The contribution of education to fertility decline in low- and middle-income countries

Abstract for EPC2024

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Abstract

The increased accessibility and enhanced quality of education represent key drivers in the reduction of fertility rates. Yet, the extent to which the educational composition of the population has contributed to fertility declines in low and middle-income countries is only partially documented. In this paper, we aim to determine the contribution of composition effects (the improvement in education) and rate effects (fertility changes within educational groups) to fertility declines. We use over 350 Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) from around 60 low- and middle-income countries. Fertility trends by educational level and trends in education are reconstructed from pooled data over 30-40 years in many countries. A decomposition method is applied to disentangle composition and rate effects in fertility transitions. Preliminary results indicate that composition effects consistently contributed to fertility declines, supporting earlier evidence that improved access to education contributes to fertility declines. However, composition effects vary greatly across countries and over time. The composition effect seems more relevant at the beginning of the fertility transition, suggesting that education would be a major driving force behind the onset of fertility decline. Later in the transition, rate effects tend to gain ground, indicating that within-group changes – related to other factors – are the dominant forces in the transition.

INTRODUCTION

Fertility transition in low- and middle-income countries

Fertility began to decline in low- and middle-income countries in the mid-20th century (Sánchez-Páez and Schoumaker 2022; United Nations, 2022). The decline started in the early 1960s in Latin America and Southeast Asia from average total fertility rate (TFR) levels of 5.9 children per woman and 6.2 children per woman, respectively. In Southern Asia, fertility decline began in the mid-1960s from an average TFR of 6.1 children per woman. In Africa, the decline in fertility started in the late 1960s and from an average TFR of 6.7. However, fertility decreased at a much slower pace in Africa, particularly in sub-Saharan Africa, than in the other low- and middle-income regions (Bongaarts 2017a; Gerland et al., 2017; Shapiro and Hinde 2017). Nearly sixty years after fertility began to decline in Africa, the average TFR currently stands at around 4.5 births per woman, while the other low- and middle-income regions are already reaching the replacement level. The slower pace of fertility reduction is explained by the reversals and halts in fertility decline – fertility stalls – that have been observed in many sub-Saharan African countries

(Bongaarts 2006, 2008; Ezeh et al., 2009; Garenne 2008; Howse 2015; Kebede et al., 2019; Schoumaker 2009, 2019; Shapiro and Gebreselassie 2008).

Fertility decline can be attributed to the interplay of several factors. Improved access to family planning services and contraceptives has played a pivotal role in enabling couples to make informed choices about the timing and number of their children (Cleland, 2002). Furthermore, increasing educational opportunities for women have been a powerful driver, as education empowers women to pursue careers and delay childbearing (Bongaarts, 2008). Urbanization has also contributed to fertility decline, with people in urban areas often having smaller families due to changes in lifestyle and economic pressures (Gries and Grundman, 2018; Montgomery and Casterline, 1996). Economic development and changes in societal norms, such as a shift towards valuing smaller families, have further reinforced this trend (Gori and Sodini, 2021).

Education improvements in low- and middle-income countries

Over the past decades, there have been notable and transformative changes in educational attainment in low- and middle-income countries. Increased access to education and improvements in educational systems have been central to these changes, resulting in higher enrollment rates and enhanced educational quality (World Bank, 2018). Notably, many countries have made substantial progress in achieving universal primary education, a goal set forth by the United Nations in its Millennium Development Goals (United Nations, 2000). Furthermore, the gender gap in education has narrowed significantly, with more girls gaining access to schooling and pursuing higher levels of education (Duflo, 2012). These changes have had positive implications for economic development, as education is a critical driver of poverty reduction and economic growth in these regions (Psacharopoulos, 2018).

Improvements in education, however, have not been distributed evenly across regions. The share of the population with no formal education was similar in low- and middle-income countries at the end of the 19th century, at levels around 95% (Our World in Data, 2023). However, it decreased sharply during the first half of the 20th century in Latin American countries and Asian countries. In the late 1960s, the share of the population with no formal education was 68% in Africa, while it was hovering 30% in the other low- and middle-income regions. Recent estimates show that the share has decreased to 22% in Africa and to less than 10% in other regions. In addition, only 27% of people have completed upper-secondary education in sub-Saharan Africa, which is similar to the levels in the early 2000s (Our World in Data, 2023). In contrast, over the same period, the share of people with complete upper-secondary education has doubled in Central and Southern Asia and Southeastern Asia, from 25% and 33%, respectively. In Latin America, the share increased 20 percentage points from 43%.

Education and fertility decline

The increased accessibility and enhanced quality of education represent key drivers in the reduction of fertility rates (Cleland, 2002; Martin, 1995). Female education shapes fertility dynamics through three overarching paths in low- and middle-income countries. Firstly, better-educated women tend to adopt contraceptives more frequently, leading to a decline in unplanned pregnancies and births (Bongaarts, 2017b; Casterline, 2017; Liu

and Raftery, 2020). Secondly, education contributes to postponing childbearing by delaying the onset of sexual activity and marriage (Bongaarts et al., 2017; Chemhaka and Odimegwu, 2019; Hertrich, 2017). Thirdly, women with higher educational attainment often exhibit a reduced desire for larger families (Hertrich, 2017; Shapiro, 2012; Shapiro and Tenikue, 2017).

When assessing the impact of education on fertility trends at the country level, it is essential to differentiate between two key dynamics, as highlighted by Bongaarts et al. (2017), Cleland (2002), and Eloundou-Enyegue et al. (2017). First, through the composition effect. As education levels rise, changes in the educational composition of the population can lead to reduced fertility rates, as women with higher levels of education typically have lower fertility rates. This shift in the composition of the population, even if fertility rates within each educational group remain constant, contributes to lower overall fertility. Second, through the rate effect. Fertility can change within specific educational groups, influencing aggregate fertility trends without altering the educational composition of the population. In practice, both these effects can simultaneously contribute to fertility trends.

Prior analyses exploring the relationship between education and fertility have demonstrated that the dominance of either composition effect or rate effect varies depending on the country, period, and specific fertility behaviors. Evidence shows that educational composition effects were the predominant factor contributing to the increases in the age at first birth in sub-Saharan Africa, Asia, and Northern Africa between the 1990s and 2010s (Bongaarts et al., 2017). In contrast, other evidence suggests that the effect of expanded education on the decline in total fertility can modest in some settings (Cleland, 2002).

In this paper, we aim to examine the contribution of education to fertility decline in low- and middle-income countries and determine whether composition or rate effects have contributed the most to the decline. Our research is innovative in two ways. First, our analyses include a large set of countries and surveys in low and middle-income countries, including the most recent ones. Second, we use a detailed definition of educational groups that favors cross-country comparisons. This refined classification enables us to discern fertility patterns within three distinct educational groups and ascertain the specific role these groups play in driving fertility decline.

DATA AND METHODS

We used over 350 Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) from around 60 low- and middle-income countries. These surveys collect birth histories and sociodemographic characteristics of women aged 15–49. We address our objective in three steps. First, we grouped women into three educational levels: no education, 1–6 years of education, and 7 years of education or more. Second, we reconstructed fertility trends by educational level going backward up to four decades. TFRs by 5-year periods and educational level were estimated using Poisson regression, with age and periods included as independent variables, the number of births as dependent variable, and exposure as offset (Schoumaker 2013). When

multiple surveys were available for one country, all birth histories were appended. We calculated TFRs over a five-year period to minimize random variations in fertility rates, enable cross-country comparisons, and effectively apply the decomposition method. We considered a period as of fertility decline if the annual decline in fertility is more than 0.025 children per year. If the decline was lower than that rate or if fertility increased, we considered that period as a fertility stall (Schoumaker and Sánchez-Páez, 2023).

Second, we derived the ratio of women by educational level by using the exposure (person-years) corresponding to each educational group during five-year intervals. The exposure corresponds to the exposure used to compute TFRs by educational level. Trends in the share of women by educational level were also reconstructed for the past four decades.

Third, we used a decomposition method (Kitagawa 1955; Preston, Heuveline and Guillot 2001) to estimate the proportion of the fertility decline that can be attributed to the composition effect and the rate effect.

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

The change in TFR at the national level from time 1 to time 2 encompasses three elements: the first component assesses the effects of TFR changes within distinct educational groups, the second component evaluates the impact of shifts in the population's educational composition (*P*), and a third, relatively minor residual component, denoted by *r*. The subscript *i* refers to educational levels.

PRELIMINARY RESULTS

For this extended abstract, we present results for 15 countries. Figure 1 displays the reconstructed fertility trends by educational level. In these selected countries, fertility is higher in sub-Saharan African countries than in Latin American and Asian countries. Overall, fertility has declined in all countries since the 1980s. However, we observe periods of stalled fertility in half of them, such as in Cameroon, Cambodia, Colombia, Dominican Republic, Guatemala, Kenya, and Zimbabwe. The fertility stall was ongoing in the latest period in Cambodia, the Dominican Republic, and Zimbabwe.

As for fertility levels by educational groups, fertility is higher among women with no education than among women with 1–6 years of education and among women with 7+ years of education. Only in the Philippines the fertility of women with no education is lower than that of women with 1–6 years of schooling. Also, better-educated women have lower fertility than women with 1–6 years of education in all cases. Interestingly, the gap between the fertility of the least-educated women and women with no education tends to be narrower than the gap between the former and the women with 7+ years of schooling. This would suggest that the more educated a woman is, the greater the effect of education on fertility.

In countries where fertility rates are still well above the replacement level, such as the sub-Saharan African countries, it is common to observe stagnation in fertility at all levels

of education. However, in countries with lower fertility levels, the fertility decline among the more educated is more pronounced and steady, reaching about 2.5 births per woman, such as in Bolivia, Cambodia, Haiti, India, and Peru. In countries where the fertility among the better educated was already at levels around 2.5, rapid declines in the fertility of the other educational groups are observed, such as in Colombia, the Dominican Republic, and Guatemala. This would suggest that both rate and composition effects contribute to fertility decline, and the largest contribution would depend on the stage of fertility transition and the initial distribution of women by educational level.

Figure 2 presents trends in the percentage of women by educational level. The proportion of women with no education was already low in some countries, such as Colombia, the Dominican Republic, and the Philippines. In the latter, the proportion of women with 7+ years of schooling has almost doubled since the 1980s from slightly above 50%, which is comparable to the increase in Colombia and the Dominican Republic. However, fertility rates among the better-educated in the Philippines were much higher than in the other two countries. As a result, the rate effect is larger than the composition effect in the Philippines as women with 7+ years of schooling changed their fertility behaviors (see Figure 3). In contrast, in Colombia and the Dominican Republic, fertility declines could be attributed to both the composition and rate effects (Figure 3), with composition effects being more relevant at the beginning of the fertility decline as women with lower fertility achieved higher educational attainment. Later, rate effects become more relevant as women within educational groups decrease their fertility. Although in Guatemala, fertility trends of women of 7+ years of schooling are similar to those of Colombia and the Dominican Republic, the share of better-educated women is considerably lower and has increased at a slower pace. This is reflected in the contribution of education to fertility decline. First, the composition effect is more relevant as the share of women with no education decreases. Then, since the education progress is slow, the fertility behavior changes within educational groups, and the rate effect becomes the most relevant contributor to fertility decline.

Figure 1. Reconstructed total fertility rates by educational level in selected countries.

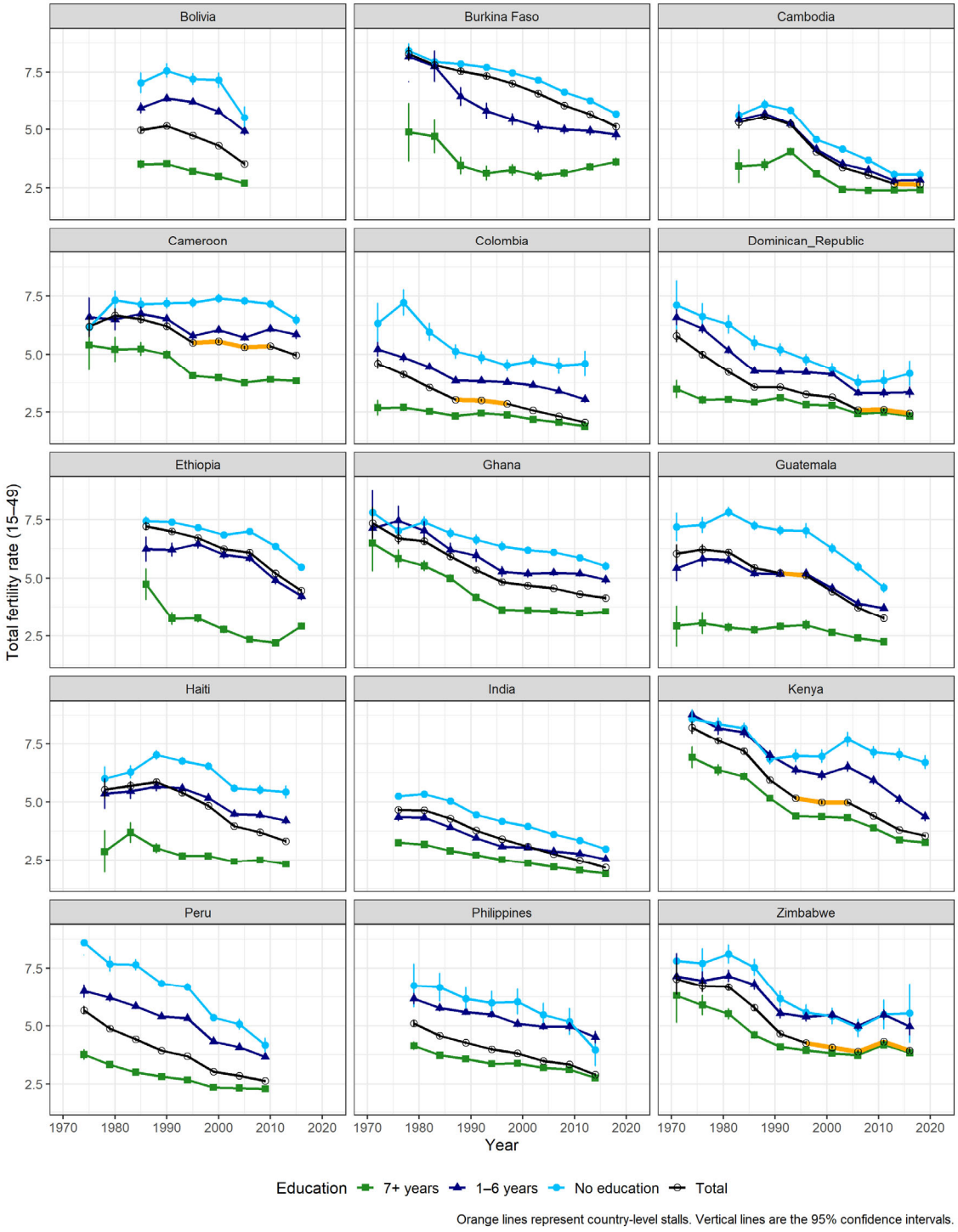
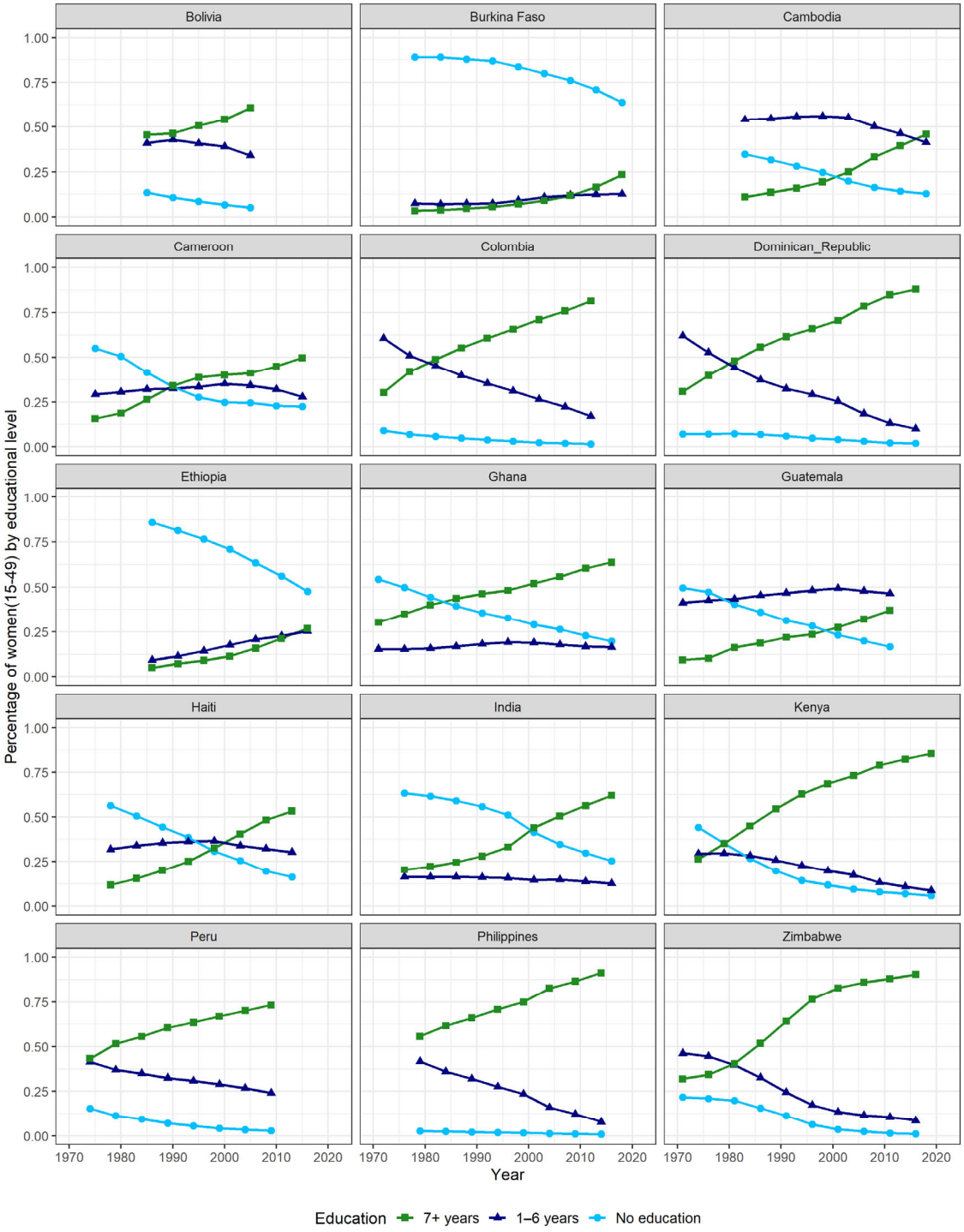


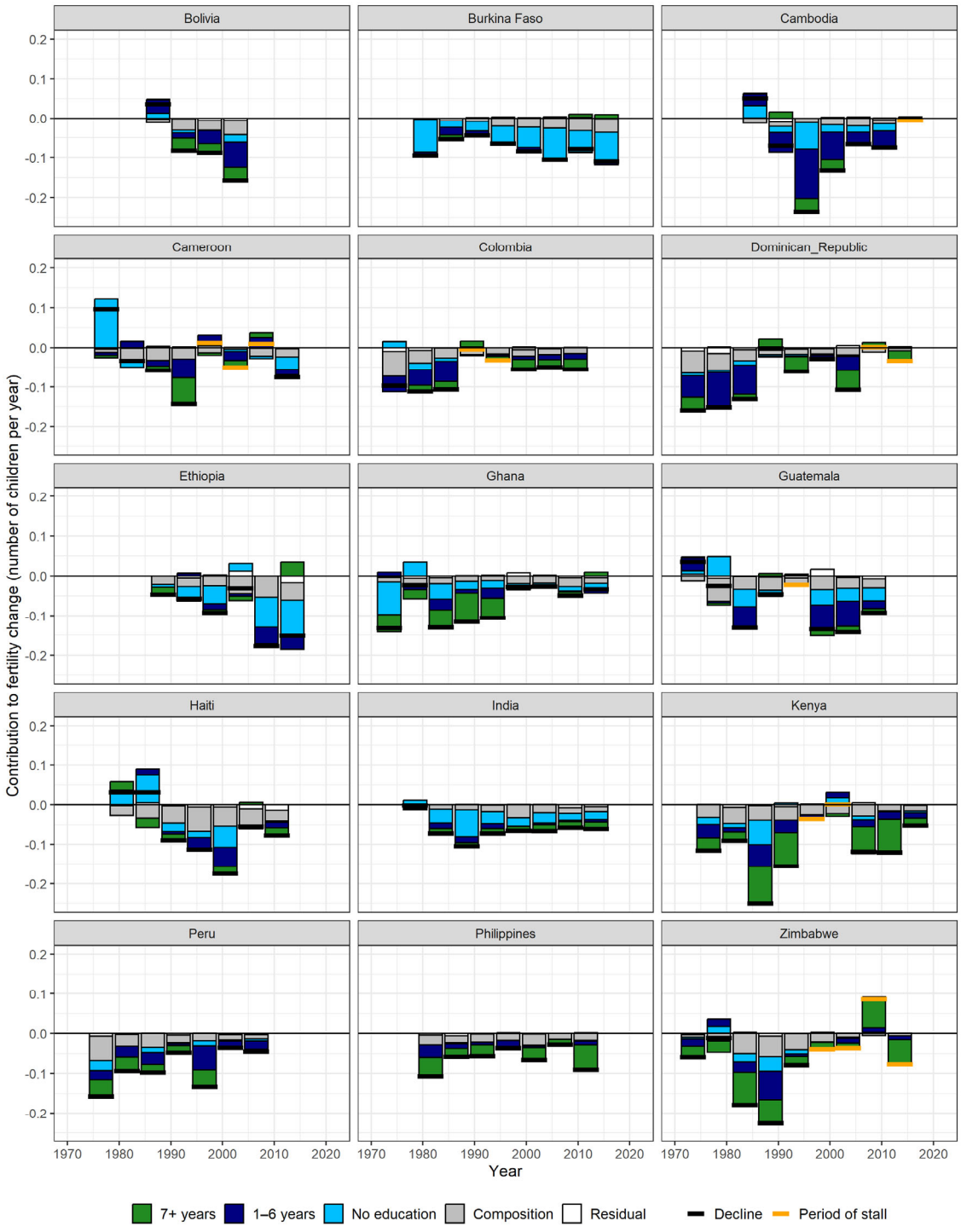
Figure 2. Trends in the share of women by the level of education in selected countries.



As mentioned, in Bolivia, Cambodia, Haiti, India, and Peru, the fertility of women with 7+ years of schooling decreased fast and steadily. In these countries, the decline in fertility has been accompanied by an increase in the proportion of women with more education and by a decrease in the proportion of women with no education. The increase was slow between the early 1980s and the mid-1990s but faster after that (Figure 2). Except in Peru, trends in the share of women with 1–6 years of schooling have remained stable over time. Results from the decomposition method (Figure 3) show that both composition and rate effects have contributed to fertility decline, although with some differences between

countries. In Bolivia and Cambodia, the contribution of the composition effect to fertility decline has been similar over time. In Bolivia, the contribution of the rate effect increased, particularly due to increases in the contribution of women with 1–6 years of schooling. Compared to the other countries in this group of countries, Bolivia shows the most modest increase in the proportion of women with 7 or more years of schooling. In Cambodia, the rate effect associated with women with 1–6 years of schooling has also been the largest contributor to fertility decline. In this case, Cambodia has the lowest proportion of better-educated women.

Figure 3. Decomposition of fertility changes in selected countries.



In Haiti and India, the contribution of the composition effect to fertility decline increased from the late 1970s to the mid-1990s and then decreased. In Haiti, in general terms, the composition effect was the main contributor to fertility decline. However, the rate effects of least educated women and of women with no education were relevant between the late 1990s and the early 2000s. This coincides with the faster increase in the proportion of women with 7+ years of schooling and the sharp decrease in fertility among women with no education and with 1–6 years of schooling. In contrast, rate effects, and particularly those of women with no education, have contributed most to fertility decline in India. This suggests not only that there are fewer women without access to education but also that these same women have changed their fertility behavior toward lower fertility. On the other hand, in Peru, the composition effect has reduced its contribution to fertility decline since the mid-1970s, and rate effects have been the main contributors to fertility decline. This can be explained in two ways. First, there are virtually no women with no education left. Second, the shift from 1–6 years of schooling to 7+ years has been slow. Therefore, the effect of changes in education composition on fertility decline has been limited, while the effect of changes in fertility behaviors within education groups has been more pronounced.

The proportion of women with no education remains high in Burkina Faso, Cameroon, Ethiopia, and Ghana: over 50% in the first three countries and around 25% in the last. In Burkina Faso, fertility decline can be attributed to the decrease in fertility rates among women with no education. However, improvements in education have also contributed to fertility decline since the mid-1990s. In Cameroon, both composition and rate effects contributed to fertility decline from the early 1980s until the mid-1990s. Then, during the stall period, the contribution of the composition effect to fertility decline was outweighed by the contribution of rate effects to increased fertility. This coincides with a slowdown in education progress. Then, fertility decline resumed, mainly attributed to the improvement in education and the reduction in fertility rates among women with no education. The contribution of the composition effect to fertility decline has increased over time in Ethiopia, particularly since the mid-2000s. This coincides with the faster increase in the share of women with 7+ years of schooling. However, the proportion of women with no education is so high that fertility decline is attributed to the change in fertility behaviors of women with no education, i.e., women with no education are having fewer children. In Ghana, the contribution of the composition effect has been stable over time, although it has become more relevant in recent periods. From the 1970s to the mid-1990s, rate effects were the main contributors to fertility decline, especially those of better-educated women. Even though educational attainment has improved in Ghana since the mid-1990s, fertility behaviors within educational groups have remained stable, which is reflected in the limited contribution of rate effects. This would suggest that even if high levels of education were achieved, fertility would not fall, and a stall could be expected.

The case of Kenya and Zimbabwe is different from the other sub-Saharan African countries since fertility rates are lower and the share of women with 7+ years of schooling is already above 80%. This means that the contribution of the composition effect is expected to be limited, as there is not much left to improve in education. Thus, Figure 3 shows that its contribution has decreased over time. In Kenya, rate effects were the main factor contributing to fertility decline, especially that of more educated women. The stall

period is explained by the stall in fertility rates by educational groups rather than by a stall in education progress. Fertility resumed its decline mainly due to the decrease in fertility rates among women with 7+ years of schooling. In Zimbabwe, the rate effect of women with 7+ years of schooling has played a main role in fertility changes over time. From the 1970s until the mid-1990s, it largely contributed to fertility decline. Then, the fertility among the better-educated contributed to the stall at the national level from the mid-1990s to the early 2010s. Since then, although the better educated have contributed to fertility decline, the invariant fertility rates among women with no education have contributed to the stall at the national level.

PRELIMINARY CONCLUSIONS

Composition effects consistently contributed to fertility declines even when rate effects contributed to fertility increases, as in Bolivia, Cambodia, Cameroon, Colombia, the Dominican Republic, Ethiopia, Ghana, Guatemala, Haiti, Kenya, and Zimbabwe. This finding supports earlier evidence that improved access to education and higher educational attainment contribute to fertility decline (Bongaarts, 2017b; Casterline, 2017; Hertrich, 2017; Liu and Raftery, 2020; Shapiro, 2012; Shapiro and Tenikue, 2017).

The fact that the composition effect is more relevant at the beginning of the fertility transition suggests that women's fertility first declines thanks to the increase in their educational attainment and that education would be the driving force behind the onset of fertility decline. However, whether the fertility decline is sustained over time also depends on how fertility decline spreads within educational groups. This means that fertility trends are strongly influenced by the fertility behavior of women within each educational group, i.e., by the rate effect.

Finally, fertility behavior, and thus the rate effect, becomes particularly important when the general level of education of women is already high, as observed in Ghana and Zimbabwe. Fertility stalls can be expected if the fertility of more educated women does not decline.

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