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The Fertility Impacts of Development Programs

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Abstract

This paper examines how women's fertility responds to increases in their earnings and household wealth, using six experiments conducted in Sub-Saharan Africa. Contrary to predictions that an increase in female earnings raises the opportunity cost of childbearing and that this will lower fertility, the findings show that an increase in the profits of female business-owners in Ethiopia and Togo results in them having more children. The findings also show a positive fertility response to increases in the value of household assets induced by land formalization programs in Benin and Ghana. These results are driven by women who are in most need of sons for support in old age or in the event of widowhood. The findings suggest that women's lack of long-term economic security is an important driver of fertility in Sub-Saharan Africa.

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1 Introduction

Fertility patterns are central to understanding economic development. Fertility in Sub-Saharan Africa (SSA) is the highest in the world, with an average of 4.6 births per woman in 2020 compared to 2.4 globally (World Bank, 2022b). Across the continent, fertility rates are declining more slowly than in other regions. A common concern among policymakers is that high fertility combined with reductions in infant mortality will increase child dependency ratios, which are associated with poor economic development, low living standards and low educational attainment (African Union, 2017). High fertility rates can also be detrimental for maternal and child health (Mahy, 2003; Stover and Ross, 2010).

This study examines how women's fertility responds to an increase in their earnings and household wealth. Rather than focusing on multi-pronged interventions that have a range of pathways, we focus on six experimental evaluations of business training and land titling interventions that were exclusively designed to, and succeeded in, increasing women's income or the value of assets in Benin, Ethiopia, Ghana, Rwanda and Togo (Ali et al., 2015; Campos et al., 2017; Goldstein et al., 2018; Alibhai et al., 2019; Agyei-Holmes et al., 2020; Bakhtiar et al., 2022).[1] Our secondary analysis of these impact evaluations examines the probability of female beneficiaries having a child (and the number of children they have) 12-72 months post-intervention and investigates underlying mechanisms using women's characteristics at baseline.

We find large positive and statistically significant effects on fertility. Women randomly assigned to receive a business training intervention were 22% more likely to have a child post-treatment in Ethiopia and twice as likely to have a child under five post-treatment in Togo. Within the land titling interventions, we find that women in treatment villages had 5% more children on average two years after demarcation in Benin, while in Ghana, the increase in children among the treatment group was 7.5% one year after demarcation. Moreover, these effects are not statistically different from later effects in second follow-up surveys, indicating that impacts constitute increases in cumulative fertility—or total number of children—and not merely a shortening of birth spacing—or change in timing of children.

Our results are inconsistent with either increases in women's bargaining power—allowing them to act on their fertility preferences—or with demand for more household labor to farm the newly-titled land driving the fertility effect. We find that fertility increases the most for women in poor households, suggesting that their demand for children may previously have been budget-constrained. However, women's fertility is unchanged if it is their husband's income that increases, rather than their own—indicating that our results are not reducible to a simple income effect at the household level. While we have this data only for one setting (Togo), a potential explanation for why women have more children only when their own income increases is that having a child is a form of personal investment to safeguard their long-term economic security. Indeed, we find that women without a son at baseline drive the observed fertility impacts across countries. This effect is even stronger for women whose husbands have sons from other relationships, constituting potential rivals for inheritance. In Ghana, we find the strongest fertility response among women whose husbands belong to an ethnic group in which wives are at greatest risk of dispossession upon their husbands'

[1] Importantly, these interventions did not include any content on women's agency and rights, focusing solely on skills and property rights certification.

death (Korang-Okrah and Haight, 2015). In Rwanda, where the land registration intervention formalized women's inheritance rights in the event of their husband's death, we find no positive fertility impacts.

Taken together, our results suggest that a key driver of fertility in Sub-Saharan Africa is women's use of childbearing as a strategy to ensure future access to land and income. Given the common age gap between spouses in Africa, widowhood is a likely eventuality that can be anticipated from a young age. In patrilineal contexts where prevailing norms exclude women from property ownership and inheritance, having a son who is entitled to inherit from his father can mitigate a woman's risk of housing and land dispossession upon her husband's death. The costs of this risk are significant: using data from Mali, Van de Walle (2013) shows that widows in Mali are worse off in a number of dimensions, even after they are absorbed into other households. Furthermore, in patrilocal contexts where the practice is for daughters but not sons to move away upon marriage, women are more likely to rely on their sons in old age than on their daughters. In particular, our study suggests how—in the face of weak inheritance rights and limited availability of formal pensions—women's demand for children results from their need for security in old age.

To the best of our knowledge, our study is the first to estimate the causal impact of an increase in women's earnings on fertility in a high-fertility, low-income setting. Previous studies have shown that providing young girls with the opportunity to have a paid job delayed their marriage and childbearing (Jensen, 2012; Heath and Mobarak, 2015). However, these studies could not disentangle the effect of an exogenous increase in income from the effect of accessing the labor market for girls who may not have worked otherwise. In the present paper, we study women who are already married and working, which allows us to isolate the impact of an increase in income. Moreover, though previous studies have estimated the impact of unconditional cash transfers and found null or negative effects on pregnancies (Baird et al., 2011; Palermo and Hjelm, 2016), these impacts have mostly been among young women. Furthermore, the transitory and unearned nature of the income received through cash transfers could potentially have different effects.

Our findings are consistent with previous theoretical insights on old-age security motives for fertility (Becker, 1960; Cochrane, 1975; Nugent, 1985; Lindo, 2010; Werding, 2014; Hackman and Kramer, 2021). They also contribute to the limited empirical literature on the topic. In Sub-Saharan Africa, a region where the role of children as investment goods is particularly salient due to the relative lack of formal pension systems and old-age insurance, the literature includes a quasi-experimental study showing a negative fertility response to the expansion of a pension program in Namibia (Rossi and Godard, 2022), an observational study in Senegal showing how demand for sons is a strategy to cope with widowhood (Lambert and Rossi, 2016), and widespread evidence of a pattern of increased son preference in places where only males inherit land (Filmer et al., 2009; Fuse, 2010; Rossi and Rouanet, 2015; Eliason et al., 2018; Boonaert et al., 2021). We complement this literature by showing how women's lack of inheritance rights over household land is an important driver of women's fertility responses across a range of Sub-Saharan African countries.

Our results run counter to simple opportunity cost models of fertility, which predict that an increase in female earnings will decrease fertility by increasing the opportunity cost of having children (Butz and Ward, 1979). Empirical support for this model comes mostly from high-income countries (Butz and Ward, 1979; Schultz, 1985; Heckman and Walker, 1990),

as well as from Madagascar (Dessy et al., 2020). Our findings support previous literature on children as 'normal goods' that increase as a result of greater wealth (Lindo, 2010; Amialchuk, 2013; Black et al., 2013; Lovenheim and Mumford, 2013)—but only partially, since we find that though fertility responses are higher among poorer households, these responses are concentrated in poorer households *in which women do not have a son*, and we find no fertility response when husbands' earnings increase (i.e., when we examine impacts on male intervention beneficiaries). Thus, we contribute to this literature by highlighting a key dimension that makes children a normal good: old age security.

In terms of methodology, our paper contributes to the growing but limited body of studies conducting secondary analyses of randomized controlled trials (RCTs) with the objective of drawing more generalizable conclusions. This literature includes pooling RCT databases from different countries to estimate the average impact of microcredit programs using Bayesian hierarchical models (Meager, 2019) and estimating the heterogeneous impacts of a similar program across contexts (Vivalt, 2015). Our study adopts a different approach by testing the impact of two interventions on a single outcome across multiple settings, strengthening the external validity of our results. Importantly, the experiments from which we draw our findings were not initially designed to generate or capture impacts on fertility. This approach to secondary analysis might be a first step towards further research exploiting the growing number of high-quality, RCT-generated panel datasets that are increasingly available to explore new research questions.

From a policy perspective, our findings suggest that strengthening women's property rights is a promising avenue for reducing fertility in Sub-Saharan Africa. Interventions that secure household-level property rights without ensuring gender equality run the risk of inadvertently increasing fertility. Making sure that laws designed to advance gender equality in property ownership and inheritance are both on the books and put into practice, and increasing provisioning for widows and the elderly (e.g., through basic income guarantees and pensions) may reduce women's reliance on their sons and could also contribute towards reducing fertility in the region. Note that our results do not speak to the fertility impacts of strengthening the economic prospects of adolescent girls (prior to marriage) on their future fertility. Our study and findings instead focus on the relationship between income and fertility for adult women, who are already married and already working.

Our paper proceeds as follows. Section 2 presents our conceptual framework and reviews current customary and legal arrangements related to inheritance and old-age security in Sub-Saharan Africa and provides a summary of the current state of the theoretical and empirical literature on the determinants of fertility. Section 3 provides details on the datasets used and our empirical strategy. Section 4 presents our main results, while Section 5 investigates mechanisms. Section 6 discusses and concludes.

2 Contextual Framework and Literature Review

2.1 Context

2.1.1 Old age and land tenure security in Sub-Saharan Africa

In Sub-Saharan Africa, old-age pensions are uncommon, covering less than 10 percent of the labor force (Abels and Guven, 2016; Social Security Administration, 2019).[2] In their absence, economic security in old-age can be precarious. Reliance upon children, extended family, and kinship networks for support in old-age is the norm, as is provisioning for oneself to the extent than one can, for example through investments that can be used to generate income (US National Research Council, 2006). In SSA, the most common strategies are to invest in children, with the expectation that their offspring will support them in old age, or to invest in real estate (i.e., land and buildings), as it can serve both as a means to store wealth as well as a productive asset that can be used to generate income streams (O'Sullivan, 2017). Houses and shops can be built brick-by-brick and later rented out, and land can be used to plant tree crops that will yield harvests in the decades to come. Investing in real estate, however, is only a path to long-term economic security if an individual has secure land rights.

In most of SSA, land is predominantly owned by men, including land that elsewhere would be considered marital property. In addition, husbands and wives are not protected equally if one of the spouses happens to die. In patrilineal societies, which comprise most of the world and which are prevalent in the countries under study, customary inheritance laws exclude the wife from inheritance rights. In the case of widowhood, only male descendants (including the man's children from previous relationships) or other male relatives can inherit the home and land (Asiimwe, 2009; United Nations, 2001; Ndulo, 2011; Richardson, 2004; WLEA, 2001; White et al., 2002). This framework is reinforced by the Shariah, which restricts widows' rights to only 1/8 of the husband's assets, to potentially be shared with co-wives. These customs often result in widows being deprived not only of their husbands, but also of their homes as well as of the lands that they have spent their lives farming. While many SSA countries have passed laws that provide women with the right to inherit land from their deceased husbands, customs often continue to take precedence over formal laws (USAID, 2013; Korang-Okrah and Haight, 2015). Importantly, most women also do not have assets of their own when they become widows because they were previously discriminated against as daughters when their families of origin distributed inheritance.

2.1.2 The vulnerability of widows

Women's lack of inheritance rights is one of main reasons why widows are among the poorest groups in SSA (United Nations, 2001). In Mali, Van de Walle (2013) has shown the negative

[2] In Sub-Saharan Africa, self-employment is the main source of income and employment, and most economic activity—50 percent of economic output, and 85 percent of employment—is in the informal sector (African Development Bank, 2021; World Bank, 2022a,b). While pensions schemes do exist, these are typically contributory social security schemes that are restricted to civil servants and formal sector employees (US National Research Council, 2006). Non-contributory universal pension systems would offer broader coverage, but most SSA countries lack the means to finance such systems (United Nations, 2007).

long-lasting effect of having experienced widowhood on women's welfare and living standards, even if they remarry. In cross-country work, Djuikom and van de Walle (2018) shows that ever-widows and ever-divorced women have a lower nutritional status than women still in their first marriage across 20 countries in SSA, and that the negative impacts of widowhood even extend to an inter-generational transmission of poverty.

Under inheritance systems where only male descendants are entitled to inherit from the male head of household, having a son is a way for women to secure housing and to ensure access to land if their husband dies. Given the common age gap in SSA, widowhood is a likely risk, and women's fertility behavior may be influenced by the widowhood insurance role of sons (Fapohunda and Todaro, 1988; Bledsoe and Hill, 1998). Lambert and Rossi (2016), for example, shows that women in Senegal who are most at risk in the case of widowhood tend to shorten birth spacing until they have a son.

Patrilocal traditions reinforce the supportive role of sons for their mothers. In places characterized by such traditions, married daughters tend to move away from their parents to their new husband's household, while sons tend to stay near or even co-reside with their parents. Women are therefore more likely to benefit from day-to-day support from their sons than from their daughters (Garg and Morduch, 1998; Ezra, 2003). This pattern has clear implications for fertility decisions conditional on the existing gender distribution of children. In addition, given gender gaps in earnings between men and women in SSA (Arbache et al., 2010; O'Sullivan et al., 2014; World Bank, 2019), sons are more likely to have greater financial resources than daughters from which to provide for their parents in their old age.

2.1.3 Fertility and desired fertility

Many different factors influence fertility and fertility preferences. Total lifetime fertility—i.e., the total number of children born to a woman—can be driven by the fertility preferences of the woman and her husband over the quantity, gender mix, and timing of children; age of marriage; access to modern contraception; and the extent to which women have a say in when and whether to marry, have sex, or use modern contraceptives. All of these determinants in turn can be influenced by factors such as educational and employment opportunities available to the girl/woman; household budget constraints; availability of childcare; considerations related to maternal and child health; child mortality rates; and considerations related to the ways in which children may eventually contribute to the household's or parents' financial well-being.

SSA has the world's highest fertility rates, the highest desired fertility rates, and is also the world's poorest region (Bongaarts, 2017; Bongaarts and Casterline, 2013). SSA's high fertility rates and slow rate of fertility decline since the 1960s have attracted attention, especially as they have occurred against a backdrop of improvements in child mortality, contraception methods, girls' schooling, and steeper fertility declines in every other world region including South Asia. Policymakers in particular worry about the impact of high fertility rates on the region's development goals. When population growth exceeds economic growth, this can result in increased poverty. Higher fertility rates increase dependency ratios, making it more difficult for households to support and educate the next generation. When the bottom of the population pyramid grows faster, governments face fiscal implications, and may find it hard to maintain per pupil and per patient spending. High fertility rates are also

associated with an increase in adverse health outcomes for mothers and children (Mahy, 2003; Stover and Ross, 2010). Both within SSA and beyond, policymakers' attempts to curb high fertility rates through family planning programs have had only modest impacts (Pitt et al., 1993). Miller (2010) finds that family planning explains less than 10% of Colombia's fertility decline during its demographic transition, while Pritchett and Summers (1994)'s cross-country analysis suggests that desired levels of fertility account for 90 percent of differences across countries in total fertility rates.

In the five countries covered in this study, at the country-level, total fertility rates (TFRs) range from 4.0 in Rwanda to 4.8 in Benin. Within these and most African countries, however, there are marked urban-rural fertility differentials, with differences in fertility rates between the capital cities and rural areas commonly on the order of 2 to 3 children (Lesthaeghe, 2014). In the five countries we study, rural, poorer, and less educated women have higher fertility and higher desired fertility (Ghana Statistical Service and ICF, 2014; Ministry of Planning, Development and Territorial Development, Ministry of Health and ICF, 2015; Ethiopia Central Statistical Agency and ICF, 2016; INSAE and ICF, 2019; Ethiopian Public Health Institute and ICF, 2021; NISR Rwanda, Ministry of Health Rwanda, and ICF, 2021). While we do not have data on the fertility preferences of the women in our study sample, we do have nationally representative data from the most recent rounds of the DHS surveys. When comparing the TFR to women's ideal family size in these five countries, looking at rural and urban areas separately, the TFR exceeds women's ideal family size in all cases except for in urban Ethiopia, urban Ghana, and urban Rwanda. Moreover, men's ideal family size exceeds that of women's in four of the five countries. Details on fertility and desired fertility rates in our five study countries can be found in Appendix Table A1.

2.2 Conceptual Framework

Our study fits within the literatures on the roles of income, wealth, and property rights in influencing fertility outcomes.

2.2.1 Income and fertility

The first generation of economic theories on fertility was developed in order to explain the empirical negative relationship between fertility and income observed in Western countries. The industrialization that began in the 19th century was followed by a demographic transition, and since then, cross-sectional, cross-country, and time series analysis have shown a strong inverse relationship between fertility and income (Jones and Tertilt, 2008; Jones et al., 2008; Doepke et al., 2023). Unless we consider children as an inferior good, this negative correlation appears puzzling. Becker (1960) introduced the first major theory of fertility with a quantity-quality tradeoff model. In this framework, the household represents a homogeneous decision unit that maximizes its utility under budget and time constraints. Under this model, the household utility function depends on consumption, the number of children and the quality of children. Child quality results from various parental investments, especially in education. These investments increase with parents' income, which in turn increase the cost of children. Consequently, fertility is decreasing in income. Even though children are a normal good in this model, the substitution effect dominates the revenue effect. Fol-

lowing this framework, we would expect a reduction in fertility resulting from an increase in female business-owners' income.

Subsequent works show that household fertility responses to an increase in income depend largely on whether the increase affects male or female earnings. The notion of the opportunity cost of women's time was introduced to explain this phenomenon and largely dominated in early theoretical work on fertility (Hotz et al., 1997). Since the time cost of having a child is overwhelmingly borne by women, household fertility decisions depend mainly on her wage. In this model, an increase in male wages induces a pure revenue effect and therefore an increase in fertility. When female incomes increase, the substitution effect dominates and fertility decreases.

An abundant literature mainly focused on developed countries has used empirical evidence to test these theoretical models. Most of these studies show that the revenue effect prevails when the shock affects male wages or household wealth, with fertility becoming an increasing function of revenue (Lindo, 2010; Amialchuk, 2013; Lovenheim and Mumford, 2013; Black et al., 2013). In contrast, the substitution effect prevails when female earnings increase, with the income-fertility relationship becoming negative (Butz and Ward, 1979; Heckman and Walker, 1990; Schultz, 1985). These strands of literature clearly predict a negative fertility response to an increase in female earnings generated through a business training for female entrepreneurs. Yet there is limited empirical evidence on the opportunity cost model in developing countries. The decreases in fertility that we see from interventions designed to promote girls' schooling, adolescent girls' programs', and cash transfer programs also appear to at least partially operate through an opportunity cost channel (e.g., Duflo et al., 2015, 2021; Giacobino et al., 2022; Bandiera et al., 2020). However, these programs target adolescent girls who face a trade-off between marriage/fertility and schooling. These results therefore cannot predict the fertility response of already married and already working women experiencing an increase in their earnings.

The models summarized above assume that consumption and fertility decisions in the household result from the maximization of a single agent's utility function. This agent might be either a household in which husband and wife perfectly agree on the number of children to have, or it may be the decision-maker of the household, in all likelihood the husband. An early strand of family economics has called into question this restrictive assumption, with newer bargaining models allowing for conflicting interests within the household. The key notions of bargaining power and outside options were introduced in the bargaining models of marriage (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg and Pollak, 1993) and in the collective model elaborated by Chiappori (1988), Chiappori (1992), and Apps and Rees (1988). Blundell et al. (2005) build on Chiappori's collective model to formalize household fertility decisions, taking into account potential differences in preferences represented by individual utility functions. Completed and empirically tested by Cherchye et al. (2012), this model predicts that an increase in female income increases the importance given to female fertility preferences in the decision-making process. Doepke and Kindermann (2019) further proposed a *dynamic* model of fertility in which fertility decisions depend on the share of the burden of caring for and raising children that each partner will assume. To the best of our knowledge, Rasul (2008) provides the only empirical validation of a bargaining model of fertility with data from a development setting (Malaysia). Under this model, variations in income can influence fertility if the relative bargaining powers of individuals are affected

and one agent can now act on his/her fertility preferences. In four of our five study countries, men desire more children than women (Appendix Table A1). We could therefore expect that an increase in female profits could translate into a boost in her bargaining power, thereby allowing her to act on her preferences and reduce fertility.

Using microdata from 48 developing countries, Vogl (2016) finds substantial variation in the relationship between economic status (proxied through asset ownership) and cumulative fertility across regions and over time. Though the relationship tends to be negatively-sloped in later periods, for African women in earlier periods—circa 1990—he finds either an increasing or hump-shaped relationship. Chatterjee and Vogl (2018) expand this analysis to study the interaction between fertility and growth since 1950, combining microeconomic data on the birth histories of 2.3 million women from 255 household surveys with macroeconomic data on economic growth. Their findings indicate that fertility responses to economic fluctuations vary depending on the duration of the economic shift and the life cycle stage at which it occurs. Specifically, fertility is procyclical with annual fluctuations, particularly among women aged 20-34 and those with lower education levels. Short-term fertility elasticity seems to be driven by economic downturns, suggesting the incapacity of poor households to smooth their income and execute their fertility plan. However, when there is sustained economic growth spanning over two decades, fertility declines and the timing of childbirth is delayed. Consistently, prior research indicates that economic crises typically correlate with a decline in fertility rates in developing countries (Council et al., 1993; Tapinos et al., 1997; Lindstrom and Berhanu, 1999; Adsera and Menendez, 2011).

Lastly, the extensive literature on cash transfers in developing countries has found either no impact or a negative impact on fertility (Baird et al., 2011; McQueston et al., 2013; Rosenberg et al., 2015; Khan et al., 2016; Palermo and Hjelm, 2016; Khan et al., 2016; Palermo and Hjelm, 2016; Anderson and Reynolds, 2017; Bastagli et al., 2019; Loeser et al., 2021).[3] We argue that this empirical literature can only provide constrained insights on the overall income-fertility relationship in developing countries. First, the conditional cash transfer literature does not allow one to disentangle the impact of the positive income shock from the increase in school participation, or any behavior which has been incentivized by the transfer. Second, cash transfers delivered through development programs are commonly understood to be temporary and therefore are not likely to influence fertility decisions in the same way as an increase in earnings built on skill accumulation, which is more likely to be sustained and potentially grow in the long-run.[4]

2.2.2 Fertility and property rights

Only a very limited set of studies have examined how the formalization of property rights influences fertility. These studies find consistent results suggesting that land titling reforms have a negative impact on fertility (Field, 2003; Galiani and Schargrodsky, 2010). In light of this literature, we may expect two opposite effects of land formalization on fertility, de-

[3] In their review, Bastagli et al. (2019) note an exception related to the PRAF program in Honduras, which had positive effects on fertility. According to the authors, this is likely due to specific elements of program design, since the level of transfers given was an increasing function of the number of children.

[4] In Togo and Ethiopia, both business training programs increased the adoption of good practices in women's businesses.

pending on i) how land titles are granted and ii) the extent to which the program merely formalizes and secures existing land rights, versus giving women greater ownership and control over household land.

If land titling is done in a way that increases female control over household plots, we expect a negative impact on fertility due to various mechanisms. Following the bargaining framework, we can consider that women who are granted property rights benefit from an increase in bargaining power in the household, and therefore can act on their fertility preferences (Field, 2003; Bose and Das, 2023). Given that women's desired family size is smaller than men's desired family size in most developing settings, we can therefore expect a reduction in fertility. In addition, Galiani and Schargrodsky (2010) find that a law allocating land titles to occupants of a poor suburban area of Buenos Aires—which were awarded to both the household head and to his/her spouse—translated into a 20% reduction in the number of offspring in the households. With formalized land rights, poor couples gained a secure saving instrument which reduced the need to use children as future insurance. By protecting families' long-term access to their home and land, and possibly also increasing access to credit, the reform may also have further reduced the old-age-security motive for fertility. However, if the land titling is done in a way that does not give women greater control or ownership over land, but simply secures the male household heads' land rights, women might be incentivized to have a son in order to secure land tenure in case of widowhood. Since customary inheritance regimes typically give sons, but not wives, the ability to inherit land, having a son is therefore the only way to make sure she will benefit from the land newly formalized in case of widowhood.

3 Data and Methodology

This paper uses data from six impact evaluations (IEs) conducted by the World Bank's Africa Gender Innovation Lab (GIL) between 2009 and 2018. Three of the evaluations examined the impacts of programs aimed at increasing female entrepreneurs' profits through business skills trainings, while the other three focused on land titling programs geared towards strengthening household property rights and asset ownership. These IEs were selected from amongst a larger set of completed GIL IEs based on the following inclusion criteria: (i) the intervention did not include a women's empowerment component and focused only on income and assets, (ii) the intervention generated a significant, positive effect on women's income, profits or asset (land) ownership, (iii) the time interval between intervention and follow-up survey was at least 12 months and (iv) the follow-up survey included variables on pregnancy or children. All six IEs had income or wealth as primary outcome variables, and although data on other potential outcomes (e.g., standard measures of bargaining power) were collected, the IEs found either no or limited impacts in these areas, allowing for a clean identification of mechanisms (Campos et al., 2017; Goldstein et al., 2018; Alibhai et al., 2019;

Agyei-Holmes et al., 2020; Bakhtiar et al., 2022).[5] Impacts on primary outcomes are summarized in Appendix Tables A2 and A3.

3.1 Datasets and Experiment Designs

3.1.1 Interventions for Entrepreneurs

The impact evaluations of business skills trainings for entrepreneurs included in our dataset took place in Ethiopia and Togo. All three trainings had sizeable impacts on entrepreneurs' profits.

The first Ethiopia IE was an RCT of a mindset-oriented business training offered by the NGO Digital Opportunity Trust (henceforth 'Ethiopia DOT'). The training was underpinned by psychological insights and aimed to foster self-esteem and entrepreneurial spirit among female small- and micro-entrepreneurs in urban Mekelle, Ethiopia. The training, delivered by young university graduates in ICT, focused on applying this mindset-oriented approach to business planning, market assessment and testing. The intervention entailed 30 hours of training, offered in half-day sessions over a period of 20 days. The IE—which randomized 400 women into treatment from a sampling frame of 800[6]—showed a 30% increase in female firm profits as a result of the training (Alibhai et al., 2019). We use data collected at baseline in October 2014, at first follow-up in March 2016 and at second follow-up in March 2017.

The second Ethiopia IE was also an RCT, this time of the Women Agribusiness Leaders Network (henceforth 'Ethiopia WALN'). The program operated in the World Bank's Agricultural Growth Program's target woredas across five regions in Ethiopia: Tigray, Amhara, Oromia, Addis Ababa and SNNPR. The sample is urban. The program identified and provided interventions to both mentors and mentees. The IE analyzed impacts on both groups and found that the training increased business profits and sales by 0.21 standard deviations for mentors, but mentees' profits did not significantly increase (Bakhtiar et al., 2022). Consequently, our analysis includes only the mentors. As part of WALN, mentors were provided with business planning and management support, leadership support by 'role models' (international business specialists and leaders) and mentoring skills. The training was provided for two days a month for six months. To participate in WALN as a mentor, female business owners had to have at least one employee and had to be able to nominate at least six mentees they could train. The training was free for the mentors on the condition that they "paid-it-forward" by mentoring the mentees. The IE randomly assigned half of the eligible 200 mentors to receive the intervention. For this study, we use the baseline data collected in March 2014, the first follow-up data collected in July 2015, and the endline data collected in January 2018.

Lastly, the IE in Lomé, Togo was an RCT of a psychology-based personal initiative training, which emphasized achieving a proactive mindset and focused on entrepreneurial behaviors (henceforth 'Togo PI'). To be eligible, entrepreneurs had to have been in business for at

[5]Effects on intermediate non-agency outcomes targeted directly by the interventions were detected, but these are specific to each program (e.g., entrepreneurial orientation and grit increased as a result of business skills training and can act as a mechanism in those impact evaluations, but are not affected in the land interventions and thus cannot explain their treatment impacts).

[6]The sampling frame was obtained through the World Bank's WEDP program, which provides loans and entrepreneurship training to growth-oriented female entrepreneurs in Ethiopia.

least 12 months with an informal (i.e., not formally registered) company, have fewer than 50 employees and operate outside of the agricultural sector. 1,500 applicant enterprises in Lomé, Togo's capital city, were first stratified by gender of the owner and sector, and then grouped by baseline profits. 500 firms were randomized into a control group, while 500 were randomized into a treatment group that was offered the personal initiative training.[7] The training was delivered through three half-day sessions per week over the course of four weeks and resulted in an increase in the use of good business practices as well as a 30% increase in profits (Campos et al., 2017). We use two survey rounds: the baseline data collected in October 2013 and the third follow-up data collected in August 2015.[8]

3.1.2 Land Titling Interventions

The property rights impact evaluations included in our dataset were conducted in Benin, Ghana and Rwanda. All three land titling programs increased household-level land tenure security. Only the Rwanda program put special emphasis on gender equality and increased the perceived and actual right of women to be registered as claimants on parcels owned by married couples.

The IE in Benin was an RCT of a land demarcation intervention, Plan Foncier Rural (PFR). The land intervention took place across nine of Benin's 12 regions. 596 eligible villages[9] were identified in which 80 public lotteries were then organized, resulting in 300 villages in the treatment group and 296 in the control group for a total of 2,972 households. The objective of the program was to formalize existing customary rights over land, held almost exclusively by men. Within communities, the project demarcated all plots, which included resolving any property rights disputes. Plots were the primary unit of treatment. At follow-up, landholders—both owners and users of the land—had been guaranteed by local authorities that they would be issued a land title in their name (though they had not received the titles yet). The program considerably increased the share of delineated parcels in treatment villages, households' perceived tenure security, and long-term investments in cash crops and trees. Treated female-headed households caught up with their male counterparts in land fallowing, another form of long-term investment (Goldstein et al., 2018).

The data from Ghana come from a land registration program implemented by the government in Awutu-Effutu-Senya. The evaluation took place in a peri-urban setting with a sample of 2,450 households. The analysis builds on three survey waves from twenty communities located on either side of a road. The "as good as random" division of communities by this road (which was arbitrarily chosen as the boundary of the treatment area) allowed for the implementation of a regression discontinuity design, since only households on one side were eligible to receive land titling. The program was initiated in 2009 with the support of the Millennium Development Authority (MiDA). By February 2012, MiDa had concluded the registration process for 2,296 parcels of land and had issued land title certificates for 1,481

[7] Another 500 were randomized into a traditional business training treatment group. We do not consider them here since this training did not have any significant economic impacts.

[8] We did not use follow-up rounds 1 and 2 because no fertility variable was available.

[9] Eligibility criteria included the region's poverty index, potential for commercial activities, regional market integration, local interest in promoting gender equality, infrastructure for economic activities, adhesion to the Plan Foncier Rural (PFR) application procedure, incidence of land conflicts, and the production of main crops.

in the treatment group. The evaluation found that actual and perceived tenure security increased in the treatment group. The clarification of property rights increased the likelihood of households having purchased land, and a decrease in renting and sharecropping led households to move from merely using the land through rental contracts to ownership through land purchases. Labor use on plots declined and was reallocated to non-farm activities with higher returns. In particular, women were 10 percentage points more likely to be engaged in off-farm work as a result of the intervention (Agyei-Holmes et al., 2020). In this study, we focus on the data collected in the first and second survey waves in 2010 and 2011, one year and two years after the beginning of the intervention in 2009.

Our last dataset is from the phase-in randomization of the national land tenure regularization (LTR) program launched in 2010 by the government of Rwanda. An evaluation of the pilot had already shown a positive impact: improved land access for married women, better records of inheritance rights, a doubling in soil conservation investment and a reduction in land market activity (Ali et al., 2014). Based on these encouraging results, a randomized impact evaluation was designed for the scale-up of the LTR program nationwide. Out of 100 eligible 'sectors' spread across the country, 50 were randomly selected to receive the program. The other half of the sectors were to receive the program at the very end of the IE. 3,600 rural households across 300 villages evenly split across the 50 sectors were selected for the evaluation. Whereas the land titling interventions in Benin and Ghana merely formalized existing land rights, the intervention in Rwanda actively increased women's perceived land rights, as it considered all landholdings by married men as marital property and included wives' names on the land certificates. Married women in treated areas were also more likely to be able to lease, mortgage, sell or bequeath land (Ali et al., 2015). We use the baseline data collected in early 2011 before the beginning of the program and the first follow-up collected in 2012.

3.2 Sample Characteristics

For each of the six datasets, we restrict our sample to female potential beneficiaries of reproductive age (18-50) at baseline.[10] Since across our datasets, less than 5% of women who report being single have children, we further restrict our sample to women that are married or in a relationship at baseline.[11] Table 1 shows descriptive statistics for the resulting sample of entrepreneurs, while Table 2 depicts our land titling sampling frame. The statistics are computed using baseline data for each sample, or the first follow-up if no baseline was conducted (this was the case in Benin and Ghana). The women in our dataset are on average in their thirties, with the youngest average age in Ethiopia DOT (31.6) and the oldest average age in the Togo sample (38.3).[12] Education levels vary substantially across datasets.

[10] While our main analysis restricts our sample to female potential beneficiaries, we do use the Togo study's broader sample (including potential male beneficiaries) as a robustness check to analyze whether there are effects on fertility when the woman is not the direct beneficiary of the treatment.

[11] The one exception is for Ethiopia DOT, where we keep the entire sample because 61.8% of single women report having children at baseline.

[12] In our four study countries, women bear approximately 22% of their children at age 35 or above. This figure is calculated using the most recently available round of DHS data for each of the four countries, accessed via USAID's statcompiler.com. We performed the following calculation: sum(age-specific fertility rates for 35-49)/sum(age-specific fertility rates 15-49)*100.

The WALN sample is the most educated (26% have any higher education) while women in Benin are the least educated (69% have no education at all). Overall, the educational attainment of women in the land samples reflects national averages, while women in the business training samples have above-average education for their respective countries. For example, 73% of women completed at least secondary school in the Ethiopia DOT sample, while only 11% reached secondary education in the country overall (DHS 2021).

Women in our sample live in relatively large households, spanning from an average of 4.3 members in Ghana to around 7 in Benin (in line with respective national averages). The share of women that report being a household head varies across datasets, ranging from 61% of women in the Ethiopia WALN sample to close to zero in Benin and Rwanda.[13] Women tend to be younger than their spouses, spanning ten years younger in Ethiopia DOT to five years younger in Rwanda, which is in line with regional marital patterns (Hertrich, 2017). Importantly for our analysis, this age gap means that most women will eventually become widows. Most women in our sample are married to their partners, with the lowest rates in Ethiopia DOT (57 percent) and the highest rates in Benin and Ethiopia WALN (where virtually all women are married to their partners).[14] The number of children at baseline is lowest in the Ghana sample at approximately 1.5, medium for Ethiopia DOT at approximately 2, and high in Benin and Rwanda at over 3 children per women.[15] For Togo, we do not have a variable on the total number of children the woman has given birth to, so we instead focus on the number of children under five who live in the household (0.6).

The three business training samples of entrepreneurs (Ethiopia DOT, Ethiopia WALN, and Togo) are urban samples. Two of the land titling samples (Benin and Rwanda) are rural, and the third (Ghana) is peri-urban.

3.3 Empirical Strategy

Our methodology leverages the empirical strategy used by the original impact evaluations (five randomized trials and one regression discontinuity design in Ghana), whose designs were described in Section 3.1. We run each of the six analyses separately, following an identical specification to the one used by the original impact evaluation authors to compute their primary treatment effects.

Our general specification follows the form:

$$Y_i = \alpha + \beta T_i + \lambda X_i + \mu_j + \epsilon_{ij}{}^{16} \tag{1}$$

Y_i are our main outcomes—the number of children at follow-up for each woman and an indicator variable equal to one if the woman had a child post-treatment—while T_i indicates

[13] It is worth noting that married women declaring that they are a household head often implies that the husband is not residing in the same place or is absent for long periods for work. In Ghana, 97.3% of women who are not household heads are co-residing with their spouse while only 8.5% of women household heads are.

[14] This data comes from survey questions asking "are you married?" or "are you formally married?".

[15] This data comes from survey questions that asked: "how many children have you had with this man?" or "how many living children do you have?".

[16] When the outcome is measured at two follow-ups, we interact the treatment with time: $Y_i = \alpha + \beta_1 T_{i1} + \beta_2 T_{i2} + \lambda X_i + \mu_j + \epsilon_{ij}$. T_{i1} and T_{i2} are equal to one for observations corresponding to the first and second follow-up, respectively.

Table 1: Descriptive Statistics for Business Training Samples

	Ethiopia DOT			*Ethiopia WALN*			*Togo*		
	Obs. (1)	Mean (2)	S.D. (3)	Obs. (4)	Mean (5)	S.D. (6)	Obs. (7)	Mean (8)	S.D. (9)
Panel A: Characteristics of the household									
Household size	689	4.97	2.23	86	7.15	3.62	424	5.59	2.42
Women is head of household	689	0.45	0.50	87	0.61	0.49	426	0.26	0.44
Panel B: Characteristics of the woman									
Age	689	31.65	6.39	87	35.56	5.3	424	38.34	6.81
No education	689	0.04	0.20	87	0.20	0.41	411	0.08	0.27
Completed primary school	689	0.23	0.42	87	0.31	0.47	411	0.34	0.47
Completed middle school	689	0.39	0.49	87	0.1	0.31	411	0.36	0.48
Completed high school	689	0.21	0.41	87	0.1	0.31	411	0.16	0.37
Completed higher education	689	0.13	0.33	87	0.26	0.44	411	0.06	0.24
Nb of children at baseline	689	2.06	1.66	87	3.46	1.57	424	0.61	0.82
Married	689	0.57	0.50	87	1.00	0.00	424	0.86	0.34
Panel C: Characteristics of the partner									
Partner age	409	42.28	9.31	87	44	8.02	420	44.74	7.65
No education	409	0.03	0.16	87	0.00	0.00	422	0.05	0.22
Completed primary school	409	0.28	0.45	87	0.26	0.44	422	0.09	0.29
Completed middle school	409	0.26	0.44	87	0.15	0.36	422	0.34	0.47
Completed high school	409	0.16	0.37	87	0.15	0.36	422	0.21	0.41
Completed higher education	409	0.26	0.44	87	0.41	0.5	422	0.31	0.47
Farmer/ farm worker				87	0.13	0.34			
Self employed	409	0.56	0.50	87	0.13	0.34	423	0.50	0.50
Employed	409	0.31	0.46	87	0.41	0.5	423	0.45	0.50
Unemployed	409	0.11	0.31	87	0.3	0.47	423	0.04	0.20
Other	409	0.02	0.14	87	0.02	0.16	423	0.01	0.08
Baseline		YES			YES			YES	

Notes: This table reports descriptive statistics of the sample of women under study. The first column of each country reports the number of observations in the sample at follow-up 1 non-attrited for the given variable, the second column reports the variable mean in the control group at baseline, or at follow-up 1 if there is no baseline. The variable married equals one if the woman declares she is formally married. For the number of children at baseline, when we have no baseline we take the number of children born before the beginning of the treatment. The level of education displayed is the highest level of education completed.

Table 2: Descriptive Statistics for Land Titling Samples

	Benin			*Rwanda*			*Ghana*		
	Obs. (1)	Mean (2)	S.D. (3)	Obs. (4)	Mean (5)	S.D. (6)	Obs. (7)	Mean (8)	S.D. (9)
Panel A: Characteristics of the household									
Household size	2,327	6.94	3.27	1,925	5.33	1.85	755	4.32	1.69
Women is head of household	2,327	0.08	0.27	1,925	0.02	0.15	755	0.47	0.50
Panel B: Characteristics of the woman									
Age	2,327	33.00	7.62	1,925	33.91	7.617	755	35.38	7.48
No education	2,327	0.90	0.30				490	0.01	0.12
Completed primary school	2,327	0.07	0.26				490	0.32	0.47
Completed middle school	2,327	0.02	0.15				490	0.36	0.48
Completed high school	2,327	0.00	0.06				490	0.20	0.40
Completed higher education	2,327	0.00	0.00				490	0.03	0.16
Nb of children at baseline	2,327	3.35	2.49	1925	3.24	2.02	755	1.47	1.65
Married	2,327	0.97	0.17	1,925	0.77	0.42	755	0.71	0.45
Panel C: Characteristics of the partner									
Partner age	2,151	41.56	11.06	1,905	38.97	11.03	462	41.47	10.15
No education	2,151	0.69	0.46				377	0.00	0.00
Completed primary school	2,151	0.19	0.39				377	0.18	0.38
Completed middle school	2,151	0.09	0.28				377	0.23	0.42
Completed high school	2,151	0.02	0.14				377	0.43	0.50
Completed higher education	2,151	0.02	0.13				377	0.07	0.26
Farmer/ farm worker				1,921	0.83	0.38			
Self employed									
Employed				1,921	0.05	0.23			
Unemployed				1,921	0.02	0.14			
Other				1,921	0.07	0.25			
Baseline		NO			YES			NO	

Notes: This table reports descriptive statistics of the sample of women under study. The first column of each country reports the number of observations in the sample at follow-up 1 non-attrited for the given variable, the second column reports the variable mean in the control group at baseline, or at follow-up 1 if there is no baseline. The variable married equals one if the woman declares she is formally married. For the number of children at baseline, when we have no baseline we take the number of children born before the beginning of the treatment. The level of education displayed is the highest level of education completed.

that the woman was assigned to receive the program as part of the impact evaluation. X_i is a vector of baseline (or time-invariant) covariates for each woman, identical across all six studies: the number of children at baseline[17], whether she is married, her age, age squared, household size, and a dummy capturing whether she is the household head. μ_j is a vector of strata fixed effects. Table 3 summarizes the strata and fixed effects in each impact evaluation, if applicable, which we use in our analysis. We cluster our standard errors at the level of randomization.

Table 3: Evaluation Specifications

Evaluation	Strata	Fixed effects	Level of randomization
Ethiopia DOT	No	No	Individual
Ethiopia WALN	Region, firm-size decile	Strata fixed effects	Individual
Togo	Sector of business, gender of business-owner	Strata fixed effects	Individual
Benin	Commune	Lottery fixed effects	Village
Ghana	No	Chiefdom	N/A
Rwanda	No	No	Sector

Appendix Tables A4 and A5 provide reassurance that our sample restrictions did not introduce imbalance across the treatment and control groups. Across samples, only a few covariates are significantly different by treatment status. Most of these imbalances do not remain significant after correcting for multiple hypothesis testing (Benjamini and Hochberg 1995). Appendix Table A6 additionally shows no differential attrition by treatment status.[18]

4 Main Results

Table 4 shows intent-to-treat effects of the business training and land titling interventions on women's number of children at follow-up. Four of the interventions had a positive and significant effect on fertility.

Female beneficiaries of the DOT program have 0.11 more children than the control group 12 months after the start of the intervention, a 5% increase over the control group mean (statistically significant at the 5% level). This effect is large considering that only 3 months of post-training fertility behavior is captured by follow-up (due to an average gestation period of 9 months), and that only 52% of women took up the program. In addition, the intervention was relatively light, consisting of 20 hours of training over the course of 15 to 20 days. In Togo, we see a 0.39 increase in the number of children as a result of the in-

[17] In Togo, the women's number of children at baseline is not available, so we use as a proxy the number of children under 5 in the household at baseline. When we have no baseline, we build a variable from the midline questionnaire equal to the number of children born before the beginning of the treatment.

[18] Overall attrition between baseline and follow-up is 10.5% for Ethiopia DOT, 6.8% for Ethiopia WALN, 10% for Togo and 1.4% in Rwanda. Baseline data is not available for Benin and Ghana, so we instead compute attrition between follow-up rounds. The rate is below 2% and is not significantly different between the treatment and control group.

Table 4: Impact on number of children at follow-up

	Ethiopia DOT	*Ethiopia WALN*	*Togo*	*Benin*	*Ghana*	*Rwanda*
		Business training			Land titling	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment follow-up 1	0.112**	-0.160	0.391***	0.202**	0.262**	0.008
	(0.055)	(0.261)	(0.122)	(0.098)	(0.099)	(0.016)
Treatment follow-up 2	0.084	-0.191		0.078	0.078	
	(0.060)	(0.278)		(0.087)	(0.134)	
Observations	1,380	178	391	3,784	1,576	1,971
Control group mean	2.326	3.588	0.569	4.021	3.474	3.390
p-val	0.646	0.934		0.253	0.044	
Controls	YES	YES	YES	YES	YES	YES
Clustered SE	YES	NO	NO	YES	YES	YES
Strata fixed effects	NO	YES	YES	YES	YES	NO
Time lag b/w intervention and follow-up 1	12 months	12 months	18 months	24 months	12 months	12 months
Time lag b/w intervention and follow-up 2	24 months	36 months		72 months	24 months	

Notes: This table describes the average treatment effect of each intervention on the women's number of children. Standard errors are clustered at the randomization level. The outcome of column (3) corresponds to the number of children under 5 in the household. The controls include: number of children at baseline, marital status, highest level of school completed, age, age square, a dummy equal to one if the woman is household head, and household size. If there is no baseline (as in Benin and Ghana), the number of children at baseline corresponds to the number of children born before the beginning of the treatment built from the midline household roster. We include stratification fixed effects when required. We control for time when there are two periods. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

tervention (statistically significant at the 1% level).[19] Compared to Ethiopia DOT, in Togo the outcome was measured six months later (18 months after the start of the intervention, instead of 12 months) and take-up rates were substantially higher at 84%. Women in the WALN sample—who were selected because they run well-established businesses[20]—do not increase their fertility. This is consistent with women business owners within WALN being located on the demand curve beyond the revenue threshold after which demand for children is income inelastic; women in the WALN sample's control group have on average 1.3 more children than women in the DOT sample's control group.

Turning to the land interventions, we detect a positive impact on women's fertility in Benin and Ghana but not in Rwanda. Women randomized into the treatment group in Benin have 0.2 more children two years after the start of land demarcation, a 5% impact over the control mean (statistically significant at the 5% level). In Ghana, women in the treatment group have on average 0.26 more children than women in the control group 12 months after the beginning of demarcation, (also statistically significant at the 5% level). This effect

[19]This dataset does not contain information on the number of biological children of the beneficiary woman, so we compute the outcome as the number of children born post-intervention in the household. Given that women in our sample are married to or in a relationship with the head of the household, we assume that most of those newborns are the children of the women under study. To verify that our estimated impact is not driven by an increase in fostered children as women improved their financial status, we show that women older than reproductive age do not see any impact on their fertility (Appendix Table A8).

[20]While women in the Ethiopia DOT sample have 1.4 employees on average, this number is 3.6 in the WALN sample. Moreover, the monthly revenue in the DOT sample is 40,479 birr, but 72,000 birr in the WALN sample.

represents a 7.5% increase over the control group. We find no effect in Rwanda, with a point estimate close to zero with small standard errors. One interpretation of these differential effects rests on the legal rights provided by the programs, which we explore in Section 5.

For those impact evaluations with a second round of follow-up data, Table 4 shows that treatment effects are insignificant across the board. This raises the question of whether we are identifying a true increase in cumulative fertility, or merely a shortening of birth spacing with no total effect. To compare the relative empirical support for these two competing hypotheses, we test whether the first follow-up and second follow-up treatment effect coefficients are statistically different from each other and show the resulting p-values in the last row of the table. Except in the case of Ghana, we cannot reject the hypothesis of equality between the two-periods coefficient, suggesting a positive overall effect on fertility.

Table 5: Probability of having had an additional child at follow-up

	Ethiopia DOT	*Ethiopia WALN*	*Togo*	*Rwanda*
		Business training		Land titling
	(1)	(2)	(3)	(4)
Treatment follow-up 1	0.061**	0.067	0.141**	0.008
	(0.030)	(0.080)	(0.056)	(0.016)
Treatment follow-up 2	0.030	-0.068		
	(0.036)	(0.116)		
Observations	1,380	145	386	1,971
Control group mean	0.273	0.283	0.136	0.155
p-val	0.270	0.325		
Controls	YES	YES	YES	YES
Clustered SE	YES	NO	NO	YES
Strata fixed effect	NO	YES	YES	YES
Time lag b/w intervention and follow-up 1	12 months	12 months	18 months	12 months
Time lag b/w intervention and follow-up 2	24 months	48 months		

Notes: This table describes the average treatment effect of each intervention on the probability that women had a child post-treatment, estimated with a linear probability model. Standard errors are clustered at the randomization level. The controls include: number of children at baseline, marital status, highest level of education completed, age at baseline, age square, a dummy equal to one if the woman is household head, and household size. If there is no baseline (as in Benin and Ghana), the variable number of children at baseline corresponds to the number of children born before the beginning of the treatment built from midline household roster. We include stratification fixed effects when required. We control for time when there are two periods. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table 5 presents impacts on women's probability to have given birth to at least one child between the intervention and the follow-up survey. We include all surveys where a baseline was conducted (i.e., we exclude Benin and Ghana). Women assigned to receive DOT are

6 percentage points more likely to have had a child. This represents an increase of 22% compared to the control group (statistically significant at the 5% level). Women assigned to the training in Togo were 14 percentage points more likely to have had a child post-treatment, statistically significant at the 5% level. This implies that women assigned to treatment were twice as likely to have a child under five post-treatment than control women. The impact of WALN is not statistically different from zero in either period. In Rwanda, we find a null effect similar to the null effect obtained with the continuous outcome.

5 Mechanisms

We now turn to exploring the mechanisms behind the observed increases in fertility.

In contexts with no public pension system and limited public healthcare, coupled with the absence of inheritance rights for widows, women face a heightened risk of destitution upon the loss a spouse and in old age in general. This risk is particularly acute in SSA where the age gap between partners is the largest globally with an average of 8.6 years (Pew Research Center, 2019) and where women have a higher life expectancy by about 4 years (World Bank Development Indicators, 2021). The realization of the widowhood risk being near certain, women need to anticipate the economic consequences of it and develop mitigating strategies.

They may make two types of investment that function as informal pension schemes. First, they may invest in children—in either their quantity or quality—with the expectation that their offspring will contribute to their future income. Women may invest in children's education and health, expecting that children will share their human capital returns on the labor or marriage market (Bau, 2021; Stark and Lucas, 1988). In a context characterized by low perceived returns to education (Nguyen, 2008), and children's imperfect commitment to repay women's investment in the future, women cannot entirely substitute quantity with quality. Women thus target a specific number of children to make sure that the likelihood of child neglect, poverty, migration is lower than the level of destitution risk that she is accepting to take (Ray, 1998).

Secondly, women may invest in assets. Ownership of household land and property in old age could offer women both housing security and potential sources of income. However, in contexts where women's property rights are scarce and less secure, and widows are deprived of inheritance rights, women may need to develop strategies to guarantee their access to their husband's property upon their death. In patrilineal settings, women need to strategically increase their fertility to have one or more sons, as sons will be entitled to inherit their father's land. Indeed, a wide range of existing research has found having sons attenuates the risk of being dispossessed (e.g., Cain, 1986; Agarwal, 1994; Carranza, 2012; Owen, 2001; Asiimwe, 2009).

In light of these patterns, the fertility responses to the business training and to the land titling programs can be understood as an increase in women's investment in their pension portfolios. As women's earnings rise, they gain the financial capacity to support an additional child, who could potentially provide support in the future or secure access to household assets down the line. The formalization of household land induces an increase in the overall value of household assets by strengthening tenure security. Depending on the context, women can either directly increase their property by obtaining a land title in their own

name or enhance their claim to their husband's land by bearing an heir. This is the mechanism that seems best supported by our data. In what follows, we explore the evidence for this hypothesis and other potential, alternative mechanisms.

5.1 Increase in Income

5.1.1 Sons as a pension asset

As explained above, age gaps between spouses are both common and large in Sub-Saharan Africa, with widowhood being a near-certain event in the later part of women's lives. Moreover, in patrilineal contexts (such as the ones from which almost all of our data derives) prevailing norms exclude women from property ownership and inheritance. Having a child—particularly a male child—can thus be a way for a woman to reduce her risk of dispossession in the event of her husband's death. Furthermore, in contexts where formal pensions are non-existent or inaccessible for much of the population, and where the practice is for daughters but not sons to move away upon marriage, women are more likely to rely on their son in old age. Having a son may thus be women's best strategy to secure long-term economic security.

In line with this hypothesis, Table 6 shows that women without a son increase their fertility, while women with sons do not. Controlling for baseline number of children, female beneficiaries randomly assigned to receive DOT without a son at baseline have 25% and 21% more children in period 1 and 2 respectively, in comparison to the control group. Looking at the magnitude of the coefficient, the entirety of the treatment effect on fertility shown in Table 4 was driven by women without a son at baseline. For Togo PI, this effect is even larger, with treated women having one more child under five on average compared to control women. The test of equality between the effects in each group shows that we can reject the hypothesis of equal impact.

Table 6: Heterogeneity by Son

	Number of children					
	Ethiopia DOT		*Togo PI*		*Ethiopia WALN*	
	No son (1)	At least one son (2)	No son (3)	At least one son (4)	No son (5)	At least one son (6)
Treatment follow-up 1	0.229**	0.025	1.070*	0.313	0.242	0.282
	(0.088)	(0.071)	(0.499)	(0.198)	(0.613)	(0.263)
Treatment follow-up 2	0.193**	0.050			0.561	0.055
	(0.078)	(0.073)			(0.655)	(0.278)
Observations	489	891	130	261	37	141
Control group mean	0.917	2.924	0.349	0.489	3.889	3.472
p-val—follow-up 1		0.108		0.054		0.898
p-val—follow-up 2		0.137				0.164

Notes: This table displays the results of an OLS regression of the number of children at each follow-up round on the treatment status in the subgroup of women who had a son at baseline and on the subgroup who had not. Controls include: number of children at baseline, marital status, highest level of school completed, age at baseline, age square, a dummy equal to one if women is household head and household size. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Though we control for the number of children at baseline in Table 6, we additionally verify that this result is not mechanically driven by a lower number of children at baseline. Appendix Table A9 shows that the interaction between treatment and the number of children at baseline is close to zero and non-significant. The interaction between treatment and the variable indicating whether the woman already had a son is large, negative and significant. This confirms that the heterogeneity in fertility effects we observe is driven by whether the woman had at least one son prior to treatment, and not by her overall number of children.

Above, we reviewed results for our business training programs. Given that land registration programs will have a different mechanism for son preference, we turn to those results in the following section.

5.1.2 Relaxed budget constraint enables investment

If women want more children as a way to safeguard their old age security, but cannot afford to do so, an increase in income may increase their fertility by relaxing their budget constraint.

First, we investigate whether the observed increase in profit is the primary driver of the fertility response, as opposed to the general attendance of a business training. To do so, we conducted a placebo test. We exploit the fact that the IE conducted in Togo included two treatment arms: a traditional business training and a personal initiative training. Only the second one had positive impact on profit (a 30% increase). If the observed impact on fertility results from the positive shock on women earnings and not merely participation in the training, then we should find no impact of the traditional business training on fertility. This is precisely what we find in Table A7.

In addition, Figure 1a and Figure 1b support the budget constraint hypothesis. Poorer women at baseline had fewer children than richer women, suggesting that women in the left-hand side of the wealth distribution may have been budget-constrained in their demand for children. Consistently, a recent DHS report indicates that unrealized fertility has surpassed unwanted fertility in West and Central Africa, and that the likelihood of having fewer children than the ideal number increases with household poverty (Assaf and Davis, 2021).

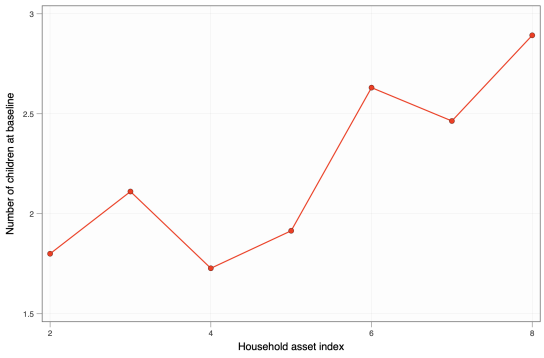
If business training increases women's fertility by alleviating their budget constraint, we would anticipate a greater impact on the poorest women. Consistent with this, we observe a stronger fertility response among women whose household wealth is below the median (see Table 7). Specifically, the impact of the business training program on the poorest segment of women exceeds the average treatment effect in both Ethiopia DOT and Togo, as shown in Table 4.

This budget constraint hypothesis is also supported by Table 8, where we look at heterogeneous effects depending on whether existing children are being taken care of by relatives, friends or elder siblings (a proxy for the availability of 'free' childcare, and thus of the cost of a marginal child). Our result suggests that when the immediate cost of children is lower, women are more likely to have a child. This suggests that women's fertility decisions (at least partially) result from a cost-benefit analysis under a budget constraint.

Importantly, what is at work here is not a simple revenue effect at the household level, where the household gets richer and can afford more 'normal goods' including children. In

Figure 1

(a) Ethiopia DOT



(b) Togo PI

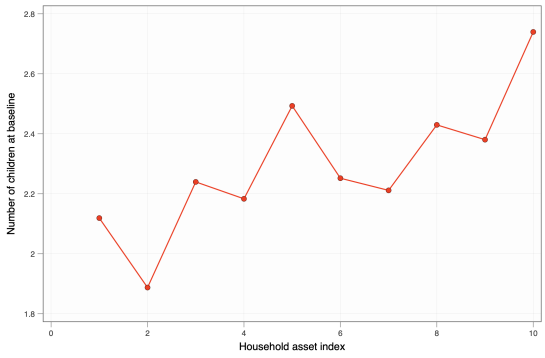


Table 7: Heterogeneity by Baseline Wealth

	Ethiopia DOT		*Togo*	
	Below median (1)	Above median (2)	Below median (3)	Above median (4)
Treatment follow-up 1	0.259***	0.041	0.573**	0.435
	(0.095)	(0.071)	(0.266)	(0.268)
Treatment follow-up 2	0.218**	0.027		
	(0.091)	(0.08)		
Observations	605	775	194	197
Control group mean	1.728	2.855	0.542	0.427
p-val—follow-up 1	0.064		0.566	
p-val—follow-up 2	0.109			

Notes: This table displays the results of an OLS regression of the number of children at each follow-up on the treatment status in the subgroup of women whose household is below and above the household asset index. In DOT, the household asset index is the sum of dummies indicating whether the household own each good, and in Togo this is an Anderson index. Standard errors are clustered at the randomization level. The controls include: number of children at baseline, marital status, highest level of education completed, age at baseline, age square, a dummy equal to one if the woman is household head, and household size. We include stratification fixed effects when required. We control for time when there are two periods. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table 8: Heterogeneity by Availability of Free Daycare (Ethiopia DOT)

	Number of children	
	Free daycare (1)	No free daycare (2)
Treatment follow-up 1	0.229**	-0.047
	(0.101)	(0.080)
Treatment follow-up 2	0.199*	-0.054
	(0.112)	(0.090)
Observations	415	686
Control group mean	3.082	2.724
p-val—follow-up 1	0.029	
p-val—follow-up 2	0.074	

Notes: This table displays the results of an OLS regression of the number of children at each follow-up on the treatment status in the subgroup of women who have access to free daycare or not. We proxy free daycare by a variable indicating who is taking care of the women's children when she is at work and they are not at school. We assume that women who declare that their children are being taken care of by their relatives/friends or elder siblings and not by a babysitter or childcare center have access to 'free' daycare. The controls include: number of children at baseline, marital status, highest level of education completed, age at baseline, age square, a dummy equal to one if the woman is household head, and household size. We include stratification fixed effects when required. We control for time when there are two periods. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Togo, half of the program recipients were male business owners. They received the same PI training as women and experienced an increase in profit of the same magnitude. In Table 9, we examine the impact of PI training on men who are married or in a relationship with a woman of reproductive age.

As shown in Table 9, if men's income increases, women do not have a fertility response: the point estimate is close to zero and not statistically significant. Only if the woman's own income increases does she have more children. This constitutes a rejection of the income-pooling cooperative model of the household, in line with a body of recent work suggesting that women bear a greater financial responsibility for children than men do in Sub-Saharan Africa's households (Dunbar et al., 2013; Heath, 2017; Finlay, 2021). The mechanism behind the positive fertility effect we observe is not reducible to a simple revenue effect at the household level. This further suggests that the observed fertility response results from women's strategic decisions to invest in their pension when they can afford to.

5.1.3 Sons as old age support for the poor

The stronger fertility response observed from the poorest women aligns with the old-age security motive hypothesis. Firstly, because the poorest women are likely to be the most dependent on their son to provide them with financial support during old-age, due to fewer alternative resources. Secondly, because the demand of poor women for a son to provide for them in old age is most likely to have been budget constrained prior to the treatment. When this constraint is released and they feel that they can now afford to have a son, they

Table 9: Male Beneficiary Effects (Togo)

	Number of children
	(1)
Treatment	-0.047
	(0.079)
Observations	529
Control group mean	0.861

Notes: This table displays an OLS regression of the number of children under 5 in the household on treatment status. The sample is restricted to men married or in a relationship with a woman of reproductive age. Controls include: number of children under 5 at baseline, women age, age square, a dummy equal to one if women is household head and household size. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

increase their fertility. The combination of these two main heterogeneous effects—no son at baseline and below median household wealth—suggests that the operative mechanism may be an old-age security motive for poor women.

We test this prediction in Table 10, which shows heterogeneous treatment effects by whether the woman already had a son at baseline, separately for households with below-median assets and households with above-median assets. We continue controlling for our vector of other socio-economic covariates, including the total number of children at baseline.

The results displayed in Table 10 confirm that the old-age security motive pattern is prevalent in both wealth groups, but that the incentive to have a son is stronger among the poorest women. The effect of the treatment on the subsample of women without a son and with below-median assets is about 0.36 and 0.3 children at first and second follow-up, respectively. This represents a 20% and 18% increase in comparison to the control group.

5.2 Increase in the Value of Assets

Women can make investments in assets to secure their long-term economic security. They may be able to invest in their own property if they have secure property rights - either individually or jointly. But if the woman's land and house are titled to or viewed as solely owned by her husband, she must develop strategies to protect her inheritance interests in the event of widowhood. Given the prevalent lack of inheritance rights for women, such strategies often necessitate the bearing of an heir.

The land titling interventions in Benin, Ghana and Rwanda significantly improved households' tenure security (Goldstein et al., 2018; Agyei-Holmes et al., 2020; Ali et al., 2015). Land demarcation and the allocation of formal property titles reduces the perceived expropriation risk, thereby increasing the value of household assets. Land owners gain confidence in their ability to sell the asset in the future or enjoy the returns of long-term investments. The studies show that households changed their behaviors accordingly, for instance, by increasing long-term investment in the land in Benin. Women can benefit from this gain in

Table 10: Heterogeneity by Son and Assets (Ethiopia DOT)

	Number of children	
	Household assets above median	Household assets below median
Treatment follow-up 1	0.107	0.361**
	(0.087)	(0.158)
Treatment follow-up 2	0.161	0.308***
	(0.115)	(0.113)
Women have at least one son X	-0.091	-0.183
Treatment follow-up 1	(0.119)	(0.201)
Women have at least one son X	-0.189	-0.163
Treatment follow-up 2	(0.143)	(0.160)
Observations	775	605
Interaction term 1	-0.091	-0.183
p-val	0.446	0.363
Interaction term 2	-0.189	-0.163
p-val	0.188	0.311
Treatment + Treatment X son—follow-up 1	0.016	0.178
p-val	0.859	0.137
Treatment + Treatment X son—follow-up 2	-0.027	0.146
p-val	0.779	0.250
Difference test p-val: Treatment follow-up 1	0.154	
Difference test p-val: Treatment follow-up 2	0.356	
Difference test p-val: Interaction follow-up 1	0.690	
Difference test p-val: Interaction follow-up 2	0.902	
Control group mean	2.855	1.728

Notes: This table displays OLS regressions of the number of children in the household on treatment status including an interaction term equal to one if the woman has no son and is treated. The left-hand column displays the coefficients of the regressions run on the subsample of women above the household asset median and the right-hand column below the median. Standard errors in parentheses are clustered at the village level. Controls include: number of children at baseline, marital status, highest level of education completed, age, age square, a dummy equal to one if the woman is household head and household size.

household wealth; however, they know they will not be able to inherit this newly formalized land when their husbands die in more patriarchal settings.

In our data, we are fortunate to have a diverse range of contexts in which a very similar intervention–strengthening of property rights through formalization–took place. This enables us to tease out various mechanisms at play.

5.2.1 Investing in Assets in a Patrilineal Setting

In Benin, land inheritance follows a patrilineal pattern, in line with the discussion in Section 2: when a man dies, either his sons or a close male relative inherits his property. Widows are not entitled to inherit the land of the deceased husband. If a woman has no son and wants to retain control of the household property, she has to marry her brother-in-law within 12 months or reimburse the bride price (Médénouvo, 2004). Having a cohabiting son who can inherit is thus her best strategy to remain in her house and keep control of household land. In these circumstances, we expect that women whose household land is formalized may be strongly incentivized to have a son (if they do not already have one) to secure their right to use the land upon their husband's death.

As expected, women who do not have a son with the household head at baseline have 14% and 8.6% more children than the control group at first and second follow-up respectively as a result of the land titling intervention (Table 11).

Table 11: Heterogeneity by Son (Benin)

	Number of children	
	No son	At least one son
	(1)	(2)
Treatment follow-up 1	0.348***	0.082
	(0.129)	(0.108)
Treatment follow-up 2	0.212	0.007
	(0.144)	(0.102)
Observations	1.414	2.337
Control group mean	2.473	5.031
Difference test p-val: follow-up 1	0.101	
Difference test p-val: follow-up 2	0.225	

Notes: This table displays heterogeneous treatment effects of the intervention on the number of children at each follow-up depending on whether the woman had a son from the household head or her current husband before the beginning of the demarcation treatment. Controls include: number of children at baseline, highest education level completed, woman's age, age square, whether woman is household head, polygamy status. Standard errors are clustered at the randomization level. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

However, the value of having a son as old-age or widowhood insurance may be mitigated if the husband had other children from current or previous unions, since this would imply rivals in the competition for inheritance. Women with no son at baseline but with rivals are at

the highest risk of dispossession in case of widowhood. We therefore expect a stronger fertility response from them. Table 12 shows that their fertility response is indeed stronger: these women have on average almost one more child than women in the control group. Women's fertility response when they do not already have a son is twice as large when there are rivals.

Table 12: Heterogeneity by Son and Rivals (Benin)

	Number of children	
	No rivals	Has rivals
	(1)	(2)
Treatment follow-up 1	-0.017	0.243
	(0.123)	(0.384)
Treatment follow-up 2	0.427***	0.883**
	(0.128)	(0.441)
Had son with head before PFR	0.286*	-0.050
X Treatment follow-up 1	(0.149)	(0.464)
Had son with head before PFR	-0.465***	-1.523***
X Treatment follow-up 2	(0.161)	(0.500)
Observations	2,963	534
Control group mean	5.031	3.743
Difference test p-val: Treatment follow-up 1	0.489	
Difference test p-val: Treatment follow-up 2	0.275	

Notes: This table displays heterogeneous treatment effect of the land titling intervention on the number of children at each follow-up round depending on whether the woman's husband had at least one son from a previous union. Controls include: number of children at baseline, highest education level completed, woman's age, age square, whether woman is household head, and polygamy status. Standard errors are clustered at the randomization level. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

5.2.2 Investing in Assets in a Matrilineal Setting

In Ghana, we also find suggestive evidence that the positive impact observed results from the old-age motive for fertility. A large share of our sample is Akan, a matrilineal ethnic group. In matrilineal ethnic groups, a father does not belong to the same lineage as his wife and children. Among the Akan, under customary land tenure systems, when a male household head dies, his property is transferred to a male member of his lineage. This means that his wife and children cannot inherit from the household head and are at high risk of dispossession. In 1985, Ghana enacted the 'Intestate Succession Law', aimed at protecting widows' rights over the property of a deceased husband, especially over assets acquired during their marriage, and children's rights over the property of a deceased father. While the law exists, it is not widely enforced, especially due to lack of land formalization. Ghana is thus an interesting setting to study the effect of a land titling intervention: when the husband's plot

of land is demarcated and claimed to be his property, the plot enters the formal system and therefore the 1985 law becomes enforceable. For women whose husband is Akan, the Intestate Law makes it strategic to have more children to claim the largest share of inheritance (the law provides 3/16 for the surviving wife and 9/16 to the surviving children).[21] This is in contrast with women whose husband is not Akan and are thus part of a patrilineal system: for these women, having children already translated to strengthened control over land if their husband passed away, and so we would expect lower fertility effects as a result of the Intestate Law.

We see this effect in Table 13: women whose husbands are Akan have on average 0.7 more children because of land titling, which represents a 20% increase over the control group. In line with the old-age security motive, Appendix Table A10 suggests that women who are most likely to be vulnerable in old age—due to their lack of ownership of at least one plot in their own name—are driving the effect.

Table 13: Heterogeneity by Matrilineal Status (Ghana)

	Number of children	
	Husband is not Akan	Husband is Akan
	(1)	(2)
Treatment follow-up 1	0.141	0.744***
	(0.090)	(0.189)
Treatment follow-up 2	-0.001	0.381
	(0.140)	(0.362)
Observations	1,269	307
Control group mean	3.405	3.796
p-val—follow-up 1	0.000	
p-val—follow-up 2	0.329	

Notes: This table displays heterogeneous treatment effect of the intervention on the number of children at each follow-up depending on whether the woman's husband is part of the Akan ethnic group. Standard errors in parentheses are clustered at the village level. Controls include: number of children at baseline, marital status, woman's education, woman's age, age square, whether woman is household head and household type. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

5.2.3 Investing Directly in Assets

Recall that we find no average treatment effect of the land titling program on fertility in Rwanda. Appendix Table A11 shows that this null result holds regardless of whether women have a son, while Appendix Table A12 shows that this is the case regardless of whether the woman has rivals over her inheritance. One plausible explanation for these null effects is that the intervention in Rwanda guaranteed women the right to own and use the land owned by the household even in the event of their husband's death. In Benin and Ghana,

[21] One-eighth goes to the surviving parent and one-eighth is determined by customary law.

the vast majority of women were not directly affected by the treatment, since the land programs issued land certificates in the name of the plot owners—the vast majority of which are men[22]—and did not emphasize expanding women's land rights. In contrast, equal rights to all household land were guaranteed to both husband and wife in Rwanda. If married women are granted the same rights over land as their husbands, they become entitled to keep the land if their husbands die and therefore have less need to secure their future rights through childbearing. In these circumstances, having a son is no longer necessary for claiming these household assets in case of widowhood.

5.3 Alternative Mechanisms

Our results cannot fully be explained by a taste for simple gender variety, similar to findings by Rossi and Rouanet (2015) in a subset of our countries (Benin and Ethiopia). For each intervention where we see fertility increases and have data on the gender of existing children at baseline, only women with no son at baseline are more likely to increase their fertility as a response to increases in earnings or wealth. We also show that this is not a result of simple son preference unrelated to economic security: in Benin, we see stronger effects for women with rivals to their inheritance, while in Ghana we see stronger effects for women in matrilineal systems whose inheritance is newly tied to their number of children. Moreover, we see stronger effects for women with weak control over land who would be most deprived in case of widowhood.

Next, we summarize how our findings relate to other potential mechanisms.

First, when households formalize their land, the return on agricultural investment can increase. Due to incomplete labor markets, this may lead households to desire a larger workforce to farm the land and increase the demand for children. However, we find fertility increases even in contexts like Ghana, where households shift towards off-farm economic activities as a result of the land titling intervention (Agyei-Holmes et al., 2020). It also cannot explain why we do not observe an effect as a result of the Rwandan land titling intervention.

A second potential mechanism is that when women increase their income or wealth as a result of the interventions studied in this paper, they increase their bargaining power in the household. This greater influence in the couple may allow them to act on their desire to have more children. However, as noted in Section 3, no impact on bargaining power was detected by the authors of the studies included this paper (Campos et al., 2017; Goldstein et al., 2018; Alibhai et al., 2019; Agyei-Holmes et al., 2020; Bakhtiar et al., 2022). Second, even if the interventions *had* increased bargaining power, women's desired family size is significantly lower than men's in all countries included in this study except for Rwanda. This makes it unlikely that if women's fertility preferences were to have more weight relative to their husbands', the result would be more children. We can thus rule out increases in women's bargaining power as driving our fertility results.

A third potential mechanism is that women increase their productivity as a result of the interventions under study, allowing them to reduce their labor supply while still increasing their income. This decrease in labor supply may make it easier to juggle work and family,

[22] At midline, only 28.3% of women in Ghana report that they own at least one plot. In Benin, only 6.4% of women declare that they have at least one plot on which they have full decision power.

lowering the cost of having a child. However, Appendix Table A13 shows that labor supply is either unchanged or higher as a result of treatment in every country context.

6 Conclusion and Discussion

We re-analyze six experiments conducted in Sub-Saharan Africa to examine how the number of children that women have changes as a function of their earnings and household wealth. We find strong unintended positive impacts of two common development programs on fertility. Women are more likely to have had a child and to have a higher number of children after their income exogenously increases, as well as in response to land titling interventions that increase household wealth. The effects are substantial, spanning from a 5% increase in women's children in Benin to a 69% increase in women's children under five in Togo.

These effects do not hold equally across all women. Fertility responses are stronger for women living in poorer households, suggesting that their demand for children may have been budget constrained. Moreover, across countries, either the majority or the entirety of treatment effects derive from women without sons before the intervention. A potential explanation for this empirical pattern is that in contexts where women's land access and tenure security comes through husbands and sons, formal pensions are absent, and customs drive daughters to leave their natal villages upon marriage, women's risk of destitution in old age sharply increases if they have not borne a son. We further find that fertility increases are exacerbated by other forms of economic precarity: having rivals over inheritance and not owning land. Moreover, we detect zero increase in fertility in Rwanda, a context with higher *de jure* and *de facto* gender equality, and where the intervention directly strengthened women's long-term economic security.

Taken together, our results show how women increase their fertility as a strategy to strengthen their long-term economic security when they can afford to do so. More broadly, our findings highlight the role of female agency in fertility outcomes, including decisions about when and whether to become pregnant, and the ability to act on these decisions. Theoretical models of fertility may benefit from incorporating these insights. Moreover, future research should continue to explore the extent to which women versus men control fertility decisions, and what factors inform their decisions and preferences to try to achieve or avoid pregnancy at different times in their lifecycle.

Our results bring to light the significant role that women's lack of long-term economic stability plays in determining fertility rates in Sub-Saharan Africa. The insight that simply boosting women's economic opportunities does not necessarily lower their demand for children—and may even result in a higher number of children—has implications for the development of programs whose primary or secondary aims include reducing fertility. In particular, programs that solely focus on increasing women's income or household wealth without addressing the broader cultural norms and legal frameworks related to asset ownership and inheritance may have unintended consequences. Alternately, programs that strengthen women's property rights may potentially be valuable tools for reducing fertility. Further research is necessary to determine whether our findings apply in other contexts and among other populations. In these cases, understanding whether elevating women's economic status can help achieve this goal will be particularly valuable.

The findings of our study also indicate that enhancing social protection and insurance programs, especially for the elderly, could be a promising avenue towards realizing the demographic dividend in Sub-Saharan Africa. Moreover, doing so in a gender-equitable fashion could shift the inter-generational transmission of wealth, as found by Duflo (2000). We recommend that future evaluations of the effects of implementing or broadening social protection services go beyond a narrow examination of labor supply outcomes and incorporate an assessment of fertility rates to capture their broader implications. This will provide a more comprehensive view of the impact of these programs and help to guide the development of more effective and efficient policies.

Our results further show that macro-level and micro-level studies of the income-fertility relationship can yield contradictory conclusions. The negative correlation between wealth or income and fertility rates, as evidenced by extensive cross-sectional studies both within and across countries, may be confounded by factors such as education and women's access to long-term economic security (including pensions, health insurance and inheritance rights). Future research should investigate the source of discrepancy between the cross-sectional literature and our findings, and identify whether accounting for additional variables in cross-sectional data can help reconcile our contradictory conclusions.

Finally, our results emphasize the potential value in leveraging datasets from past rigorous impact evaluations of development programs to consider unintended consequences or additional effects that may have gone unnoticed in previous studies. Making impact evaluation data accessible for secondary analysis, including for pooling data from various settings, is crucial for comprehending the true, multidimensional impact of development efforts. By doing so, we can optimize the design of future development initiatives and maximize their impact on the communities they serve.

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7 Appendix

Table A1: Nationally representative fertility statistics from most recent round of DHS

	Benin			*Ethiopia*			*Ghana*			*Rwanda*			*Togo*		
	R		U	R		U	R		U	R		U	R		U
Total fertility rate	6.1		4.0	5.2		2.4	5.1		3.4	4.3		3.4	5.7		3.7
		4.8			4.1			3.8			4.0			4.3	
Wanted fertility rate	5.2		3.5	4.0		2.1	4.3		3.1	3.2		2.8	4.9		3.1
Women's ideal family size	5.5		3.9	4.6		3.8	4.7		4.0	3.5		3.4	4.9		3.6
		5.1			4.5			4.3			3.5			4.3	
Men's ideal family size		7.2			4.6			4.8			3.1			4.9	
	T	W	I	T	W	I	T	W	I	T	W	I	T	W	I
By Wealth															
Lowest Q1	7	6	6.2	6.4	5.2	5.5	6.3	5.5	5.5	4.9	3.6	3.6	6.3	5.5	5.7
Q2	6.2	5.2	5.6	5.6	4.4	4.6	5.5	4.5	4.7	4.4	3.2	3.2	5.8	5.0	5.1
Q3	6.1	5.3	5.4	4.9	3.7	4.5	3.9	3.2	4.2	4.2	3.2	3.2	5.4	4.5	4.4
Q4	5.3	4.6	4.8	4.3	3.2	4.3	3.5	3.1	4.0	4.0	3.0	3.0	3.9	3.3	3.7
Highest Q5	4.2	3.6	4.1	2.6	2.1	3.9	2.8	2.6	3.7	3.4	2.8	2.8	3.5	3.0	3.4
By Education															
None	6.4	5.4	5.8	5.7	4.4	5.2	6.2	5.5	5.7	4.2	2.9	2.9	6.1	5.3	5.5
Primary	5.4	4.7	4.8	4.2	3.3	4.0	4.9	4.1	4.6	4.4	3.3	3.3	5.0	4.2	4.2
Secondary	4.5	4.0	4.3	2.2	2.0	3.6	4.2	3.6	4.1	3.7	3.2	3.2	3.4	3.1	3.4
More	—	3.3	3.7	1.9	1.7	3.6	2.6	2.3	3.5	3.3	3.0	3.0	—	—	—

Note: This table presents nationally representative fertility statistics. The Demographic and Health Surveys (DHS) Program calculates wanted fertility rates by classifying births as wanted or unwanted at the time of conception. The wanted fertility rate (WFR) is an estimate of the total fertility rate (TFR) if all unwanted births were avoided.Abbreviations: R (Rural), U (Urban), T (Total fertility rate), W (Wanted fertility rate), I (Ideal family size). Data sourced from the Demographic and Health Surveys (DHS).

Table A2: Program summaries: Business training

Program	**DOT**	**PI**	**WALN**
Country	Ethiopia	Togo	Ethiopia
Content	Fostering self-esteem, entrepreneurial spirit and general business skills	Psychology-based personal initiative training	Mentors-mentees program
Duration	30 hours of training over a period of 20 days	3 half-day sessions per week over the course of 4 weeks	2 days a month for 6 months
Eligibility	Female micro and small growth-oriented entrepreneurs	Entrepreneurs (men and women) in business for at least 12 months, outside of agriculture and with <50 employees	Female business owners with at least one employee, able to nominate at least six mentees they could train
Impact	30% increase in profits	30% increase in profits	Increase of 0.20 S.D. in profit and sales index
N	800	1500	200

Table A3: Program summaries: Land titling

Program	**Plan fonciers ruraux**	**Pilot land titling program**	**National land tenure regularization**
Country	Benin	Ghana	Rwanda
Content	Land demarcation and certification	Land demarcation and certification	Land titling program with special emphasis on women's property rights
Impact	Increase in the share of delineated parcels, in perceived tenure security and long-term investment in cash crops and trees	Increase in actual and perceived tenure security and land purchases, reallocation of labour inputs to high return non-farm activities	Improved perceived and actual rights over land, especially for women
N	596 villages	20 communities	300 villages

Table A4: Balance checks: Business training programs

	Ethiopia - DOT				***Ethiopia - WALN***				***Togo***			
	(1) T-C	**(2)** S.E.	**(3)** Unadj p-val	**(4)** Adj p-val	**(5)** T-C	**(6)** S.E.	**(7)** Unadj p-val	**(8)** Adj p-val	**(9)** T-C	**(10)** S.E.	**(11)** Unadj p-val	**(12)** Adj p-val
Panel A: Characteristics of the household												
Household size	0.371	0.172	0.032	0.349	-0.358	0.634	0.574	0.861	-0.339	0.353	0.337	1.000
Women is head of hh	-0.07	0.038	0.077	0.282	0.024	0.104	0.819	0.905	-0.034	0.064	0.598	1.000
Wealth index	0.091	0.078	0.241	0.442					0.044	0.083	0.597	1.000
Panel B: Characteristics of the woman												
Age	1.122	0.494	0.023	0.517	-0.162	1.358	0.905	0.905	-0.780	0.976	0.425	1.000
No education	0.014	0.016	0.405	0.637	-0.109	0.079	0.172	0.722	-0.018	0.047	0.706	1.000
Primary education	0.024	0.033	0.460	0.674	-0.020	0.099	0.841	0.883	-0.012	0.075	0.876	0.964
Middle school	-0.005	0.037	0.892	1.000	0.107	0.085	0.212	0.637	0.017	0.075	0.819	1.000
High school	-0.030	0.030	0.319	0.539	0.090	0.079	0.261	0.609	0.018	0.055	0.745	1.000
Higher education	-0.003	0.025	0.919	1.000	-0.041	0.095	0.671	0.783	-0.006	0.024	0.813	1.000
Nb of children at baseline	0.246	0.131	0.061	0.336	-0.548	0.433	0.210	0.736	-0.103	0.119	0.388	1.000
Married	0.055	0.037	0.144	0.317								
Panel C: Characteristics of the partner												
Partner age	1.509	0.953	0.114	0.315	-0.879	2.012	0.664	0.820	1.210	1.247	0.333	1.000
No education	-0.006	0.015	0.667	0.815	0.069	0.047	0.145	1.000	-0.017	0.031	0.592	1.000
Primary education	-0.003	0.045	0.943	0.988	-0.048	0.095	0.614	0.807	0.011	0.043	0.796	1.000
Middle school	-0.063	0.041	0.127	0.312	-0.069	0.075	0.358	0.751	-0.017	0.072	0.810	1.000
High school	-0.001	0.036	0.989	0.989	0.130	0.084	0.126	1.000	0.024	0.060	0.685	1.000
Higher education	0.079	0.045	0.084	0.263	-0.061	0.116	0.601	0.841	-0.001	0.069	0.984	0.984
Farmer/farm worker					-0.059	0.076	0.440	0.770				
Self employed	-0.091	0.049	0.065	0.285	0.131	0.092	0.160	0.841	-0.034	0.076	0.657	1.000
Employed	0.100	0.047	0.036	0.262	0.093	0.115	0.421	0.804	-0.040	0.076	0.602	1.000
Unemployed	-0.016	0.030	0.589	0.809	-0.150	0.103	0.150	1.000	0.068	0.037	0.068	1.000
Other	0.008	0.015	0.589	0.762	-0.015	0.026	0.557	0.899	0.006	0.016	0.734	1.000

Notes: This table reports results from OLS regressions of socio-economic characteristics on treatment indicators in the subsample of women under study. Standard errors are clustered at the randomization level and strata fixed effect are included when required by the study design. The level of education corresponds to the highest level attained. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A5: Balance Table for Land Titling Sample

	Benin				*Rwanda*				*Ghana*			
	T-C	S.E.	Unadj p-val	Adj p-val	T-C	S.E.	Unadj p-val	Adj p-val	T-C	S.E.	Unadj p-val	Adj p-val
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Characteristics of the household												
Household size	0.138	0.176	0.432	0.810	-0.017	0.097	0.862	0.941	0.233	0.133	0.080	0.342
Women is head of hh	-0.007	0.013	0.620	0.930	-0.004	0.007	0.497	0.781	-0.007	0.037	0.843	1.000
Panel B: Characteristics of the woman												
Age	-0.448	0.373	0.230	0.864	-0.406	0.385	0.292	0.803	-0.502	0.578	0.386	0.819
No education	0.000	0.014	0.978	0.978					0.006	0.009	0.516	0.877
Primary education	-0.001	0.012	0.951	1.000					0.130	0.044	0.003	0.018
Middle school	0.001	0.007	0.841	1.000					-0.019	0.045	0.667	1.000
High school	-0.001	0.002	0.598	0.996					-0.111	0.035	0.002	0.014
Higher education	0.000	0.000							0.000	0.015	0.991	0.991
Nb of children at baseline	0.149	0.120	0.215	1.000	-0.099	0.103	0.337	0.741	-0.182	0.122	0.137	0.387
Married	0.001	0.008	0.872	1.000	0.071	0.022	0.002	0.016	-0.034	0.035	0.326	0.790
Panel C: characteristics of the partner												
Partner age	-0.944	0.549	0.087	0.650	-0.802	0.569	0.160	0.585	0.204	1.111	0.854	1.000
No education	-0.022	0.028	0.430	0.922					0.014	0.008	0.102	0.346
Primary education	0.024	0.020	0.232	0.697					0.005	0.044	0.907	1.000
Middle school	0.003	0.016	0.860	1.000					-0.016	0.048	0.735	1.000
High school	0.005	0.006	0.401	1.000					0.046	0.058	0.428	0.809
Higher education	-0.011	0.005	0.031	0.459					-0.003	0.030	0.916	0.973
Farmer/ farm worker					0.009	0.023	0.676	0.929				
Self employed												
Employed					0.002	0.014	0.862	1.000				
Unemployed					0.000	0.006	0.968	0.968				
Other					-0.010	0.011	0.387	0.710				

Notes: This table reports results from OLS regressions of socio-economic characteristics on treatment indicators in the subsample of women under study. Standard errors are clustered at the randomization level and strata fixed effects are included when required by the study design. The level of education corresponds to the highest level attained. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A6: Attrition Across Samples

Country	Program	Obs.	Mean	S.D.	T-C	p-val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ethiopia	DOT	759	0.105	0.306	-0.026	0.223
Ethiopia	WALN	96	0.068	0.255	-0.052	0.254
Togo	PI	463	0.1	0.300	0.007	0.863
Rwanda	LTR	1971	0.014	0.119	0.017	0.014

Notes: This table displays the average attrition rate from baseline to the first follow-up in each impact evaluation. Column (4) reports the average attrition rate in the control group. Column (6) reports the coefficient of the regression of the attrition dummy on the treatment variable. Attrition rates for Benin and Ghana are not reported since no baseline was conducted, though attrition rates are below 2% across follow-up rounds and do not significantly differ by treatment status.

Table A7: Placebo test

	Number of children under 5
Personal initiative training	0.391***
	(0.122)
Traditional training	0.170
	(0.122)
p-val PI = TT	0.067
Observations	391
Control group mean	0.569

Notes: This table displays an OLS regression of the number of children under 5 in the household on the two treatment status: the personal initiative training and the traditional training. Controls include: number of children under 5 at baseline, women age, age square, a dummy equal to one if women is household head and household size. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively

Table A8: Impact on Number of Children for Older Women (Togo)

	Number of children under 5 in the household
Treatment	0.001
	(0.301)
Observations	177
Control group mean	0.458

Notes: This table displays an OLS regression of the number of children under 5 in the household on treatment status. The sample is restricted to women whose reproductive life is over– women who are stricly older than 45. Controls include: number of children under 5 at baseline, women age, age square, a dummy equal to one if women is household head and household size. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively

Table A9: Son and Treatment Interaction Effects

	Number of children	
	Ethiopia DOT	*Benin*
Treatment follow-up 1	0.174*	-0.080
	(0.095)	(0.125)
Treatment follow-up 2	0.209**	0.419***
	(0.086)	(0.148)
Women have at least one son	0.062	1.263***
	(0.077)	(0.122)
Women have at least one son X	-0.246*	0.209
Treatment follow-up 1	(0.134)	(0.156)
Women have at least one son X	-0.231*	-0.647***
Treatment follow-up 2	(0.131)	(0.171)
Number of children at baseline	0.848***	0.296***
	(0.040)	(0.031)
Number of children X	0.043	0.036
Treatment follow-up 1	(0.047)	(0.035)
Number of children X	0.012	0.013
Treatment follow-up 2	(0.048)	(0.037)
Observations	1,381	3,751
R-squared	0.810	0.493
Control group mean	2.326	4.021

Notes: This table displays OLS regressions of the number of children in the household on treatment status including interaction terms equal to one if the woman had at least one son and is treated at both periods. We also interact the treatment indicator with the number of children at baseline in both periods. Standard errors are clustered at the randomization level. Controls include: number of children at baseline, marital status, highest education level completed, age, age squared, whether woman is the household head and household size. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A10: Heterogeneity by land ownership (Ghana)

	Number of children	
	Woman owns at least one plot	Woman doesn't own at least one plot
	(1)	(2)
Treatment follow-up 1	0.042	0.402*
	(0.130)	(0.208)
Treatment follow-up 2	-0.176	0.45
	(0.243)	(0.269)
Observations	578	998
Control group mean	3.439	3.548
Difference test p-val: follow-up 1	0.233	
Difference test p-val: follow-up 2	0.352	

Notes: This table displays heterogeneous effect of the intervention in Ghana depending on whether women own at least one plot at baseline. Standard errors are clustered at the randomization level. Controls include: number of children at endline, age, age squared, marital status, whether the woman is household head. Village fixed effects are included. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A11: Heterogeneity by Son (Rwanda)

	Number of children	
	No son	At least one son
	(1)	(2)
Treatment	-0.001	0.011
	(0.030)	(0.019)
Observations	750	1,221
Control group mean	2.289	3.906
p-val	0.737	

Notes: This table displays heterogeneous effect of the intervention in Rwanda depending on whether the woman had at least one son at baseline. Standard errors in parentheses are clustered at the randomization level. Controls include: number of children, age, age squared, marital status and whether woman is household head. Village fixed effects are included. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A12: Heterogeneity by Rivals (Rwanda)

	Number of children	
	Woman has no rivals	Woman has rivals
	(1)	(2)
Treatment	0.001	0.050
	(0.017)	(0.041)
Observations	1,681	290
Control group mean	3.374	3.310
p-val	0.239	

Notes: This table displays heterogeneous effect of the intervention in Rwanda depending on whether the woman's husband had at least one son from a former union. Standard errors in parentheses are clustered at the randomization level. Controls include: number of children, age, age squared, marital status and whether woman is household head. Village fixed effects are included. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.

Table A13: Treatment Effects on Labor Supply

	Ethiopia	*Togo*	*Benin*		*Ghana*	
	Hours worked in self-employment (typical week)		Hours spent on paid work (past week)	Months spent in paid work (past 12 months)	Days worked in self-employment (past month)	Days spent on paid work (past 3 months)
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment follow-up 1	-0.792	5.109***	0.498	-0.062	0.455	0.026
	(2.351)	(1.773)	(0.452)	(0.102)	(0.469)	(0.027)
Treatment follow-up 2	-3.002					
	(2.464)					
Observations	1,113	1,514	2,459	2,459	879	833
Control group mean	74.85	62.65	2.098	0.684	5.595	0.113

Notes: This table displays the impact of the different treatments under study on women's labor supply. In Ethiopia and Togo, women's labor supply is proxied by the number of hours that the respondent declares she spends working for her business on a typical week. In Benin, we use two questions asking whether the woman has been employed in paid work or not and for how long she has been doing this job over the last 7 days and the last 12 months. In Ghana, women are asked the number of days they were self-employed last month and the number of days they spent working as an employee in the last 3 months. Controls include: woman's age, age squared, gender and cohabitation status of the household head, woman's marital status and number of children at baseline. Standard errors in parentheses are clustered at the randomization level. Village fixed effects are included. *, **, *** denote significance at the 10, 5 and 1 percent levels respectively.