Disruptions in Educational Progress and Fertility Dynamics by Educational Level: Unraveling the Link between Education and Fertility Stalls in Sub-Saharan Africa

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Abstract

Stalls in fertility declines have been found in many sub-Saharan African countries. Our objective is to unravel the relationship between education and stalled fertility by analyzing the extent to which fertility stalls reflect a lack of changes in the educational composition of the population or are related to reversals and halts in the fertility decline within educational groups. Using the Demographic and Health Surveys and Multiple Indicator Cluster Surveys, we first estimate total fertility rates by educational level and examine how they have varied over time, especially during periods of stagnation. Then, we use the Kitagawa decomposition method to analyze changes in country-level fertility rates. We show that fertility stalls tend to be a collective experience, with fertility stalls found among all educational groups in most countries that have experienced a fertility stall. In contrast, composition effects either have no or a limited impact on fertility stalls. However, slow educational progress made some countries more vulnerable to stalls.

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Introduction

In sub-Saharan Africa (SSA), the fertility transition has been different from low- and middle-income countries in other parts of the world (Bongaarts 2017a; Shapiro and Hinde 2017). It began later than in other less developed regions, started from higher fertility levels, and has occurred at a slower pace (Bongaarts and Casterline 2013; Gerland, Biddlecom, and Kantorová 2017). Since the early 2000s, stalls in fertility transitions have been identified in several African countries, contributing to the overall slow decline in fertility in the region (Schoumaker 2019). As many as 25 SSA countries have been classified under the stalled category at some point in the last 20 years (Bongaarts 2006, 2008; Ezeh, Mberu, and Emina 2009; Garenne 2008; Howse 2015; Kebede, Goujon, and Lutz 2019; Machiyama 2010; Schoumaker 2009, 2019; Shapiro and Gebreselassie 2008). Although recent evidence shows that fertility stalls in SSA are not as widespread as initially thought, they are not exceptional either (Sánchez-Páez and Schoumaker 2022; Schoumaker 2019). As fertility has stalled at rates well above replacement level, Africa's demographic future has become uncertain and is of renewed research interest (Bongaarts 2008; Howse 2015).

Given the prominent role of education in shaping demographic behavior and trends, the impact of education on fertility stalls in SSA is expected to be substantial. As previously documented, progress in education has been uneven in SSA and may have contributed to slowing down or halting fertility declines (Goujon, Lutz, and KC 2015). Yet, previous research on the links between fertility stalls and education not only is limited (Bongaarts 2006; Ezeh, Mberu, and Emina 2009; Goujon, Lutz, and KC 2015; Kebede, Goujon, and Lutz 2019; Shapiro and Gebreselassie 2008) but has also led to mixed evidence (Sánchez-Páez and Schoumaker 2022). In addition, most of the analyses have relied on aggregate data and do not distinguish the effect of changes in the population's education level – the composition effect – from fertility changes within educational groups – the rate effect –. We argue that this distinction is essential to unravel the relationship between education and stalled fertility, as they lead to different interpretations and policy options.

In this paper, we aim to identify the effects of changes in the educational composition of the population and fertility changes within educational groups on fertility stalls in SSA. The paper begins with a review of the links between education and fertility changes in SSA, focusing on fertility stalls. In the second section, we present the data and the methods. In the next step, we reconstruct total fertility rates by educational level and examine how they have varied over time, especially during periods of country-level stalled fertility. We identify 14 country-level fertility stalls. Then, we use the Kitagawa decomposition method (Kitagawa 1955) to separate the effects of changes in the composition of the population by educational level from fertility changes within educational groups on country-level fertility trends. From there, we identify the extent to which fertility stalls are related to lack of progress in education or reversals and halts in the fertility decline within some or all educational groups. Finally, we also discuss alternative approaches to identifying the contribution of slow educational progress to fertility stalls. We show that in most countries, fertility stalls are a collective experience that is found across educational groups. Overall, the increase or lack of fertility changes within educational groups is the main driver of fertility stalls, and composition effects have had a limited direct impact on fertility stalls in most countries in SSA. However, slow progress in education made some countries more exposed to stalls, as the progress in education was not sufficient to counter reversals in fertility trends with educational groups. In the conclusion, we discuss the implications for the future of fertility transitions in SSA.

Background: Education and fertility changes

Education is one of the most relevant determinants of a country's development and well-being, and has the most long-lasting impact on society (OECD 2013). Increased access to and improved quality of education are also major factors leading to reduced fertility levels (Cleland 2002; Martin 1995). Female education influences fertility through three broad channels. First, in developing countries, better-educated women tend to have a lower demand for children (Hertrich 2017; Shapiro 2012; Shapiro and Tenikue 2017). Second, better-educated women have higher rates of contraceptive use, which decreases unplanned pregnancies and births (Bongaarts 2017b; Casterline 2017; Liu and Raftery 2020). Third, education contributes to postponing childbearing by delaying sexual debut and marriage (Bongaarts, Mensch, and Blanc 2017; Chemhaka and Odimegwu 2019; Hertrich 2017).

To measure the effect of education on country-level fertility trends, two types of change can be distinguished (Bongaarts, Mensch, and Blanc 2017; Cleland 2002; Eloundou-Enyegue, Giroux, and Tenikue 2017). First, if education increases, changes in the composition of educational groups in the population will lead to lower fertility, as better-educated women usually have lower fertility and will have a greater weight in the population. In other words, even if fertility remained constant within each educational group, increased levels of education would lead to lower fertility (the composition effect). In contrast, stagnating or decreasing levels of education would lead to fertility stalls. Second, fertility can also change within educational groups (the rate effect) and lead to aggregate fertility changes without changes in the educational composition of the population (Bongaarts, Mensch, and Blanc 2017; Cleland 2002; Eloundou-Enyegue, Giroux, and Tenikue 2017). In practice, of course, both effects can contribute to fertility trends at the same time, possibly in opposite directions. Measurement of the composition effects and the rate effects is usually performed with decomposition methods.

Earlier decomposition analyses of changes in fertility and education have shown that, depending on the countries, periods, and types of fertility behavior, changes in the educational composition can be the dominant driver of aggregate fertility changes or, conversely, have a minor impact. Cleland (2002), analyzing fertility changes between the 1970s and the 1990s in a few countries, found that the percentage of decline in total fertility attributable to expanded education varied from 8% (Kenya) to 60% (Peru, Philippines). He concluded that improvements in women's education may be a "modest force behind fertility decline" (Cleland 2002:192). In contrast, Bongaarts et al. (2017) showed that educational composition effects were the dominant force in the increases in age at first birth in sub-Saharan Africa, Asia, and Northern Africa between the 1990s and 2010s. Previous work using such decomposition methods has usually focused on fertility declines and increases in age onset of fertility, not on fertility stalls.

Fertility and education in sub-Saharan Africa in the context of stalls

Comparative studies have shown that better-educated women consistently have lower fertility than other women in SSA (Eloundou-Enyegue, Giroux, and Tenikue 2017; Kebede, Goujon, and Lutz 2019; Shapiro 2012; Tabutin and Schoumaker 2020). Women with primary education have lower fertility than women without education, but the difference is especially pronounced from secondary education onwards. Overall, women with at least secondary education tend to have between two and three fewer children than women without education (Shapiro 2012; Tabutin and Schoumaker 2020). Research on sub-Saharan African countries has also shown that increases in women's educational attainment tend to contribute to fertility declines (Agyei-Mensah and Owoo

2015; Chemhaka and Odimegwu 2019; Liu and Raftery 2020) and increases in age at first birth (Bongaarts, Mensch, and Blanc 2017), but to varying extents across countries.

Studies on the links between fertility stalls and education have led to mixed evidence (Sánchez-Páez and Schoumaker 2022) but suggest that disruptions in the progress of education partly account for recent fertility stalls in some SSA countries (Bongaarts 2006; Ezeh, Mberu, and Emina 2009; Goujon, Lutz, and KC 2015; Kebede, Goujon, and Lutz 2019; Shapiro and Gebreselassie 2008). Aggregate analyses showed that the proportion of women with some education had leveled off in the early 2000s in Kenya and Ghana during periods of stalled fertility (Bongaarts 2006). Shapiro and Gebreselassie (2008) also found that countries with slow or no improvement in education had, on average, experienced slower or no fertility declines in the 1990s and early 2000s. Goujon et al. (2015), also using aggregate analyses, found that fertility stalls (between 1995 and 2010) were more common in countries that had experienced an education stall. They showed that the share of women with some education had stalled for the cohorts born in the late 1970s and early 1980s in 16 countries, probably partly because of structural adjustment programs. Among the ten countries with stalling fertility, eight had experienced a stall in education[1]. The stalls in education were especially pronounced in four countries (Kenya, Congo, Zambia, and Zimbabwe). On the other hand, recent work by Grimm et al. (2022) on *conditional* fertility stalls identified some SSA countries (e.g., Zambia, Nigeria, Mali, Uganda, Congo, and Gabon) in which fertility failed to decline despite improvement in socioeconomic conditions,— including education[2]. More recently, Kebede et al. (2019) estimated the effect of the stalls in education on fertility trends using a counterfactual approach. They first estimated – using extrapolation methods – the trends in education that could have been observed in each country if progress in education had not slowed down. Next, they used age-specific fertility rates by educational level in combination with the proportions of women by educational group (no education, some primary, completed primary, and over) to compute a "counterfactual TFR." While fertility would have been lower in most countries if there had been no stalls in education, the trend in the counterfactual TFR was often not substantially different from the observed trends. For instance, in Zimbabwe, the Republic of Congo, and Gabon, the stalls remained clear under the counterfactual TFR. In other countries, such as Cameroon, Côte d'Ivoire, Kenya, Nigeria, and Zambia, stalls in education had a more substantial impact on fertility trends. However, even in these cases, they only partly accounted for fertility stalls and sometimes only for a small portion. In other words, even though the authors did not highlight this observation, the trends in education failed to explain a sizeable part of the stalls in several countries. Finally, Eloundou-Enyegue et al. (2017) investigated the links between education and fertility stalls differently. Their focus was on the fertility differentials across educational groups during the fertility transition in SSA, and one of their conclusions is of particular interest here. In four countries where they identified stalls (Côte d'Ivoire, Ethiopia, Lesotho, and Mozambique), they found that fertility differentials increased during periods of stalls, and the stalls were not "a collective experience": fertility continued declining among better-educated women, while it stalled or increased among the less educated. In summary, previous research has used aggregate analyses (Bongaarts 2006; Grimm et al. 2022; Shapiro and Gebreselassie 2008), a counterfactual approach (Kebede, Goujon, and Lutz 2019), or analysis of inequalities in fertility across groups during periods of stalled fertility. While early aggregate analyses suggested that stalls in education were correlated with fertility stalls, more recent aggregate analyses and the counterfactual approach, which measures the effect of the educational composition of the population on the fertility stall, are less conclusive. Analyses of inequalities highlight that fertility changes may diverge across education groups (the rate effects), and that country-level fertility stalls may be influenced by fertility trends within one or several educational groups (Eloundou-Enyegue, Giroux, and Tenikue 2017).

This paper uses another approach to assess the links between fertility stalls and education. As in Kebede et al. (2019), we consider the changes in the educational composition an essential aspect to consider. However, as in Eloundou-Enyegue et al. (2017), we believe that analyzing fertility changes within educational groups is also crucial to understanding the links between education and fertility stalls. Identifying whether stalls reflect composition effects or rate effects indeed has different policy implications. If stalls mainly reflect compositional effects, investing in greater access to education is a significant avenue for the resumption of fertility declines. In contrast, if fertility stalls mainly reflect stalls within each educational group (or among some of them), improving levels of education may have a more limited impact on ending fertility stalls. In addition, these two forces may have opposite effects on fertility trends, as fertility stalls within educational groups may be outweighed by large composition effects and vice versa. The decomposition method thus sheds new light on the drivers of fertility stalls in SSA. Our approach also differs from previous research in two respects. First, our data include a more extensive set of countries, covering more extended periods, and rest on a larger number of surveys than previous studies, including the most recent ones. Second, we use a more detailed classification of educational levels than in some previous analyses. In this way, we can identify fertility trends within three educational groups, as well as the contribution of these groups to fertility stalls.

Data and methods

Since the 1980s, the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) have collected information on, among other things, birth histories and socioeconomic characteristics of women aged 15–49 in SSA. We use all available DHS, including

Malaria Indicators Surveys (MIS) and AIDS Indicator Surveys (AIS), as well as MICS from 33 SSAn countries where at least two surveys are available and where the available surveys are spaced by less than 15 years. In total, 215 surveys were used (Supplemental Materials, Table A1)[3]. We group women into three educational levels: (1) no education, (2) 1–6 years of education, corresponding to some or completed primary education in most countries, and (3) 7 years of education or more (some secondary or higher education in most countries)[4]. In this article, we will sometimes refer to these groups as women with no education, with some primary education, and with secondary education and over, even though this does not exactly correspond to these categories in some countries.

The first step consists of reconstructing fertility trends by educational level since the 1970s–1980s in each of the 33 countries. The method uses birth history data to create tables of births and exposure by 5-year age groups and by single calendar years for each level of education using the Stata tfr2 command (Schoumaker 2013)[5]. The tables of births and exposure from all the surveys in a country are appended. Total fertility rates (TFRs) are then estimated using Poisson regression, with age and periods included as independent variables (Schoumaker 2013). The age pattern of fertility is kept constant for each survey. This is done by computing a pattern of proportional age-specific fertility rates for each survey and controlling for this in the offset. To limit random fluctuations in fertility rates, facilitate cross-country comparisons, and implement the decomposition method, we computed TFRs by 5-year periods. With this method, TFRs can be reconstructed over more than 30 years for most countries. The use of pooled birth histories also attenuates the impact of data quality problems (see Supplemental Materials).

We consider that fertility has stalled at the country level if (1) it has decreased by at least 10% from its highest TFR, and (2) it has stopped decreasing or has decreased very slowly at levels above two children per woman and below six children per woman. We define fertility as not falling or falling very slowly if the annual decline in fertility is less than 0.025 children per year (one child per 40 years)[6]. We measure the average annual decline over one or more periods. After identifying a period of stall between two successive TFRs, we compute the average decline when including subsequent periods. If the average decline for two or more adjacent periods is less than 0.025 children per year, we consider that all adjacent periods are experiencing a fertility stall. This means that fertility may decrease a little faster than 0.025 children per year for some time during a longer stall. However, this approach has the advantage of focusing on longer periods of very slow decline rather than on short stalls that would be followed by a slightly more rapid fertility decrease.

Figure 1 illustrates the method in Kenya, one of the first SSAn countries where a fertility stall was identified (Bongaarts 2006; Westoff and Cross 2006). It represents the 5-year TFR estimates and their 95% confidence intervals at the country level (black line) and by level of education (colored lines). At the country level, fertility started declining in the late 1970s. The speed of decline decelerated in the 1990s, and fertility stalled at around five children between the late 1990s – early 2000s (orange segment) for a short period. The decline resumed in the late 2000s; the most recent TFR was around 3.5 children. The same approach is used within each educational group. In the early 1980s, fertility was already two children lower among better-educated women (green lines) than among women with no education (light blue lines) or with 1–6 years of education (dark blue lines). In the three groups, fertility declined substantially in the 1980s. Still, it slowed down or stopped from the early 1990s (no education) or mid– and late 1990s (secondary education and primary education, respectively). It even increased in the early 2000s among women with no education and primary education. Since the late 2000s, fertility has decreased in the three groups.

These trends show that the stall at the country level at least partly reflects fertility stalls within each educational group.

FIGURE 1

Next, we adapt the decomposition method proposed by Kitagawa (Kitagawa 1955; Preston, Heuveline, and Guillot 2001) to identify how much of the fertility change is attributable to fertility changes within educational groups and how much is due to composition effects. The decomposition of the changes in the TFR between two dates, time 1 (t1) and time 2 (t2), is expressed as follows:

$$TFR_T^{t1} - TFR_T^{t2} = \sum_{i=1}^{K}\left(TFR_i^{t1} - TFR_i^{t2}\right) \times \left[\frac{P_i^{t1}+P_i^{t2}}{2}\right] + \sum_{i=1}^{K}\left(P_i^{t1} - P_i^{t2}\right) \times \left[\frac{TFR_i^{t1}+TFR_i^{t2}}{2}\right] + residual$$

[Eq. 1]

The change in the country-level TFR (subscript *T*) between time 1 and time 2 is the sum of three components: one component measuring the contribution of the changes in the TFR within levels of education, a second component measuring the contribution of changes in the composition of the population by level of education, and a third minor residual component. The first sum on the right side of the equation is decomposed into three components (Eq. 2, Box 1), one for each level of education (subscripts *N* for no education, *P* for 1–6 years, and *S* for 7+ years). The first three components of Equation 2 thus refer to fertility changes within each educational level (the rate effects), weighted by the average share of women in each group. The fourth component (the second sum on the right-hand side of Eq. 1) measures the effect of changes in the composition of the population (the composition effect), computed as the weighted sum of changes in the proportion of women (*P*) in each educational group, weighted by the average TFR in each group. The last residual component accounts for the fact that the observed TFR at the country level is not rigorously equal to the weighted average of education-specific TFRs weighted by the share of women 15–39 by educational level. This has only a minor influence on trends and is discussed in Appendix

(Supplemental Materials). The decomposition can be performed between any two points, for instance, between successive 5-year periods or a 10-year or 15-year period between the beginning and the end of the stall.

The decomposition thus relies on fertility trends by educational level (discussed above, as in Figure 1) and on the share of women by educational level. We computed the share of women by educational level using the exposure (person-years) in each educational group among women 15-39 for each 5-year period from the same tables as those used for the computation of fertility rates. This leads to trends that are very close to survey-specific estimates of education with good-quality data. Yet, since exposure is computed from pooled surveys, it leads to smoother trends than survey-specific estimates, as it is less affected by data quality problems. The method for computing the share of women by educational groups, as well as the choice of the 15-39 age group, are discussed in Appendix (Supplemental Materials).

Box 1: Decomposition of changes in total fertility rates

$TFR_T^{t2} - TFR_T^{t1} =$	Fertility change at the country-level (total) between time 1 (*t1*) and time 2 (*t2*).
$(TFR_S^{t2} - TFR_S^{t1}) \times \left[\frac{P_S^{t2} + P_S^{t1}}{2}\right] +$	Fertility change between *t1* and *t2* among women with 7+ years of education, weighted by the share of women with 7+ years of education.
$(TFR_P^{t2} - TFR_P^{t1}) \times \left[\frac{P_P^{t2} + P_P^{t1}}{2}\right] +$	Fertility change between *t1* and *t2* among women with 1–6 years of education, weighted by the share of women with 1–6 years of education.

$(TFR_N^{t2} - TFR_N^{t1}) \times \left[\frac{P_N^{t2} + P_N^{t1}}{2}\right] +$	Fertility change between *t1* and *t2* among women without education, weighted by the share of women with no education.
$\sum_{i=1}^{K}(P_i^{t2} - P_i^{t1}) \times \left[\frac{TFR_i^{t2} + TFR_i^{t1}}{2}\right] +$	Changes in the composition of the population by education between *t1* and *t2* weighted by the average fertility in each group.
$Residual$	Difference between the change in the observed total fertility rate and the change in the weighted average of the education-specific total fertility rates.
	[Eq. 2]

Figure 2 summarizes the changes in the proportion of women by level of education in Kenya. Overall, the share of women with no education decreased rapidly, from more than 40% in the late 1970s to less than 10% in the 2010s. The decrease was especially rapid until the early 1990s and slowed down as it approached low levels. The share of women with 1–6 years of education also decreased from the 1990s at a slower pace. Finally, the share of women with 7+ years of education increased more than threefold, from around 25% in the 1970s to 85% in the most recent period. Although this is not obvious from Figure 2, progress in secondary education was almost twice as slow in the late 1990s – early 2000s as in the previous period. The decomposition method measures the contribution of the four components and whether this slowdown in educational progress contributed to the country-level stall.

FIGURE 2

Figures 3a and 3b show the result of the decomposition method for Kenya, by 5–year periods and for broad periods (before, during, and after the stall). The solid segments (black or orange) represent the absolute annual fertility change between successive periods, for instance, the difference between the TFR at time *t*+5 and the TFR at time *t*, divided by the interval (5 years in the case of Figure 3a). A negative value of −0.1 on the Y-axis shows that total fertility decreased by 0.1 children per year between the two successive periods. Black segments indicate that fertility declined by more than 0.025 children per year on average, while orange segments correspond to periods of stalled fertility. The colored areas represent the contributions of the five components of Equation 2 to the total change[7]. In this example, we comment on both Figure 3a and 3b. For clarity, we will later focus on the decomposition by broad periods, as it facilitates the identification of the main differences between periods of fertility stalls and other periods.

In the late 1970s and early 1980s (first two bars), fertility decreased by around 0.1 child per year due to increased educational levels and within-group fertility changes. In the mid– and late 1980s and early 1990s (third and fourth bar), fertility decrease accelerated, mainly driven by rapid fertility declines within educational groups, especially among women with secondary education. The composition effect also contributed to the decline during that period at the same pace as in the early 1980s. On average, between the mid-1970s and the late 1990s (Figure 3b), fertility decreased by 0.13 children per year, and changes in the composition of the population by education contributed to roughly a quarter of the decline. After a first slowdown in the mid-1990s, fertility stalled at around five children between the late-1990s and the mid-2000s. The country-level stall was mainly driven by the fertility stalls within educational groups. As shown in Figure 3b, women with no education or with 1–6 years of education contributed to increasing fertility, while better-educated women contributed slightly to decreasing fertility, but to a much lesser extent than before the mid-

1990s. Changes in educational composition still contributed to the decrease in fertility, albeit to a slightly lesser extent than before. From the mid-2000s, fertility decline resumed, mainly driven by the decline of fertility among women with secondary education, although all the components (including the increase in education) contributed to the decline. In summary, the fertility stall in Kenya affected all educational strata. The decomposition shows that fertility changes within educational groups (the rate effect) had a larger influence on the country-level fertility stall than changes in education (the composition effect). Fertility stalls within educational groups were the clear drivers of the stall. Changes in education continued contributing to fertility decline, and the composition effect was not a driver of the stall. However, the contribution of education to the fertility decline slowed down in the late 1990s. In that sense, one could argue that it also contributed to the stall. We will address this question in the next section.

FIGURE 3

Results

In this section, we present and discuss the reconstructed trends in fertility and education and decomposition results for countries where a fertility stall was found. Fertility trends are presented in Figure 4, trends in education in Figure 5, and decomposition by broad periods in Figure 6. The decomposition by 5-year periods for countries with a stall is available in Appendix Figure A7 (Supplemental Materials), and fertility trends for countries without fertility stalls are available in Appendix Figure A8.

Fertility stalls are frequent and are a collective experience across educational groups

We found 14 fertility stalls at the country level (Figure 4 and Table 1). These cases include most countries (Cameroon, Congo, Zimbabwe, Namibia, Kenya, Côte d'Ivoire, Gabon, Madagascar, and Tanzania) where at least moderate evidence for stalls was found a few years ago (Schoumaker 2019), as well as additional countries with more recent stalls (Rwanda) or where recent data provides stronger evidence for stalls (Benin, Senegal, Guinea, and Togo).

Most of the 14 stalls started in the mid– or late 1990s. They occurred at fertility levels below five children per woman in Congo, Gabon, Namibia, Rwanda, and Zimbabwe (mid-transition stalls); in the other nine countries, fertility stalled between five and six children. Stalls were ongoing in seven countries in the most recent period (Benin, Congo, Gabon, Namibia, Rwanda, Togo, and Zimbabwe), while fertility decline had resumed in the seven other countries. These stalls lasted at least 15 years in six cases and only 5 years in four countries[8]. In summary, stalls are not exceptional and may last long at fertility levels well above replacement levels.

FIGURE 4

FIGURE 5

FIGURE 6

In all these countries, better-educated women have lower fertility than less-educated women (Figure 4). Also, women with primary education often have lower fertility than those with no education, although the differences are usually smaller (Shapiro 2012; Tabutin and Schoumaker 2020). No clear stylized pattern appears from the fertility trends by level of education, but differences by educational group tend to remain large, even when fertility decreases. This pattern of fertility decline by education is broadly consistent with the "permanent difference" model (Bongaarts 2003), where fertility remains higher among the less educated, even when the fertility transition is completed or well underway. In such situations, the educational composition of women could significantly influence fertility levels and trends (Bongaarts 2003) and could contribute to stalls.

However, Figure 4 already suggests that rate effects are expected to be major drivers of stalls. We find that fertility stalls are widespread within educational groups (Table 1) and are a collective experience in most countries. In all the countries, fertility stalled in at least two educational groups for the duration of the country-level stall, and it stalled in the three groups in most of them (10 countries). While this does not rule out the role of composition effects in the stall, it already highlights that there is more to fertility stalls than a slowdown in education.

Educational stalls are less frequent than fertility stalls

Figure 5 shows that educational attainment has improved in all countries, although starting from distinct levels and at varying paces. In all countries, the share of women with no education decreased, sometimes substantially. However, the decrease has been very uneven across countries. In Cameroon, Côte d'Ivoire, and Madagascar, the share of women (15-39) with no education stagnated or decreased slowly at fairly high levels (around 25% in Cameroon, 20% in Madagascar, and above 50% in Côte d'Ivoire). In Congo, Kenya, and Zimbabwe, the decrease was also slight in recent periods, but in this case, the proportion of uneducated women was already very low. The share of better-educated women sometimes increased very rapidly, as in Kenya, Namibia, Tanzania, and Zimbabwe, where it was above 75% in the most recent surveys. In Zimbabwe, progress in secondary education leveled off in recent years, but it has already reached high levels. In some other countries, progress in secondary education slowed down or was interrupted at much lower levels. We find such situations in Benin, Cameroon, Rwanda, and Senegal in the 1990s and in Madagascar between the late 1980s and mid-2000s. Some of these educational stalls were highlighted in previous research and were linked to structural adjustment programs and/or economic disruptions (Goujon, Lutz, and KC 2015). For instance, a lack of educational progress was identified in Côte d'Ivoire in the 1980s–1990s, a period of economic crisis and structural adjustment programs (Cogneau and Mesplé-Somps 2003). In Madagascar, a decline in schooling in the 1980s was highlighted more than 20 years ago. It was linked to cutbacks in public spending on education and households' increased difficulties in covering educational expenses (Roubaud 1999). In summary, some countries suffered from education stalls, which may have contributed to halts and reversals in fertility declines. However, stalls in education are not widespread and probably only account for a limited part of fertility stalls.

Fertility stalls primarily reflect stalling fertility within educational groups

The decomposition method offers additional evidence that educational composition effects do not primarily cause stalls in fertility rates. We use the decomposition method to identify the drivers of the stalls (Table 1). Drivers typically refer to "the most influential groups in fertility transition" (Eloundou-Enyegue, Giroux, and Tenikue 2017:2). We instead use the term *driver* to name which of the four components of Equation 2 (except the residual term) makes the largest contribution to the stall. This corresponds to the educational group or the composition effect with the largest positive contribution (largest area above zero in the Y-axis in Figure 6) during the period of stalling fertility. The component with the largest positive value is listed first, and other components with a positive contribution are also mentioned in descending order (Table 1). In case all the components contribute to decreasing fertility, the one with the smallest negative contribution is reported in parentheses.

Table 1 shows that the drivers vary substantially across countries. Nonetheless, it is evident that in none of these countries are composition effects the primary drivers of fertility stalls. The most frequent drivers are rate effects among women with 1–6 years of education, who contributed to stalls in all the 14 countries. They were the largest contributors in six countries (Cameroon, Congo, Côte d'Ivoire, Madagascar, Namibia, and Senegal) and had a lesser impact in eight other countries. Women with secondary education were also the largest drivers of country-level fertility stalls in six countries (Benin, Gabon, Guinea, Rwanda, Togo, and Zimbabwe) and contributed to stalls in another three. In the case of Rwanda, this can be primarily attributed to the significant increase in fertility within this educational group in recent years[9]. In Zimbabwe, the larger contribution of women with secondary education reflects the fact that women with 7+ years of education are the largest group that has a strong influence on country-level trends. Finally, women with no education contributed to stalls in seven countries and were the largest contributors in only two countries (Kenya and Tanzania).

TABLE 1

FIGURE 7

Figure 7 summarizes these findings with boxplots, which show the distribution of the contributions of the five components to fertility changes. We use all the broad periods from Figure 6 (35 periods), which we classify into three groups according to the speed of the fertility decline: periods of rapid decline (more than 0.10 children per year on average), those of moderate decline (between 0.025 and 0.10 children per year), and stalls (decline slower than 0.025 children per year or increase). We find that composition effects do not vary substantially between these three groups and always contribute to fertility declines by around 0.020 children per year. In contrast, fertility changes within educational groups are correlated to country-level fertility changes: they tend to contribute to fertility decline when country-level fertility declines and to fertility stalls when country-level fertility decreases very slowly or does not decrease[10].

The contribution of education to stalls: Alternative perspectives

These results demonstrate that educational composition is not a driver of stalls in the sense that it does not contribute to an increase in fertility rates. However, one could argue that this outcome is not surprising, given that the educational composition of a population at any given point in time represents an average of educational levels across successive cohorts. This composition evolves at a relatively smooth pace, even if there are strong variations in educational attainment across cohorts. In contrast, the TFR is more susceptible to short-term fluctuations, and changes in fertility within educational groups are more likely to influence the trend in total fertility. To account for this specificity of composition effects, we consider measuring the contribution of educational composition to fertility stalls in a less conservative manner.

The first alternative approach (the *high vulnerability to stalls*) involves identifying cases where the composition effect was only slightly negative, that is, cases where the progress in education was slow and did not substantially contribute to the fertility decline (Table 2). We consider the country highly vulnerable to stalls if the composition effect exceeds −0.0125 children per year, which is half of the rate of decline used to identify stalls. This threshold is based on the idea that if both the rate effects (the sum of their values) and the composition effect contribute to the decline by a greater amount than this threshold, the change in fertility would not be classified as a stall. Conversely, if the composition effect is above this threshold, the rate effects would need to be lower for the stall to be averted. Using that threshold, we find that the composition effect was very small in five countries (Congo, Côte d'Ivoire, Madagascar, Tanzania, and Zimbabwe). In the case of Zimbabwe and Tanzania, this reflects the slowdown in education progress at high levels. In cases such as Madagascar and Côte d'Ivoire, it rather reflects the slowdown in education related to the crises discussed above. In essence, these countries were at a higher risk of experiencing fertility stalls due to their slower educational progress, and — had education progressed more robustly — they would have been less susceptible to such stalls.

An alternative way to assess the contribution of education to fertility stalls is by examining the changing magnitude of the composition effect over time (the *diminished preventive effect*). In several countries, the composition effect played a significant role in the decline in fertility before the stall occurred. However, its impact on the reduction in fertility during the stall was considerably diminished. If the composition effect had remained stable, it might have averted the occurrence of the stall. In other words, the deceleration in educational progress was so pronounced that the composition effect alone was no longer sufficient to prevent the stall. We identify such cases by calculating the annual change in total fertility during the stall period based on the assumption that the composition effect remains at its pre-stall level. If the new value of the annual change in total fertility is less than −0.025 children per year, we consider that the stall could have been prevented. In Table 2, we have identified four countries (Cameroon, Côte d'Ivoire, Namibia, and Tanzania) where, if the composition effect had remained constant at the pre-stall level, it would have prevented the occurrence of the fertility stall.

TABLE 2

Next, the 14 stalls are classified into four groups (Table 2). In seven countries, we find no substantial effect of education on the occurrence of stalls. In these countries, the composition effect contributed to decreasing fertility, and although educational progress may have slowed down, it did not significantly contribute to the stall[11]. In the second group of countries (Cameroon and Namibia), the diminished composition effect of education led to a situation where the educational progress was not sufficient to avert the stall, even though the composition effect was not particularly small. These are examples of countries where the stall could have been averted if the composition effect had remained at its pre-stall level. The five remaining countries (Congo, Côte d'Ivoire, Madagascar, Tanzania, and Zimbabwe) are cases where the composition effect was so small (educational progress was so slow) that these countries were vulnerable to stalls. In two of them (Côte d'Ivoire and Tanzania), this high vulnerability to stalls resulted from a notable decrease in the composition effect. In contrast, in the other three countries (Congo, Madagascar, and Zimbabwe), the composition effect was already low before the stall. We find no clear link between the length of the stall and the contribution of composition effects to stalls.

Discussion and conclusion

Fertility stalls are no exception in SSA. While they occasionally have a limited duration and can occur at relatively high fertility levels, they illustrate that the fertility transition in SSA is not hapless. We identify stalls in 14 countries, a finding consistent with previous research

(Schoumaker 2019), even though the number of stalls in this paper is larger, partly because more recent data is available (e.g., in Benin and Rwanda).

Have fertility stalls been primarily caused by a slowdown in educational progress? The short answer is no. In no country has the change in educational composition been the predominant factor contributing to the stall, and in no country have the composition effects been positive. Has slow educational progress contributed to fertility stalls? In half of the countries, the answer is also no. However, we find that slow educational progress made some countries (Congo, Côte d'Ivoire, Madagascar, Tanzania, and Zimbabwe) more vulnerable to fertility stalls, and slowdowns in educational progress also reduced the preventive effect of education on fertility stalls in a few countries (Cameroon, Côte d'Ivoire, Namibia, Tanzania).

However, even when slow educational progress somehow contributed to stalls, they were not the dominant force. They contributed to country-level stalls *in addition* to fertility stalls within educational groups. We find that fertility stalled within all educational groups in most countries during country-level stall periods. Whether these stalls within educational groups reflect stagnating fertility preferences, lack of access to contraception, or other factors that influence fertility is beyond the scope of this paper[12]. However, these results stress the potential importance of factors that affect the fertility of all educational groups.

How do our results compare with previous research on the links between stalls and education, and especially the work of Kebede et al. (2019)? It should first be noted that the data and methods differ in several respects, making detailed comparisons difficult. For instance, the countries with stalls differ between our study and their study. Their research used data from 18 countries (DHS), while we covered 33 countries with more recent data (DHS as well as MICS). They identified stalls in countries that we identify as not having experienced a fertility decline in the first place (Chad, DR Congo, Nigeria). We focus on stalls below 6 children while they consider all the stalls regardless of the level of fertility. Moreover, their analysis relies on creating a counterfactual trend in education to estimate the impact of education on fertility stalls. Their results thus depend on the assumption about the trends in education. Nevertheless, we can highlight some major commonalities and differences in our conclusions. We find — as Kebede et al. (2019) did — that slow educational progress partly accounted for the stalls in some countries, such as Côte d'Ivoire and Cameroon. But we establish that this is only part of the story and only in a subset of the countries. We show that in half of the countries where a fertility stall was identified, trends in education did not contribute to stalls, even when using a less conservative approach to measure the contribution of education to stalls. In countries where education may have contributed to stalls, this was limited compared to the contribution of fertility trends within educational groups. While Kebede et al. (2019) mentioned that fertility stalls were more likely among less-educated women, a key finding of our paper is that stalls are a collective experience that also involves better-educated women. In some countries, fertility trends among the better-educated women were even the most important driver of stalls. This also differs from what was shown by Eloundou-Enyegue et al. (2017) in a more limited number of cases. Compared to analyses based on aggregate data (Shapiro and Gebreselassie 2008), our results disentangle composition effects from rate effects and show that – even if trends in education and fertility may be correlated at the aggregate level in some countries – this does not mean that slowdown in education is the major driver of the stalls.

This has important policy implications. If slow education is not the primary driver of the fertility stalls, a more rapid increase in education is not the primary solution to the resumption of fertility declines. This is not to say that better education is not important *per se* or that faster progress in education will not contribute to faster fertility declines and fewer stalls. We can indeed expect that without major slowdowns in education in the future and given the large differentials in fertility by education groups, further progress in education will contribute to further fertility declines. Yet, as shown in this paper, composition effects are rarely the dominant forces in fertility trends, and the role of fertility changes within groups is expected to have a more substantial impact on trends, including stalls. A better grasp of the causes of the fertility stalls within educational groups is thus crucial to understanding the resumption of fertility declines.

Finally, based on our findings, what can we expect in the future? In countries where a large share of the population has no education, future fertility declines or stalls will depend to a considerable extent on fertility changes among the less-educated women, as their weight in the population is large. If fertility differentials across educational groups remain large, composition effects are also expected to be important factors in the fertility transition, as low-fertility women will represent a larger share of the population. In contrast, if low levels of schooling persist, this will make these countries vulnerable to fertility stalls, as progress in education may not be sufficient to outweigh possible stalls with educational strata (Bongaarts 2003). In countries where education is already widespread (e.g., Zimbabwe, Namibia, and Gabon), the room for further increase in educational attainment is more limited. As a result, fertility changes at the country level will increasingly depend on fertility trends among better-educated women and less on composition effects. However, we have shown that fertility stalls among better-educated women are common, well above the replacement level, usually between three and four children. Unless fertility further declines in these groups, stalls will likely last and fuel further population increases.

References

Agyei-Mensah, Samuel, and Nkechi S. Owoo. 2015. "Explaining Regional Fertility Variations in Ghana." *Journal of Population Research* 32(3): 157–172. doi:10.1007/s12546-015-9147-7.

Bongaarts, John. 2003. "Completing the Fertility Transition in the Developing World: The Role of Educational Differences and Fertility Preferences." *Population Studies* 57(3): 321–335. doi:10.1080/0032472032000137835.

Bongaarts, John. 2006. "The Causes of Stalling Fertility Transitions." *Studies in Family Planning* 37(1): 1–16. doi:10.1111/j.1728-4465.2006.00079.x.

Bongaarts, John. 2008. "Fertility Transitions in Developing Countries: Progress or Stagnation?" *Studies in Family Planning* 39(2): 105–110. doi:10.1111/j.1728-4465.2008.00157.x.

Bongaarts, John. 2017a. "Africa's Unique Fertility Transition." *Population and Development Review* 43: 39–58. doi:10.1111/j.1728-4457.2016.00164.x.

Bongaarts, John. 2017b. "The Effect of Contraception on Fertility: Is Sub-Saharan Africa Different?" *Demographic Research* 37(6): 129–146. doi:10.4054/DemRes.2017.37.6.

Bongaarts, John, and John B. Casterline. 2013. "Fertility Transition: Is sub-Saharan Africa Different?" *Population and Development Review* 38(s1): 153–168. doi:10.1111/j.1728-4457.2013.00557.x.

Bongaarts, John, Barbara S. Mensch and Ann K. Blanc. 2017. "Trends in the Age at Reproductive Transitions in the Developing World: The Role of Education." *Population Studies* 71(2): 139–154. doi:10.1080/00324728.2017.1291986.

Casterline, John B. 2017. “Prospects for Fertility Decline in Africa.” *Population and Development Review* 43(S1): 3–18. doi:10.1111/padr.12055.

Castro-Martin, Teresa. 1995. “Women’s Education and Fertility: Results from 26 Demographic and Health Surveys.” *Studies in Family Planning* 26(4): 187–202. doi:10.2307/2137845.

Chemhaka, Garikayi B., and Clifford O. Odimegwu. 2019. “The Proximate Determinants of Fertility in Eswatini.” *African Journal of Reproductive Health / La Revue Africaine de la Santé Reproductive* 23(2): 65–75.

Cleland, John. 2002. “Education and Future Fertility Trends, with Special Reference to Mid-transitional Countries.” *Population Bulletin of the United Nations. Completing the fertility transition* (48–49): 183–195.

Cogneau, Denis, and Sandrine Mesplé-Somps. 2003. “Les illusions perdues de l’économie ivoirienne et la crise politique.” *Afrique contemporaine* 2(206): 87–104. doi:10.3917/afco.206.0087.

Eloundou-Enyegue, Parfait, Sarah Giroux, and Michel Tenikue. 2017. “African Transitions and Fertility Inequality: A Demographic Kuznets Hypothesis.” *Population and Development Review* 43(S1): 59–83. doi:10.1111/padr.12034.

Ezeh, Alex C., Blessing U. Mberu, and Jacques O. Emina. 2009. “Stall in Fertility Decline in Eastern African Countries: Regional Analysis of Patterns, Determinants and Implications.” *Philosophical Transactions of the Royal Society B: Biological Sciences* 364(1532): 2991–3007. doi:10.1098/rstb.2009.0166.

Garenne, Michel. 2008. *Fertility Changes in Sub-Saharan Africa*. Calverton, Maryland, USA: Macro International. DHS Comparative Reports 18. http://dhsprogram.com/pubs/pdf/CR18/CR18.pdf.

Gerland, Patrick, Ann Biddlecom, and Vladimíra Kantorová. 2017. "Patterns of Fertility Decline and the Impact of Alternative Scenarios of Future Fertility Change in sub-Saharan Africa." *Population and Development Review* 43(S1): 21–38. doi:10.1111/padr.12011.

Goujon, Anne, Wolfgang Lutz, and Samir KC. 2015. "Education Stalls and Subsequent Stalls in African Fertility: A Descriptive Overview." *Demographic Research* 33(47): 1281–1296. doi:10.4054/DemRes.2015.33.47.

Grimm, Michael, Isabel Günther, Kenneth Harttgen, and Stephan Klasen. 2022. "Slow-downs of Fertility Decline: When Should We Call it a 'Fertility Stall'?" *Demographic Research* 46(26): 737–766. doi:10.4054/DemRes.2022.46.26.

Hertrich, Véronique. 2017. "Trends in Age at Marriage and the Onset of Fertility Transition in sub-Saharan Africa." *Population and Development Review* 43(S1): 112–137. doi:10.1111/padr.12043.

Howse, Kenneth. 2015. "What is Fertility Stalling and Why Does it Matter?" *Population Horizons* 12(1): 13–23. doi: 10.1515/pophzn-2015-0003.

Kebede, Endale, Anne Goujon, and Wolfgang Lutz. 2019. "Stalls in Africa's Fertility Decline Partly Result from Disruptions in Female Education." *Proceedings of the National Academy of Sciences* 116(8): 2891–2896. doi:10.1073/pnas.1717288116.

Kitagawa, Evelyn M. 1955. “Components of a Difference Between Two Rates.” *Journal of the American Statistical Association* 50(272): 1168–1194. doi:10.1080/01621459.1955.10501299.

Liu, Daphne H., and Adrian E. Raftery. 2020. “How Do Education and Family Planning Accelerate Fertility Decline?” *Population and Development Review* 46(3): 409–441. doi:10.1111/padr.12347.

Machiyama, Kazuyo. 2010. *A Re-Examination of Recent Fertility Declines in Sub-Saharan Africa*. Calverton: ICF Macro. DHS Working Paper 68. https://dhsprogram.com/publications/publication-wp68-working-papers.cfm.

OECD. 2013. “What are the Social Benefits of Education?” *Education indicators in focus*(1): 1–4. doi:10.1787/5k4ddxnl39vk-en.

Preston, Samuel, Patrick Heuveline, and Michel Guillot. 2001. *Demography: Measuring and Modeling Population Processes*. Oxford: Blackwell.

Roubaud, François. 1999. “Éducation et ajustement structurel à Madagascar. ” *Autrepart* (11): 81–100.

Sánchez-Páez, David A., and Bruno Schoumaker. 2022. “Fertility Transition in Africa. What Do We Know and What Have We Learned about Fertility Stalls?” In *The Routledge Handbook of African Demography*, edited by Clifford O. Odimegwu, and Yemi Adewoyin, 217–251. London: Routledge.

Schoumaker, Bruno. 2009. *Stalls in Fertility Transitions in Sub-Saharan Africa: Real or Spurious?* Louvain-la-Neuve: Université catholique de Louvain. Document de travail SPED 30.

Schoumaker, Bruno. 2013. "A Stata module for computing fertility rates and TFRs from birth histories: tfr2." *Demographic Research* 28(38): 1093–1144.

Schoumaker, Bruno. 2019. "Stalls in Fertility Transitions in Sub-Saharan Africa. Revisiting the Evidence." *Studies in Family Planning* 50(3): 257–278. doi:doi:10.1111/sifp.12098.

Shapiro, David. 2012. "Women's Education and Fertility Transition in Sub-Saharan Africa." *Vienna Yearbook of Population Research* 10: 9–30.

Shapiro, David, and Tesfayi Gebreselassie. 2008. "Fertility Transition in Sub-Saharan Africa: Falling and Stalling." *African Population Studies* 23(1). doi:10.11564/23-1-310.

Shapiro, David, and Andrew Hinde. 2017. "On the Pace of Fertility Decline in Sub-Saharan Africa." *Demographic Research* 37: 1327–1338. doi:10.4054/DemRes.2017.37.40.

Shapiro, David, and Michel Tenikue. 2017. "Women's Education, Infant and Child Mortality, and Fertility Decline in Rural and Urban Sub-Saharan Africa." *Demographic Research* 37(21): 669–708. doi:10.4054/DemRes.2017.37.21.

Tabutin, Dominique, and Bruno Schoumaker. 2020. "The Demography of Sub-Saharan Africa in the 21st Century." *Population* 75(2): 165–286.

Westoff, Charles F., and Anne R. Cross. 2006. *The Stall in the Fertility Transition in Kenya*. Calverton: ORC Macro.

TABLE 1 Characteristics of Fertility Stalls in 14 Countries and Main Contributors to the Country-level Stalls.

Country	Period of the country-level stall [a]	Duration of the stall [b]	Average TFR during the stall	Stall by level of education			Contributors ranked by decreasing impact [c]
				No education	1–6 years	7+ years	
Benin	1999–2014	Long*	5.9	Yes	Yes	Yes	7+ / 1–6
Cameroon	1999–2014	Long	5.3	No	Yes	Yes	1–6
Congo	1996–2011	Long*	4.6	Yes	Yes	Yes	1–6 / No / 7+
Cote d'Ivoire	1993–2013	Long	5.2	Yes	Yes	Yes	(1–6)
Gabon	2006–2016	Medium*	3.8	Yes	Yes	Yes	7+/ 1–6 / No
Guinea	2003–2013	Medium	5.7	Yes	Yes	Yes	1–6 / 7+
Kenya	1999–2004	Short	5.0	Yes	Yes	Yes	No / 1–6
Madagascar	1988–1998	Medium	5.9	Yes	Yes	Yes	1–6 / No
Namibia	2005–2010	Short*	3.6	No	Yes	Yes	1–6 / 7+
Rwanda	2011–2016	Short*	4.3	No	Yes	Yes	7+ / 1–6
Senegal	1997–2012	Long	5.5	Yes	Yes	Yes	1–6 / 7+ / No
Tanzania	1999–2004	Short	5.7	Yes	Yes	No	No / 1–6
Togo	1994–2014	Long*	5.3	No	Yes	Yes	7+ / 1–6
Zimbabwe	2006–2016	Medium*	4.0	Yes	Yes	Yes	7+ / 1–6 / No

[a] Mid-year of the 5-year periods of the beginning and end of the stall.

[b] Long stalls: 15 years or over; Medium stalls: 10 years; Short stalls: 5 years. Ongoing stalls are identified by *.

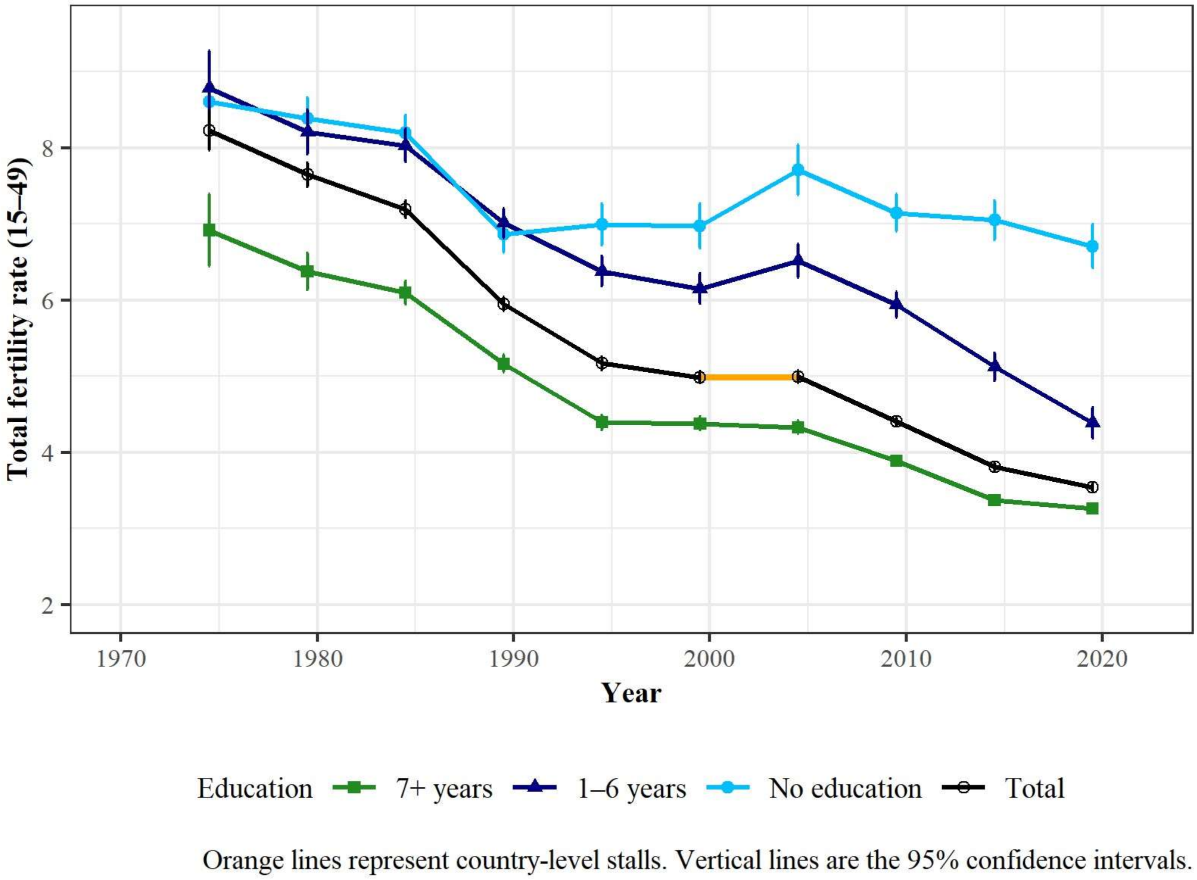
[c] The contributors are ranked by decreasing order of impact on the stalls. Only components that contribute to increasing fertility are mentioned unless all the components contribute to lower fertility. In that case, the component with the smallest negative contribution is indicated in parentheses.

Data sources: authors' calculation from Demographic and Health Surveys and Multiple Clusters Indicator Surveys.

TABLE 1 Contribution of Composition Effects of Education on Fertility Stalls.

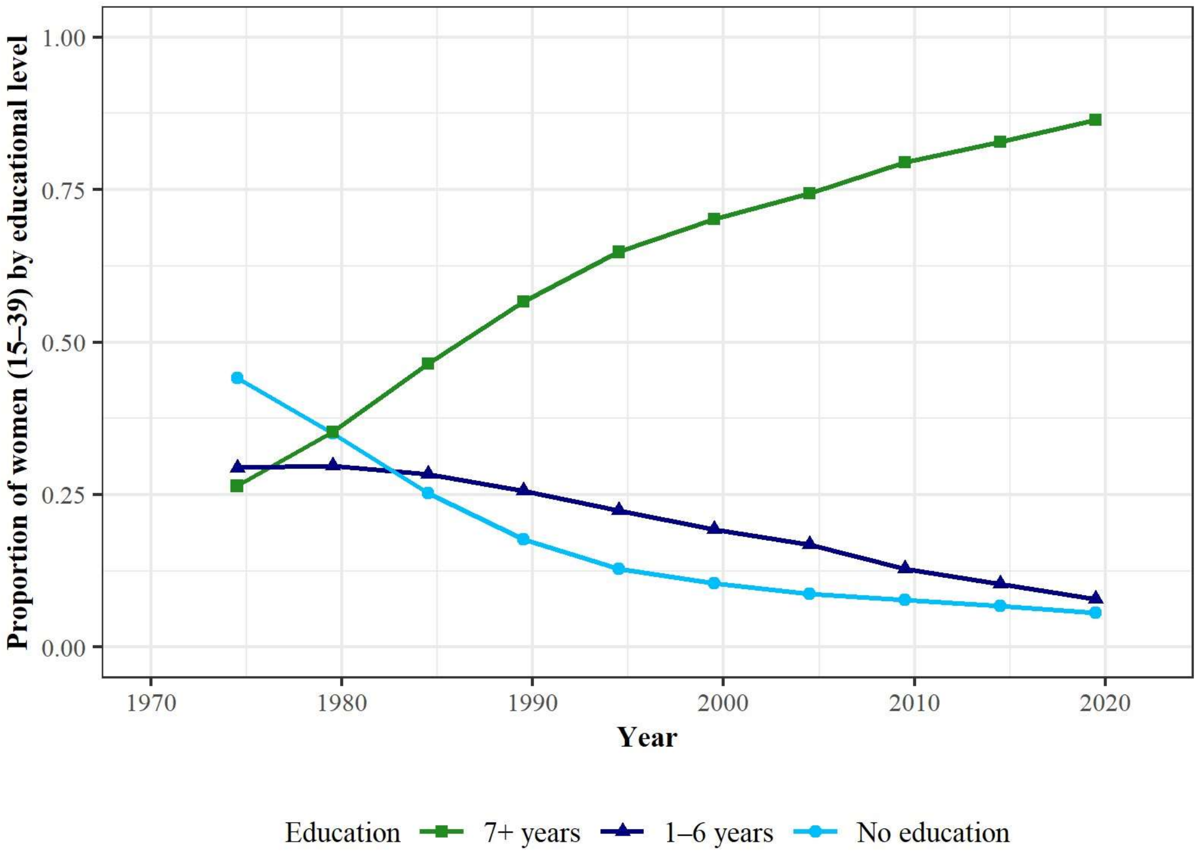
Country	Contribution of composition effects of education on fertility stalls		
	Direct contribution to stalls (the composition effect is positive)	**High vulnerability to stalls** (the composition effect was greater than −0.0125 children per year)	**Diminished preventive effect of education on stalls** (the rate of progress in education became insufficient to prevent the fertility stall)
No effect of education on stalls			
Benin	No	No	No
Gabon	No	No	No
Guinea	No	No	No
Kenya	No	No	No
Rwanda	No	No	No
Senegal	No	No	No
Togo	No	No	No
Diminished preventive effect of education			
Cameroon	No	No	Yes
Namibia	No	No	Yes
High vulnerability to stalls			
Congo	No	Yes	No
Madagascar	No	Yes	No
Zimbabwe	No	Yes	No
High vulnerability to stalls and diminished preventive effect of education			
Côte d'Ivoire	No	Yes	Yes
Tanzania	No	Yes	Yes

FIGURE 1 Reconstructed Total Fertility Rates by Educational Level in Kenya.



Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

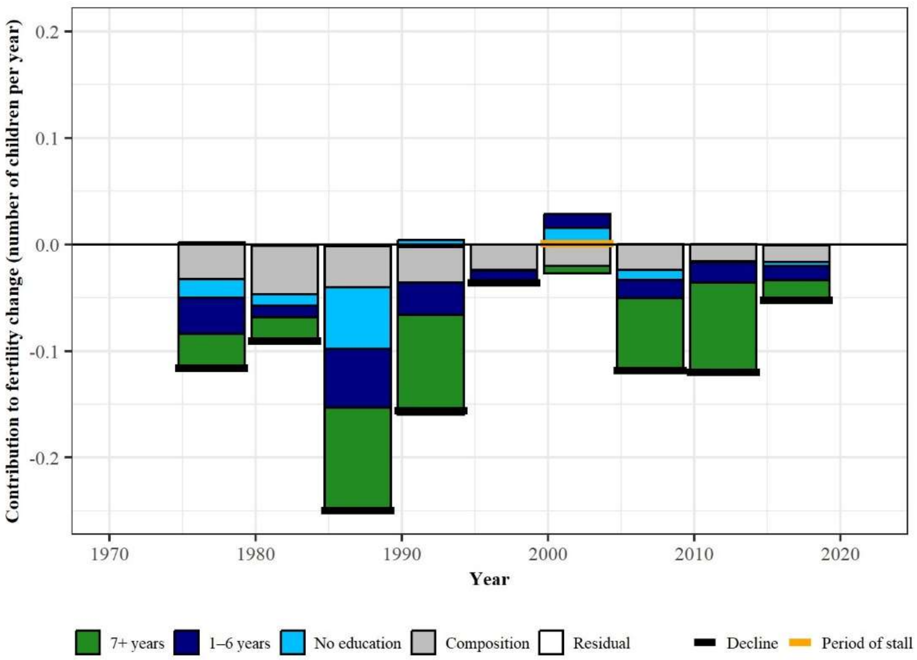
FIGURE 2 Trends in the Level of Education among Women (15–39) in Kenya.



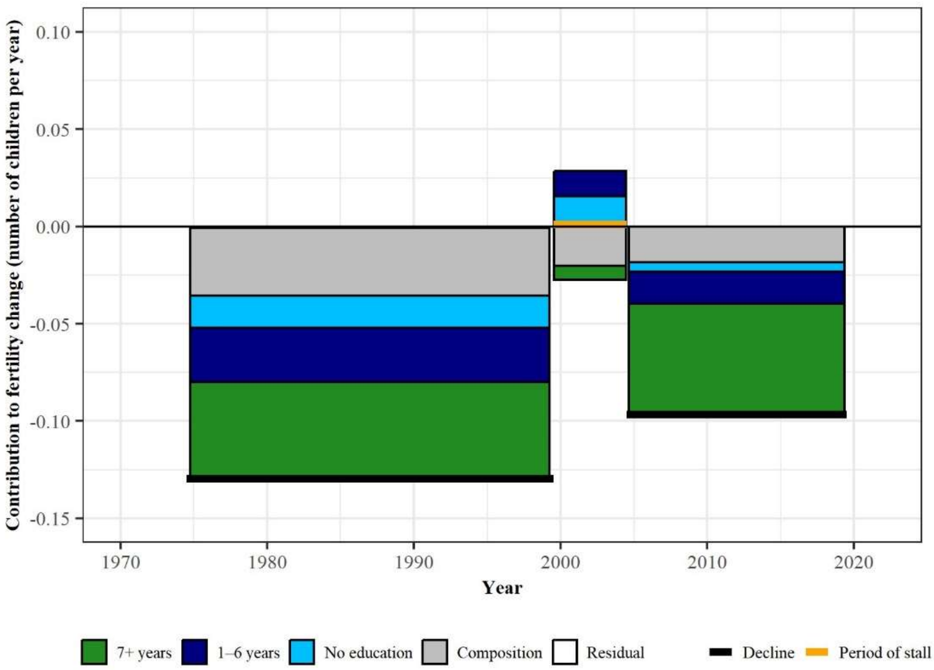
Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

FIGURE 3 Decomposition of Fertility Changes in Kenya.

(a) by 5-year periods

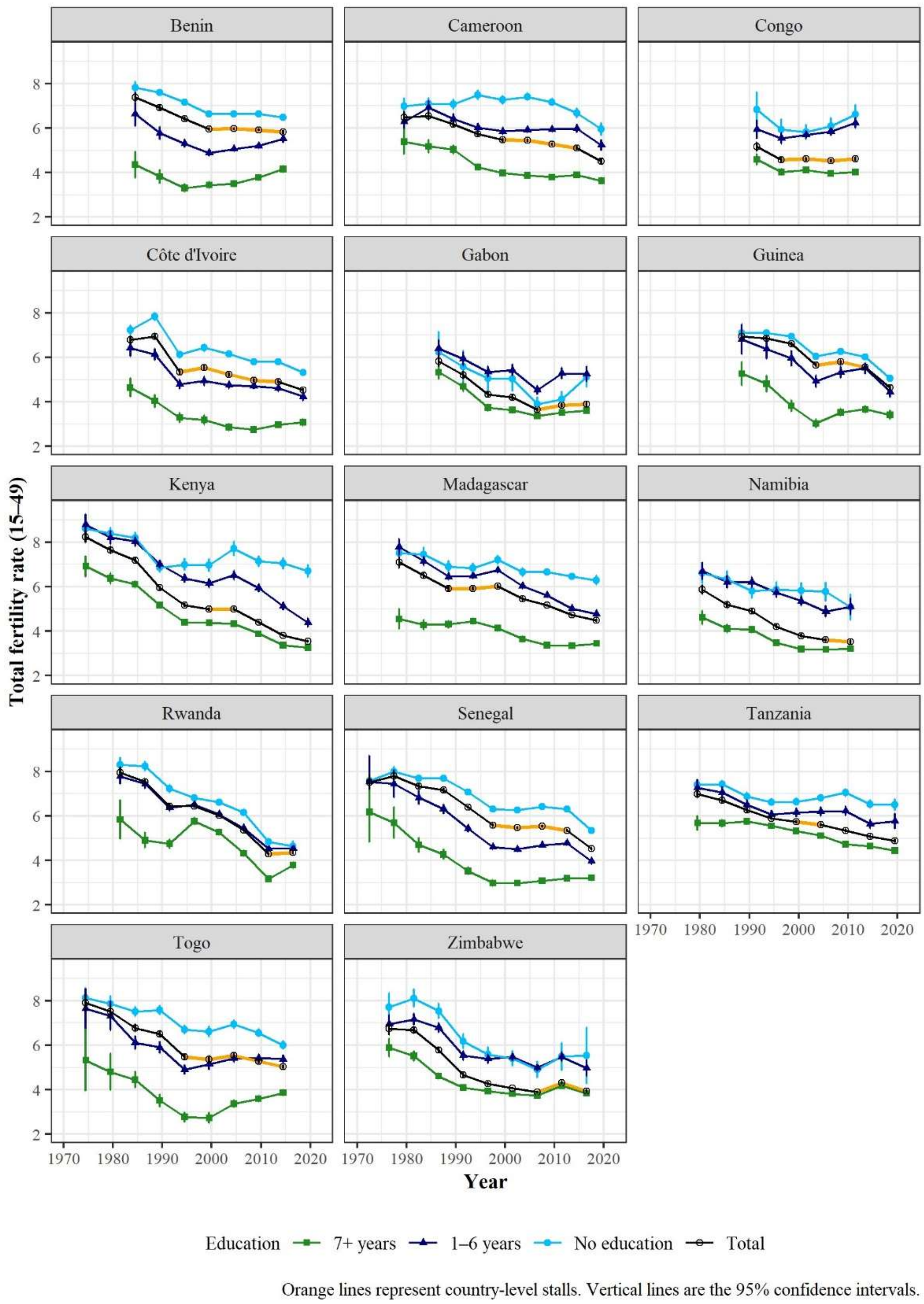


(b) Decomposition by broad periods



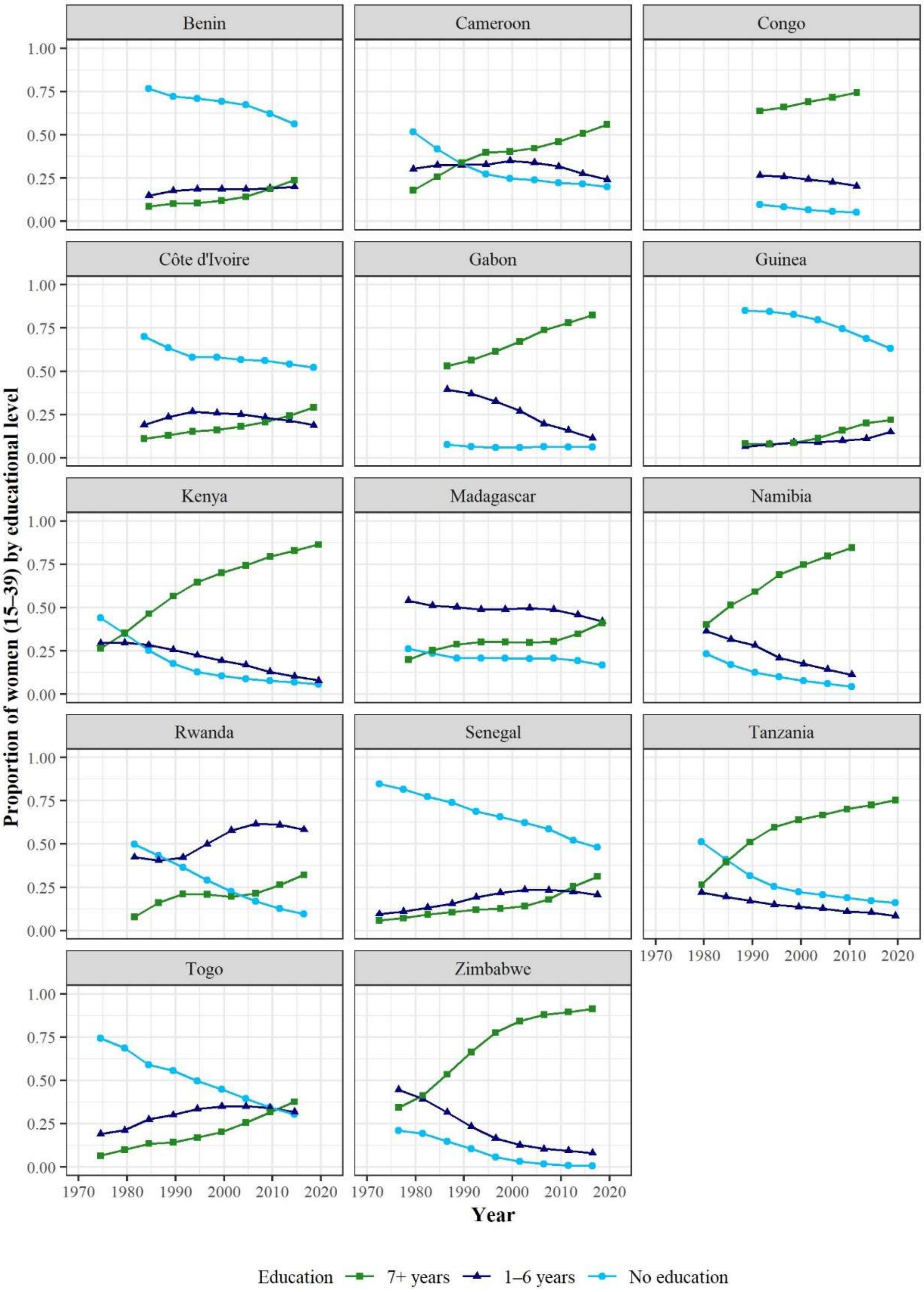
Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

FIGURE 4 Trends in Total Fertility Rates by Educational Level in 14 Countries with Fertility Stalls.



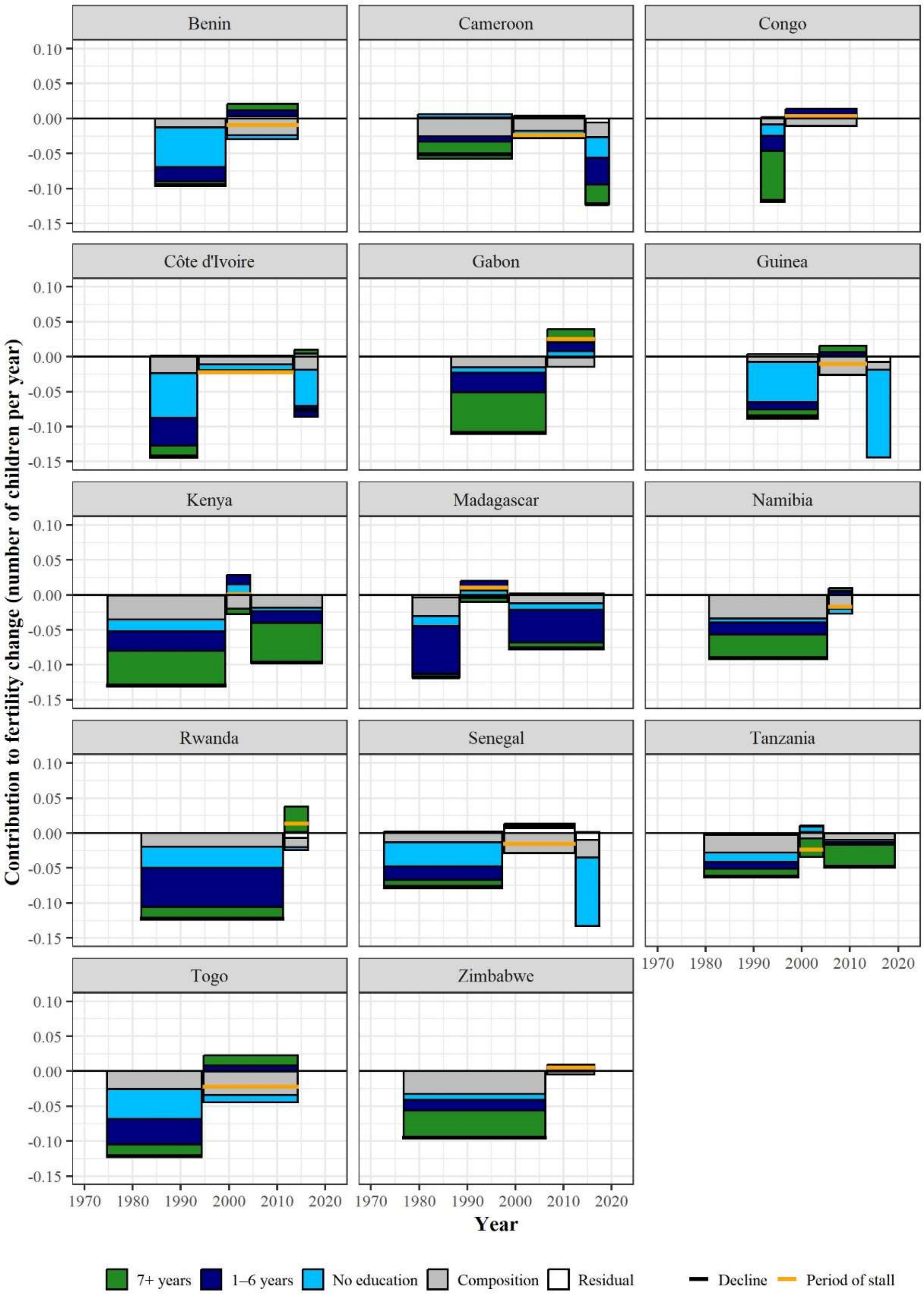
Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

FIGURE 5 Trends in Level of Education among Women (15–39) in 14 Countries with Fertility Stalls.



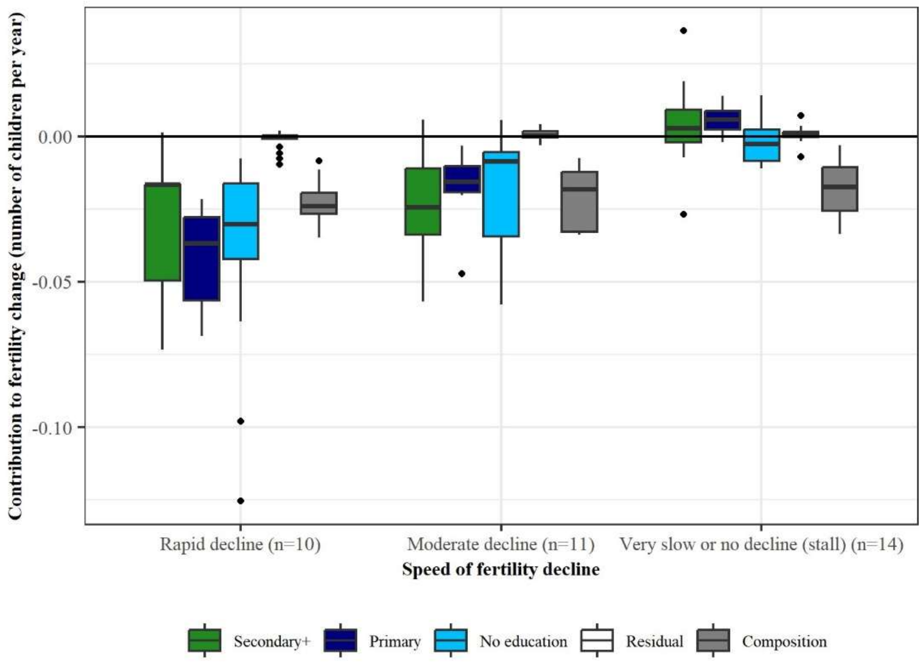
Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

FIGURE 6 Decomposition of Fertility Changes by Broad Periods in 14 countries with Fertility Stalls.



Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

FIGURE 7 Distribution of the Contribution of Five Components to Fertility Changes over Broad Periods According to the Speed of Fertility Changes in 14 countries with Fertility Stalls (35 periods).



Data source: Demographic and Health Surveys and Multiple Indicator Cluster Surveys

Notes

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[1] On the other hand, of the 22 countries with no fertility stalls, eight had experienced a stall in education.

[2] The definition of conditional stalls also includes countries where the fertility transition has not yet started and is not the same as the one used in other research. However, it points to the fact that stalls are not accounted for by socioeconomic variables in some countries.

[3] The following countries are excluded because the data is not available, the duration between surveys is too long or only one survey with full birth histories is available, or because of data quality issues: Angola, Botswana, Cape Verde, Central African Republic, Comoros, Equatorial Guinea, Guinea Bissau, South Africa, South Sudan.

[4] The harmonization based on years of education is justified when computing retrospective estimates of fertility by educational level. In countries where primary education is eight years long, it is common for girls to enter secondary education after age 15. In computing retrospective fertility rates by level of education, we assume that the level of education does not change after age 15, i.e., that the level of education at the survey is a good estimate of the level of education at age 15. This assumption is more reasonable when considering six years of primary education. In some countries, such as Ghana and Nigeria, the harmonization is also necessary for comparisons over time, as the education system changed during the studied period.

[5] We use data from birth histories for the 15 years prior to the survey. In some surveys (mainly MIS), birth histories cover only the last five or six years. Only the five years preceding the survey are used in such cases.

[6] At the country level, this is very similar to results obtained with one-tailed tests of a decrease in fertility ($p < 0.1$).

[7] If all five components contribute to the decline in fertility, their sum equals the change in total fertility. When some components are positive and others are negative, the segment does not correspond to the limit of the colored areas.

[8] They were ongoing in Namibia and Gabon and may thus last longer.

[9] This may reflect that some women who entered the group of better-educated women may have continued the fertility behavior of less-educated women in a context of rapidly increasing education (Bongaarts, Mensch, and Blanc 2017).

[10] We weigh the observations by length of period, but this has a limited impact on the results. A similar boxplot using 5-year periods as observations (instead of long periods) leads to similar results. Using all observations, including in countries without stalls, also leads to the same picture.

[11] The contribution of the composition effect to the fertility decline did diminish in Kenya and Rwanda, but not sufficiently to consider that education influenced the stalls.

[12] The fact that stalls are a collective experience is also a key difference with countries that did not experience country-level fertility stalls. Although fertility stalls were also found in some educational groups in these countries (especially among the better-educated women in around half of them), they never occurred in all the groups at the same time. They were especially infrequent among the less-educated women.