The Demand Side of Africa's Demographic Transition: Desired Fertility, Wealth, and Jobs

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Abstract

Sub-Saharan Africa (SSA) accounts for around 40% of projected global births over the next 80 years. To investigate the roots of persistently high fertility rates across the region, I assemble micro data from 192 Demographic and Health Surveys covering 66 low-and-middle-income countries and document three key facts. First, women's fertility ideals and intentions are, on average, substantially higher in SSA than other low-and-middle-income regions. This gap is particularly large among poorer households: the socioeconomic gradient in desired fertility is twice as steep (more negative) on the sub-continent. Second, poorer women are also significantly less likely to work for a wage in SSA, where there exists a robust negative relationship between female wage work prevalence and desired fertility across provinces. Third, exploiting within-SSA variation across 25 countries, I find that increases in female salaried employment opportunities at the province level are associated with a flattening of this gradient over time, conditional on a rich set of covariates. These findings provide suggestive evidence that the nature of SSA's occupational change process may be an important contributor to the region's distinct fertility transition.

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1 Introduction

More than three-quarters of global population growth over the rest of this century is projected to take place in sub-Saharan Africa (SSA), a region that will account for a quarter of the world's population and around 40% of births by 2050 (United Nations 2019). Persistently high fertility rates underlie these predictions: demographers refer to the subcontinent's aggregate fertility decline, characterized by a later onset and slower pace than has been observed in other low-and-middle-income regions, as a "unique fertility transition" (Bongaarts and Casterline 2013; Bongaarts 2017). Indeed, after accounting for conventional macro-level correlates such as GDP per capita, fertility rates remain on average about one birth higher in SSA compared to other low-and-middle-income countries (Bongaarts 2017; World Bank 2019).

This significant, unexplained gap motivates the micro-level investigation at the heart of this paper. I examine individual data on fertility ideals and intentions across regions and within SSA to (i) shed light on the role of *desired* fertility in SSA's fertility trends, and (ii) draw links between the region's occupational change process and women's work and fertility desires across the wealth distribution.[1] I construct a pooled sample of over 2.5 million women of childbearing age (15-49) by assembling 192 Demographic and Health Surveys (DHS) from 37 SSA countries and 29 other low-and-middle-income countries. Cross-regional comparisons of within-country patterns in these data yield a set of new stylized facts about the fertility transition in SSA.

First, my analysis suggests that *desired* fertility is higher in SSA compared to other low-and-middle-income countries. To begin, I argue that unmet demand for contraceptives cannot be the only driver of higher fertility rates in SSA. While fertility is substantially higher in SSA compared to non-SSA provinces at similar levels of modern contraceptive prevalence, I find no such difference in indicators of unmet need for family planning methods across the two groups of countries.[2]

Thus, I next dissect the anatomy of desired fertility in SSA by focusing on individual-level prospective and retrospective questions designed to elicit fertility preferences: women's desire for additional children and ideal family size. This analysis reveals that preferences for larger families appear much more common in SSA, where women are significantly more likely to report wanting an additional child when they have up to eight living children. For example, 48% of women with four children state that they want at least one more child, compared to only 10% in the group of other countries.

In a second step, I study heterogeneity in these preference gaps across the wealth distribution. To do this, I merge my sample with the International Wealth Index, an indicator constructed by Smits and Steendijk (2015) from the household sections of the

[1] While desired fertility has been recognized as a key contributor to cross-country variation in fertility rates (Pritchett 1994), much of the literature on fertility transitions in developing countries to date evaluates "supply-side" policies aiming to expand access to contraceptives (e.g. Miller 2009, Portner et al. 2011, McKelvey et al. 2012 and Joshi and Schultz 2012). Information campaigns aiming to correct misinformation about the side effects of contraception can also increase uptake and thereby lower fertility (Glennerster et al. 2021).

[2] Province - the first administrative unit in a country - is the level at which the DHS is representative.

DHS surveys, which has the key advantage of ranking all households in this sample on a common scale. I then split each group of countries into equal-size wealth bins, and re-weigh individuals within each bin by age to account for possible bias in stated fertility ideals stemming from ex-post rationalization of prior births. I find that desired fertility in SSA stands starkly above the average of other low-and-middle-income countries at all levels of household wealth, but that the gap narrows as wealth increases: the slope of the gradient is *twice* as negative in SSA than in the comparison group of countries. Since poorer women are also much more numerous in SSA, their preferences carry more weight toward the subcontinent's average demand for children. This gradient differential is robust to restricting the analysis to women who have never given birth and are thus not at risk of over-stating their fertility ideals by rationalizing prior births.

The stronger association between socioeconomic status and desired fertility in SSA suggests that economic factors contribute to the region's exceptionally high demand for children. One factor that I argue may not have been given sufficient attention thus far is the *nature* of jobs available in the region. A growing literature suggests that structural change in SSA is also distinct from that of other countries: it is characterized by only limited employment gains in large manufacturing firms (Diao et al. 2021; McMillan and Zeufack 2022) and lower rates of salaried employment among young labor market entrants (Bandiera et al. 2022). I hypothesize that the pace of the fertility transition in SSA could be linked to these features of the region's occupational change process. In fertility choice models, parental income-earning opportunities have a negative substitution effect on optimal fertility levels by raising the opportunity cost of children (Becker and Lewis 1973; Jones et al. 2011). Employment that is less compatible with looking after young children - namely wage/salaried work - might augment the substitution effect, leading women to prefer a smaller number of children. This would generate a more negative relationship between parental income and desired fertility if richer women are more likely to hold wage/salaried jobs.

The paper thus goes on to explore the distribution of salaried employment opportunities available to women in SSA and how it relates to the gradient differential in desired fertility between the two sets of countries. This analysis generates three additional findings. First, the type of jobs held by women is much more sensitive to socioeconomic status in SSA, mirroring the gradient differential in desired fertility. While women at all levels of wealth are more likely to report engaging in some form of paid economic activity in SSA, among labor market participants, the fraction of women with wage/salaried jobs is significantly more positively correlated with wealth than in other regions. Second, at the sub-national level, I observe a much stronger (negative) correlation between desired fertility and the share of women in salaried jobs in a province in SSA, while this relationship is virtually flat outside of SSA. Other features of women's work - working for pay or outside of agriculture - are much less predictive of fertility ideals. Third, I find that the gradient differential between SSA and non-SSA is driven by provinces in which the level of wage work prevalence is below the sample median.

Thus, the share of women working for a wage in an area is a strong predictor of the strength of the relationship between wealth and desired fertility in SSA.

Finally, to isolate the correlation between female wage work and the wealth-desired fertility gradient from other factors, I exploit panel variation at the sub-national level within SSA. I restrict my sample to the set of SSA countries for which at least two waves of the DHS were collected, province boundary changes over time are harmonized by IPUMS, and the International Wealth Index is available. This allows me to observe how changes in the socioeconomic gradient in desired fertility correlate with changes in the pool of female wage work opportunities within SSA provinces over time. I find a clear dampening effect of women's wage/salaried employment on the slope of the wealth gradient in desired fertility: an increase in wage work prevalence is, on average, associated with a flatter gradient across SSA, controlling for province and time fixed effects and a rich set of covariates. Thus, the relative abundance of female wage jobs mediates the sensitivity of women's desired fertility to socioeconomic status in the region. This suggests that women's employment prospects partially contribute to the region's high demand for children among poorer women, although not all potential confounding variables can be ruled out.

In sum, this paper's key contribution is to provide a new set of facts highlighting the prevalence of high demand for children in SSA by dissecting the anatomy of desired fertility across and within countries. These show that (i) fertility ideals are higher in SSA than other regions, and particularly so among poorer women, who represent a large share of the region's population (ii) these desired fertility differentials appear intimately connected to the type of work available to women across the subcontinent.

This paper relates to two main strands of literature. The first studies the determinants and implications of SSA's "unique" fertility transition (Bongaarts 2017). Existing research focuses on the role of cultural and historical factors. For instance, polygyny – the practice of men having multiple wives – has been shown to drive up demand for children (Rossi 2019), which Tertilt (2005) estimates to have large negative impacts of this practice on the pace of economic development in SSA. Canning et al. (2022) show that divergence in British and French colonial population policies predict variation in fertility behavior within SSA, but that present-day market access mitigates these long-run effects. Few papers study the role of specific economic channels in keeping demand for children high in SSA contexts, of which Rossi and Godard (2022) is a notable exception: they show that the extension of social pensions in Namibia substantially reduced fertility, especially among older women. This study aims to complement that literature by building new, continent-wide facts characterizing desired fertility trends in SSA and how these relate to wealth and women's work. In a similar vein, the study closest to this one is probably Vogl (2022), who exploits cross-cohort variation in SSA to document a robust negative relationship between fertility decline and adult women's education in the region, while fertility decline correlates with growth in children's educational attainment but not with school enrollment.

The second strand of literature that this paper speaks to examines the two-way link between women's labor supply and fertility in the earlier stages of economic development. In a sample of 103 countries spanning two centuries constructed from micro-censuses and surveys, Aaronson et al. (2020) find that women's labor supply is virtually unchanged by the birth of an additional child at low levels of development while the response is large and negative at higher levels of development. In line with this paper's hypothesis, the authors show that "the changing relationship between fertility and labor supply is driven by women who work for wages". Previous research has also established a causal link in the other direction. Evidence from South Asia (Jensen 2012; Heath and Mobarak 2015), pre-industrial Sweden (Schultz 1985) and the US South at the turn of the 20th century (Ager et al. 2020) shows that the expansion of female employment opportunities – or an increase in the relative return to women's labor – can reduce fertility at low levels of development. In SSA, the only piece of evidence on this question to date is Berge et al. (2022), who randomized access to entrepreneurship training in a sample of young women in Tanzania. The training increased the share of women going into self-employment and raised their incomes, but also *increased* their fertility. The authors attribute this to a positive income effect, with the positive income-fertility association coming entirely from self-employed women in their sample. While these results are puzzling, they also corroborate the salience of distinguishing between the different types of employment available to women for understanding the link between women's labor market and fertility choices and how these relate to the pace of aggregate fertility decline in SSA.

2 Data

2.1 Demographic and Health Surveys

The DHS Program collects and disseminates nationally representative data on fertility, family planning, and a broad set of health indicators including maternal and child health outcomes. With samples for 83 low and middle-income countries in the public domain, geographical coverage of the DHS data is extensive, and the most complete for SSA. Information on women's employment is also collected in most surveys and can be easily harmonized across countries and years.

Measuring socioeconomic status. My main measure of socioeconomic status is an asset-based indicator of household wealth comparable across countries called the International Wealth Index (IWI) (Smits and Steendijk 2015). This initiative from the Global Data Lab[3] provides a measure of absolute living standards at the household-level for 66 of the low and middle-income countries in my initial DHS sample. Since the middle of the 1990s, all DHS surveys collect information on asset ownership, dwelling characteristics and access to utilities at the household level. Smits and Steendijk (2015) aggre-

[3]More details can be found on the Global Data Lab website.

gate and harmonize these into twelve variables: seven consumer durables (possession of a TV, refrigerator, phone, bicycle, car, a cheap utensil, and an expensive utensil), three housing characteristics (number of sleeping rooms, quality of the floor material and quality of the toilet facility), and access to two public services (clean water and electricity). They then perform Principal Component Analysis (PCA) on the pooled sample of over 2 million households, which are weighed by the square root of their country's population size.[4] PCA estimates a weight for each initial variable, which the authors then use to first compute a raw wealth score, summing up the weights multiplied by the asset indicator variables. Finally, they rescale the wealth score to range from 0 to 100, generating wealth rankings on a common scale for the entire sample.

The DHS also provides a measure of households' relative ranking within samples, constructed using the entire range of sample-specific household-level variables on assets and dwelling conditions. Grouping households into quintiles ensures that these are sufficiently large bins for socioeconomic status differentiation. I use these quintiles as a proxy for relative income as an alternative indicator of socioeconomic status to the IWI. The other alternative measure of socioeconomic status I use is years of education (binned). Because the results are very similar across each of these three measures, I only report those using the International Wealth Index.[5]

Measuring desired fertility. The analysis in this paper focuses on two different measures of desired fertility that can be constructed from the DHS data: whether respondents report wanting an additional child, which I examine by number of living children, and women's reported "ideal number of children" - the main outcome variable which my analysis focuses on.

The ideal number of children variable is collected by customising a survey question according to women's fertility history. Women with no living children at the time of the interview are asked "If you could choose exactly the number of children to have in your whole life, how many would that be?", while women with at least one living child are asked "If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?"

As emphasized by Pritchett (1994), we should be cautious about interpreting variation in reported ideal number of children as capturing inherent differences in demand for children. Indeed, women with higher *realised* fertility may be more likely to report a higher ideal number of children to avoid admitting that they have children they did not want. Such ex-post rationalisation of prior births may lead us to overestimate desired fertility. If women in the poorest quintiles in particular tend to report higher fertility ideals in SSA than elsewhere in part because of their higher *realised* fertility, this may lead us to overestimate the gradient differential in desired fertility across the two

[4] PCA is a widely used method in development economics for measuring living standards (Montgomery et al. 2000; Filmer and Pritchett 2001; McKenzie 2005) which reduces the number of variables in a dataset by converting them into components, which are themselves linear weighted combinations of the initial variables.

[5] Results using the within-sample wealth quintiles are available upon request.

sets of countries. To deal with this concern, I re-weigh the data in each wealth bin by women's age (which predicts realised fertility differentially across SSA and non-SSA, as can be seen in the bottom panel of Appendix Figure A3). As a robustness check, I also replicate all of my analysis restricting the sample to women who have never having given birth.

Employment variables. Most rounds of the DHS surveys also include a module collecting information on respondents' employment and work. Female respondents are typically asked whether they are currently working, what was their primary occupation over the last 12 months, do they typically work throughout the year, seasonally, or only occasionally; is this work paid or unpaid; and who employs them for this work (i.e. whether they are self-employed, work for a family member or are self-employed). Given that DHS surveys are representative at the first administrative level (province or region) I can construct female employment shares for different occupations at the province level to study the link between the availability of suitable labor market opportunities for women and their desired fertility.[6]

Sample construction. Due to the program's focus on reproductive, maternal and child health, the target population of the DHS surveys is women of childbearing age. The most common sample universe is therefore women aged 15-49. Many DHS waves also include a questionnaire for adult males aged 15 and older, but the men's samples are smaller and most do not include a key indicator I need to examine correlations between desired fertility and the nature of job opportunities: the variable asking what kind of employer the respondent works for (self, family, or someone else). I pool together all the surveys that include information on household wealth or that can be matched to the IWI, as well as on individuals' desired fertility and the nature of work they perform. These amount to 192 surveys in total, covering 66 countries: 37 from SSA and 29 from other regions. Appendix Figure A2 shows the country coverage of the sample, as well as the number of survey waves included for each country. To maximize overlap in the wealth distribution across all countries in the sample, I exclude European countries from the non-SSA sample, as households in these countries have markedly higher living standards, placing most of them at the right-tail of the common support distribution of the international wealth index.

Population density. To preserve respondent confidentiality, the DHS Program provides the point coordinates of each cluster of respondents displaced within a radius of 5-10 km from their exact location. This allows me to construct a rural-urban classification harmonized across the entire pooled sample. Following Gollin et al. (2021), I compute the average population density within a 5km buffer around the displaced location, using raster data at a resolution of 30 arc-seconds (approximately 1km at the equator) from the WorldPop Country Database from 2000-2020 (where 2000 is the earliest year for which this data is available). In addition to this time coverage restriction,

[6]The coverage of these variables is not as good for men's samples, e.g. only a quarter of these ask about respondents' employment type.

the GPS location of DHS clusters is not available for over half of my initial sample; therefore, only 42% of observations can be mapped to this population density (about 1.6 million women). I thus only use this restricted sample for examining heterogeneity in desired fertility trends by rural-urban status.

3 Five Facts about Desired Fertility in SSA

Fact 1. Differences in unmet demand for contraceptive methods cannot be the only driver of higher fertility rates in SSA.

In Figure 1, I investigate the extent to which the high fertility rates in SSA can be explained by lower access to contraceptives - i.e. a pure "supply-side" explanation - in the region. Panel A plots the most commonly used measure of realised fertility - total fertility rates - against the share of married women using modern contraceptives on the x-axis. The latter indicator is a common proxy measure of modern contraceptive prevalence, but this itself does not accurately capture variation in *access* to contraceptives, since for the same level of modern contraceptive use in two areas, there may be unmet demand in some areas while not in the other (Choi et al. 2016). Therefore, in Panel B, I plot the DHS measure of unmet need for family planning (Bradley et al. 2012) as a further test of the presence of stronger supply-side constraints in SSA.

Figure 1a shows that, at similar levels of modern contraceptive prevalence, fertility is substantially higher, by 1.37 births per woman on average across 1,590 province-year units, in SSA compared to non-SSA countries. Removing the lower quadrant of outliers from the group of non-SSA countries (Armenia and Azerbaijan) brings this estimate down to 0.98 births per woman, but it remains significant at the 1% level. In contrast, Figure 1b shows no significant difference in indicators of unmet need for family planning methods by modern contraceptive prevalence across the two groups. Taken together, these two facts suggest that constraints in access to contraceptives cannot be the only explanation for SSA's slower fertility transition.

Fact 2. Desired fertility is, on average, higher in SSA, especially among poorer women, who are also more numerous in the region.

Figure 2 plots women's number of living children at the time of the survey while the y-axis plots the share of women responding "yes" to the question "Do you want to have another child?". The curves plot smoothed fitted values from local polynomial regression estimates with 95% confidence bands. The gap between the SSA (orange) curve and the non-SSA (blue) curve indicates that women in SSA are significantly more likely to report wanting an additional child when they have between 0 and 10 living children. For example, 62% of women with three children report wanting a fourth child compared to 19% of their counterparts in other countries. This suggests that preferences for larger families tend to be much more common in SSA. Appendix Figure A3, which plots age gradients in realized and desired fertility, shows that women's ideal

family size consistently exceeds their achieved number of living children on the subcontinent. In contrast, in other countries, women in the second half of the reproductive cycle tend to report lower fertility ideals than what they achieve.

This cross-regional disparity could simply reflect persistent historical or cultural differences across countries (Canning et al. 2022; Rossi 2019). However, comparisons of the association between desired fertility and socioeconomic status across SSA and other countries indicate that economic factors may also be at play.

Figure 2b plots women's average ideal number of children against household wealth. Here, households from all countries in my pooled DHS sample are ranked on the same scale according to the international wealth index constructed by Smits and Steendijk (2015). Observations are grouped into equal-size wealth bins separately for SSA and non-SSA, depicted by the orange diamond and blue circular markers respectively. Three key findings emerge. First, average desired fertility in SSA stands starkly above the average of other developing countries at all levels of household wealth. Second, this gap is significantly larger for the poorest households. Finally, the higher concentration of orange bins towards the left of the x-axis indicates that the SSA population is on average much poorer than that of other low-income regions in the DHS database. In other words, poorer women are more numerous in the region, so their preferences carry more weight towards the subcontinent's average demand for children. This significant difference in socioeconomic gradients across SSA and non-SSA also holds among women who have never given birth (Appendix Figure A6), thus increasing confidence that Figure 2b does not pick up different distributions of realised fertility - which would prompt women to rationalize their past births, whether those were wanted or unwanted - across SSA and non-SSA wealth bins. Appendix Table A2, column 2 shows that the interaction of the SSA dummy with wealth is similarly negative among childless women. Here again, we can reject the equality of slopes test (p=0.000).

Disaggregating the data by rural-urban status reveals that this pattern also holds true within rural and urban areas (see Appendix Table A2). The difference in slopes across the two sets of countries is also statistically significant when socioeconomic status as measured by years of education, as shown in Appendix Figure A7. Appendix Figure A11a shows that the gradient differential in desired fertility is even more pronounced for men, and poorer married women in SSA are more likely to report that their husband desires more children than them (Appendix Figure A11b). In this paper, I focus on the drivers of the gradient differential in women's desired fertility - the "lower bound" - and leave the investigation of these gender and intra-couple gaps for future work.

Fact 3. The desired fertility gradient differential is mirrored by differences in wealth-wage work gradients between SSA and non-SSA.

The stronger association between socioeconomic status and desired fertility in sub-

Saharan Africa documented in Figure 3 suggests that economic mechanisms contribute to the region's exceptionally high demand for children. One factor which I argue has not been given sufficient attention thus far is the nature of jobs available on the subcontinent. Both theoretical and empirical arguments motivate this hypothesis.

The theoretical literature on fertility transitions helps shed light on possible channels through which the set of labour market opportunities available to families could contribute to the difference in slopes observed in Figure 3. Starting with the seminal model of Becker and Lewis (1973), at least two key mechanisms have been shown to explain a negative relationship between parental income and fertility: the time cost associated with children and the "quantity-quality trade-off".

According to the first channel, the absence of suitable jobs may deter poor women from reducing their fertility by keeping the opportunity cost of childbearing low. This is in line with empirical evidence from South Asia (Jensen 2012; Heath and Mobarak 2015) and historical evidence from Sweden (Schultz 1985) and the US South (Ager et al. 2020). These studies show that the expansion of female employment opportunities – or an increase in the relative return to women's labor – can reduce fertility.

The second channel stipulates that an increase in the returns to education should also decrease parents' desired fertility by making "child quality" relatively more appealing than "quantity" of children. Empirical evidence of this channel includes a natural experiment in the US South around 1910, where Bleakley and Lange (2009) show that the eradication of the hookworm disease decreased fertility rates by raising the returns to schooling. In sub-Saharan Africa, however, a recent study by Alidou and Verpoorten (2019) exploiting the birth of twins to study the effect of a quasi-exogenous increase in family size on the schooling of children does not find any evidence of this negative relationship between family size and schooling.

Thus, I draw on the evidence linking fertility choices to women's employment opportunities from other settings to ask whether the distribution of employment opportunities in SSA could explain, at least in part, the gradient differential in desired fertility between the two sets of countries.

The same DHS data reveal that women's work is much more sensitive to socioeconomic status, much like desired fertility, in SSA. Two additional findings emerge from Figure 3. First, while women at all levels of wealth are more likely to (i) engage in some form of economic activity over the past 12 months in SSA than elsewhere (Panel A) and (ii) work for pay (Panel B), one cannot reject that the relationship with wealth is the same across the two sets of countries. Second, among labor market participants, socioeconomic gradients in job type mirror the difference in slopes from Figure 3, as shown in Panel C. Here, we see that the fraction of working women in *wage/salaried* jobs is significantly more positively correlated with wealth in SSA than in other regions. While only a bit more than 10% of working women in the bottom half of the SSA wealth distribution work for a wage, at comparable levels of wealth, this number

is two to three times as large for working women in non-SSA countries. Both gaps progressively close as we move up the wealth distribution.

Appendix Table A3 reports estimates of the interaction of wealth with the SSA dummy as well as p-values of equality of slopes tests, and yields the same conclusion. While *levels* of female workforce participation or participation in paid work are higher in SSA (the SSA dummy is statistically significant at the 1% level for workforce participation, while the one for paid work only at the 10% level), the slope of the wealth gradient is only statistically different for the wage/salaried work outcome.

Breaking down this gradient by rural-urban status and education levels reveals that the difference in the type of work women engage in when they are in the workforce is particularly pronounced for less educated women in both rural and urban settings. Appendix Figure A12 shows that women who completed primary school are 16 percentage point less likely to work for a wage than their counterparts in other countries in both rural and urban locations. In rural areas, 25% of working women with less than primary education (i.e. incomplete primary or no formal schooling) are working for a wage in the non-SSA sample compared to 11% in SSA. In urban areas, these numbers are 40% and 20% respectively.

Fact 4. Fertility ideals are negatively correlated with the share of women working for a wage in SSA, while this relationship is flat in non-SSA countries.

Correlating the availability of female salaried employment at the subnational level with fertility ideals brings another striking difference to light between SSA and my comparison group of other developing countries. Panel C of Figure 4 displays a much stronger correlation between desired fertility and the share of women working for a wage in a province, the smallest administrative unit at which the DHS is representative. While the relationship between the two variables is negative in both groups, the slope of this relationship is once again much larger in magnitude in SSA, where a 10 percentage point increase in the prevalence of female wage/salaried work in a province is associated with a decrease of 1 child in women's average ideal number of children. In contrast, the share of women working outside of agriculture is much less negatively correlated with fertility ideals (Panel A, where the corresponding coefficient estimate is -0.26), and the relationship between the share of women working for pay is *positive* in SSA: a 10 percentage point increase in the share of women working for pay in a province is associated with an increase of 0.24 children in women's stated fertility ideals on average (Panel B). Both of these relationships are also flat outside of SSA.

In Panel D, I then test whether the share of women working for a wage affects the SES-desired fertility gradient differential in SSA. The figure shows that the SSA wealth gradient in desired fertility is much flatter in provinces with above-median wage work prevalence. Testing for equality of slopes across the SSA and non-SSA samples yields a p-value of 0.000 in the below-median wage work prevalence group while one can no longer reject the null of equal gradients in the above-median group. The results of

these tests can be found in Appendix Table A4.

Fact 5. Within SSA, increases in wage work prevalence over time within provinces are associated with a flatter wealth gradient in desired fertility

Finally, I zoom in on within-SSA variation by restricting my sample to the set of SSA countries for which at least two repeated DHS cross-sections were collected, province boundary changes over time are harmonized by IPUMS, and all relevant outcomes of interest are included in the surveys. This allows me to observe how changes in the socioeconomic gradient in desired fertility correlate with changes in the share of women working for a wage over time, controlling for province and time fixed effects and a rich set of individual and province-level covariates.

Table 1 reports the results of regressing women's ideal number of children on the wealth index and a rich set of covariates. At the individual level, I control for age and religious group fixed effects, an index measuring respondents' reported exposure to family planning messages and urban/rural residence. The index of exposure to family planning messages is constructed by applying Principal Components Analysis on a set of variables capturing different media outlets (radio, TV, newspapers, brochures and post) to each country-year survey separately. I include this in the set of control variables because evidence from other countries has shown that fertility preferences can respond to media campaigns promoting the benefits of small families (e.g. Jensen and Oster (2009) in India and La Ferrara et al. (2012) in Brazil), and the proliferation of such campaigns may vary across provinces and over time in a way that correlates with the slope of socioeconomic gradients in desired fertility. All specifications also control for the following time-varying province-level covariates: the share of married men in polygynous unions and median years of male education (both of which are constructed from the men's surveys and merged with the women's sample on province-survey year), median years of female education, and under-5 child mortality rates (constructed from the birth histories collected by the DHS for all female respondents).

Columns (2), (4) and (6) display the results of adding the share of women working for a wage and its interaction with the wealth index to the set of explanatory variables. Columns (3) and (4) control for province fixed effects and columns (5) and (6) control for province and 5-year time period fixed effects. My preferred specifications are thus those used to produce columns (3)-(6), since those control for all unobservables fixed at the province-level over time that are likely to predict fertility ideals (such as cultural practices and social pressure to adhere to group norms) and may also correlate with wealth and women's jobs. The time fixed effects account for common trends in fertility norms over time across SSA.

The strongly significant and positive coefficient estimate on the interaction of wealth with female wage work prevalence shown in the last row of columns (2), (4) and (6) indicates a strong dampening effect of women's salaried employment on the slope of the gradient. Importantly, the addition of province fixed effects to the specification

from column (3) reduces the size of both the coefficient on the main term (share of female wage work) and its interaction with wealth, suggesting that, in addition to all the time-varying covariates already included in the regression, province-level unobservables correlate with women's stated fertility ideals and how those vary across the wealth distribution.

Appendix Table A5 shows the results from applying the same set of specifications on only the younger cohorts in the sample, i.e. women aged 15-24 at the time of each survey. The coefficient estimates on the wealth index in columns (1), (3) and (5) are smaller in magnitude: for instance, the estimate in column (3) is -0.008 on the sample of younger women compared to -0.011 in the full sample (Table 1), suggesting that wealth does not predict younger women's fertility preferences as strongly as that of older cohorts. On the other hand, the estimate on the main term of wage work prevalence is more negative for poorer cohorts (-1.061 compared to -0.703) and the interaction is more strongly positive (0.026 compared to 0.016). Assuming that young women's fertility decisions are the most closely intertwined with their employment options (as they face the decision of whether and when to start childbearing), this increases confidence that the estimates in Table 1 pick up a meaningful correlation between women's desired fertility, their ranking in the wealth distribution, and the type of jobs available to them.

Of course, those estimates should be treated with caution, as this specification does not account for all possible omitted variables. Nonetheless, the overarching takeaway from the results shown in Table 1 is that wage/salaried job opportunities mediate the sensitivity of women's desired fertility to socioeconomic status within SSA provinces as they correlate with changes in this gradient over time.

4 Discussion

This paper uses micro data on desired fertility across the wealth distribution to examine the role of demand for children in SSA's exceptionally high fertility rates. I find that fertility preferences are significantly higher on the subcontinent and document a three-way link between desired fertility, wealth and the type of economic activities that women engage in. Due to their correlational nature, these findings should be treated with caution; nevertheless, they motivate the need for further research to improving our understanding of the underlying economic determinants of the fertility transition in SSA, a region that will soon become the world's largest continent population-wise, and currently hosts the largest share of people living in poverty.

These findings open up a number of other avenues for future research. A natural follow-up study would attempt to reconcile the fact that the income-desired fertility gradient is steeper in sub-Saharan Africa with the small but growing literature on gender gaps in fertility in sub-Saharan Africa. These have been documented both in terms of realised (Field et al. 2016) and desired fertility (Doepke and Tertilt 2018) at the coun-

try level. Accounting for differences in desired fertility across spouses may allow us to better understand the pace of fertility transitions across and within SSA countries. Examining differences in desired fertility across husbands and wives across the SES distribution reveals that not only do men typically report a higher ideal number of children than their wives on average, but poorer married women in SSA are disproportionately more likely to report that their husband desires more children than them (see Appendix Figure A11b). If poorer women's ideal number of children is shaped at least in part by the will to meet their husbands' own fertility aspirations, it would be fundamental to understand why men's socioeconomic gradient in desired fertility is steeper than women's in SSA. Gender dynamics in the balance of intra-household decision-making power may play an important role in fertility decisions, as recent evidence suggests (Ashraf et al. 2014; Ashraf et al. 2022).[7] How these facts vary along the wealth distribution of couples, however, remains an open question.

Finally, growing body of research also suggests that norms play an important role in shaping fertility preferences, and as such, can influence the pace of fertility decline in regions undergoing a demographic transition (Fernández and Fogli 2009; Jensen and Oster 2009; La Ferrara et al. 2012; de Silva and Tenreyro 2020; Spolaore and Wacziarg 2021; Rossi and Xiao 2021). This study's focus on socioeconomic gradients in desired fertility raises questions about a potential tension between economic incentives and adherence to social norms. Identifying and quantifying this trade-off, and how it varies across cultural groups and along the wealth distribution, constitutes another exciting direction for future work.

[7]The role of spousal bargaining power in fertility has been documented in other settings. In Malaysia, Rasul (2008) finds that the outcome of spousal bargaining over fertility decisions depends on the distribution of bargaining power in the couple. In a richer country context, Doepke and Kindermann (2019) account for the distribution of childcare duties between mothers and fathers.

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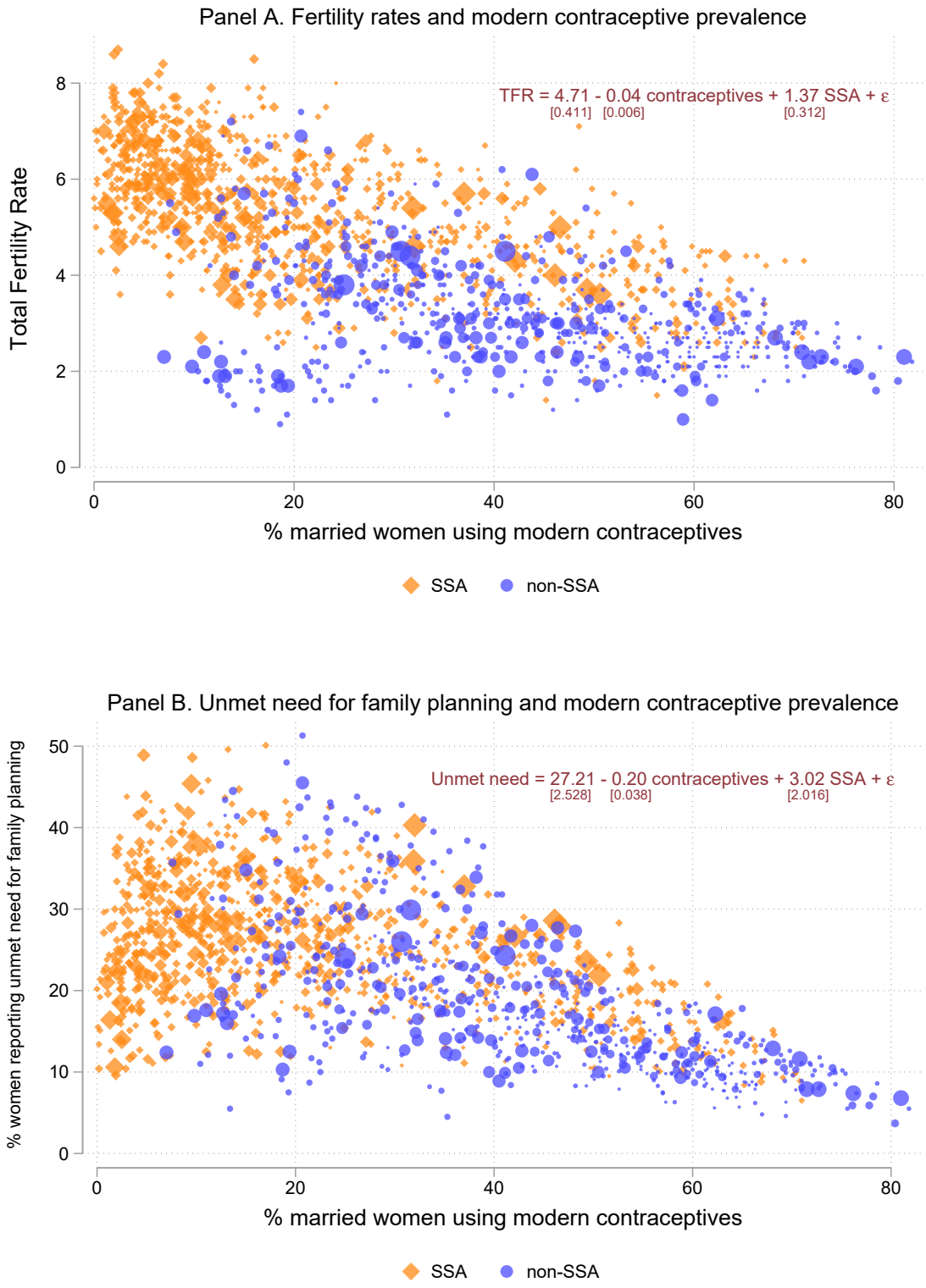
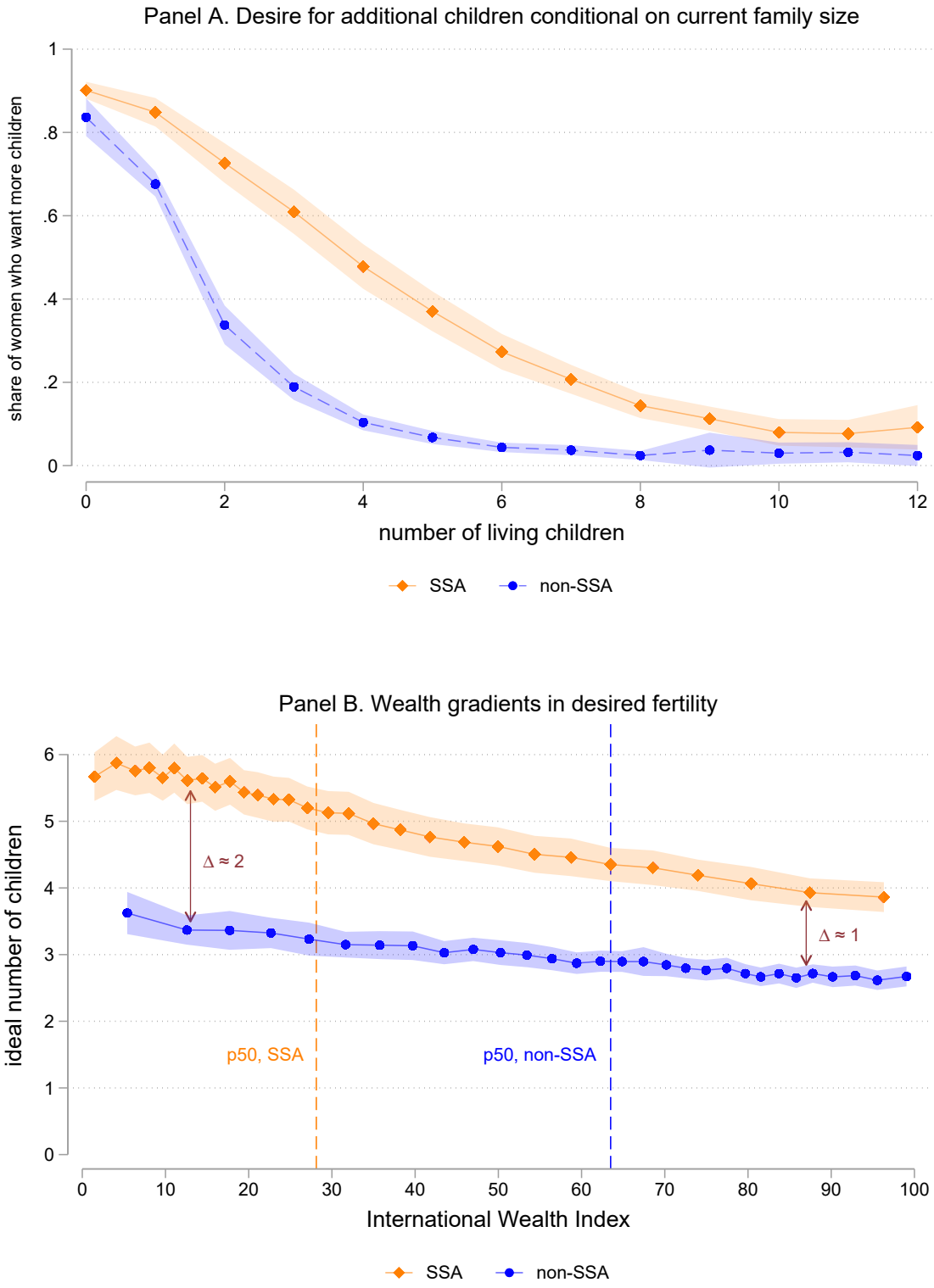
Figure 1: Realised fertility gap conditional on modern contraceptive prevalence.



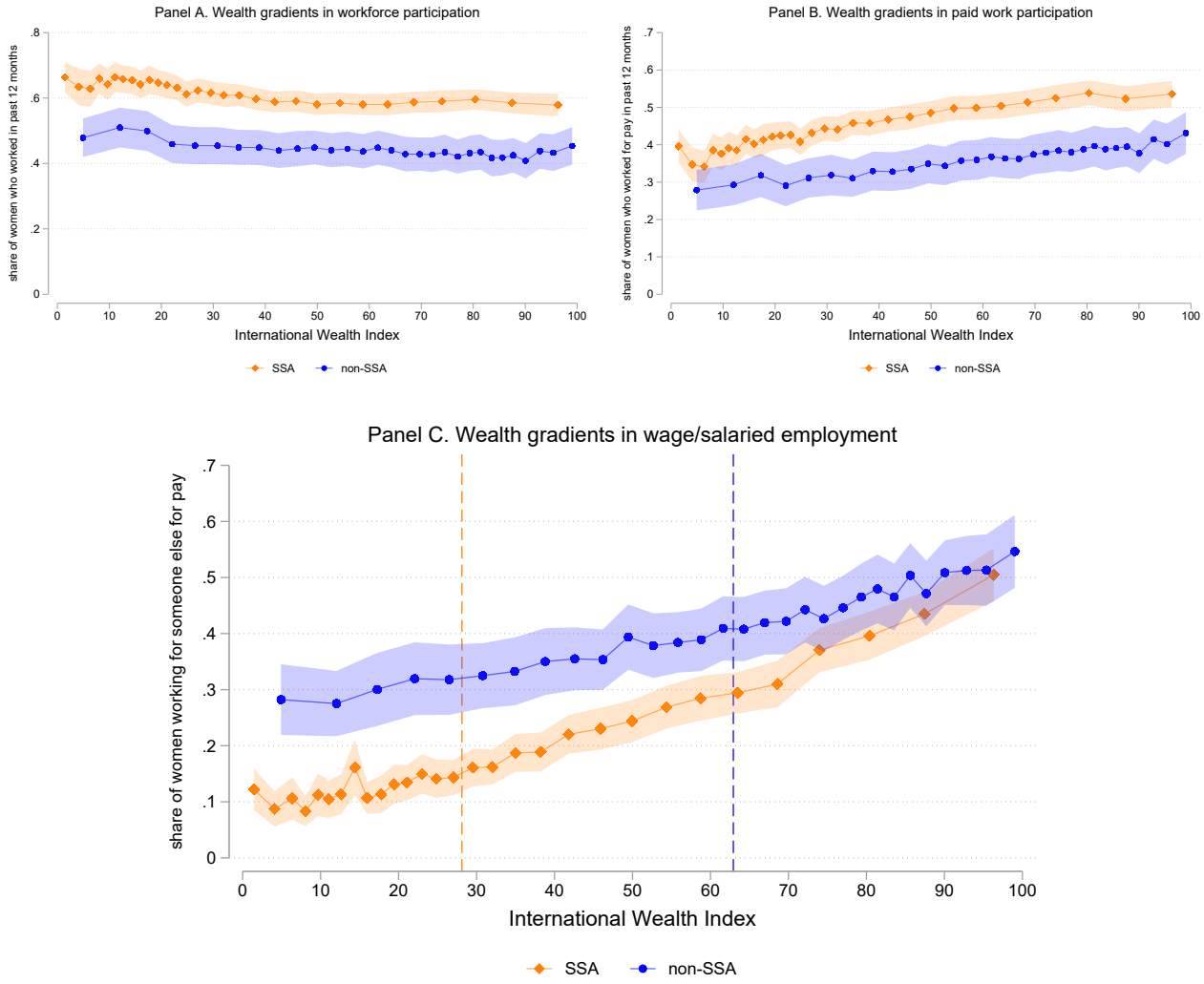
Source: Demographic and Health Surveys (DHS) Statcompiler [2022]. 1,596 province-survey aggregates, covering 37 SSA and 26 non-SSA low- and middle-income countries. Each country weighs equally into the linear fit estimation. **Panel A**: the outcome is the percentage of currently married women using at least one modern method of contraception. **Panel B**: Percent of women classified as having unmet need for family planning methods according to the revised method designed by Bradley, Croft, Fishel and Westoff (2012). See https://dhsprogram.com/topics/upload/Figure-2-Revised-unmet-need-definition-flowchart-Bradley-et-al-AS25.pdf for details on how this measure is constructed from 15 different survey questions.

Figure 2: Higher desired fertility in SSA.



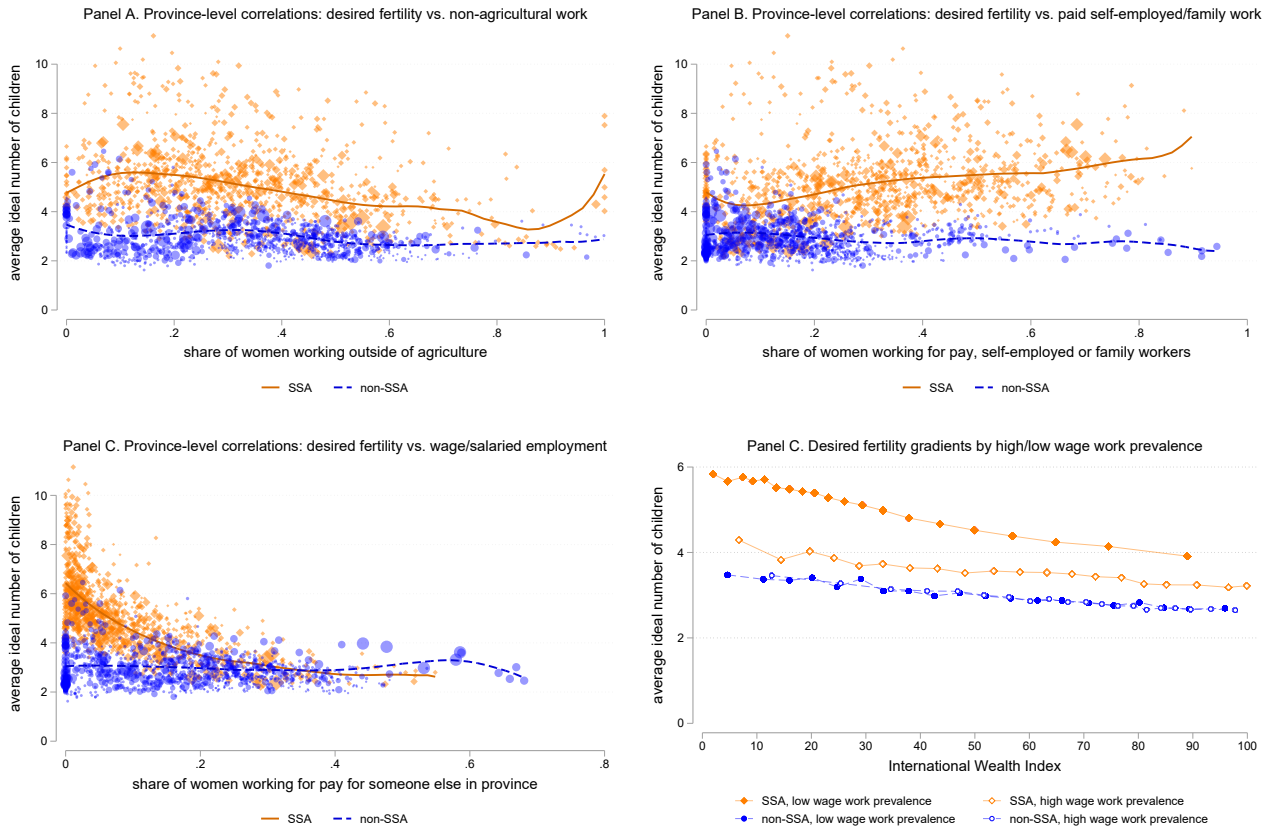
Source: Demographic and Health Surveys (DHS). Panel A: The x-axis plots women's number of living children at the time of the survey. The y-axis plots the share of women responding "yes" to the question "Do you want to have another child?". Average shares and 95% confidence bands by SSA x number of children alive group. These are constructed from DHS individual data (women's samples) covering 35 SSA countries (in orange) and 31 non-SSA countries (in blue). The gap between the two curves indicates that women in SSA are significantly more likely to report wanting an additional child when they have between 0 and 10 living children. Panel B: The x-axis plots the international wealth index (IWI) constructed from all household-level DHS data by Smits and Steendijk (2015). Observations are grouped into equal-size wealth bins separately for SSA and non-SSA, depicted by diamond and circular markers respectively. Vertical lines show the median value of the international wealth index in each sample of countries. 95% confidence intervals capture dispersion across countries in group means within each region (SSA vs. non-SSA). Equality of slopes tests are rejected at the 1% significance level (see Appendix Table A2).

Figure 3



Source: Demographic and Health Surveys (DHS). The x-axis plots the International Wealth Index constructed from all household-level DHS data by Smits and Steendijk (2015). Observations are grouped into equal-size wealth bins separately for SSA and non-SSA, depicted by diamond and circular markers respectively. Panel (a): share of 15-49-year-old women who engaged in some form of economic activity over the past 12 months. Panel (b): share of 15-49-year-old women who engaged in paid work over the past 12 months. Panel (c): the y-axis plots the share of women whose main occupation is wage/salaried work. The shaded areas represent 95% confidence bands around plotted means. Appendix Table A3 shows that the null hypothesis of equality of slopes across the SSA and non-SSA samples can only be rejected for wage/salaried work (Panel C).

Figure 4



Source: Demographic and Health Surveys (DHS). Panel A, B, and C plot, on the y-axis the average ideal number of children in the province (the sub-national unit at which the DHS is representative) for 2,150 province-survey units. Aggregates are constructed from the same micro data as Figures 1-3. Panels A, B, C also include smoothed values of local polynomial regression estimates. Each country is weighed equally in each local polynomial estimation (for SSA and non-SSA respectively). Panel A: the x-axis is share of 15-49 year-old women whose main occupation in the past 12 months was outside of agriculture. Panel B: the x-axis is the share of 15-49 year-old women who worked for pay, for themselves or the family business/farm, in the past 12 months. Panel C: the y-axis plots the share of women whose main occupation is wage/salaried work. Panel D: The x-axis plots the International Wealth Index constructed from all household-level DHS data by Smits and Steendijk (2015). Observations are grouped into equal-size wealth bins separately for SSA and non-SSA *and* whether the province is above or below the median female wage/salaried employment rate in the pooled sample. The y-axis plots average fertility ideals for each wealth bin within each group. Testing for equality of slopes across the SSA and non-SSA samples yields a p-value of 0.000 in the below-median wage work prevalence group, while one can no longer reject the null of equal gradients in the above-median group (see Appendix Table A4.)

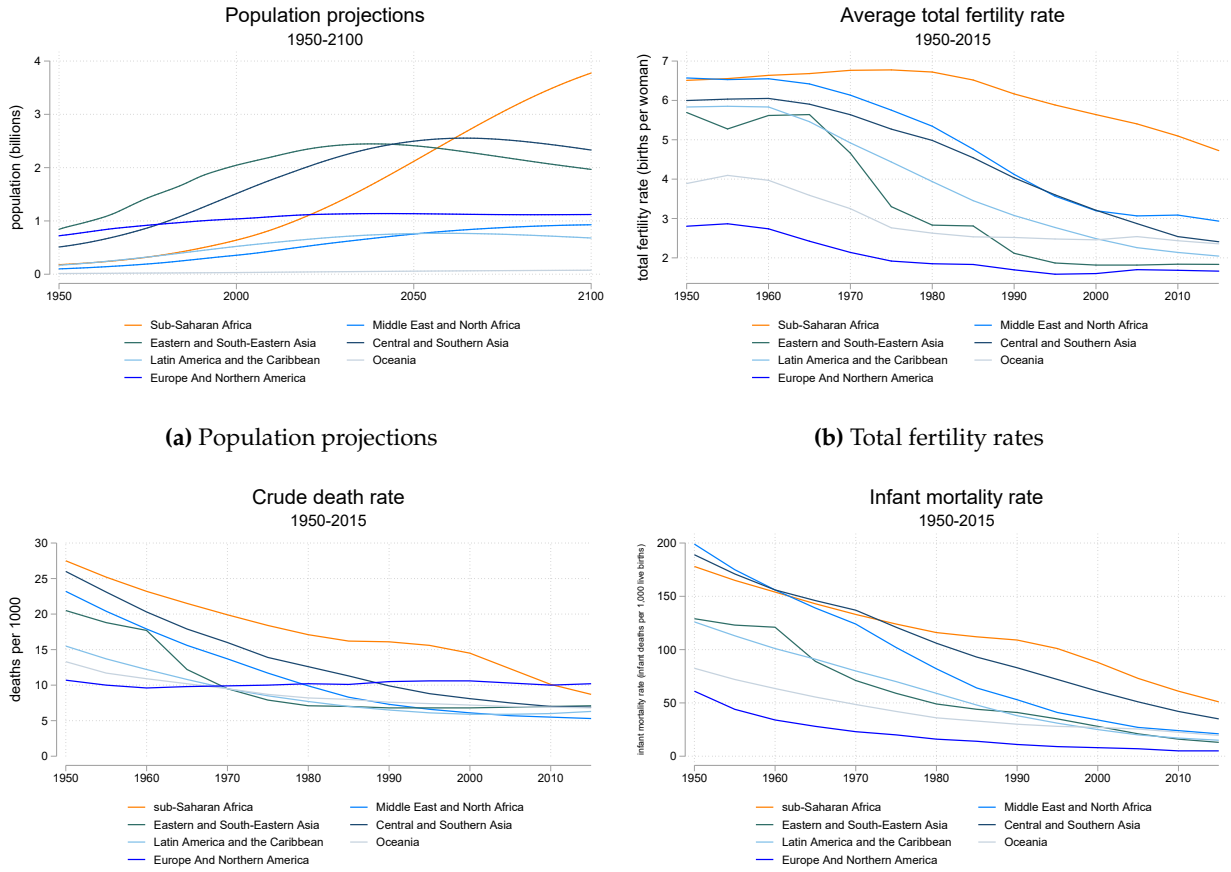
Table 1: Within-SSA associations between desired fertility gradients and province-level wage work prevalence.

	Ideal number of children					
	(1)	(2)	(3)	(4)	(5)	(6)
wealth index	-0.012***	-0.017***	-0.011***	-0.014***	-0.011***	-0.014***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]
% female wage work in province		-3.332***		-0.703***		-0.889***
		[0.434]		[0.248]		[0.231]
wealth X % female wage work		0.034***		0.016***		0.016***
		[0.005]		[0.003]		[0.003]
Outcome mean	5.052	5.052	5.052	5.052	5.052	5.052
R-squared	0.28	0.29	0.38	0.38	0.38	0.39
Observations	900269	900269	900269	900269	900269	900269
Controls	X	X	X	X	X	X
Age FE	X	X	X	X	X	X
Religious group FE	X	X	X	X	X	X
Province FE			X	X	X	X
Time FE (5-year bins)					X	X

Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country-province level. The sample covers 178 provinces with stable boundaries over time (harmonized by IPUMS-DHS) across 25 SSA countries. Provinces are observed in 2, 3, 4 or 5 DHS waves (14.4% have only two waves, 20.7% have 3, 28.9% have 4 and 36% have 5). Observations are re-weighted so that each country carries equal weight in the sample. All specifications control for the individual respondent's exposure to family planning messages and urban/rural residence, as well as time-varying province-level controls: share of married men in polygynous unions, median years of male education (constructed from the men's surveys), median years of female education, and under-5 child mortality rates (constructed from the birth histories collected by the DHS for all female respondents).

Appendix: Additional Tables and Figures

Appendix Figure A1. Global Demographic Trends and Projections.



(a) Population projections

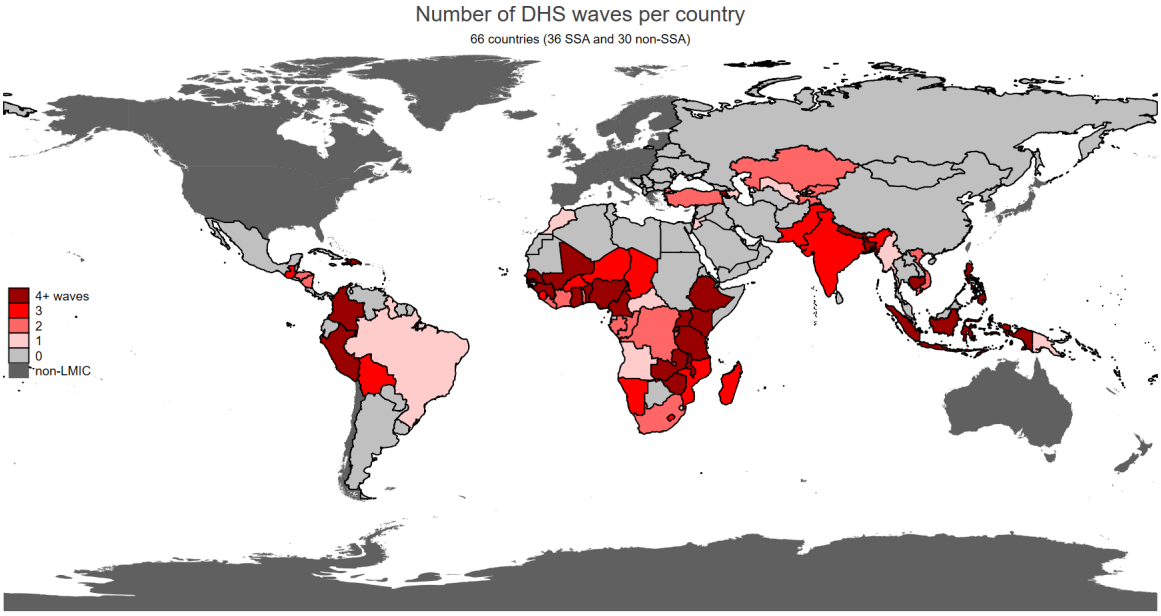
(b) Total fertility rates

(c) Crude death rates

(d) Infant mortality rates

Source: UN World Population Prospects, 2019. Regions correspond to the SDG regions provided in the source data. The orange curve depicts the fertility decline in sub-Saharan Africa, which is characterized by a later onset and slower pace than that of other low-and middle-income regions.

Appendix Figure A2. Sample country coverage

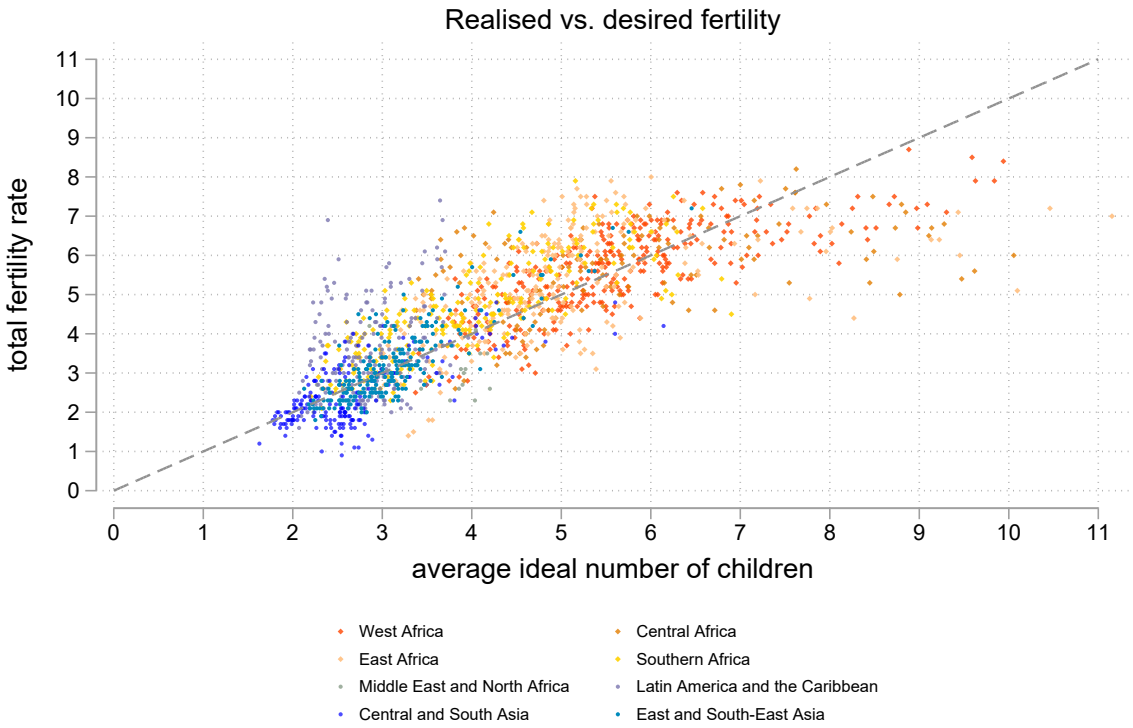


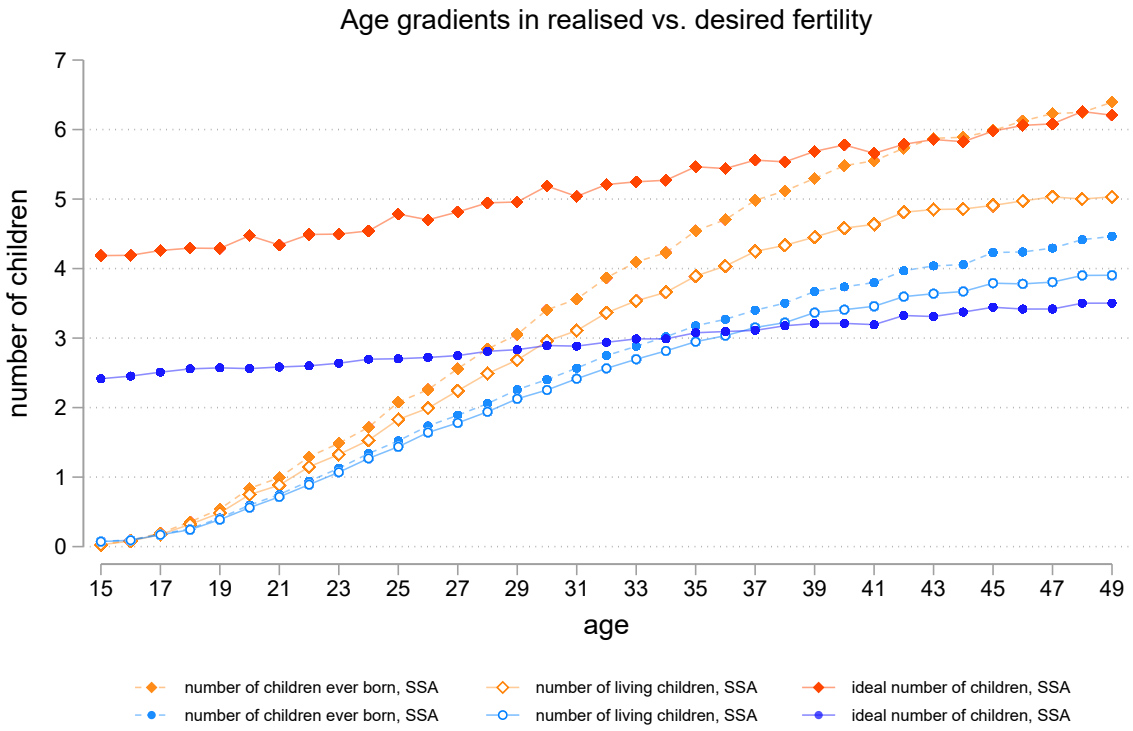
Appendix Table A1. Desire for more children conditional on current family size: the SSA dummy.

	(1) Wants more children
number of living children	-0.169***
	[0.005]
number of living children^2	0.009***
	[0.001]
sub-Saharan Africa	0.193***
	[0.021]
Outcome mean, non-SSA	0.194
R-squared	0.78
Observations	2433

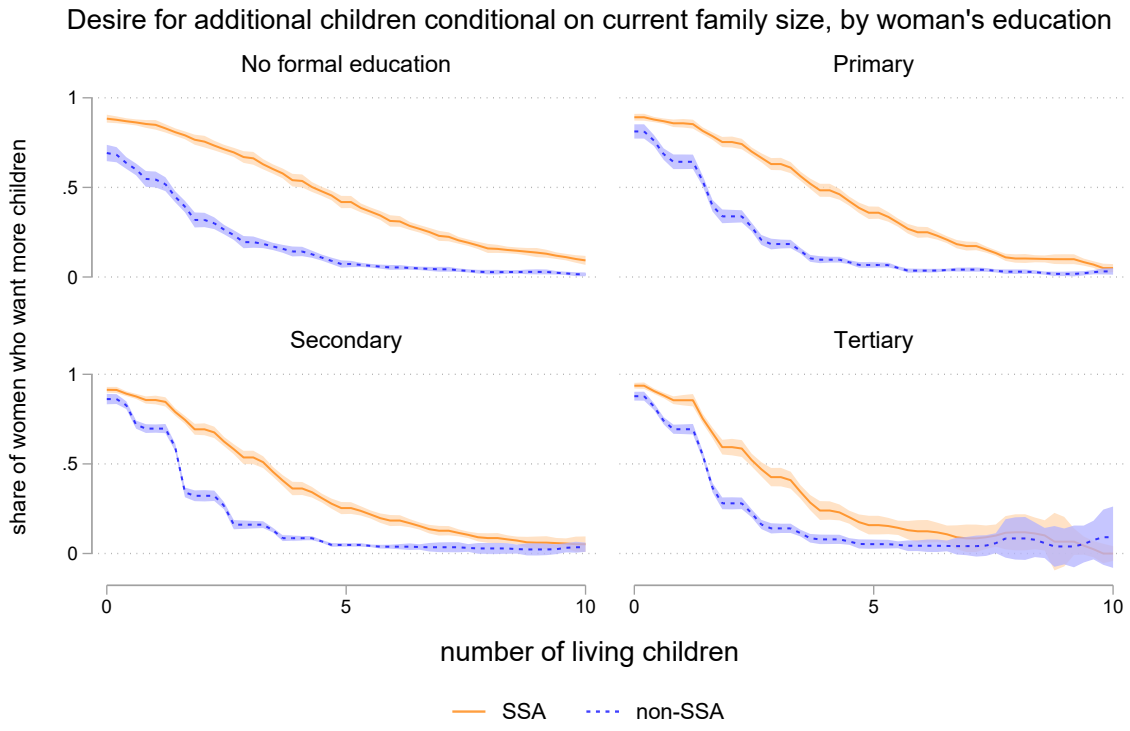
Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country level. Each observation is a country-specific average for each number of children alive value ranging from 0 to 12. The sample covers 36 countries from SSA and 30 from outside SSA.

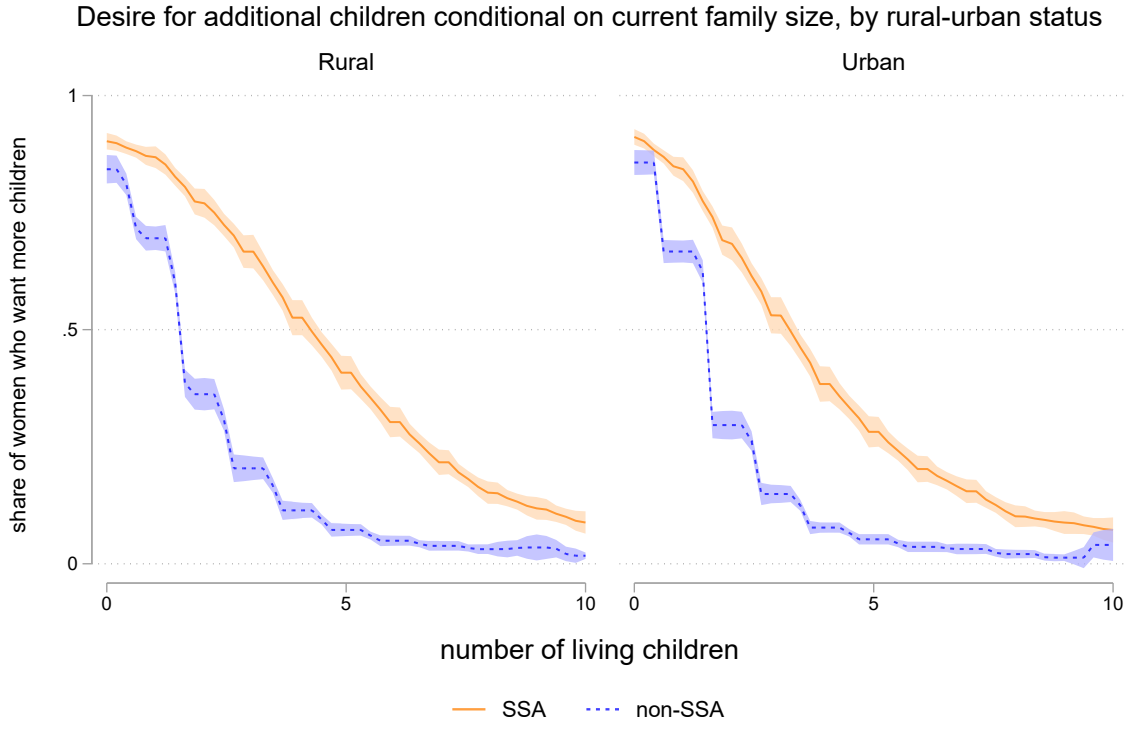
Appendix Figure A3. Realised fertility vs. fertility ideals.



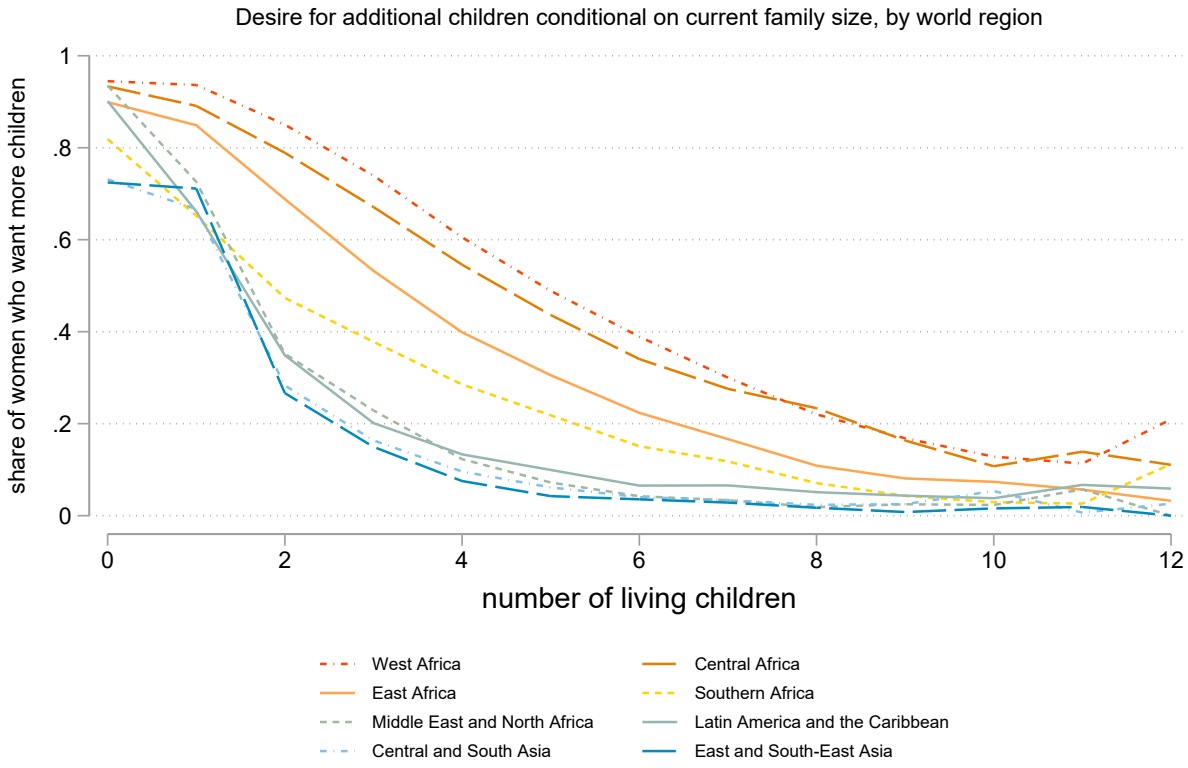


Appendix Figure A4.

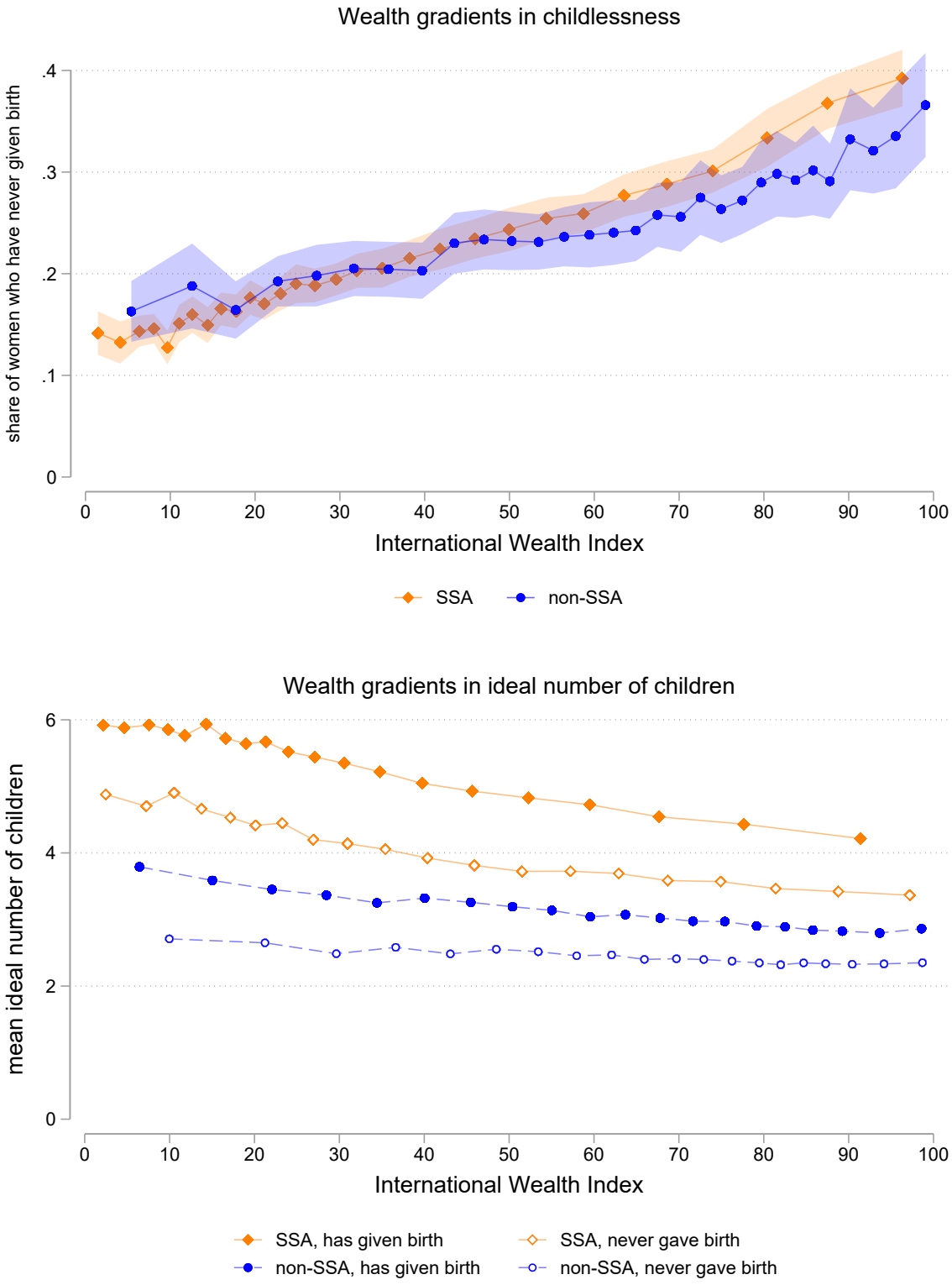




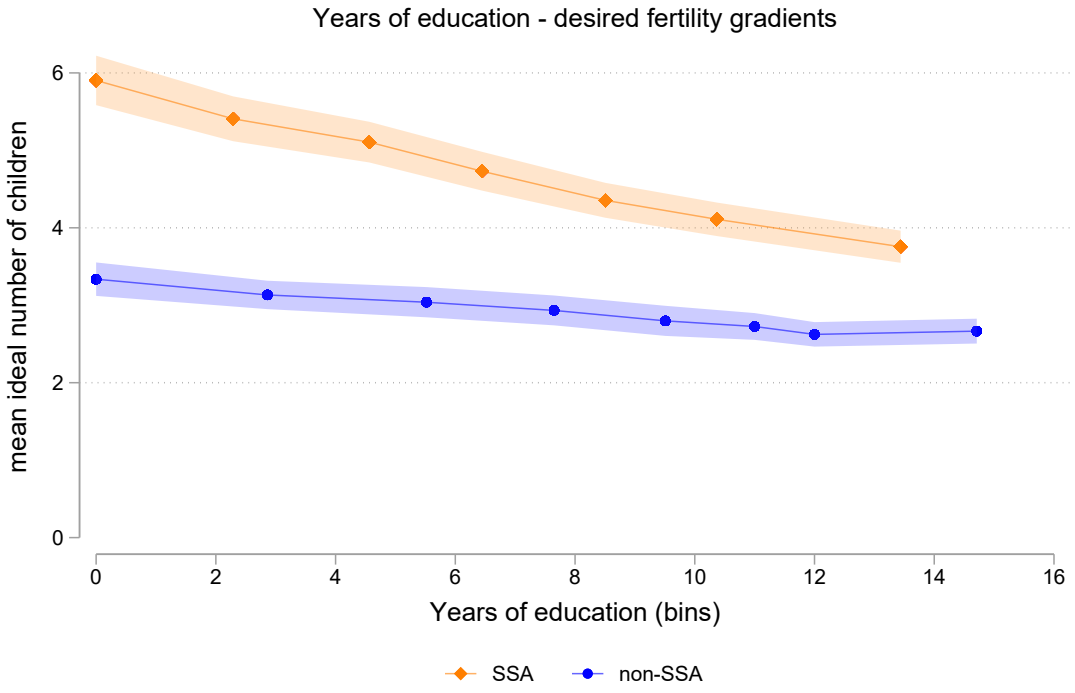
Appendix Figure A5.



Appendix Figure A6. Wealth gradients by fertility status.



Appendix Figure A7. Education-desired fertility gradients.

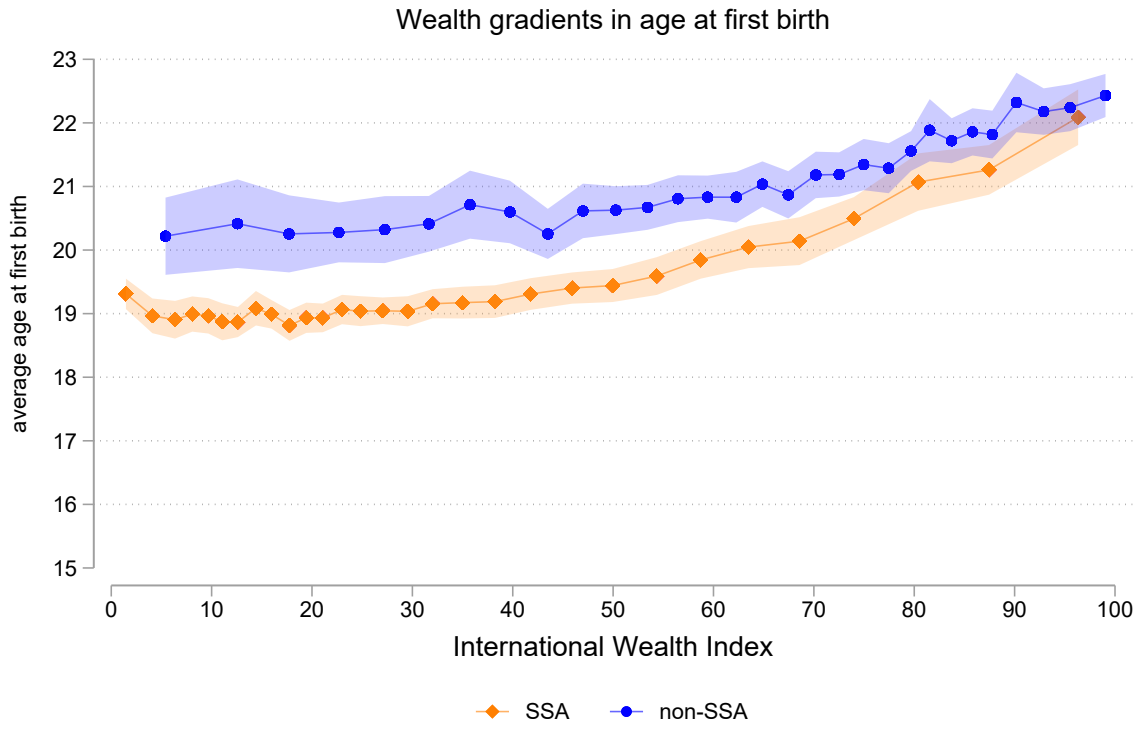


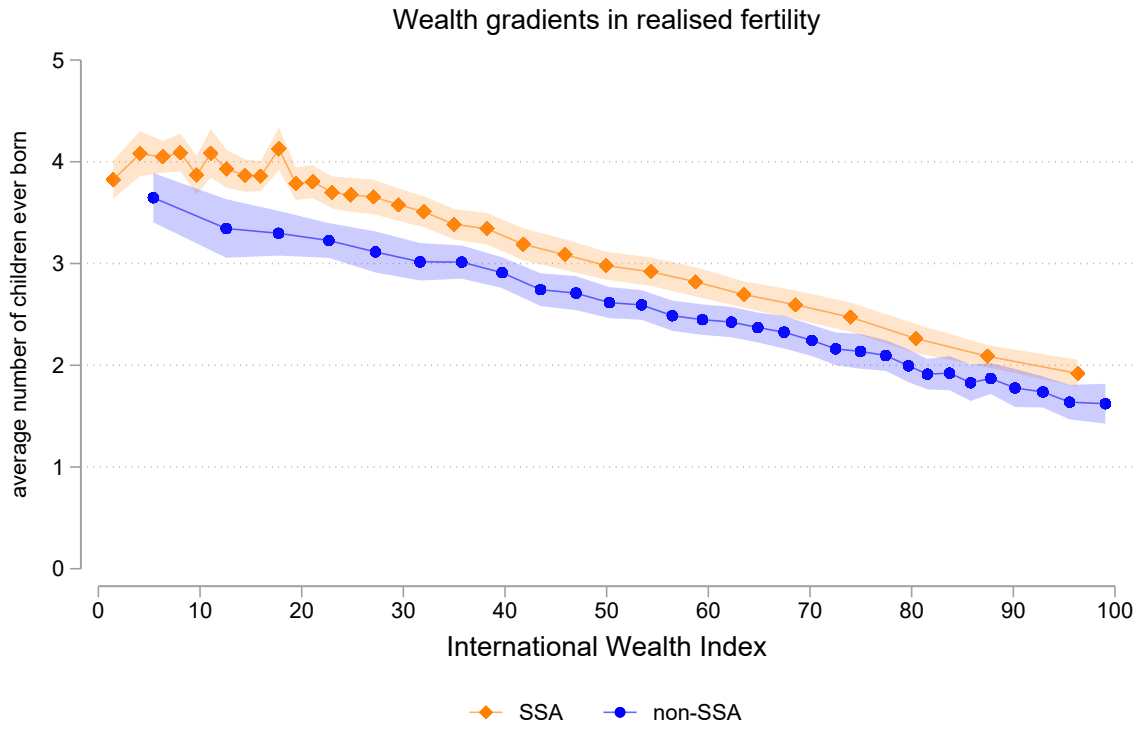
Appendix Table A2. Wealth gradients in desired fertility: slope differentials.

	Ideal number of children			
	All	Childless women	Rural	Urban
	(1)	(2)	(3)	(4)
SSA	2.363***	2.073***	2.400***	2.086***
	[0.279]	[0.261]	[0.276]	[0.259]
wealth index	-0.010***	-0.004***	-0.008***	-0.006***
	[0.001]	[0.001]	[0.001]	[0.001]
SSA x wealth	-0.014***	-0.013***	-0.010***	-0.009***
	[0.002]	[0.002]	[0.002]	[0.002]
Outcome mean, non-SSA	2.864	2.389	3.047	2.674
R-squared	0.54	0.46	0.48	0.48
p-value: slope[SSA]=slope[non-SSA]	0.000	0.000	0.000	0.000
Observations	5670	3792	3758	3793

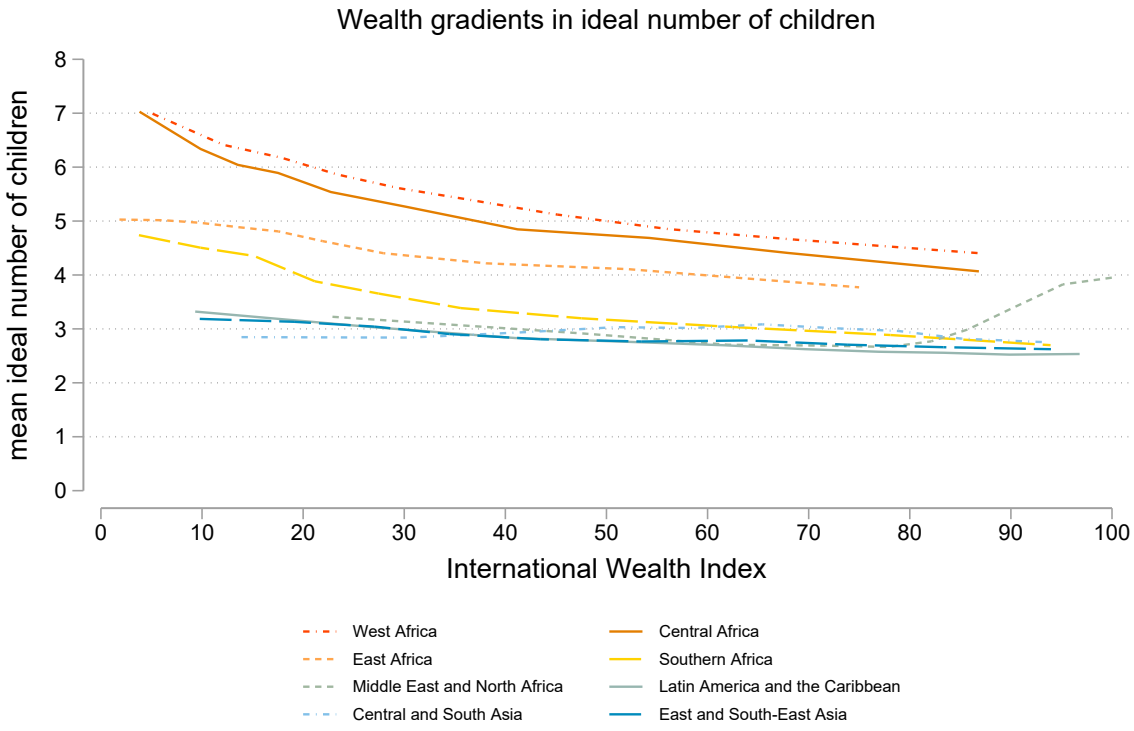
Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country level. Each observation is a country-year-wealth bin. In column (1), wealth bins are 30 equal sized wealth bins for each set of countries (SSA vs. non-SSA), re-weighted by age. In column (2), each pooled sample (SSA vs. non-SSA) is split into 20 equal sized wealth bins for women who never gave birth and women who gave birth to at least one child separately for each set of countries, re-weighted by age. Column (2) shows the output of the same specification as column (1) for childless women only. Columns (3) and (4) show gradient differentials for rural and urban women separately (splitting each sample into 20 equal sized wealth bins, re-weighted by age). P-values at the bottom of the table report results of equality of slopes Chow tests across the two samples. 37 SSA countries and 29 non-SSA countries.

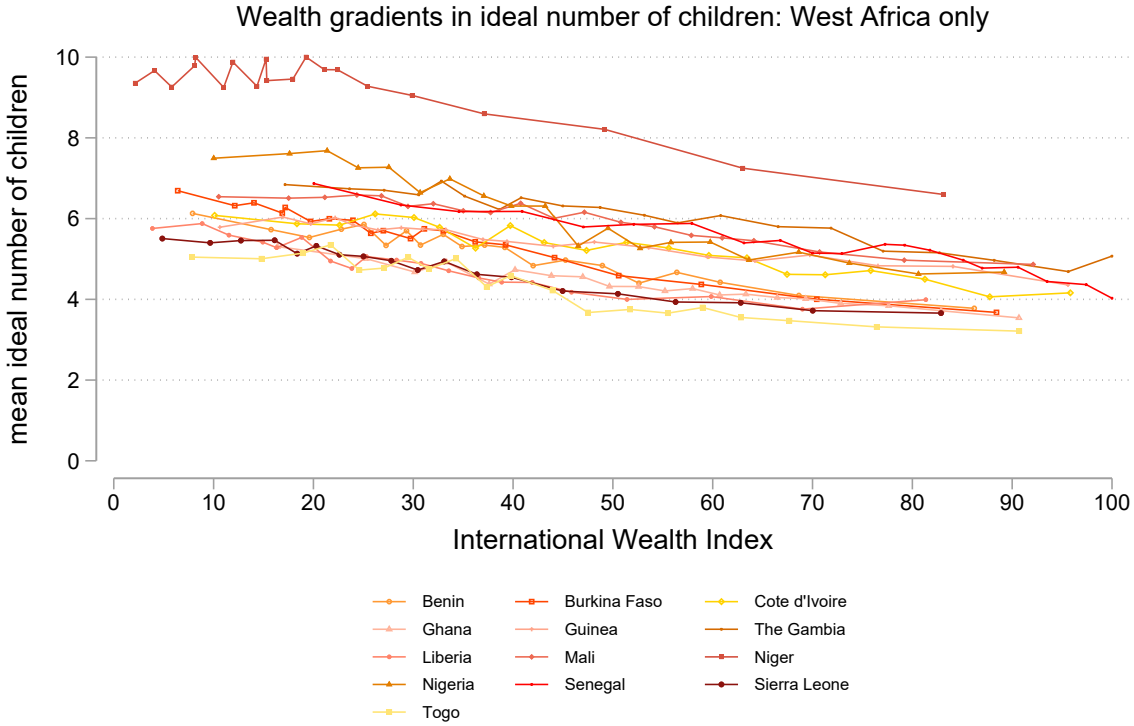
Appendix Figure A8. Wealth gradients in age at first birth and total number of children ever born.





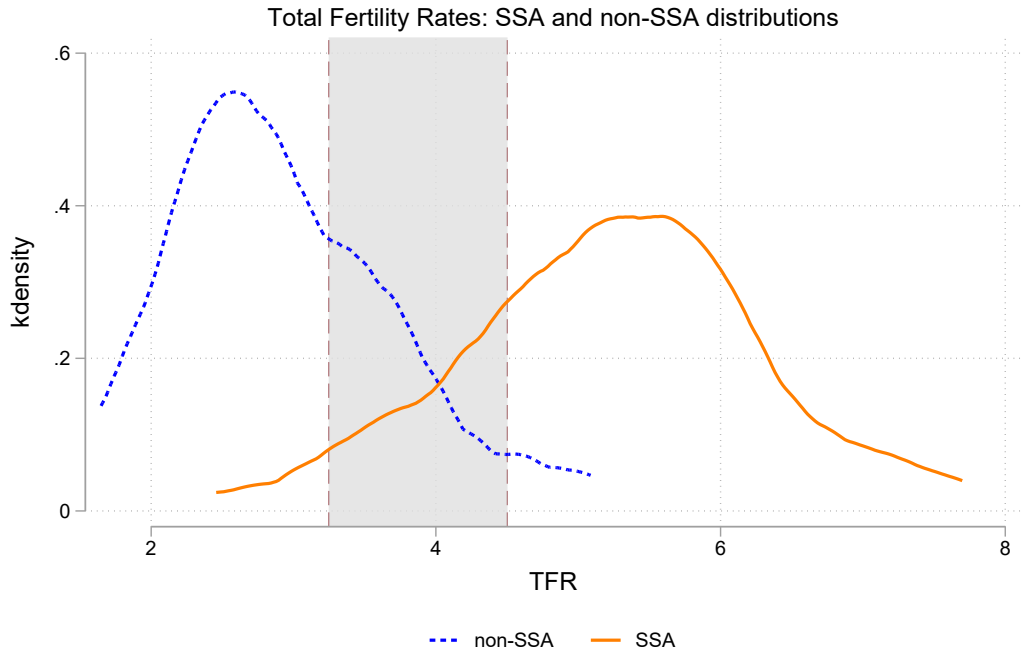
Appendix Figure A9. Wealth gradients in ideal number of children, by region and selected countries.



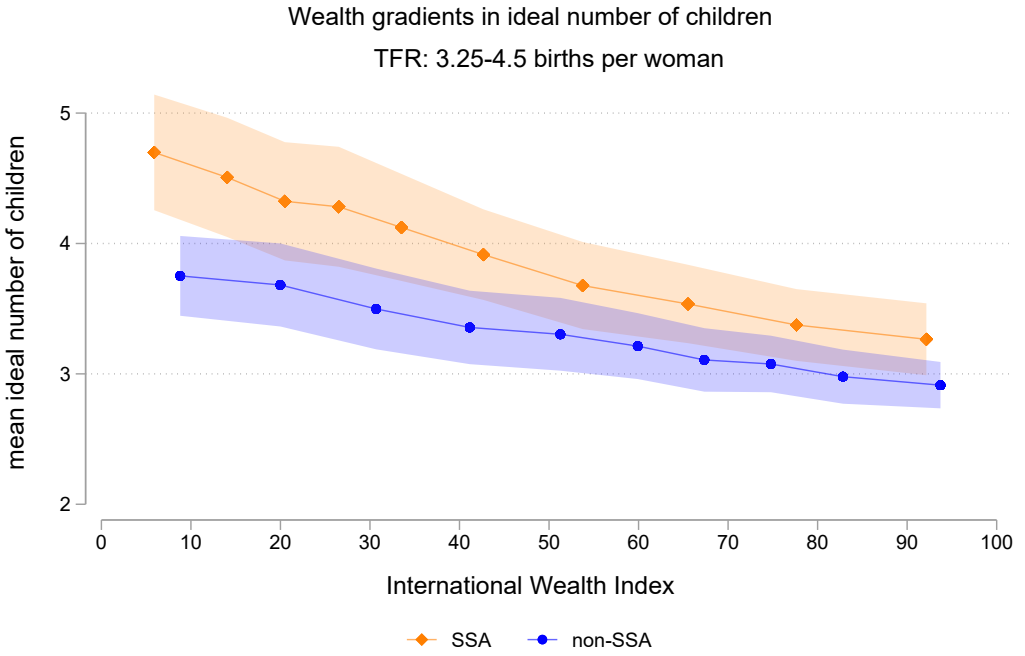


Appendix Figure A10.
Wealth-desired fertility gradients, restricting the sample to countries with similar TFR levels.

Appendix Figure A10a.



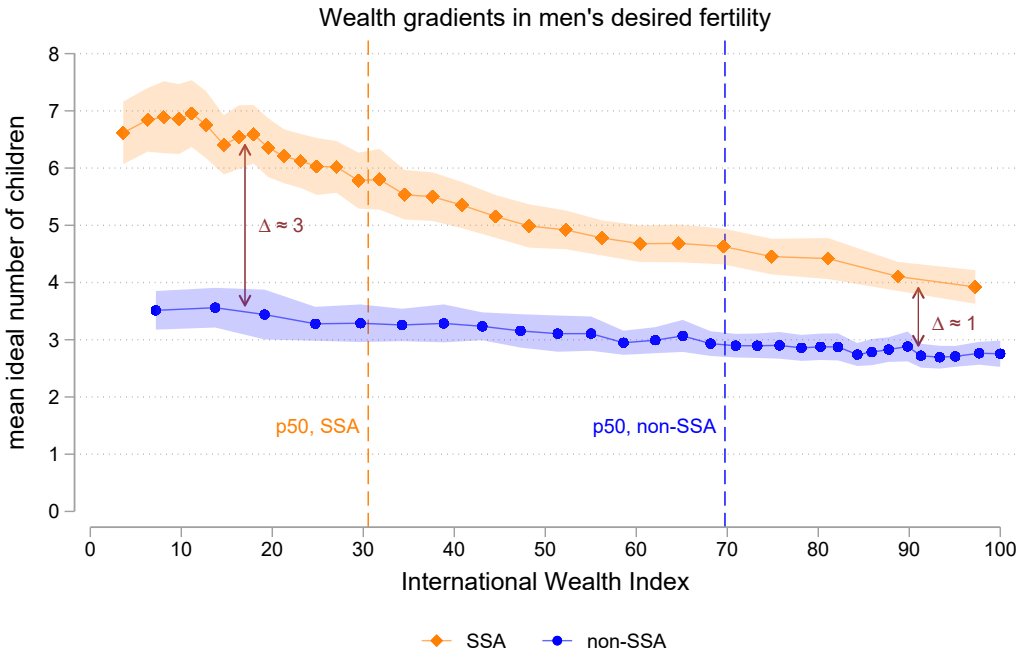
Appendix Figure A10b.



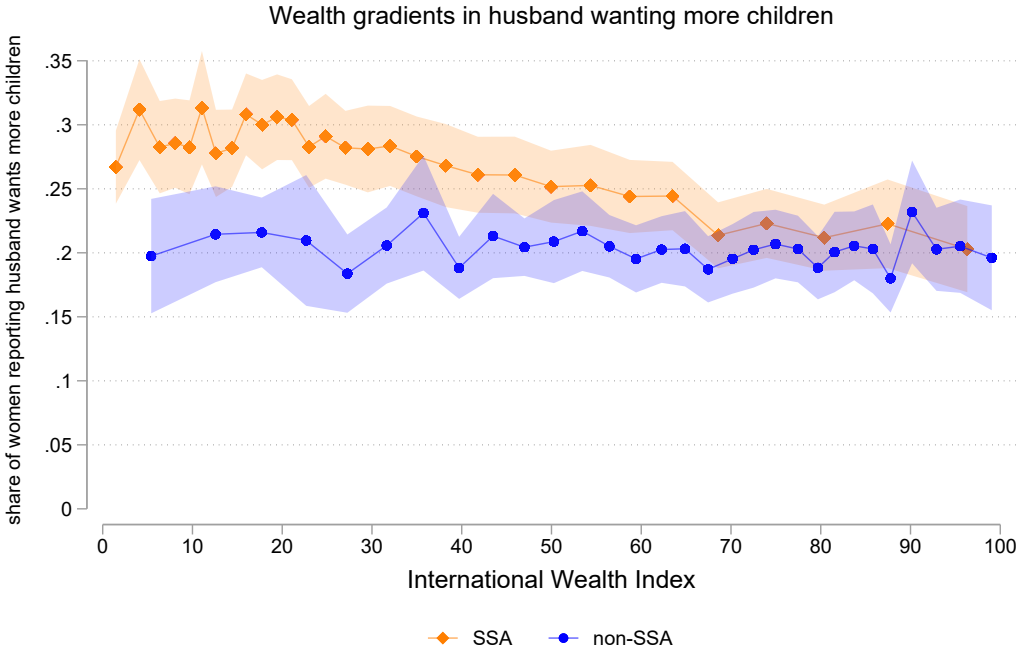
Notes: Figure A10a plots the kernel density distributions of Total Fertility Rates, at the country-year level for the SSA and non-SSA samples separately. Figure A10b shows socioeconomic gradients in desired fertility for the sub-sample corresponding to the gray shaded area in Figure A10a. This is a sub-set of countries for which the TFR in SSA overlaps closely with that of the non-SSA sample, but where the TFR is also much lower than the SSA median, mean and mode. TFR ranging from 3.25 to 4.5 births per woman. Each country is weighted equally in each group (SSA-wealth bin) mean. The null hypothesis of equality of slopes across SSA and non-SSA is still rejected ($p<0.02$). SSA countries: Eswatini (2006), Ethiopia (2016), Gabon (2012), Ghana (2008, 2014), Kenya (2014), Lesotho (2004, 2010), Malawi (2016), Namibia (2000, 2006, 2013), Rwanda (2014), Sierra Leone (2019), Zimbabwe (1994, 1999, 2005, 2010, 2015). TFR distribution, SSA: mean=3.95, min=3.30, max=4.46. Non-SSA countries: Bolivia (1998, 2003, 2008), Cambodia (2000), Haiti (2000, 2005, 2012), Honduras (2005), India (1999), Nicaragua (1998), Pakistan (2006, 2012, 2017), Papua New Guinea (2018), Philippines (1998, 2003, 2008), Tajikistan (2012, 2017), Timor-Leste (2016), Uzbekistan (1996). TFR distribution, non-SSA: mean=3.69, min=3.288, max=4.344.

Appendix Figure A11. Gender differences in wealth-desired fertility gradients.

Appendix Figure A11a. Wealth-desired fertility gradients: men's sample.



Appendix Figure A11b. Wealth gradients in within-couple differences in desired fertility.

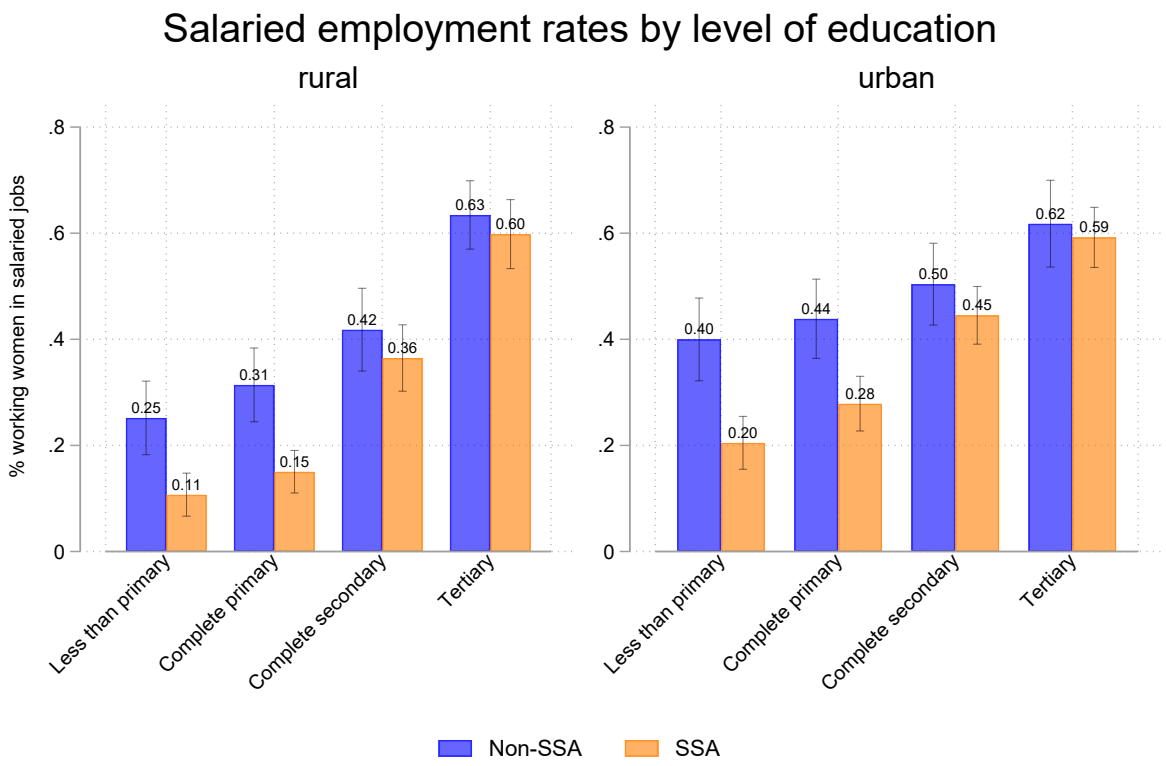


Appendix Table A3. Wealth gradients in women's employment status and type of work.

	Share of women who:		
	Did any work (paid or unpaid) in past 12 months	Worked for pay as their primary occupation	Share of working women who worked for someone else for pay
	(1)	(2)	(3)
SSA	0.171***	0.099*	-0.186***
	[0.053]	[0.051]	[0.054]
wealth index	-0.001	0.001***	0.003***
	[0.000]	[0.000]	[0.000]
SSA x wealth	-0.000	0.001	0.001***
	[0.001]	[0.001]	[0.000]
Outcome mean, non-SSA	0.474	0.384	0.382
R-squared	0.14	0.08	0.26
p-val.: slope[SSA]=slope[non-SSA]	0.629	0.275	0.008
Observations	5729	5729	5528

Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country level. Each observation is a country-year-wealth bin. There are 30 equal sized wealth bins for each set of countries (SSA vs. non-SSA), re-weighted by age. Each country is weighed equally in the binning and estimation. P-values at the bottom of the table report results of equality of slopes Chow tests across the two samples. 37 SSA countries and 29 non-SSA countries.

Appendix Figure A12. Female wage/salaried employment rates by rural-urban status and highest level of education.



Appendix Table A4. Wealth gradients in desired fertility, by high/low wage work prevalence.

	Ideal number of children	
	Below-median wage work prevalence (1)	Above-median wage work prevalence (2)
SSA	2.511***	1.089***
	[0.287]	[0.266]
wealth index	-0.008***	-0.010***
	[0.002]	[0.001]
SSA x wealth	-0.016***	-0.003
	[0.002]	[0.002]
Outcome mean, non-SSA	3.080	2.875
R-squared	0.53	0.37
p-value: slope[SSA]=slope[non-SSA]	0.000	0.192
Observations	3378	2319

Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country level. Each observation is a country-year-wealth bin. In column (1), wealth bins are 30 equal sized wealth bins for each set of countries (SSA vs. non-SSA), re-weighted by age. In column (2), each pooled sample (SSA vs. non-SSA) is split into 20 equal sized wealth bins for women who never gave birth and women who gave birth to at least one child separately for each set of countries, re-weighted by age. Column (2) shows the output of the same specification as column (1) for childless women only. Columns (1) and (2) show gradient differentials for rural and urban women separately (splitting each sample into 20 equal sized wealth bins, re-weighted by age). P-values at the bottom of the table report results of equality of slopes Chow tests across the two samples. 37 SSA countries and 29 non-SSA countries.

Appendix Table A5. Within-SSA associations between desired fertility gradients and province-level wage work prevalence, restricting the sample to women aged 15-24.

	Ideal number of children					
	(1)	(2)	(3)	(4)	(5)	(6)
wealth index	-0.009***	-0.015***	-0.008***	-0.014***	-0.009***	-0.014***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]
% female wage work in province		-3.884***		-1.061***		-1.256***
		[0.387]		[0.245]		[0.231]
wealth X % female wage work		0.041***		0.026***		0.026***
		[0.005]		[0.003]		[0.003]
Outcome mean	4.446	4.446	4.446	4.446	4.446	4.446
R-squared	0.26	0.27	0.38	0.38	0.38	0.38
Observations	371365	371365	371365	371365	371365	371365
Controls	X	X	X	X	X	X
Age FE	X	X	X	X	X	X
Religious group FE	X	X	X	X	X	X
Province FE			X	X	X	X
Time FE (5-year bins)					X	X

Note: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the country-province level. The sample covers 178 provinces with stable boundaries over time (harmonized by IPUMS-DHS) across 25 SSA countries. Provinces are observed in 2, 3, 4 or 5 DHS waves (14.4% have only two waves, 20.7% have 3, 28.9% have 4 and 36% have 5). Observations are re-weighted so that each country carries equal weight in the sample. All specifications control for the individual respondent's exposure to family planning messages and urban/rural residence, as well as time-varying province-level controls: share of married men in polygynous unions, median years of male education (constructed from the men's surveys), median years of female education, and under-5 child mortality rates (constructed from the birth histories collected by the DHS for all female respondents).