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# Female Labor Force Participation in Sub-Saharan Africa: A Cohort Analysis

ANDREAS BACKHAUS  AND ELKE LOICHINGER 

*Female labor force participation rates have been stagnating despite rising female education in sub-Saharan Africa since the turn of the millennium. Using representative and repeated census data from a heterogeneous sample of 13 sub-Saharan African countries, this paper analyzes female labor force participation from a demographic perspective. We show that enrollment in education is substantially higher among the most recent female cohorts than among the earlier-born ones. The higher enrollment mechanically depresses female labor force participation, weakening the relationship between female labor force participation and education. After taking this cohort trend into account, we find a strong and positive association between female labor force participation and female education. We further find a cohort trend toward higher female employment in the nonprimary sector and a positive association between female employment in the nonprimary sector and female education. The higher investments in education by younger female cohorts, together with the demographics of sub-Saharan African countries, have implications for a potentially arising “demographic dividend”.*

## Introduction

The last few decades have seen considerable global progress with regard to female access to education, health, and other factors generally considered as contributing to female empowerment. These factors are inclined to improve female outcomes in the labor market, both in terms of labor force participation and in terms of the quality of work. However, recent trends in female labor supply in some countries in the developing world fell short of these expectations, as female labor force participation rates (LFPRs) have been stagnating or declining. Broadly speaking, this pattern can also be found in sub-Saharan Africa (SSA), where the aggregate female LFPR has hardly changed since the 1990s but stagnated slightly above 60% (ILO 2021). At first sight, this pattern is puzzling, given the substantial gains in educational

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enrollment and attainment that have taken place in SSA during the same period.

In this paper, we analyze female labor force participation in SSA from a demographic perspective using repeated census data on 13 sub-Saharan African countries provided by the Minnesota Population Center (2020), in the following referred to as IPUMS International. Observing different cohorts at the same stages of their working lives, we find that at early working age (aged 15–19 years), enrollment in education is substantially higher among the latest-born female cohorts than among the earlier-born ones. The higher enrollment mechanically depresses female labor force participation among the latest-born cohorts at this age, which in turn weakens the relationship between female labor force participation and educational attainment. After taking this cohort-specific trend toward lower labor force participation in early working age into account, our regression analyses report a strong and positive association between female labor force participation and female educational attainment. Regarding the quality of women's work, we find a cohort trend toward higher female employment in the non-primary sector, as well as a positive association between female employment in the nonprimary sector and female educational attainment.

Our results further point to an important life-cycle perspective on female labor force participation in SSA: The latest-born female cohorts sharply decrease their labor supply and increase their investment in education during early working life. The effects of these adjustments cannot be fully grasped yet, as they will unfold over the entire working lives of these cohorts, which we do not fully observe in the current data yet. However, the differential behavior of these later-born cohorts does already and will continue to affect aggregate patterns due to the predominant demographic structure of SSA countries, where the most recent cohorts account for relatively large shares of the working-age populations.

By adopting a cohort perspective on female labor force participation, we bridge a gap between the demographic and the economic literatures. The demographic literature frequently draws on the cohort approach in its analyses of the evolution of important female characteristics such as female education, fertility, as well as gender gaps regarding these variables (see, e.g., Tabutin et al. (2020); Batyra, Kohler and Furstenberg (2021) for recent contributions on SSA). However, demographic studies rarely consider economic factors such as labor force participation, unemployment, incomes, how these evolve with the demographic structure of the female population at working age, and how these interrelate (for a recent exception, see Kebede, Striessnig and Goujon (2021) who consider the association between female fertility desires and household wealth). The economic literature, in turn, while unsurprisingly putting a focus on variables such as labor force participation, predominantly analyzes changes within broadly defined age groups across periods. This approach, while technically valid, is

not well suited for highlighting the impact of changes in the demographic structure on trends in employment-related variables. Two notable exceptions are Goldin and Mitchell (2017) and Mammen and Paxson (2000) who adopt cohort-centered perspectives to highlight changing patterns in female employment in the United States and in South Asian countries, respectively. Regarding the stagnation in female LFPRs, the economic literature presents mixed results: Klasen (2019) finds substantial regional heterogeneity across the developing world but rather weak associations between female labor supply and correlates such as female education. On a more pessimistic note, Klasen (2020) highlights a general stagnation and regress in several dimensions of gender equality. Heath and Jayachandran (2017) review the existing evidence on female labor force participation more favorably, pointing to the positive impact of increased female enrollment in education. Klasen et al. (2021) also find evidence for a positive association between female education and female labor force participation in eight developing and emerging economies. An important point of reference is Verick (2014), who notes that female LFPRs are not only heterogeneous across regions, but also across age groups, with the age group in school age showing falling labor supply due to higher school enrollment. He further points out that in regions with comparatively high female LFPRs and small gender gaps in employment, such as SSA, the quality of female employment is an important dimension, as many women have to participate in the labor market due to poverty. In the following, we show that by adopting the cohort perspective, we can arrive at a more nuanced assessment of the recent trends in female labor force participation than a broad age-period perspective would allow. Our results further underline the value of large and representative micro-level data for cross-country cohort studies, among which our investigation is the most comprehensive with regard to female labor force participation in SSA as of yet.

In a broader context, the cohort perspective on female labor force participation we adopt in this paper relates to the debate on the prospects of a “demographic dividend” in SSA countries (Bloom, Kuhn, and Prettnner 2017; Groth and May 2017). Changes in the age composition of a population can have an effect on economic performance when the working-age population grows faster than the overall population (Bloom, Canning, and Sevilla 2003; Bloom and Williamson 1998). Our results indicate that the female working-age population in SSA is poised to change not only in relation to the total population but also in terms of its human capital and the resulting labor supply, with this change being driven by the differential behavior and experience of the recent cohorts currently at early working age. Assessments of a “demographic dividend” in SSA and the potential contribution of the female workforce might therefore be premature at this point, as substantial gains in human capital are just about to be carried over into the labor market. The time lag between the acquisition of human capital

via school attendance and the human capital fully coming into effect in the labor force is also noted by Goujon et al. (2016) and Kotschy, Suarez Urtaza and Sunde (2020). Similar points regarding the demographic potential of the large and relatively well-educated recent cohorts that are about to enter the labor markets of SSA economies are raised by Fox, Senbet and Simbanegavi (2016).

The remainder of the paper is structured as follows: The *Data* section describes the IPUMS International data, followed by a brief exposition of our sample data. The following section outlines our empirical strategy used in this study. The *Results* section presents our main results followed by a series of robustness checks. The *Discussion* section considers the implications for a demographic dividend and the potential consequences of the COVID-19 pandemic in SSA. The last section concludes the study.

## Data

### Data source

Our approach requires detailed demographic data on female labor force participation in SSA and the related variables of interest, as we intend to differentiate the sampled individuals along their birth years. Although the birth year can be computed at the aggregate level by subtracting the current age of a group from the given period, finer cohort sizes can be constructed and aggregated more flexibly from the birth years of individuals reported in micro data. By utilizing comprehensive micro data, we can also ascertain that all of our variables are aggregated from the same representative sample of individuals. However, given that we intend to use single cohorts instead of broader cohort groups, we require rather large micro data sets in order to obtain representative cohort sizes.

Further, our intention is to compare different cohorts at the same age, while also following the same cohorts across their working lives. This approach allows us to assess whether a later-born cohort exhibits a different labor supply behavior than an earlier-born cohort exhibited at the same age and whether these differences persist over the life cycle. Consequently, given that each cohort is observed once per sample period, we require at least two sample periods per cohort. These sample periods need to be sufficiently far apart from each other to allow differential cohort patterns to materialize but sufficiently close to each other to observe the same cohorts repeatedly during their working life.

We rely on multiple waves of IPUMS International census extracts from sub-Saharan African countries provided by the Minnesota Population Center (2020). We select census extracts from all those sub-Saharan African countries for which at least two subsequent census waves are available since the late 1980s. This limits our analysis to 13 countries: Benin,

TABLE 1 Cohort observations of female LFPR by age group

| Age groups | Cohort (birth year) |      |      |      |      |      |
|------------|---------------------|------|------|------|------|------|
|            | 1970                | 1975 | 1980 | 1985 | 1990 | 1995 |
| 15–19      | 5                   | 4    | 4    | 9    | 4    | 9    |
| 20–29      | 8                   | 13   | 13   | 13   | 9    | 0    |
| 30–39      | 13                  | 13   | 9    | 0    | 0    | 0    |

NOTES: Each cell indicates how many times the respective cohort denoted in the top row is observed in the respective age group denoted in the last column to the left.  
SOURCE: Authors' own calculations.

Botswana, Ghana, Kenya, Lesotho, Malawi, Mali, Rwanda, Senegal, South Africa, Tanzania, Uganda, and Zambia. Some variables are not available for all countries in all census waves; for example, information on the sector of employment is missing in the census data for several countries. The census waves are approximately 10 years apart for most countries (see Table T1 in Online Appendix A on the available census years for each country). Broadly speaking, the sample countries cover the various regions of SSA while also reflecting the large heterogeneity in economic development across SSA.

We select the cohorts for our analysis in five-year intervals beginning at the turn of every decade of interest since 1970 (i.e., birth cohorts 1970, 1975, 1980, 1985, 1990, and 1995). We further allocate each cohort to one of three age groups in a given period: The age group 15–19 comprises cohorts at early working age, whereas the age groups 20–29 and 30–39 cover the prime working age. Our reason for choosing a narrower width for the youngest age group is that we intend to capture the potential changes in female labor supply due to growing secondary and tertiary enrollment. We do not study higher age groups, as most of our cohorts of interest do not reach these age groups during the sample period; older cohorts might further be affected by survival bias.

From the IPUMS International micro data, we compute population-weighted cohort averages of the female LFPRs, with Table 1 displaying the total number of cohort observations of female LFPRs available from all our sample countries and all periods for each age group. Due to the comprehensiveness of the census extracts, more than 1,000 individual observations underlie each cohort-age group aggregate even in countries with comparatively small populations such as Botswana and Lesotho, whereas some of the aggregates for larger countries such as South Africa and Tanzania are based on more than 40,000 individuals (see Table T2 in Online Appendix A for detailed information on the number of observations by country, cohort, and age group). Unsurprisingly, observations in the youngest age group 15–19 are predominantly composed of the later-born cohorts in our sample, as our sample period does not reach back far enough to observe all of the earlier-born cohorts in their early working age. Conversely, observations in the two higher age groups mostly stem from the earlier-born cohorts, as we do not observe the later-born cohorts at these ages yet.

It is obvious from Table 1 that the number of observations in a given age group-cohort cell is often smaller than the total of 13 sample countries. The uneven distribution of observations across cohorts is particularly pronounced in the youngest age group 15–19: The cohorts born in 1995 and 1985 are observed in the same nine countries; however, the cohort born in 1975 is observed in only four of these countries. The cohorts born in 1990 and 1980 are observed in the remaining four countries, while the country composition partly changes for the cohort born in 1970. Given that we intend to analyze cohort trends in female LFPRs within fixed age groups, it should be kept in mind that in the age group 15–19, these trends will for the most part be composed of two trends, one for the countries providing observations on even birth years, and another one for the countries providing observations on uneven birth years.

From the IPUMS International data, we further compute cohort averages of the female school attendance rate, the female years of schooling, and the share of women who are employed and do not work in the primary sector. For our robustness checks, we additionally compute cohort averages of the number of children ever born to women and the share of women that have given birth to at least one child. We further utilize information on different levels of educational attainment in the IPUMS International data: The micro-level data classify the various country-specific levels of educational attainment into four broad levels (less than primary completed, primary completed, secondary completed, university completed). We aggregate this information to cohort shares of women who have completed the respective level of education. For yet another robustness check, we re-aggregate all variables but exclude women who still attend school. Importantly, school attendance and enrollment rates comprise enrollment in primary, secondary, and post-secondary education in our context. School attendance rates and LFPRs further do not necessarily add up to 100%, as a number of women simultaneously attend school and participate in the labor market in many of our sample countries. We present cohort averages of the variables by age group aggregated across all sample countries in Tables T3 and T4 in Online Appendix A. Note that these averages are affected by the changing country composition across cohorts, in particular in the age group 15–19, as discussed in the previous paragraph. In Figure A1 in Online Appendix B, we further validate our variables computed from the IPUMS International data against similar variables provided by other secondary data sources.

Our focus on female LFPR warrants a digression into the topic of measuring female labor force participation in the context of SSA. Unsurprisingly, the definition of whether an individual is participating in the labor market may differ across countries and potentially also across census waves. The IPUMS data harmonize these definitions by simplifying them to a binary indicator for labor force participation that is primarily derived from the recorded employment status. However, this simplification cannot take



into account that some countries, for example, define employment based on the individual labor supply in the most recent week, whereas others define it according to the labor supplied in the most recent month. If these differences can be assumed to be constant within countries across census waves, country fixed effects (FE) can address this problem in a regression framework.

Although the dichotomization of the labor force participation nexus provides us with a basic data framework for our analysis, it obscures several important nuances. For example, it does not differentiate whether the individual is participating in the formal or in the informal labor market of the economy. Access to the formal sector is often gender specific if the informal sector is large, which is the case in many sub-Saharan African countries (Vanek et al. 2014). Another gender-specific issue is that the IPUMS International data categorize individuals who mainly provide domestic work neither as participating nor as not participating in the labor force. Hence, domestic workers, many of them women, do not enter the calculation of the female LFPR, while their domestic labor supply might be high. In the context of SSA, the distinction between domestic work, which is not recorded as formal labor force participation, and work, which is essentially domestic but potentially recorded as formal labor force participation in the primary or tertiary sector, is not always clear-cut. This applies to sporadic hours of labor spent on a self-owned micro-enterprise or the household's agricultural plot, for example. Finlay et al. (2018) provide more in-depth qualitative evidence on how to measure women's work in SSA. On a related note, the IPUMS data do not allow us to study the intensive margin of labor supply, as information on the hours worked is unavailable. McCullough (2017) shows that the hours worked differ substantially between the agricultural and the nonagricultural sectors in four African economies. Van den Broeck and Kilic (2019) further shed light on gender-specific patterns in off-farm employment in five SSA countries, pointing out that important shifts from farm to wage- or self-employment can take place entirely within the primary sector.

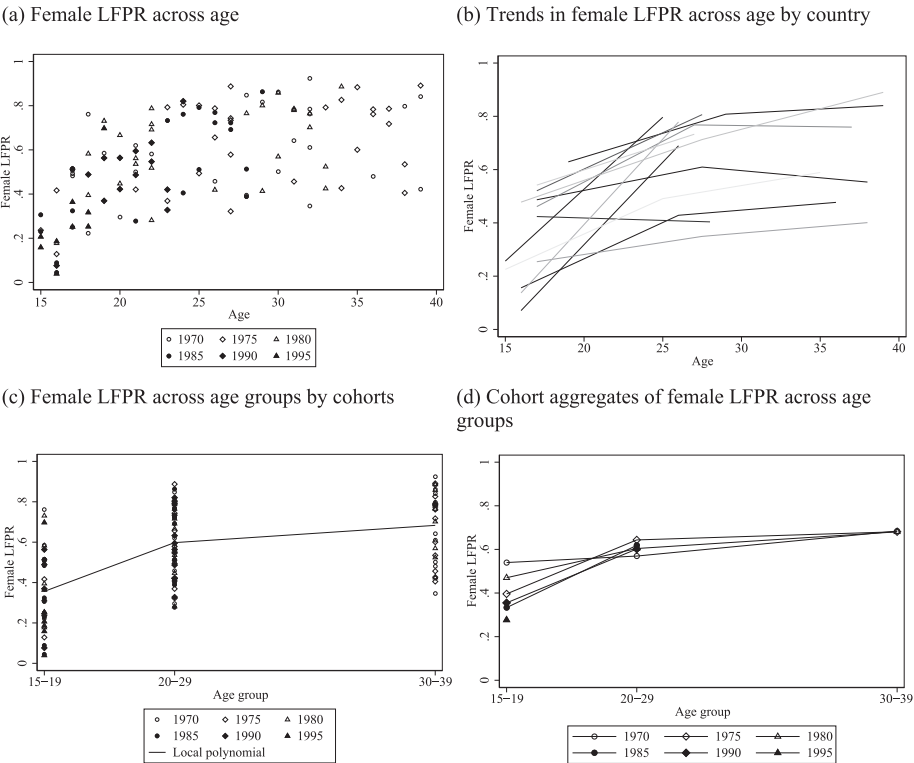
## Data exposition

In the following, we guide through a sequence of steps from the cohort observations that we compute from the IPUMS International micro data for the various countries and age groups to the aggregate cohort depictions we present and analyze in section *Aggregate Cohort Depictions*.

Figure 1(a) plots the pooled data. Each marker represents a country-cohort observation of the female LFPR at a given age, with the marker shape and filling changing with the respective birth years. The plot indicates a positive relationship between the female LFPR and age between 15 and 25, which then flattens out at higher ages. As expected, the cohort composition



FIGURE 1 Data exposition



NOTES: The upper-left panel shows a scatter plot of the female LFPR against age. Each marker represents one country-cohort observation of the female LFPR at a given age. Different cohorts are indicated by different marker shapes and fillings. The upper-right panel shows polynomials of the female LFPR in age. Each polynomial represents one sample country. The lower-left panel shows a scatter plot of the female LFPR against three age groups and a polynomial of the female LFPR in three age groups. The lower-right panel shows cohort plots of the female LFPR across the three age groups. The plots are obtained by regressing the female LFPR on linear splines of age interacted with cohort FE while controlling for country FE, and by estimating the predictive margins of the cohort FE over the three age groups.

SOURCE: Authors' own depictions.

of the data changes with age: At early working age, the data are predominantly, yet not entirely, composed of country-cohort observations of the cohorts born since 1985, as the earlier-born cohorts are not observed in our sample at this young age. Near age 40, in turn, all observations originate from the cohorts born in 1970 or 1975, which are the earliest-born cohorts in our sample.

Figure 1(b) visualizes the country heterogeneity in our data by estimating local polynomials of the association between the female LFPR and age for each country. With only one exception, the polynomials indicate an increasing relationship between the female LFPR and age at early working age in every sample country, which then levels off in those countries for which female LFPRs at higher ages are observed. From these similar country patterns, we infer that our sample countries primarily differ by their level

of female LFPRs at a given age and much less by the shape of the association between the female LFPR and age within each country. Hence, we are confident that the lower levels of female LFPRs observed at early working age are not a data artifact of only a few countries but represent a general pattern across countries in SSA.

In Figure 1(c), we take into account that we observe only relatively few cohorts at precisely the same age due to differential time spans between census waves and different census years across countries. The allocation of the observations to the three age groups 15–19, 20–29, and 30–39 retains the positive association between age and the female LFPR in early working age, as indicated by the upward-sloping polynomial connecting age groups 15–19 and 20–29. Between age groups 20–29 and 30–39, the association then flattens out again as indicated in the pooled data before.

Finally, in Figure 1(d), which we return to in section *Aggregate Cohort Depictions*, we present cohort plots of the female LFPR across age groups. These plots are obtained by regressing the female LFPR on linear splines with knots specified at the three age groups. The convenient feature of the splines is that they restrict the linear “pieces” to be connected at the respective knots, thereby creating graphical outputs that resemble the familiar cohort graphs. In the underlying regression, we additionally add country FE to absorb country-specific heterogeneity. Age group 15–19 is the only age group in which all six cohorts are being observed. The cohort born in 1995 is not observed yet in the age group 20–29, whereas only the three earliest-born cohorts (1970, 1975, 1980) are observed in age group 30–39.

## Empirical strategy

Our empirical strategy relies on the panel structure of our data, which allows us to differentiate between age and cohort effects on female labor force participation. Age and cohort effects cannot be differentiated within a single cross-section of data, as the two effects are collinear in this context. In the panel data context, both effects are identified, whereas additional period effects can generally not be identified without imposing additional constraints.

Although including age effects in the regression model for allowing heterogeneity in labor supply across the life cycle is rather standard, our approach of further including cohort instead of period effects warrants a more thorough explanation: Period effects result from external factors that equally affect all age groups at a particular point in time. Cohort effects, by contrast, are variations resulting from the unique experience or exposure of a group of subjects (i.e. the members of the same birth cohort) as they move across time (Keyes et al. 2010). Our interpretation of the available data is that the main factors that have been driving female LFPRs in SSA in recent periods are to be found in the behavior of the latest-born female

cohorts at early working age. More specifically, these cohorts have been presented with substantially broader access to secondary and post-secondary education than the earlier-born cohorts have. Although the broadened access to education already affects the labor supply of the youngest cohorts during their early working life, their cohort-specific exposure to education will continue to influence their labor supply behavior over their future life course. Consequently, we prefer to model the female LFPRs that we observe during our sample period as being explained by cohort- rather than period-specific effects.

Our main empirical specification underlying the results reported in section *Female Labor Supply and Education* is a linear regression model that reads as follows:

$$\text{FemaleLFPR}_{ijt} = \alpha + \beta \text{Schooling}_{ijt} + \theta_i + \sigma_j + \mu_t + \varepsilon_{ijt}, \quad (1)$$

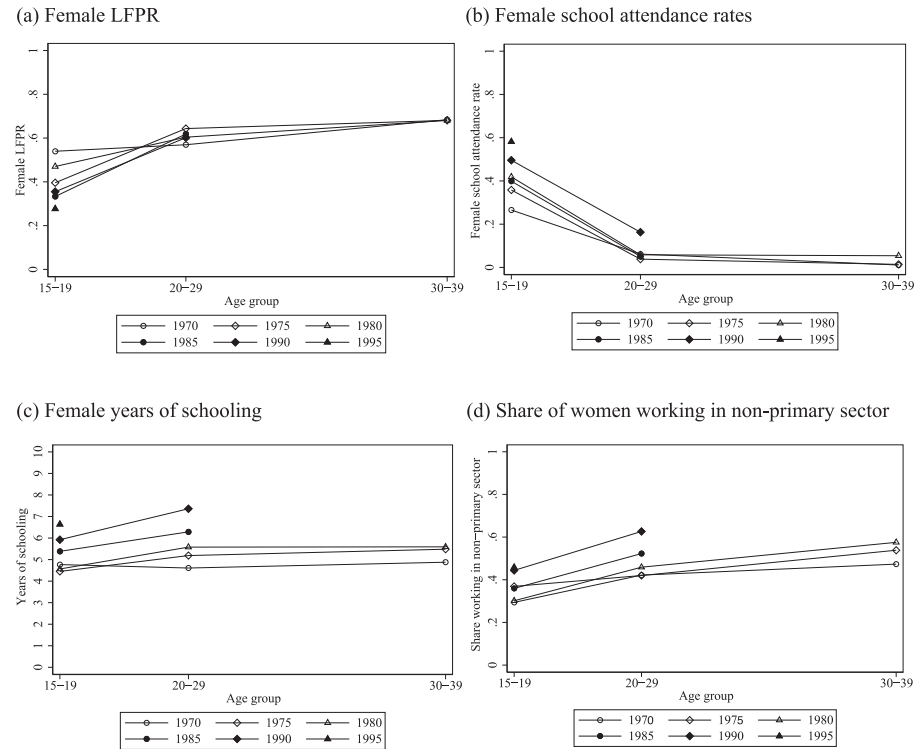
where  $\text{FemaleLFPR}_{ijt}$  is the female LFPR of cohort  $t = \{1970, 1975, 1980, 1985, 1990, 1995\}$  at age group  $j = \{15-19, 20-29, 30-39\}$  in country  $i$ . Accordingly, the country FE  $\theta_i$  absorb time-constant country-level heterogeneity, whereas the age group FE  $\sigma_j$  absorb time-constant age group-specific effects. The cohort FE  $\mu_t$ , in turn, absorb shocks that are common to all observations of the same birth year across all sample countries at any age. As per the discussion above, we do not include period FE in the model in order to avoid multicollinearity. The parameter  $\beta$  reflects the association between the female LFPRs and the female years of schooling.  $\varepsilon_{ijt}$  is an unobserved error term and  $\alpha$  is a constant. In section *Female Employment in the Nonprimary Sector*, the share of women working in the nonprimary sector replaces the female LFPR as the dependent variable in Equation 1. In the *Robustness* section, linear fertility covariates are added to the regression model and the years of schooling are substituted for shares of women who have completed specific levels of education.

## Results

### Aggregate cohort depictions

Figure 2(a) depicts the cohort movements in female LFPRs within and across the three age groups. In the age group 15–19, the earliest-born female cohort from 1970 exhibits the highest LFPR of more than 50%, with the cohort born in 1980 also exhibiting a high level of female labor force participation in early working life. The LFPR of the cohort born in 1975 is notably lower, which could be partly the result of the particular country division within this age group. The LFPRs of the cohorts born in 1985 and 1990 are below the levels shown by the earlier-born cohorts but similar to each other. The cohort born in 1995, which is also the latest-born cohort, clearly exhibits the lowest female LFPR in this age group; the gap between

FIGURE 2 Aggregate cohort depictions



NOTES: The upper-left panel shows cohort plots of the female LFPR. The upper-right panel shows cohort plots of female school attendance rates. The lower-left panel shows cohort plots of female years of schooling. The lower-right panel shows cohort plots of the share of women working in the nonprimary sector. The plots are obtained by regressing the respective variable on linear splines of age interacted with cohort FE while controlling for country FE, and by estimating the predictive margins of the cohort FE over the age groups 15–19, 20–29, and 30–39, respectively.

SOURCE: Authors' own depictions.

the cohort born in 1970 and the cohort born in 1995 amounts to more than 20 percentage points (pp). In the next-higher age group 20–29, the LFPRs of all female cohorts that are observed within this age span are more similar to each other, averaging about 60%. In the age group 30–39, the differences between the observed cohorts are even smaller.

Turning to the female school attendance rates, it is worthwhile keeping in mind that both enrollment in education and educational attainment have substantially increased in SSA over the past decades: According to Evans and Mendez Acosta (2021), the median primary completion rate in SSA countries soared from about 40% to 70% between 1995 and 2015. Simultaneously, the median lower secondary completion rate doubled from 20% to 40%. These trends are reflected in the cohort depiction displayed in Figure 2(b). Although the school attendance rate of the earliest-born cohort barely exceeds 20%, the female cohorts born between 1975 and 1985 already reach attendance rates of around 40% in the age group 15–19. The

cohort born in 1990 gains another 10 pp, whereas the cohort born in 1995 reaches an attendance rate of nearly 60%. The attendance rates in this age group hence show an inverted pattern to the female LFPR displayed in Figure 2(a). In the age group 20–29, the attendance rates are unsurprisingly rather low and more compressed; however, the relatively high attendance rate of the cohort born in 1990 could indicate a stronger female transition into tertiary education.

The cohort gains in female education are depicted in Figure 2(c). In the age group 15–19, the three latest-born cohorts have clearly acquired more years of schooling than the earlier-born cohorts. In the age group 20–29, when most individuals have completed their education, the cohort born in 1990 exhibits particularly large gains in years of schooling over previous cohorts.

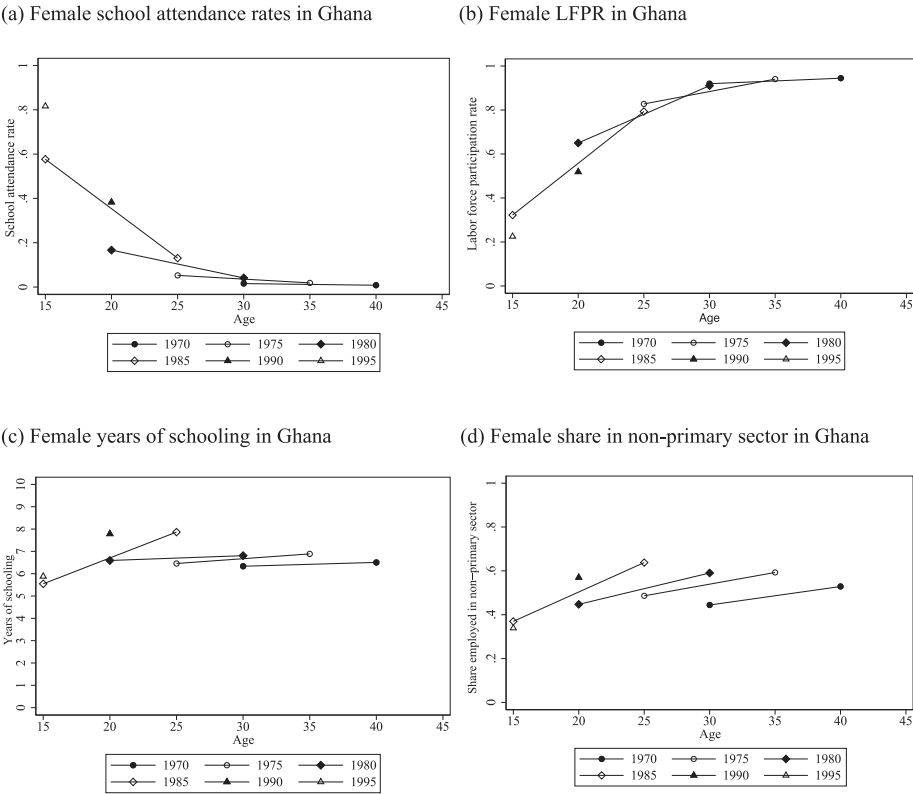
Cohort gains are also evident with regard to the share of women working in the nonprimary sector, as shown in Figure 2(d): In the age group 15–19, the cohorts born in the 1980s exhibit higher employment shares in the nonprimary sector than cohorts born in the 1970s, whereas the cohorts born in the 1990s make additional gains over the cohorts born in the 1980s. In the age group 20–29, the gains for the latest-born cohorts are still visible and even slightly amplified, with the cohort born in 1990 reaching a female employment share in the nonprimary sector of about 60%.

### Country cohort depictions

The following four countries were selected based on their representation of different geographic regions and differing levels of development: Ghana (Western Africa, lower-middle income economy), Rwanda (Central/Eastern Africa, low-income economy), Mali (Western Africa, low-income economy), and South Africa (Southern Africa, upper-middle income economy). The corresponding depictions of their cohort trends allow us to highlight very different cohort variation within each country, especially in age group 15–19.

*Ghana.* The West African country of Ghana is exemplary of the trend toward higher female enrollment in education and lower female labor supply at early working age. Figure 3(a) displays the strong increase in female school attendance among the recently born cohorts: At age 15, 80% of the female cohort born in 1995 are attending school, whereas less than 60% of the cohort born in 1985 attended school at the same age. Furthermore, at age 20, the school attendance rate of the female cohort born in 1990 is twice as high as the school attendance rate of the female cohort born 10 years earlier. At age 25, close to 20% of the women born in 1985 were still enrolled in education, potentially reflecting increasing tertiary enrollment. Above

FIGURE 3 Ghana



NOTES: The upper-left panel shows a plot of female school attendance rates by cohort and across age in Ghana. The upper-right panel shows a plot of the female LFPR by cohort and across age in Ghana. The lower-left panel shows a plot of the average female years of schooling by cohort and across age in Ghana. The lower-right panel shows a plot of the share of women working in the nonprimary sector among all employed women in Ghana. Each marker represents one cohort observation; each line connects observations from the same cohort. SOURCE: Authors' own depictions.

age 25, the school attendance rates of the different cohorts converge to a very low level, reflecting that most women have completed their education by then regardless of their birth cohort. Figure 3(b) displays the opposing trend in the female LFPR: Both at age 15 and at age 20, the female LFPR among the respective later-born cohort is 10 pp lower compared with the earlier-born cohort. Above age 20, the female LFPR is high and virtually identical for every of the two cohorts in comparison. Figure 3(c) indicates that the increasing female school attendance results in later-born female cohorts accumulating more years of schooling in Ghana. Although the difference in terms of years of schooling is rather small between the cohorts born in 1995 and 1985 at age 15, this might potentially be due to already achieved broad access to primary education for both cohorts. At age 20 and 25, respectively, the later-born cohorts make large gains of about two years

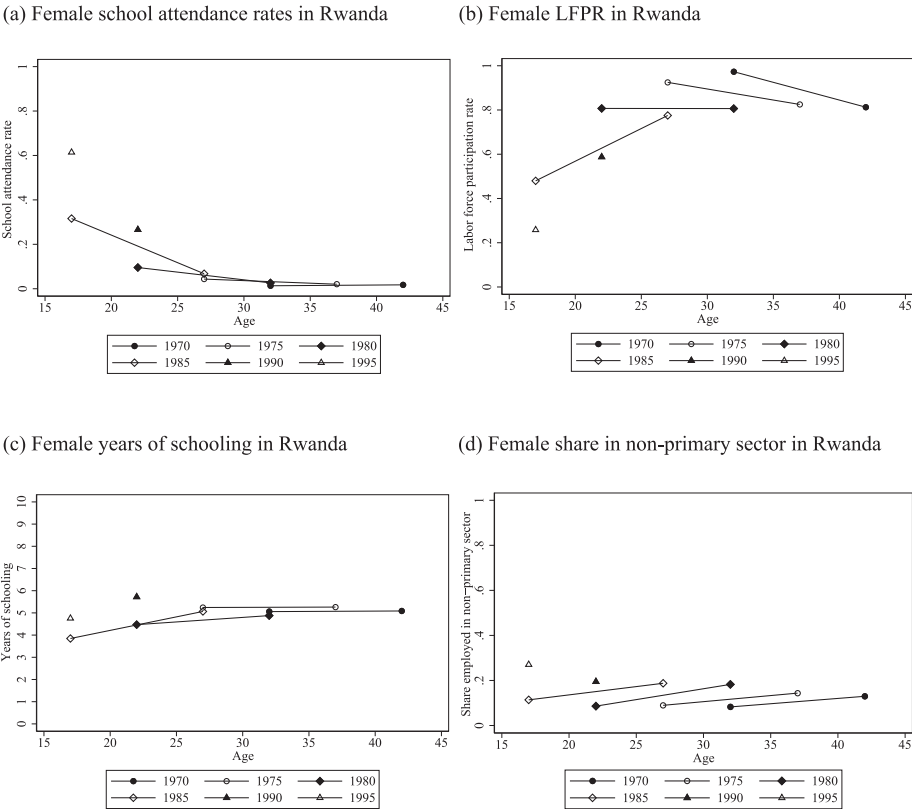
of schooling over the earlier-born cohorts. Figure 3(d) shows a trend across cohorts toward increasing employment of Ghanaian women in the nonprimary sector: At any given age between 20 and 30, we observe that the female employment shares in the nonprimary sector increase by at least 10 pp for every cohort. Due to the high school attendance of the most recent cohorts, the fairly constant nonprimary employment shares at age 15 may reflect relatively small and selected groups of women who leave education at early age.

*Rwanda.* In Rwanda, the cohorts are observed at slightly higher ages due to the different timing of the Rwandan census waves. The Rwandan patterns are similar to the ones observed in Ghana in terms of their dynamics, fitting the popular characterization of both countries as “emerging economies,” while the data still indicate substantial level differences between the two. Figure 4(a) displays a strong increase in female school attendance across cohorts at early working age: At age 17, the school attendance rate differs by almost 30 pp between the cohort born in 1995 and the cohort born in 1985. Correspondingly, the female LFPR experiences sharp declines in the magnitude of 20 pp at the youngest ages, as shown in Figure 4(b). Interestingly, younger female cohorts also exhibit a lower LFPR in later working life than older cohorts do. Figure 4(c) indicates that the years of schooling acquired by the later-born female cohorts in Rwanda increases by at least one year below age 25 due to the higher enrollment in education. Overall though, Rwandan women complete fewer years of education than Ghanaian women born in the same years and at comparable ages. Similarly, the share of women in Rwanda employed in the nonprimary sector has been increasing across cohorts, albeit from a much lower level than in Ghana, as shown in Figure 4(d).

*Mali.* Mali is one of the poorest countries in terms of GDP per capita in our sample. This characteristic is potentially correlated with female enrollment in education generally being at a much lower level in Mali than in Ghana or Rwanda. The interpretation of the evolution across cohorts is slightly complicated by the Malian census waves being more than ten years apart from each other and the cohort born in 1995 not being observed yet. However, some variables show strong dynamics across cohorts, in particular in relative terms. As shown in Figure 5(a), the female school attendance rate reaches more than 20% around age 20 among the cohorts born in 1990 and 1980, respectively. The female LFPR, in turn, decreases to a modest extent from earlier- to later-born cohorts below age 20, as displayed in Figure 5(b). Figure 5(c) shows that the average years of schooling acquired by young Malian women below age 20 increase more than twofold from the cohort born in 1980 to the cohort born in 1990. Similarly large gains



FIGURE 4 Rwanda



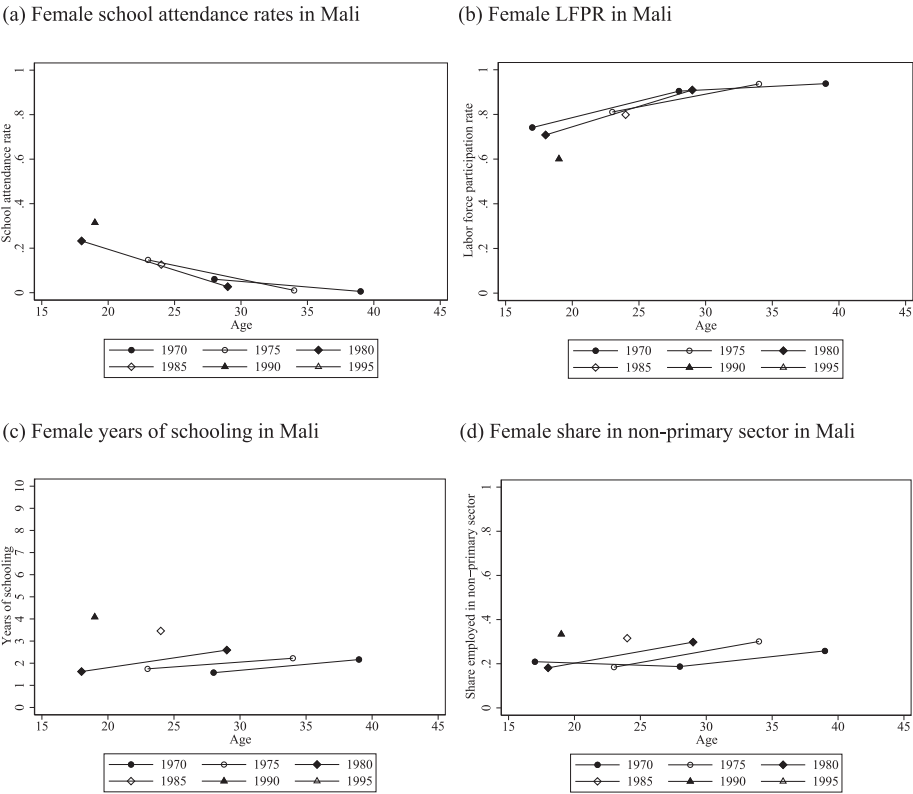
NOTES: The upper-left panel shows a plot of female school attendance rates by cohort and across age in Rwanda. The upper-right panel shows a plot of the female LFPR by cohort and across age in Rwanda. The lower-left panel shows a plot of the average female years of schooling by cohort and across age in Rwanda. The lower-right panel shows a plot of the share of women working in the nonprimary sector among all employed women in Rwanda. Each marker represents one cohort observation; each line connects observations from the same cohort.

SOURCE: Authors' own depictions.

in relative terms are observed for the cohort born in 1985 over the cohort born in 1975. Also, the share of Malian women employed in the nonprimary sector has been increasing by magnitudes of 50% for the cohorts born in 1990 and 1985, respectively, as shown in Figure 5(d).

*South Africa.* South Africa represents a case that has essentially completed the inverse evolution toward high female school enrollment and low female labor supply at early working age that other sample countries are still undergoing. The various panels of Figure 6 show only little variation across cohorts at the same ages. Female school attendance during early working life is high, while female labor force participation is low, with both variables first moving in opposite directions as age increases and then levelling off. Between age 15 and age 20, female cohorts in South Africa accumulate

FIGURE 5 Mali

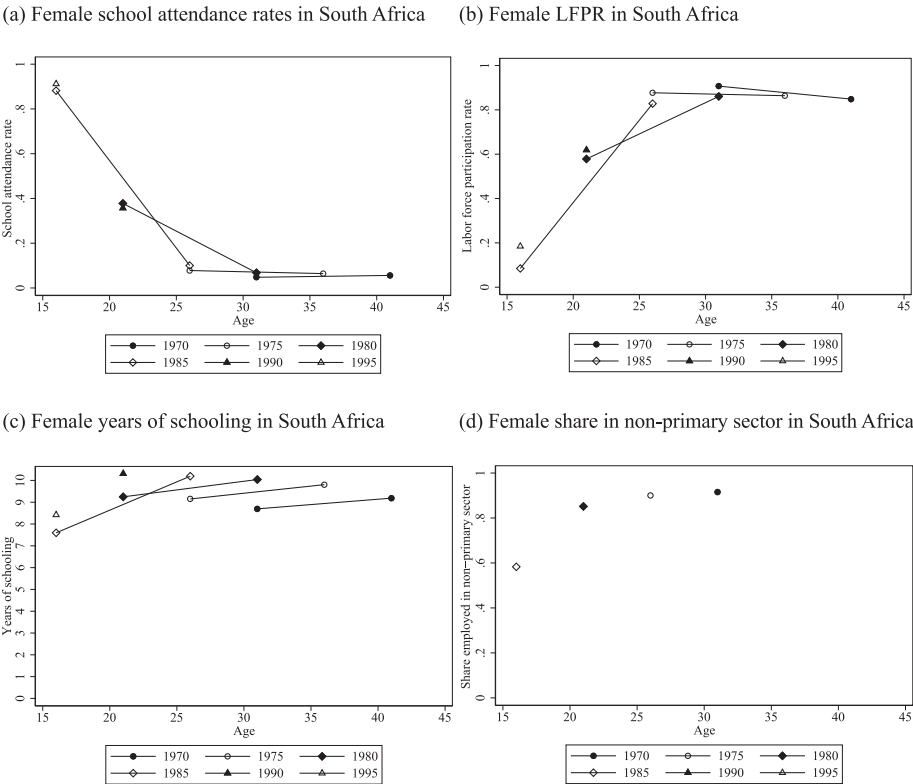


NOTES: The upper-left panel shows a plot of female school attendance rates by cohort and across age in Mali. The upper-right panel shows a plot of the female LFPR by cohort and across age in Mali. The lower-left panel shows a plot of the average female years of schooling by cohort and across age in Mali. The lower-right panel shows a plot of the share of women working in the nonprimary sector among all employed women in Mali. Each marker represents one cohort observation; each line connects observations from the same cohort. SOURCE: Authors' own depictions.

more years of schooling on average than in the previously presented countries, with the accumulation reaching completion shortly above age 20 in South Africa. The large share of women employed in the nonprimary sector, which is only observed in one South African census wave, is much higher than in the other three countries despite only the earlier-born cohorts being observed at prime working age.

In summary, female school attendance rates increase and female LFPRs at young ages decrease across cohorts in Ghana, Rwanda, and Mali, albeit starting from very different levels and changing at varying speed. Developments of female years of schooling and the share of women employed in the nonprimary sector show diverse patterns across cohorts. In South Africa, in turn, women have already completed the transition toward high

FIGURE 6 South Africa



NOTES: The upper-left panel shows a plot of female school attendance rates by cohort and across age in South Africa. The upper-right panel shows a plot of the female LFPR by cohort and across age in South Africa. The lower-left panel shows a plot of the average female years of schooling by cohort and across age in South Africa. The lower-right panel shows a plot of the share of women working in the nonprimary sector among all employed women in South Africa. The lower-right panel shows a plot of the gender gap in LFPR in South Africa. Each marker represents one cohort observation; each line connects observations from the same cohort.

SOURCE: Authors' own depictions.

school enrollment and low levels of labor supply at young ages, which is reflected in the absence of noticeable cohort variation there.

Female labor supply and education

In order to confirm the mechanistic character between enrollment in education and participation in the labor force during early working life, we first regress the female LFPR on the female school attendance rate while restricting the sample to the age group 15–19. As shown in column 1 of Table 2, the female LFPR and the female school attendance rate are strongly negatively related in this age group, suggesting a significant decline in the female LFPR by 0.6 pp for a one pp increase in the female school attendance rate. The coefficient of the association increases further in absolute magnitude

TABLE 2 Regressions of the female LFPR on female school attendance rate

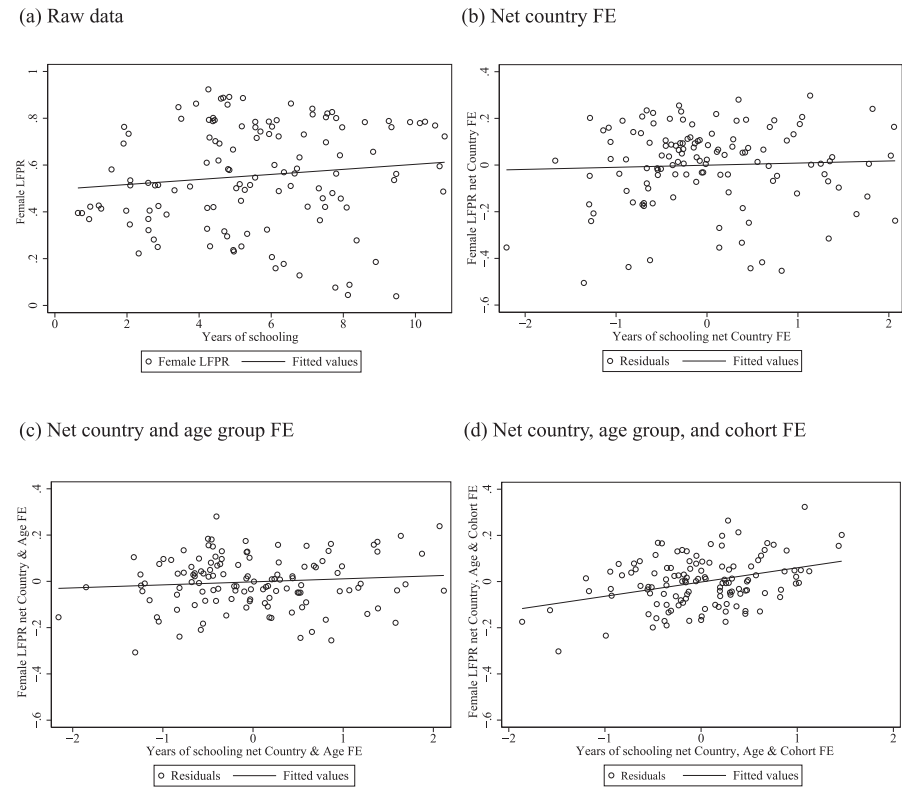
|                        | Female LFPR in age group 15–19 |                      |                      |
|------------------------|--------------------------------|----------------------|----------------------|
|                        | (1)                            | (2)                  | (3)                  |
| School attendance rate | –0.593***<br>(–0.09)           | –0.712***<br>(–0.12) | –1.163***<br>(–0.15) |
| Year of birth = 1970   |                                |                      | Omitted<br>(.)       |
| Year of birth = 1975   |                                |                      | 0.002<br>(–0.07)     |
| Year of birth = 1980   |                                |                      | 0.076*<br>(–0.04)    |
| Year of birth = 1985   |                                |                      | 0.042<br>(–0.06)     |
| Year of birth = 1990   |                                |                      | 0.047<br>(–0.05)     |
| Year of birth = 1995   |                                |                      | 0.169**<br>(–0.07)   |
| N                      | 34                             | 34                   | 34                   |
| Within-R2              | 0.579                          | 0.601                | 0.831                |
| No. of clusters        | 34                             | 34                   | 34                   |
| Country FE             | No                             | Yes                  | Yes                  |

NOTES: The table reports results from linear regressions of the female LFPR on the female school attendance rate. Sample restricted to age group 15–19. The baseline results without any fixed effects are reported in column 1. Column 2 reports results from adding country FE to the regression. Cohort FE are added to the regression reported in column 3. A constant is included in all regressions. Robust standard errors clustered at the country-cohort level reported in parentheses.  
\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.  
SOURCE: Authors’ own computations.

once we control for country-specific time-invariant heterogeneity (column 2). Once we further add cohort FE to the regression, the estimated coefficient implies close to a one-to-one trade-off between the female LFPR and the female school attendance rate (column 3). Notably, the cohort FE are mostly statistically insignificant except for the cohorts born in 1980 and 1995, suggesting that the variation in school attendance rates, which we have shown to increase strongly among later-born cohorts, explains much of the cohort-specific variation in the female LFPR at early working age.

Turning to the association between the female LFPR and female education across all three age groups, Figure 7(a) shows a scatterplot of the female LFPR against the female years of schooling, with each marker representing one of the six cohorts observed at the country-age group level. The association between the two variables is noisy and only weakly positive, as indicated by the slope of the linear fit. The slope flattens further after regressing both variables on country FE, as shown in the plot of the residuals displayed in Figure 7(b). Further regressing the two variables on FE for two of the three age groups leaves the slope of the association essentially unchanged but compresses the residuals (Figure 7(c)). Only after

**FIGURE 7** Scatterplots of the female LFPR and years of schooling



NOTES: The upper-left panel shows a scatterplot of female the LFPR and years of schooling. The upper-right panel shows a scatterplot of the residual female LFPR and years of schooling after regressing both variables on country FE. The lower-left panel shows a scatterplot of the residual female LFPR and years of schooling after regressing both variables on country and age group FE. The lower-right panel shows a scatterplot of the residual female LFPR and years of schooling after regressing both variables on country, age group, and cohort FE.

SOURCE: Authors' own depictions.

regressing the two variables also on FE for five of the six cohorts do the residuals exhibit a strong positive association, which is visible in the plot shown in Figure 7(d).

The visual patterns are mirrored in the results reported in Table 3 from estimating Equation 1. Regressing the female LFPR on the female years of schooling and a constant only yields a small, positive, and statistically insignificant coefficient (column 1). The coefficient is unchanged after country FE are added to the regression (column 2) and increases slightly in magnitude after age group FE are further included in the regression (column 3). Adding cohort FE to the regression substantially increases the size of the schooling coefficient, with the latter now being highly significant (column 4). The association is furthermore economically relevant, as it implies that on average, one more year of schooling is associated with an 11 pp higher female LFPR. In turn, the cohort FE all have negative signs and increase

**TABLE 3 Regressions of the female LFPR on years of schooling**

|                      | Female LFPR     |                 |                 |                     |
|----------------------|-----------------|-----------------|-----------------|---------------------|
|                      | (1)             | (2)             | (3)             | (4)                 |
| Years of schooling   | 0.011<br>(0.01) | 0.009<br>(0.02) | 0.013<br>(0.02) | 0.110***<br>(0.02)  |
| Year of birth = 1970 |                 |                 |                 | Omitted<br>(.)      |
| Year of birth = 1975 |                 |                 |                 | -0.040<br>(0.03)    |
| Year of birth = 1980 |                 |                 |                 | -0.079***<br>(0.03) |
| Year of birth = 1985 |                 |                 |                 | -0.179***<br>(0.04) |
| Year of birth = 1990 |                 |                 |                 | -0.305***<br>(0.05) |
| Year of birth = 1995 |                 |                 |                 | -0.403***<br>(0.07) |
| N                    | 125             | 125             | 125             | 125                 |
| Within-R2            | 0.015           | 0.002           | 0.010           | 0.310               |
| No. of clusters      | 74              | 74              | 74              | 74                  |
| Country FE           | No              | Yes             | Yes             | Yes                 |
| Age group FE         | No              | No              | Yes             | Yes                 |

NOTES: The table reports results from linear regressions of the female LFPR on the female years of schooling. The baseline results without any fixed effects are reported in column 1. Column 2 reports results from adding country FE to the regression. Results reported in column 3 additionally control for age group FE. Cohort FE are added to the regression reported in column 4. A constant is included in all regressions. Robust standard errors clustered at the country-cohort level reported in parentheses.

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

SOURCE: Authors' own computations.

in absolute magnitude with the cohorts' years of birth: Compared with the female cohort born in 1970, the LFPR of the female cohort born in 1995 is 40 pp lower, after controlling for the years of schooling and accounting for time-constant heterogeneity within countries and age groups, respectively. Presumably, the cohort FE absorb the heterogeneity between cohorts induced by the higher school attendance rates of the later-born cohorts at early working age.

Our result that female LFPRs are positively associated with female education is consistent with studies that use micro-level data from SSA countries to study the female education–employment relationship, including those that evaluate the causal effects of (quasi-)experimental interventions in education on economic outcomes. Using Ghanaian data from the late 1990s, Sackey (2005) finds a positive association between female educational attainment and female participation in the labor market. Abekah-Nkrumah, Asuming, and Yusif (2019) find some evidence that an exogenous increase in the duration of high school education in Ghana significantly increases the female employment rate, while male employment rates remain unaffected.

**TABLE 4** Regressions of the share of women working in the nonprimary sector on years of schooling

|                      | Share working in nonprimary sector |                    |                    |                   |
|----------------------|------------------------------------|--------------------|--------------------|-------------------|
|                      | (1)                                | (2)                | (3)                | (4)               |
| Years of schooling   | 0.062***<br>(0.01)                 | 0.060***<br>(0.01) | 0.050***<br>(0.01) | 0.029**<br>(0.01) |
| Year of birth = 1970 |                                    |                    |                    | Omitted<br>(.)    |
| Year of birth = 1975 |                                    |                    |                    | 0.046**<br>(0.02) |
| Year of birth = 1980 |                                    |                    |                    | 0.040*<br>(0.02)  |
| Year of birth = 1985 |                                    |                    |                    | 0.079**<br>(0.03) |
| Year of birth = 1990 |                                    |                    |                    | 0.094**<br>(0.04) |
| Year of birth = 1995 |                                    |                    |                    | 0.121**<br>(0.05) |
| N                    | 96                                 | 96                 | 96                 | 96                |
| Within-R2            | 0.279                              | 0.458              | 0.276              | 0.355             |
| No. of clusters      | 65                                 | 65                 | 65                 | 65                |
| Country FE           | No                                 | Yes                | Yes                | Yes               |
| Age group FE         | No                                 | No                 | Yes                | Yes               |

NOTES: The table reports results from linear regressions of the female LFPR on the share of women working in the nonprimary sector. The baseline results without any fixed effects are reported in column 1. Column 2 reports results from adding country FE to the regression. Results reported in column 3 additionally control for age group FE. Cohort FE are added to the regression reported in column 4. A constant is included in all regressions. Robust standard errors clustered at the country-cohort level reported in parentheses.  
\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.  
SOURCE: Authors' own computations.

Female employment in the nonprimary sector

We further consider a measure of the quality of female labor supply: the share of women employed in the nonprimary sector among all women employed. Averaging across all countries, cohorts, and age groups in our sample, this share amounts to 36%, which is seven pp lower than the share of men employed in the nonprimary sector among all employed men. The female share is roughly in accordance with the estimates provided by Palacios-Lopez, Christiaensen, and Kilic (2017).

Following the same sequence of FE being added to the estimation of Equation 1 as before, we first regress the share of women working in the nonprimary sector on the female years of schooling and a constant only. Other than in case of the female LFPR, the association is already both statistically and economically significant, indicating that on average, one additional year of schooling is associated with a 6.2 pp higher share of women working in the nonprimary sector (column 1 in Table 4). The coefficient



decreases only slightly in magnitude and remains highly significant once country FE (column 2) and age group FE (column 3) are added to the regressions. The addition of cohort FE reduces the size of the coefficient more notably but leaves it significant at the 5% level (column 4). One additional year of schooling is now associated with on average a 2.9 pp higher share of women working in the nonprimary sector. The cohort FE are positive, significant at varying levels, and increasing in magnitude in the year of birth. Thus, while controlling for cohort heterogeneity was important for establishing the positive association between the female LFPR and education, the cohort FE diminish the strength of the positive association between female labor shares in the nonprimary sector and education.

The positive association between education and the quality of female work is consistent with Duflo, Dupas, and Kremer (2021), who conduct an RCT of scholarships for secondary-school attendance in Ghana. They find that the female scholarship recipients are more likely to work in the public sector than nonrecipients are, whereas the self-employed among the female recipients are more likely to be involved in a more formal enterprise instead of petty trade or services than nonrecipients are. In a broader sense, our results are also consistent with the evaluation of an RCT-type female empowerment program in Uganda by Bandiera et al. (2020), who find that providing entrepreneurial human capital to adolescent women raises the probability that the latter engage in skilled self-employment. Our interpretation of the positive and increasing coefficients of the cohort FE is that there has been an aggregate trend toward higher employment in the nonprimary sector in SSA, which is not exclusively tied to education but to a more general structural transformation. Our finding is consistent with Diao, Harttgen, and McMillan (2017), who use data from the Demographic and Health Surveys to study structural change in SSA economies, and Yeboah and Jayne (2018), who use a combination of living standards measurement surveys, labor force surveys, and IPUMS International to analyze employment trends in SSA.

### Robustness

A potential concern is that due to widespread grade repetition and over-aged students in sub-Saharan African school systems (Lewin 2009; Burger, Berg, and Fintel 2015), the years of schooling may only poorly reflect actual educational attainment and human capital. We can address this concern by utilizing the information on different levels of educational attainment in the IPUMS International data and substituting the resulting variables for the years of schooling in our main regression specification. Notably, individuals that have already completed a lower level of education may still be enrolled in higher educational institutions.

TABLE 5 Robustness: Measures of education and fertility

|                             | Female LFPR         |                     |                     |                     |                     |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                             | (1)                 | (2)                 | (3)                 | (4)                 | (5)                 |
| Years of schooling          | 0.110***<br>(0.02)  |                     |                     | 0.118***<br>(0.02)  | 0.084***<br>(0.02)  |
| Share w/ university         |                     | 2.687***<br>(0.71)  | 2.924***<br>(0.70)  |                     |                     |
| Share w/ secondary          |                     | 0.650***<br>(0.19)  | 0.919***<br>(0.27)  |                     |                     |
| Share w/ primary            |                     |                     | 0.316<br>(0.21)     |                     |                     |
| Children ever born          |                     |                     |                     | 0.023<br>(0.02)     |                     |
| Share w/ ≥ 1 child          |                     |                     |                     |                     | 0.478***<br>(0.09)  |
| Year of birth = 1970        | Omitted<br>(.)      | Omitted<br>(.)      | Omitted<br>(.)      | Omitted<br>(.)      | Omitted<br>(.)      |
| Year of birth = 1975        | −0.04<br>(0.03)     | −0.016<br>(0.03)    | −0.026<br>(0.03)    | −0.050*<br>(0.03)   | −0.031<br>(0.02)    |
| Year of birth = 1980        | −0.079***<br>(0.03) | −0.035<br>(0.03)    | −0.047*<br>(0.03)   | −0.080***<br>(0.03) | −0.044*<br>(0.03)   |
| Year of birth = 1985        | −0.179***<br>(0.04) | −0.108***<br>(0.03) | −0.135***<br>(0.04) | −0.196***<br>(0.04) | −0.137***<br>(0.04) |
| Year of birth = 1990        | −0.305***<br>(0.05) | −0.163***<br>(0.04) | −0.212***<br>(0.05) | −0.313***<br>(0.06) | −0.193***<br>(0.05) |
| Year of birth = 1995        | −0.403***<br>(0.07) | −0.176***<br>(0.06) | −0.243***<br>(0.07) | −0.431***<br>(0.07) | −0.314***<br>(0.07) |
| N                           | 125                 | 125                 | 125                 | 124                 | 124                 |
| Within-R2                   | 0.31                | 0.363               | 0.379               | 0.318               | 0.452               |
| No. of clusters             | 74                  | 74                  | 74                  | 74                  | 74                  |
| Age group FE and country FE | Yes                 | Yes                 | Yes                 | Yes                 | Yes                 |

NOTES: The table reports results from linear regressions of the female LFPR on different measures of female education and controls for female fertility. Column 1 again reports the results from regressing the female LFPR on the female years of schooling. Column 2 reports results from substituting the years of schooling for the shares of women who have completed university education or secondary education respectively. Column 3 additionally adds the share of women who have completed primary education to the regression. Column 4 reports results from regressing the female LFPR on the years of schooling and controlling for the number of children ever born, while the regression reported in column 5 controls for the share of women who have given birth to at least 1 child instead. A constant, age group FE, country FE, and cohort FE are included in all regressions. Robust standard errors clustered at the country-cohort level reported in parentheses.  
\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.  
SOURCE: Authors' own computations.

Column 1 in Table 5 again shows our main estimate of the association between the female LFPR and years of schooling, whereas columns 2 and 3 present results from replacing the years of schooling with the shares of women that have completed a specific level of education. Including only the shares for the two highest levels of educational attainment (column 2) yields positive, large, and highly significant associations of both shares

with the female LFPR, while keeping in mind that the share of women who have completed university education is low in the sample. When additionally including the share of women who have completed primary education (column 3), the corresponding coefficient is also positive but insignificant. This suggests that the transition from education into the labor force is particularly pronounced once a certain threshold level of education, in this case the completion of secondary education, has been reached. In turn, women who have completed their primary education may still be enrolled in secondary education, explaining the weak association with the female LFPR at this lower level of educational attainment. Overall, these checks reaffirm our previous result that education is positively associated with the female LFPR.

Although fertility is not the main focus of this study, its potential association with both female education and the female LFPR nevertheless deserves attention. Consequently, columns 4 and 5 present results from adding fertility covariates to the Equation 1. As displayed in column 4, including the average number of children ever born to a woman at the country-cohort level does not affect the estimated association of the years of schooling with the female LFPR, while the coefficient of the fertility covariate itself is small and insignificant. Including the share of women that have given birth to at least one child yields a different result though (column 5): This share is positively and significantly associated with the female LFPR, implying that an increase in this share by one pp is associated with an increase in the female LFPR by 0.478 pp, which is a quantitatively relevant magnitude. Still, the association of the female years of schooling with the female LFPR remains quantitatively relevant, too, at a high level of statistical significance. These results suggest that the onset rather than the scope of fertility is relevant for female participation in the labor force. Interestingly, the magnitude of the cohort FE decreases markedly in column 5 for the most recent cohorts born in 1990 and 1995 respectively, suggesting that our control variable for the onset of fertility explains some cohort-level variation that would otherwise be absorbed by the cohort FE. Given that school attendance is still high among these cohorts when we observe them, the positive sign of the association between the onset of fertility and the female LFPR may suggest that a negative correlation exists between the onset of fertility and the female school attendance at early working age. Evidence for such a negative relationship in the sub-Saharan African context is presented by Duflo, Dupas, and Kremer (2015), Keats (2018), Osili and Long (2008), and Ozier (2018), whereas Herrera, Sahn, and Villa (2019) provide complementary evidence that first births occurring during adolescence increase the probability of employment, which is partially mediated through school dropout. A control variable for the onset of fertility can then be expected to correlate with school attendance, which in turn implies that the control variable

explains some of the cohort-specific variation that would otherwise be absorbed by the cohort FE.

We can further perform a simple falsification test for our main hypothesis that the cohort FE primarily account for increasing school attendance among more recent cohorts in the education–labor force participation association. For this purpose, we re-aggregate our variables from the micro-level data but exclude women who still attend school (see Table T4 in Online Appendix A for summary statistics on this sample). Table 6 reports results from estimating the same regression models as reported in Table 5 but using the variables aggregated from the female out-of-school population. Our main specification still yields a positive and significant association between the female years of schooling and the female LFPR when both variables are restricted to the out-of-school population (column 1). As expected, the magnitudes of the cohort FE decrease substantially, implying that the female cohorts differ less in terms of their LFPR once we eliminate the direct impact of increased school attendance among the more recent cohorts from the data. The cohort FE further decrease in magnitude and partially also lose statistical significance once the years of schooling are substituted for the shares of women who have completed specific levels of education and are not enrolled in education anymore (columns 2 and 3). The number of children ever born still do not exhibit a significant association with the female LFPR and do further not affect the education–LFPR association (column 4). Interestingly though, the large and significant positive association between the share of women who have already given birth and the female LFPR that we reported in column 5 of Table 5 disappears entirely once the data are restricted to the out-of-school population, as shown in column 5 of Table 6. This supports our previous notion that the onset of fertility may primarily interact with school attendance in early working life, with the first birth decreasing the likelihood of further school attendance and potentially increasing labor force participation. Naturally, no indication of this interaction can be found in data that are restricted to the population that has already left education. Further, it seems straightforward that the coefficients of both the years of schooling and the shares of completed education decrease in magnitude compared with when the variables are covering both the in-school and the out-of-school populations: At low levels of education, a large share of women is still enrolled in education and does not participate in the labor force, implying a relatively low female LFPR and resulting in a steeper increase in the female LFPR once women exit education after having completed higher levels of education. Excluding the in-school population pushes the female LFPR at low levels at education upward, which in turn results in a flatter association between the female LFPR and education overall.

**TABLE 6 Robustness: Out of school population**

|                             | Female LFPR when out of school |                    |                     |                     |                     |
|-----------------------------|--------------------------------|--------------------|---------------------|---------------------|---------------------|
|                             | (1)                            | (2)                | (3)                 | (4)                 | (5)                 |
| Years of schooling          | 0.070***<br>(0.01)             |                    |                     | 0.075***<br>(0.01)  | 0.071***<br>(0.01)  |
| Share w/ university         |                                | 1.898***<br>(0.71) | 2.039***<br>(0.70)  |                     |                     |
| Share w/ secondary          |                                | 0.583***<br>(0.14) | 0.761***<br>(0.19)  |                     |                     |
| Share w/ primary            |                                |                    | 0.300*<br>(0.15)    |                     |                     |
| Children ever born          |                                |                    |                     | 0.014<br>(0.01)     |                     |
| Share w/ $\geq 1$ child     |                                |                    |                     |                     | 0.040<br>(0.09)     |
| Year of birth = 1970        | Omitted<br>(.)                 | Omitted<br>(.)     | Omitted<br>(.)      | Omitted<br>(.)      | Omitted<br>(.)      |
| Year of birth = 1975        | -0.012<br>(0.02)               | -0.006<br>(0.02)   | -0.009<br>(0.02)    | -0.022<br>(0.02)    | -0.018<br>(0.02)    |
| Year of birth = 1980        | -0.027<br>(0.02)               | -0.008<br>(0.02)   | -0.016<br>(0.02)    | -0.033<br>(0.02)    | -0.033<br>(0.02)    |
| Year of birth = 1985        | -0.086***<br>(0.03)            | -0.062**<br>(0.03) | -0.073**<br>(0.03)  | -0.102***<br>(0.03) | -0.096***<br>(0.03) |
| Year of birth = 1990        | -0.128***<br>(0.03)            | -0.067**<br>(0.03) | -0.091***<br>(0.03) | -0.139***<br>(0.03) | -0.136***<br>(0.04) |
| Year of birth = 1995        | -0.158***<br>(0.05)            | -0.067<br>(0.04)   | -0.106**<br>(0.04)  | -0.183***<br>(0.04) | -0.173***<br>(0.05) |
| N                           | 125                            | 125                | 125                 | 124                 | 124                 |
| Within-R2                   | 0.281                          | 0.280              | 0.315               | 0.304               | 0.299               |
| No. of clusters             | 74                             | 74                 | 74                  | 74                  | 74                  |
| Age group FE and country FE | Yes                            | Yes                | Yes                 | Yes                 | Yes                 |

NOTES: The table reports results from linear regressions of the female LFPR on different measures of female education and controls for female fertility when the sample is restricted to women who are not enrolled in education. Column 1 reports the results from regressing the female LFPR on the female years of schooling. Column 2 reports results from substituting the years of schooling for the shares of women who have completed university education or secondary education respectively. Column 3 additionally adds the share of women who have completed primary education to the regression. Column 4 reports results from regressing the female LFPR on the years of schooling and controlling for the number of children ever born, while the regression reported in column 5 controls for the share of women who have given birth to at least 1 child instead. A constant, age group FE, country FE, and cohort FE are included in all regressions. Robust standard errors clustered at the country-cohort level reported in parentheses.

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

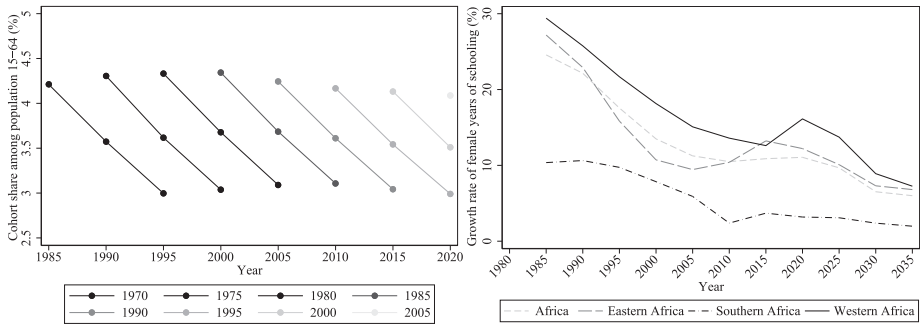
SOURCE: Authors' own computations.

## Discussion

### Implications for the demographic dividend

In the *Results* section, we have shown how adopting a cohort perspective can help understand and explain past and current empirical trends in female

FIGURE 8   Prospects of a demographic dividend



NOTES: The left panel shows cohort percentage shares among the female population aged 15–64 in SSA. The right panel shows growth rates of female years of schooling in Africa and in various African regions. SOURCE: Authors’ own depictions based on data from UN DESA (2019) and Lutz et al. (2018).

LFPRs. In this section, we will in turn discuss implications of our cohort-centered perspective for a potential demographic dividend in SSA and the contribution of the female sub-Saharan African labor force to the latter.

Young age groups maintain a notable demographic importance for labor markets in SSA: According to UN DESA (2019), 11% of the total sub-Saharan African population in 2020 fall into the age group 15–19, while this age group accounts for almost one-fifth of the population at working age (aged 15–64). In Figure 8(a), we plot working-age population shares of female cohorts born in SSA between 1970 and 2005 over time. Each cohort is observed first at age 15, then again at age 20, and finally again at age 25 if the corresponding data are available. This depiction underlines the enduring demographic importance of the more recently born female cohorts for the female working-age population in SSA: The cohort population shares are nearly constant across the time span of 35 years, irrespective of the cohorts’ age, with the cohort born in 1990 accounting for the same share of the female workforce between 2005 and 2015 as the cohort born in 1970 did between 1985 and 1995. Although the latest-born cohorts are projected to decline slightly in terms of their population shares, this decline still appears to be rather subtle in magnitude.

Taken together with the large increases in school enrollment and gains in educational attainment we observe among the later-born cohorts, we can infer that these better-educated female cohorts will have a similar demographic impact on the female sub-Saharan African working-age population as the earlier-born cohorts had while contributing more human capital to the population at working age than the latter. This combination of relatively constant cohort population shares and higher levels of educational attainment among the more recent cohorts gives rise to the pattern depicted in Figure 8(b): In both Eastern and Western Africa, the growth rate of the average years of schooling of the female working-age population reverses

its decline and is projected to remain above 10% for a prolonged period. In Eastern Africa, the reversal starts in the year 2005 and peaks in 2015, whereas it begins in 2015 at a higher level of growth in Western Africa and peaks in 2020.

In the short run, these projected developments shed a promising light on the prospect of a demographic dividend in SSA: From the early 2000s till the mid-2020s, the female working-age population in several sub-Saharan African regions is projected to undergo elevated levels of growth in education, carried by younger cohorts who have accumulated more human capital replacing less educated older cohorts at a high rate due to nearly constant cohort population shares. Hence, this time period, which is only partially observed in our data, appears to exhibit the prerequisites for a magnified female contribution to a demographic dividend in SSA. Clearly, whether this dividend will materialize depends on a large variety of factors, such as improvements in gender equality when it comes to secondary and tertiary enrollment (Klasen 2020), social norms hindering women from finding employment that would match their human capital (Jayachandran 2021), other potential “deep determinants” of female labor supply, the extent to which the higher educational attainment translates into relevant labor market skills (Hanushek et al. 2015; Backhaus 2020), and whether in particular the nonprimary sector will expand to provide sufficient and skilled employment opportunities (Rodrik 2016; Kruse et al. 2021). Presently, the majority of employment outside of agriculture in SSA is in the informal sector. Women who lack the opportunity to take up better quality jobs often end up with informal jobs of low quality (Turbat 2017). Often, they work in these jobs due to the sheer need to make ends meet (Klasen 2019). An exceptional challenge to the demographic dividend in SSA is currently being posed by the COVID-19 pandemic, which we discuss below.

### Implications of the COVID-19 pandemic

The ongoing COVID-19 pandemic poses a threat to both the human capital accumulation and the transition to the labor market of the young cohorts, with the potential for a gender-specific impact. Sumner, Hoy, and Ortiz-Juarez (2020) estimate that the poverty impact of the pandemic is likely to be concentrated in the poorest regions of the world, with SSA being one of them. A higher risk of poverty could force students to abandon education to supply labor instead, which would increase the LFPR in the youngest age groups. At the same time, however, the economic downturn could increase employment in low quality and unstable jobs and sectors, which has already been detrimentally affecting women in SSA. Addison, Sen, and Tarp (2020) note that the pandemic is likely to increase home production outside of the market economy in developing countries, with the burden of time likely being imposed on women. Regarding education,



Azevedo (2021) simulate that school closures are likely to lead to a reduction in the learning-adjusted years of schooling and a decrease in lifetime income in all regions of the globe. UNESCO (2020) further estimates that SSA is the region with the second-highest number of students globally that are at risk of not returning to education following the closure of educational facilities due to the pandemic. The estimates further indicate that female students are at greater risk of not returning to education in SSA than male students for all educational levels above primary schooling.

Another particular aspect affecting women will be the fertility response in SSA countries to the pandemic: If the onset of fertility happened earlier during the life course than among current cohorts while education stalled and economic outlooks darkened, early motherhood might additionally withdraw young women in SSA from education.

Despite the global character of the pandemic, we point out against the backdrop of our study that the impacts of the pandemic will likely be cohort specific: While the mortality risk is concentrated among the currently older cohorts, the educational and economic risks are particularly pronounced for the young cohorts at school age and early working age. In the worst case, the COVID-19 pandemic might eradicate much of the lifetime gains for the young cohorts in SSA that our results have given reason to anticipate, in particular regarding women.

## Conclusion

Summarizing our findings, recently born female cohorts in our sample of sub-Saharan African countries decrease their labor force participation in early working age in favor of higher enrollment in education. This pattern is particularly pronounced in those countries that have greatly expanded access to (female) education around the turn of the millennium, such as Ghana and Rwanda, whereas it is largely absent in countries where enrollment in education has already been high at the beginning of our sample period, such as South Africa. Accounting for the differential cohort patterns in our regression analyses recovers a strong and positive association between the female LFPR and female educational attainment across our sub-Saharan African sample countries. Furthermore, encouraging with regard to the human capital gains of the later-born female cohorts is the positive association that we find between female employment in the nonprimary sector and female educational attainment. Although we do not attribute causality to these associations, our findings are consistent with causal estimates that have been recovered by (quasi-) experimental studies in a variety of SSA countries.

One limitation of our study is that we do not observe economic outcomes of the sampled female populations besides their labor force participation and sector of employment. Further, this paper takes an exclusively

female perspective on labor force participation in SSA due to the female LFPR having been at the center of debate recently. The analysis of male cohort trends and of the potentially resulting gender dynamics in SSA labor markets poses a promising avenue for further research. A recent example of a cohort-based examination of gender inequality in SSA that also relies on IPUMS International data is provided by Baten et al. (2021), who focus on education. In addition, the interaction of female school attendance, fertility, and labor force participation during adolescence that our results point to may warrant a more in-depth investigation.

From our cohort perspective, we argue that the decrease in female LFPRs at the beginning of the working life should be evaluated by taking into account that young female cohorts have simultaneously made substantial gains in terms of their school attendance and their human capital stock. From this perspective, efforts to increase female enrollment in education have been successful by invoking the rather inevitable trade-off of lowering female labor supply in early working life. With our sample period ending in the early 2010s, we cannot evaluate the life-cycle performance of the young cohorts for which we have found particularly promising gains in education yet. The next round of census or comparatively representative data will be more informative about the performance of the female (and male) cohorts born around 1990 at their prime working age and to what extent they will be able to contribute to the realization of a sub-Saharan African demographic dividend despite the presumed detrimental impact of the COVID-19 pandemic.

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## Data availability statement

The census extracts data used in this paper are available upon registration through IPUMS International (<https://international.ipums.org/international/>). The complementary data are available without registra-

tion at the ILOSTAT database (<https://ilostat.ilo.org/>), the World Population Prospects database (<https://population.un.org/wpp/>), the Wittgenstein Human Capital data explorer (<http://dataexplorer.wittgensteincentre.org/wcde-v2/>), and the World Development Indicators database (<https://databank.worldbank.org/source/world-development-indicators>).

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