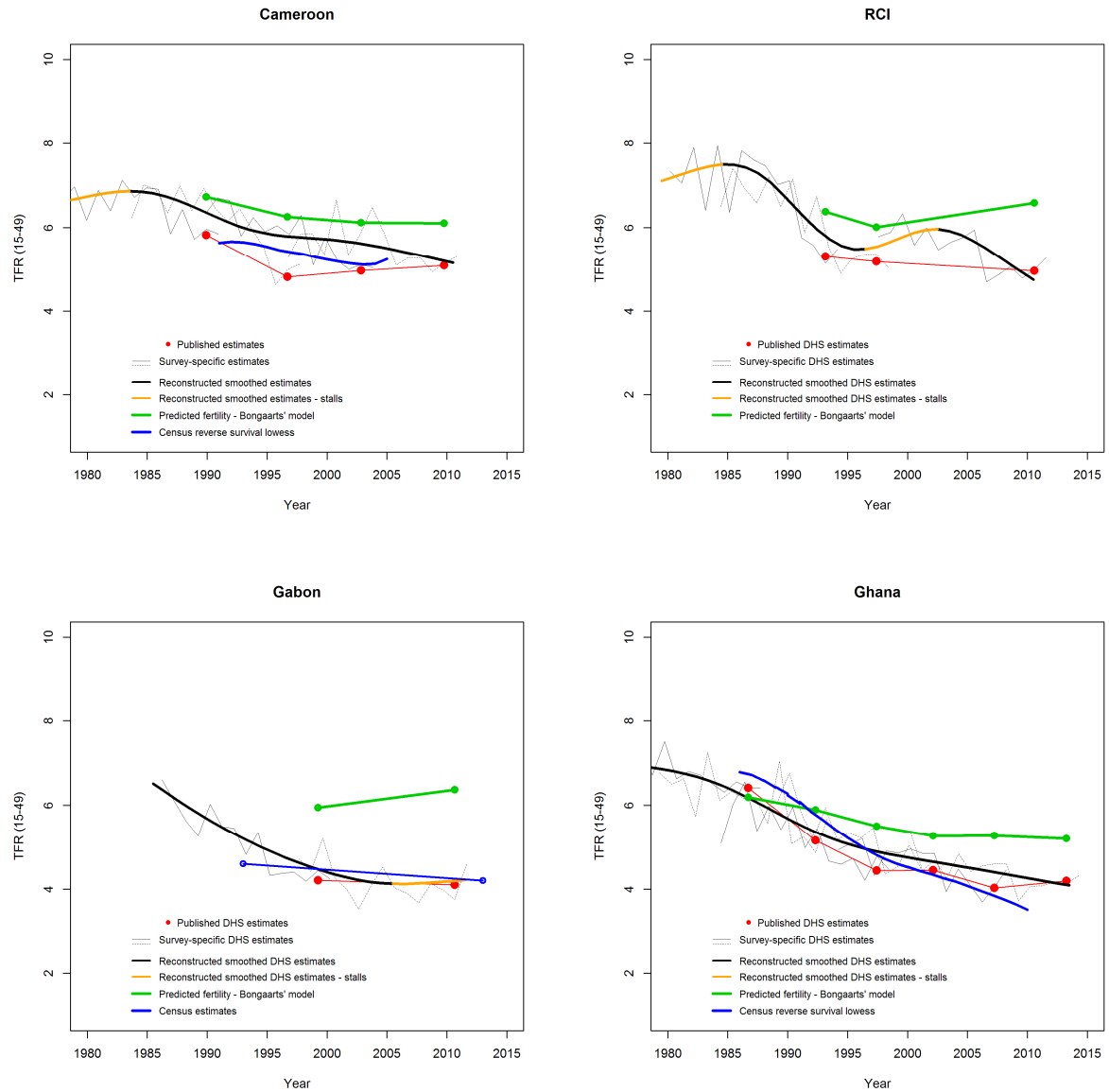
¹² Data from the 2003 census would be useful, but are not readily available.

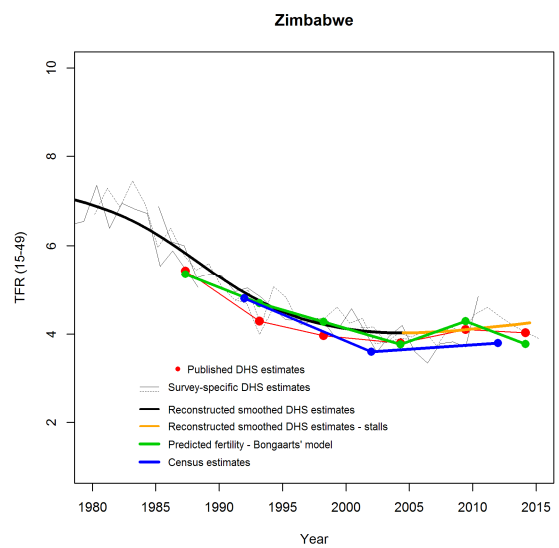
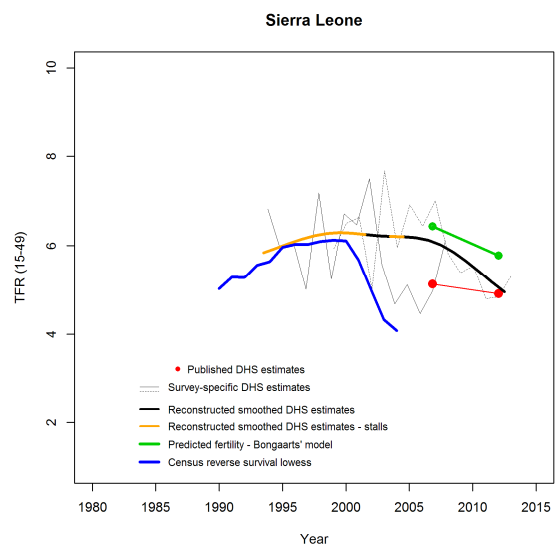
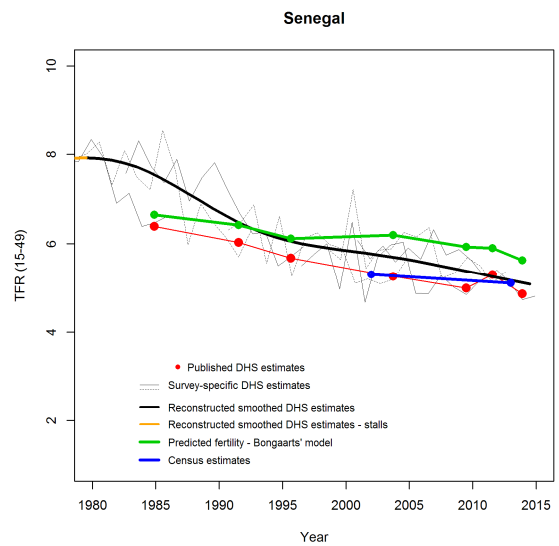
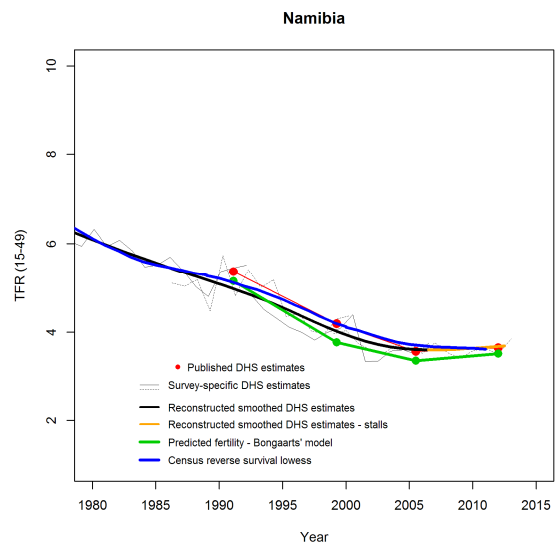
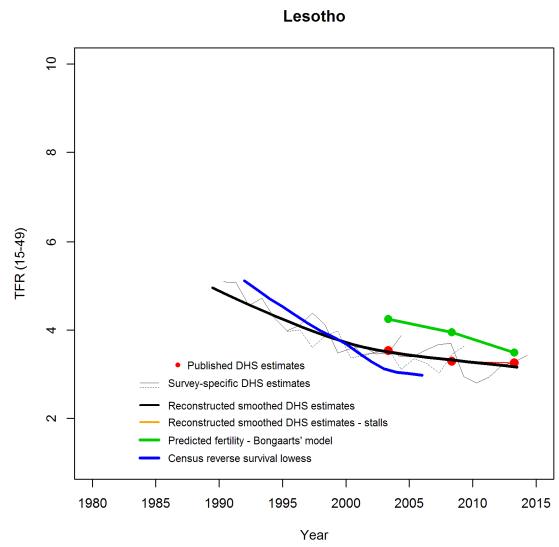
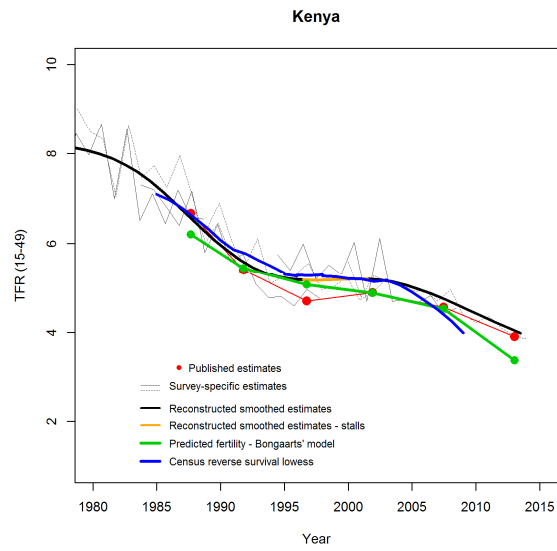
discrepancy between trends and levels of expected fertility based on Bongaarts' model and observed fertility¹³. The increase in expected fertility is thus compatible with a stall. In Côte d'Ivoire, a stall is also found with reconstructed trends, in the late 1990s early 2000s; published TFR suggest a non-significant decline, and proximate determinants are consistent with a fertility increase. In Lesotho, there is a clear slow down in fertility decline, visible in published DHS estimates and reconstructed trend (although the decline remains significant); census data do not cover the same period, but also indicate a slow down in the decline around 2005. In contrast, proximate determinants are consistent with a fertility decline. Overall, a stall is possible in Lesotho, but the evidence is less conclusive. The evidence is also not conclusive in Cameroon. While the published TFRs increase between the late 1990s and 2010, reconstructed fertility trends from DHS indicate that fertility continuously decline since the mid 1980s. Census data also suggest fertility decreased in the 1990s, but suggests a small increase may have occurred around 2005. Proximate determinants are consistent with a stagnation or slow decrease in fertility, but as mentioned earlier, these trends do not take into account abortion. All in all, a stall in Cameroon is not excluded, but the evidence is not very strong. Ghana was one of the early stalls to be identified in Africa (Bongaarts, 2008). Published data indicate that fertility stalled in the late 1990s, and again between the two most recent surveys. Reconstructed from pooled birth histories show no stall, and census data also show a continuous decline since the mid 1980s. In contrast, trends in proximate determinants support a stagnation of fertility. Overall, the evidence for a stall in fertility in Ghana is weak, in line with previous analyses (Machiyama, 2010b; Schoumaker, 2009). The same conclusion holds for Senegal. Finally, the situation in Sierra Leone indicate that both DHS data and census data are affected by serious data quality problems, and there is weak evidence for a fertility stall: either fertility decline, or if fertility transition is not underway.

In summary, we find strong evidence for fertility stalls in four countries : Zimbabwe, Namibia, Kenya and Gabon. Possible stalls are found in Côte d'Ivoire and Lesotho, and to a lesser extent in Cameroon. Evidence is weak in Ghana, Senegal and Sierra Leone.

¹³ Gabon is one of the few countries with data on abortion in DHS that could be used in the Bongaarts' model.

FIGURE 3. COMPARISONS OF METHODS AND SOURCES FOR IDENTIFYING STALLS IN 10 COUNTRIES WITH MID-TRANSITION STALLS





+ solidity of evidence

EARLY TRANSITION STALLS

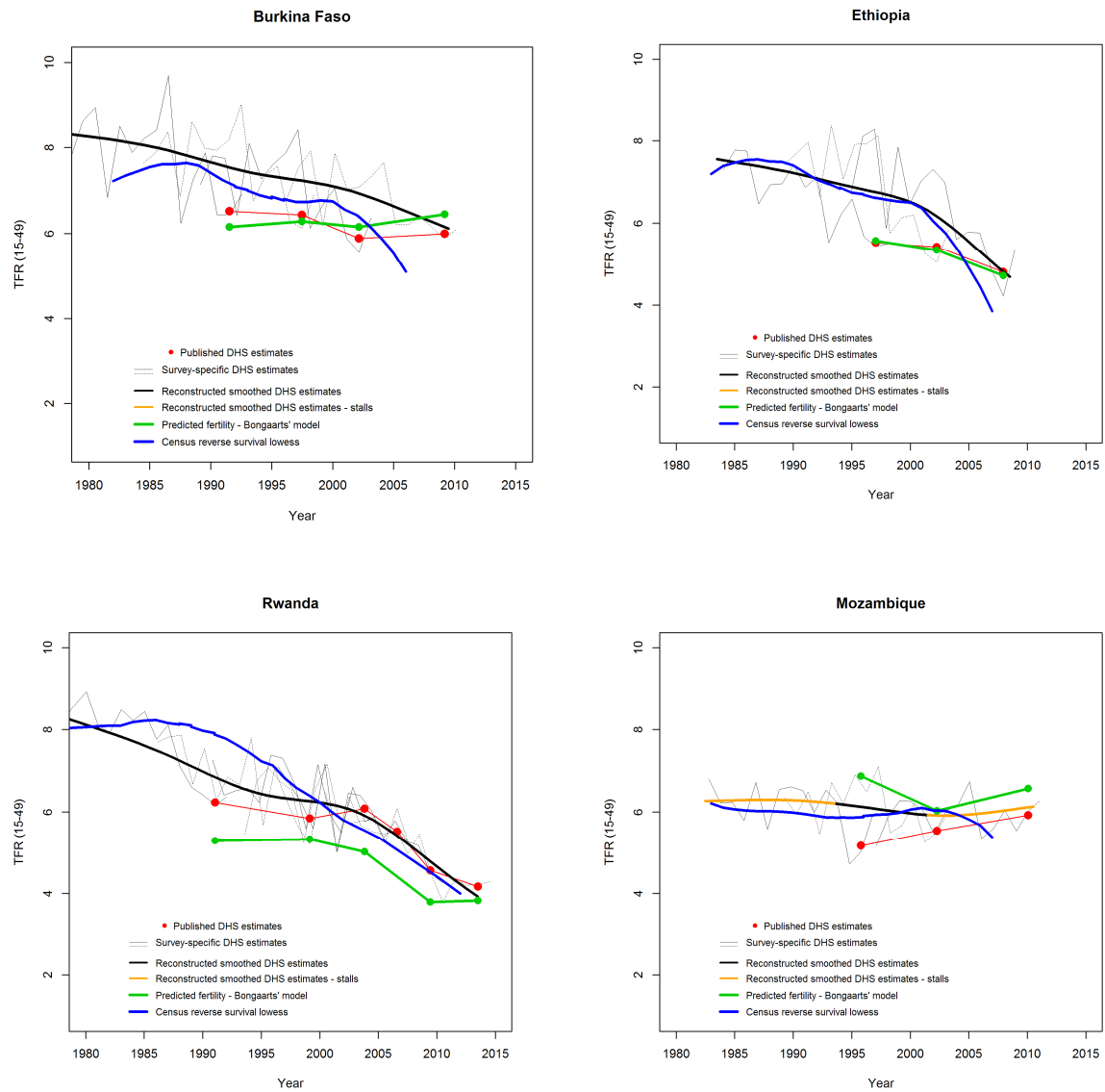
15 countries are classified in the early transition stalls category (Table 1). At this stage, we focus on five countries with an early transition stall where census data are available (Zambia, Mozambique, Ethiopia, Rwanda, Tanzania). In Zambia, both census data and reconstructed trends with DHS indicate a stall in the 1990s, whereas published DHS data and proximate determinants rather suggest a stall in the early 2000s. In Rwanda, published DHS data and proximate determinants indicate fertility decline slowly or stalled between the early 1990s and around 2005; in contrast, reconstructed trends suggest a slowdown in the 1990s but no stall; Census data indicate a continuous decline since the late 1980s. While a stall in Rwanda is not excluded, the evidence is not strong. In Mozambique, the long term fertility trends from census data and DHS pooled birth histories indicate the fertility is higher than published fertility, and had not declined. As a result, the slight increases that are observed with reconstructed trends and census data should not be interpreted as stalls. Evidence for stalls is also weak in Ethiopia, where census estimates and reconstructed trends both show decreasing fertility¹⁴. Weak evidence is also found in Tanzania. Preliminary results in the other countries also indicate weak evidence for stalls. Actually, in a number of countries (results not shown), both census data and reconstructed trends suggest that published DHS fertility levels are underestimated, and that the fertility decline had not started (as in Mozambique). As a result, countries that are classified in the stall category with published data are considered as pre-transitional countries with other approaches. Further analyses will include all the countries included in Table 1.

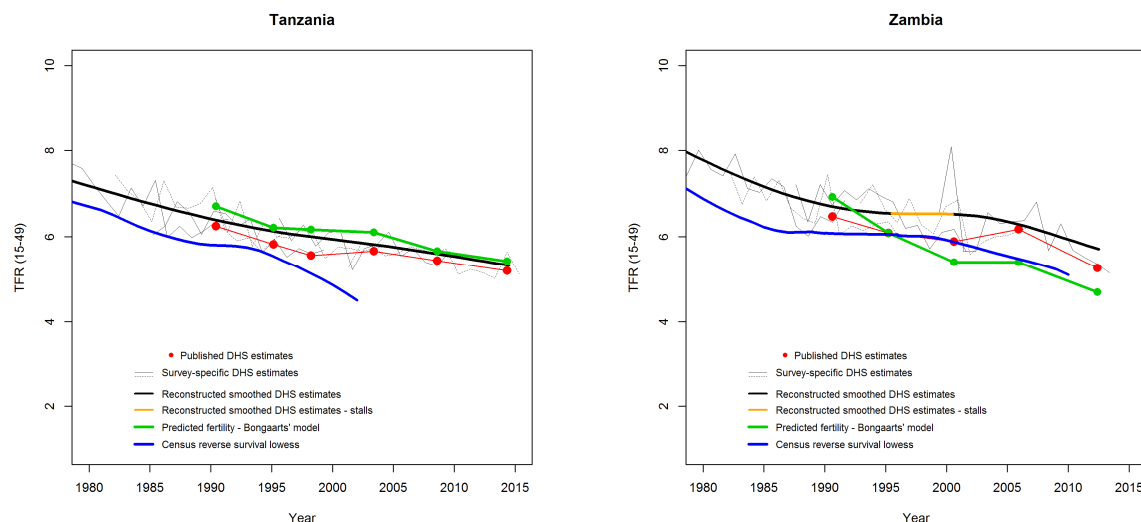
Country	Published DHS	Reconstructed DHS	Census	Proximate determinants	Total
Mid-transition					
Namibia	Yes (1)	Yes (1)	Yes (1)	Yes(1)	4
Zimbabwe	Yes (1)	Yes (1)	Yes (1)	Yes(1)	4
Gabon	Yes(1)	Yes(1)	Yes(1)	Yes(1)	4
Kenya	Yes (1)	Yes (1)	Yes (1)	Plausible (0.5)	3.5
Côte d'Ivoire	Yes(1)	Yes(1)	-	Yes (1)	3

¹⁴ Although both trends match fairly well, they may both be affected by data quality issues, and the rapide recent decline may be an artefact of data quality issues.

Lesotho	Yes(1)	No (0.5)	Yes (0.5)	Plausible (0.5)	2.5
Cameroon	Yes(1)	No (0)	No (0.5)	Plausible (0.5)	2
Senegal	Yes(1)	No (0)	No (0.5)	Plausible (0.5)	2
Ghana	Yes(1)	No (0)	No (0)	Plausible (0.5)	1.5
Sierra Leone	Yes (1)	No (0)	No(0)	No (0)	1
Burkina Faso	Yes (1)	No (0)	No(0.5)	Yes (0.5)	2
Ethiopia	Yes (1)	No (0)	No (0)	No (0)	1
Rwanda	Yes (1)	No (0)	No (0)	Yes (1)	2
Mozambique	Yes (1)	No (0)	No (0)	No (0.5)	1.5
Tanzania	Yes (1)	No (0)	No (0)	Yes (1)	2
Zambia 2002-2007	Yes (1)	No (0)	No (0)	Yes (1)	2
Zambia 1996-2002	Yes (1)	Yes (1)	Yes (1)	No (0)	3
Tanzania 1999-2004	Yes (1)	No (0)	No (0)	Yes (1)	2

FIGURE 4. COMPARISONS OF METHODS AND SOURCES FOR IDENTIFYING STALLS IN 4 COUNTRIES WITH EARLY TRANSITION STALLS



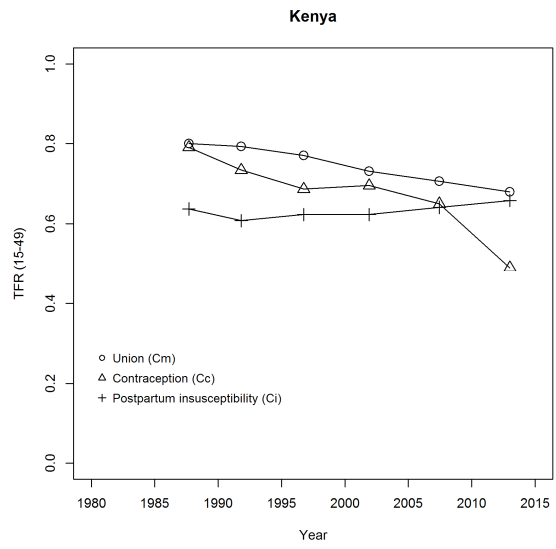
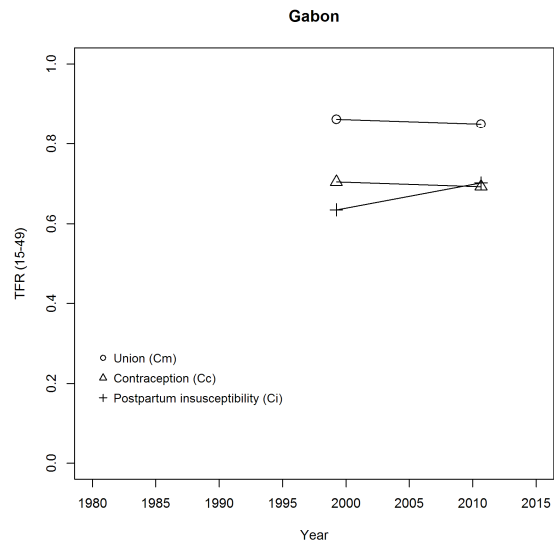


5. CHANGES IN PROXIMATE DETERMINANTS AND DEMAND FOR CHILDREN IN 4 COUNTRIES WITH STALLING FERTILITY

Further analyses of proximate determinants and fertility preferences are done in the 4 countries with strong evidence for stalls. Figure 5 shows the trends in the fertility-reducing indices of the Bongaart's model. In all four countries, the contraceptive index stalled at some point: between the two surveys in Gabon, in the late 1990s in Kenya, between the latest two surveys in Namibia, and between 2005 and 2010 in Zimbabwe. Interestingly, the stall in contraception is accompanied by an increase of the postpartum insusceptibility index in Gabon, and a slight increase or a stall in this index in the other countries. Changes in union also tend to lead to increasing fertility in Namibia and in Zimbabwe, they have no influence on fertility in Gabon, and lead to decreases in fertility in Kenya. These preliminary analyses thus show that stalls in contraceptive use are clearly part of the explanations for these stalls, but are not the only factors at play, which may vary across countries.

In all four countries, demand for children has also clearly stalled or decreased slowly (Figure 1). The median ideal family size has remained around 3.5 children in Kenya, around 4 in Gabon and Zimbabwe and around 3 in Namibia. Further decrease in fertility in these countries is thus not only a matter of increasing access to contraceptive use, but also decreasing demand for children (Casterline & Agyei-Mensah, 2017).

FIGURE 5. TRENDS IN FERTILITY-REDUCING INDICES OF THE BONGAART'S MODEL IN FOUR COUNTRIES WITH MID-TRANSITION STALLS



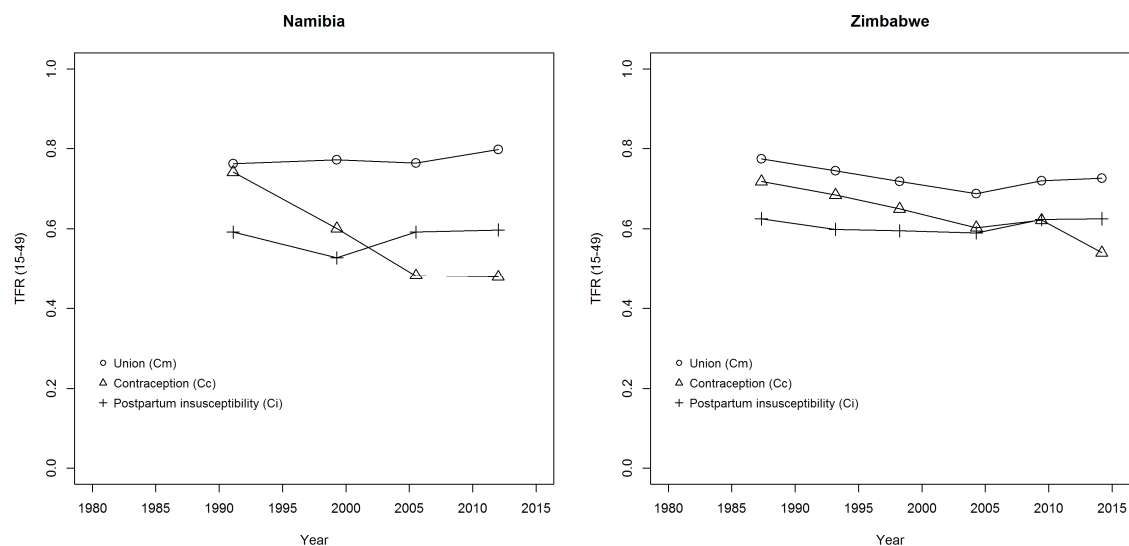
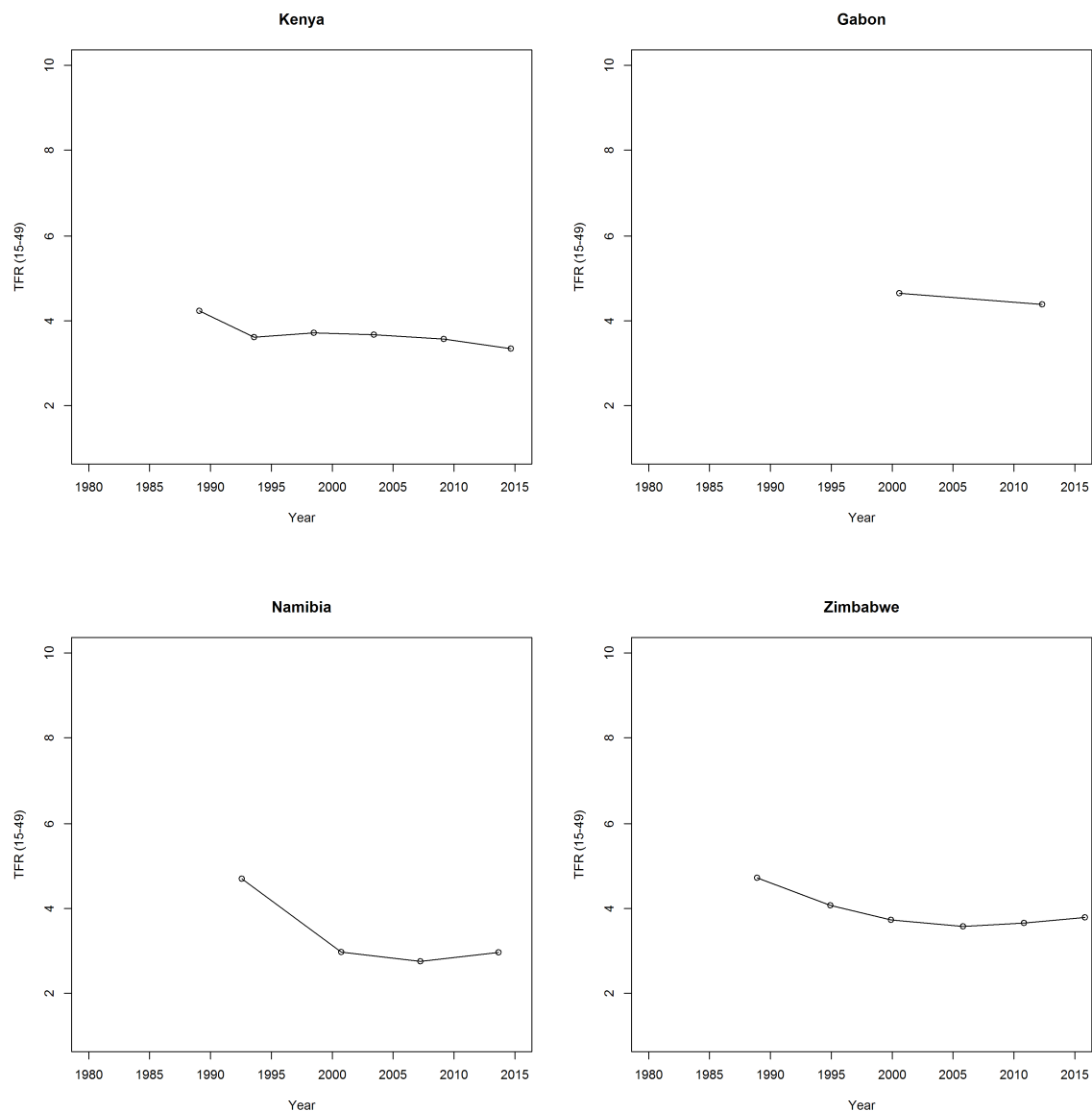


FIGURE 6. TRENDS IN MEDIAN IDEAL NUMBER OF CHILDREN IN FOUR COUNTRIES WITH MID-TRANSITION STALLS



6. PRELIMINARY CONCLUSION

In this paper, different data and methods are used to identify fertility stalls. Using published TFRs from DHS reports and a broad definition of stalls (including early transition countries and slight fertility declines that are not significant), more than 40 situations of stalling fertility in 24 countries are found; focusing on mid-transition stalls brings down their number to 15 in 10 countries. Confronting published fertility levels to fertility estimates using other methods and sources leads to a smaller number of stalls. We find strong support for mid-transition stalls in only four countries (Kenya, Zimbabwe, Namibia and Gabon). Less conclusive evidence is found in Lesotho, Cameroon and Côte d'Ivoire. In early transition countries, some support is found for a stall in Zambia, but little support for stalls in other countries. These results confirm that the identification of stall is highly sensitive to the definition, the data and the methods that are used.

In the four countries with strong evidence for stalls, we find that stalls in contraceptive use are part of the explanation, but that increasing time spent in union and decreasing length of postpartum insusceptibility also influence fertility trends in some settings. Trends in fertility preferences show that stalls are also related to a demand of children that tends to stagnate between 3 and 4.5 children in the four countries. Further decline may be delayed until fertility preferences decrease.

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TABLE 1. CLASSIFICATION OF FERTILITY CHANGES, 31 COUNTRIES, 89 CASES OF FERTILITY CHANGES

	No stall – significant decline or no 48 cases, 24 countries	Slight stall-No significant decline 20 cases, 14 countries	Stall – stagnation or increase 21 cases, 17 countries
No transition	5 cases, 4 countries Burundi (1987-2010), Congo (2005-2011), DR Congo (2007-2013), Uganda (1988-1995, 2006-2011) Average yearly change=0.00		
		26 cases, 15 countries	
Early Transition	23 cases, 15 countries Benin (1996-2001) Burkina Faso (1999-2003) Ghana (1988-1993) Guinea (2005-2012) Kenya (1989-1993) Liberia (1986-2007) Madagascar (1997-2004) Malawi (1992-2000, 2000-2004, 2004-2010) Mali (1987-1996, 2006-2013) Nigeria (1990-2003; 2008-2013) Rwanda (1992-2000, 2005-2008) Senegal (1986-1993, 1993-1997, 1997-2005) Tanzania (1992-1996) Togo (1988-1998) Zambia (1992-1996, 2007-2013)	13 cases, 10 countries Burkina Faso (1993-1999), Chad (1997-2004), Cote d'Ivoire (1994-1999), Ethiopia (1992-1997), Madagascar (1992-1997), Mali (2001-2006), Niger (1998-2006), Tanzania (1996-1999, 2004-2010, 2010-2015), Uganda (1995-2001, 2001-2006), Zambia (1996-2002). Average yearly change= -0.03	13 cases, 11 countries Benin (2001-2006), Burkina Faso (2003-2010), Chad (2004-2015), Guinea (1999-2005), Mali (1996-2001), Mozambique (1997-2003, 2003-2011), Niger (1992-1998, 2006-2012), Nigeria (2003-2008), Rwanda (2000-2005), Tanzania (1999-2004), Zambia (2002-2007) Average yearly change= +0.04
		15 cases, 10 countries	
Mid Transition (17 countries)	20 cases, 13 countries Benin (2006-2012), Cameroon (1991-1998), Comoros (1996-2012), Ethiopia (1997-2003), Ghana (1993-1999, 2003-2008), Kenya (1993-1998, 2003-2009, 2009-2014), Liberia (2007-2013), Madagascar (2004-2009), Namibia (1992-2000, 2000-2007), Rwanda (2008-2011, 2011-2015), Senegal (2005-2011, 2013-2015), Togo (1998-2014), Zimbabwe (1988-1994, 1994-1999) Average yearly change= -0.11	7 cases, 5 countries Côte d'Ivoire (1999-2012), Gabon (2000-2012), Lesotho (2004-2009, 2009-2014), Sierra Leone (2008- 2013), Zimbabwe (1999-2005, 2011-2015) Average yearly change= -0.02	8 cases, 6 countries Cameroon (2004-2011, 1998-2004), Ghana (1999-2003, 2008-2014), Kenya (1998-2003), Namibia (2007-2013), Senegal (2011-2013), Zimbabwe (2005-2011). Average yearly change= +0.04