

# CHILDREN ARE A POOR WOMEN'S WEALTH: HOW INHERITANCE RIGHTS AFFECT FERTILITY

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# Children are a Poor Women’s Wealth: How Inheritance Rights Affect Fertility

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## Abstract

Does improving widows’ inheritance rights have the potential to reduce fertility rates in Sub-Saharan Africa? This paper exploits a natural experiment in Namibia to identify the causal impact of a reform implemented in 2008 that improved widow’s inheritance rights on fertility behaviors. I combine pre-reform variations in customary inheritance laws across traditional authorities with time variation, using a difference-in-differences strategy. The results indicate that the reform led to a 24% decrease in the annual birth rate, equivalent to a reduction of one child over a woman’s reproductive life. Additionally, the reform delayed the age at first birth by 5.5 months. I find suggestive evidence that women had more children and at an earlier age as a mitigating strategy against the prevalent risk of dispossession in widowhood. In contexts where the widowhood risk may materialize at a young age due to large age gap between partners and to women’s longer life expectancy, women anticipate the need to have a financially independent child by their 40’s. These findings suggest that protecting widows’ inheritance rights could be a novel, low-cost policy lever to reduce fertility rates and delay early childbearing, addressing major development challenges in the subcontinent.

*Keywords:* Inheritance rights, Widows, Fertility, sub-Saharan Africa, Insurance

*JEL codes:* O12, J12, J13, J16

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# 1 Introduction

As the population in Sub-Saharan Africa (SSA) is projected to double by 2050 and account for 40% of global births (Nations, 2019), reducing high fertility rates is widely seen as a key lever for economic growth in the subcontinent (United Nations, 2024). In a context where women marry men eight years older and outlive them by four years on average, widowhood is a near-certain, gendered life experience (Pew Research Center, 2019; World Bank). Children often serve as a protective device against widowhood-related dispossession and financial insecurity. Providing alternative forms of old-age economic security for widows could therefore significantly reduce fertility rates. However, surprisingly little is known about this issue. This paper contributes to fill this gap by examining whether improving widows' inheritance rights might be a low-cost policy lever to tackle high fertility rates in SSA.

Due to the largest age gap between spouses globally (Pew Research Center, 2019) and to women's longer life expectancy, the risk of widowhood is particularly high in Sub-Saharan Africa. One in five women in their late 40' have experienced widowhood and one in two in their mid 60's (Beegle et al., 2016; Djuikom and Van de Walle, 2022). In the absence of inheritance rights, the death of a husband can lead to significant economic upheaval, as women may lose both their home and means of subsistence. Women are therefore likely to anticipate such a high and observable risk and to develop mitigating strategies, among which is having children early and often. In the event of dispossession, children can provide a place to live, financial support, and care. Since the risk of widowhood may materialize at an early age, women need to have their first child early to ensure they have a financially independent child when such an event occurs. The need for a widowhood insurance may also explain the demand for more children. The insurance potential of a given child could be at risk from death, migration or other shocks. As a result, women need to have a sufficient number of children to ensure the presence of a safety net, especially in a context where the quantity-quality trade off is limited. If women have more children and have them earlier than they would have had due to lack of inheritance rights, they pay a high cost to cope with this insecurity. In this paper, I examine whether the lack of widows' inheritance contributes to the persistence of high and early fertility in Africa.

To do so, I estimate the impact of a reform that significantly improved widows' inheritance rights over household land in Namibia. Namibia provides a relevant context to study this research question

since widows have historically faced a high risk of dispossession due to long-standing matrilinearity<sup>1</sup> and patrilocality<sup>2</sup> traditions. Furthermore, this reform offers a unique opportunity to examine the impact of enhancing widows' rights, as it is notably ambitious compared to previous efforts in other contexts. First, it provides extensive protection to women, recognizing both formal and customary marriages and allowing women to retain land rights even if they remarry. Additionally, the reform directly address customary laws rather than focusing solely on statutory laws. In contrast, most attempts to reform statutory inheritance laws in other African countries have been hindered by enforcement issues, as customary law still prevails in terms of inheritance practices (Richardson, 2004).

To identify the causal impact of the reform, I exploit a natural experiment induced by pre-reform variations in customary laws across local authorities. Approximately half of Namibia's territory is administered by Traditional authorities (hereafter, TAs) which allocate land in the territories under their governance according to their own customary laws. Prior to the reform, some TAs already protected widows from dispossession, while others applied discriminatory customary laws. As a result, the reform changes the laws governing inheritance practices only for women living in TAs that used to be discriminatory. I combine this geographical variation with a time variation in a difference-in-differences strategy to identify the impact of an improvement of widow inheritance rights on fertility. As TAs borders are different from official administrative borders, I build a novel database combining the geographic location of the TAs with the pre-reform customary laws to identify treated and untreated areas.

Before the reform, widows in discriminatory TAs seemed to be more likely to depend on their family, particularly their children, than widows in non-discriminatory TAs. Widows in discriminatory TAs were 18 pp less likely to be household heads, 4.5 pp more likely to live with a sibling and 16.6 pp more likely to reside with at least one married child. Living with a married child can be considered as a proxy of a mitigating strategy since these children are financially independent and capable of providing their mothers with both housing and potential financial support. Consistently,

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<sup>1</sup>In matrilinearity systems, the wife and the children do not belong to the husband lineage, and therefore are not entitled to inherit his property. Instead, the husband property is transmitted to the male members of his family and his wife and children may be left with nothing.

<sup>2</sup>Patrilocality traditions implies that sons tend to settle in the village where they were born, close to their parents, while daughters join their husband's village of residence (Murdock (1967)).

women in discriminatory TAs desired more children, had more children on average, and tended to have their first child earlier compared to those in non-discriminatory TAs<sup>3</sup>.

I measure the impact of the reform on the *quantum* and on the *tempo* of fertility using three waves of the Namibian Demographic and Health Surveys (NDHS) collected in 2000, 2006 and 2013. To study the impact of the reform on the annual birth rate, I build a panel dataset at the woman-year level with retrospective birth histories. In this first specification, I compare the average annual birth rate of women living in discriminatory and non-discriminatory TAs before and after the reform. I include years and TAs fixed effects to flexibly control for common time trends in fertility and for unobserved heterogeneity across TAs. Then, I examine the impact of the reform on the onset of childbearing with two approaches. I first employ a difference-in-differences method comparing the age at first birth of women who had their first child within the 5-years span before reform to the age at first birth of women who had their first birth within the 5 years post-reform. To address the potential selection bias in this approach, I then estimate a Cox proportional hazard model which efficiently handles right-censored durations.

I find that the reform reduces the annual birth rate by 4.7 pp, which is a sizable effect representing a 24% decrease over the pre-reform annual birth rate in discriminatory TAs. This effect corresponds to a decrease of one child over a women reproductive life. The coefficient is statistically significant at the 1% level and is remarkably robust to the addition of various individual or regional time-invariant covariates. The effect is also stable when I include women fixed effects, indicating that women adjust their behavior in response to the reform over the course of their reproductive life. I also conduct an event study analysis which lends credibility to the common trends assumption.

I also find that the reform affects the onset of fertility. I find that the reform delays the age at first birth by 5.5 months on average and reduces the likelihood of having a first birth before or at 23 years old (4th quartile) by 7.3 percentage points. The reform appears to bridge the pre-reform gap between discriminatory and non-discriminatory TAs, suggesting that the 8 pp initial disparity was largely due to women who had a child earlier than they would have preferred due to the absence of inheritance rights. The results estimated by the Cox model corroborate these findings, indicating that the reform led to a 30% reduction in the hazard ratio of first birth between the treatment and the control group.

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<sup>3</sup>In 2005, the total fertility rate was 3.7 children per women in non-discriminatory TAs and 5.6 in discriminatory TAs (Computations are my own). Women's ideal number of children was higher in discriminatory (4 against 3.4) and the age at first birth was also two years lower.

Consistent with the hypothesis that high and early fertility are employed as mitigating strategies against the risk of widow dispossession, I find a decline in co-residence patterns following the reform. Using a dataset of all widows listed in households rosters from 2007 and 2013, I find that the reform induced a 30% decline in the likelihood of widows living with at least one married child. These findings corroborate the idea that improved inheritance rights have reduced women’s reliance on their children for economic security in widowhood.

This study contributes to the literature on women inheritance rights and its implications in terms of gender inequalities and women empowerment in developing setting. Most papers focus on the effects of reforms that aim to equalize inheritance rights between sons and daughters. A significant portion of these studies examines the impact of the Indian Hindu Succession Act and find positive effects on women’s assets (Deininger et al., 2013), education in the first and second generation (Deininger et al., 2013); (Roy, 2015); (Bose and Das, 2017); (Deininger et al., 2019), dowries (Roy, 2015), bargaining power (Mookerjee, 2019), business creation (Naaraayanan, 2020), autonomy and labor supply (Heath and Tan, 2020). Only a few studies have examined inheritance rights in the African setting (Harari, 2019; La Ferrara and Milazzo, 2017; La Ferrara, 2007) and the few papers which explore how inheritance rights affect fertility behaviors primarily focus on son preferences (Carranza, 2012; Bhalotra et al., 2020). The implications of the lack of inheritance rights for widows remain however largely understudied (Anderson and Bidner, 2023; Djuikom and Van de Walle, 2022), especially *before* widowhood (Dillon and Voena, 2018). This study starts to fill this gap by showing that women are forward-looking and incorporate the expropriation risk associated with widowhood into their fertility decision.

This study is among the first to investigate the institutional determinants of fertility in low-income countries. An extensive literature in developed countries shows the importance of institutions affecting the compatibility between family and career in determining fertility rates (Doepke et al., 2022). Fertility rates are influenced by the availability of public childcare (Olivetti and Petrongolo, 2017; d’Albis et al., 2017; Bauernschuster et al., 2017; Rindfuss et al., 2010), parental leave policies (Olivetti and Petrongolo, 2017; Lalive and Zweimüller, 2009; Raute, 2019; Erosa et al., 2010), fiscal policies (Apps and Rees, 2004; Fehr and Ujhelyiova, 2013; Eckstein et al., 2019), and labor market flexibility (Del Boca and Sauer, 2009; Guner et al., 2021). Such factors are less relevant in contexts where most women are self-employed in the informal sector and rely on informal childcare (Finlay, 2021). Institutions in developing countries may however influence fertility through alternative channels, such as women rights (Godefroy, 2019), land distribution regulations

(Ali et al., 2022), or rules regulating the transmission to children (Fontenay et al., 2024). This paper contributes to this literature by showing that widows' inheritance rights may be a key institutional factor in explaining the persistence of high and early fertility in Africa.

My core contribution to the literature is to provide novel evidence on how to significantly delay early childbearing in low-income contexts. Various policy tools have been tested to delay the onset of childbearing. One approach has targeted girls' beliefs and preferences with the underlying idea that early pregnancy was the result of misinformation about the risks or a lack of girls capacity to control their births. Such programs promote girls' empowerment providing them with life skills and/or health-related information including family planning information. Another approach has been focused on delaying marriage and within-marriage pregnancy by increasing educational and professional opportunities, thereby increasing the opportunity cost of early marriage and pregnancy. Programs promoting girl's empowerment have shown contrasted impacts at high costs (Bandiera et al., 2020; Buehren et al., 2015; Berge et al., 2022). Information dissemination has had mixed impact as well (Duflo et al., 2015; Dupas et al., 2018; Doyle et al., 2010). However, increasing girls' opportunity cost of fertility has proved effective in delaying early marriage and fertility (Duflo et al., 2015; Hahn et al., 2018; Alam et al., 2011; Giacobino et al., 2022; Jensen, 2012; Heath and Mobarak, 2015). I show that a novel approach based on the early fertility motives may significantly delay early childbearing at low-cost. Importantly, I estimate an impact that is either equivalent or superior to the impact of all the programs targeting early pregnancy, as listed by (Berge et al., 2022). Furthermore, while the policy interventions mentioned earlier are effective when targeting adolescents, enhancing inheritance rights appears to be more impactful for young adult women. Hence, these policy approaches can be considered complementary, and their combination may yield a substantial cumulative effect.

The paper is structured as follows. Section 2 provides an overview of the Namibian context and widows inheritance rights. Section 3 presents the data and descriptive statistics. Section 4 outlines the empirical strategy. Section 5 presents the main results. Section 6 discusses the mechanisms at play. Section 7 discusses the external validity of the results and the political implications. Section 8 concludes.

## 2 Context

### 2.1 Communal Land and Traditional authorities

Land tenure in Namibia is based on a dual system inherited from colonial policy. In the 1890s, the German colonial administrators divided the country into two areas to protect their settlement in the South from a cattle disease outbreak (Miescher (2012)). As a result, the German authorities restricted their governance over land south of this frontier, known as the "Red Line", while land in the North continued to be governed by traditional authorities. These institutional differences have persisted during South African colonial administration and after independence in 1990, resulting in a divergent land tenure regime (Chlouba and He (2021)). South of the Red Line, land is allocated through the market under a private property regime. In the North, land belongs to the state and is held in trust by Traditional authorities (TAs) who allocate land titles to the population. Customary land titles cannot be owned, sold, or used as a collateral, but are held for life, thereby providing a high level of tenure security (Werner (2018)). 65% of the population live in communal areas, which account for 39% of Namibian land (USAID (2010); Mendelsohn et al. (2012)) Communal areas are mainly rural and the population livelihood is based on livestock rearing or subsistence farming with low productivity.

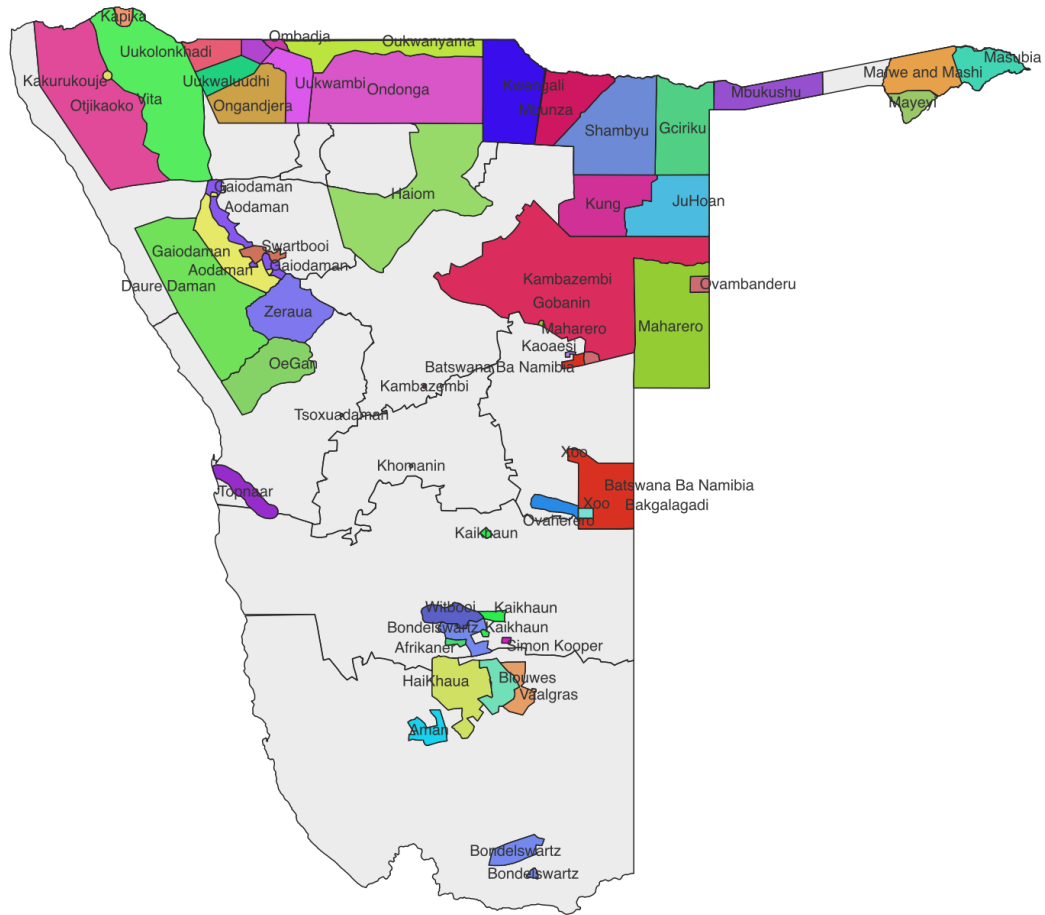
Communal areas in Namibia are divided into territories under the jurisdiction of Traditional authorities. TAs have been in existence for hundreds of years, with clearly defined boundaries and well-known customary laws among the population (Mendelsohn (2008)). As displayed in figure 1, 51 TAs are recognized by the Namibia Constitution (Chlouba (2020)). The population generally trusts TAs and sees them as intermediaries between the state and the community, as they communicate the needs of the population to the central government<sup>4</sup>. TAs are recognized by the government and receive financial compensation for their work. In this mixed governance system, TAs administer and execute customary laws, while the central government applies statutory laws. Customary laws are defined as the norms, procedures, usages, and traditions of a traditional community, and they can be applied "so far as they do not conflict with the Namibia Constitution" (Traditional Authorities Act of 2000). TAs are organized hierarchically, with the chief at the highest level of authority, followed by senior headmen, and local headmen (usually village headmen) who assist in the administration of the territory (Mendelsohn (2008)).

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<sup>4</sup>According to the Afrobarometer survey conducted in 2003, in regions with only or mostly communal land, 53% of the population expressed a high level or very high of trust in Traditional Authorities, while 85% reported having at least some level of trust in them.



Figure 1: Traditional authorities in Namibia



Note: This map displays the 51 traditional authorities recognized by the Namibian government. Source: Chlouba, 2019

## 2.2 Widows Rights and Land Dispossession in Namibia

Since most ethnic groups in Namibia are matrilineal, inheritance when a man dies has traditionally been governed by matrilineal principles<sup>5</sup>. In this system, the wife and children of a man do not belong to his lineage and are not entitled to inherit his property. Instead, a man's property is typically transmitted to the male members of his matrikin, such as a brother or the son of his brother or sister. In addition, the traditional marriage practice in Namibia is patrilocal, which means that sons tend to settle in the village where they were born, close to their parents, while daughters join their husband's village of residence (Murdock (1967)).

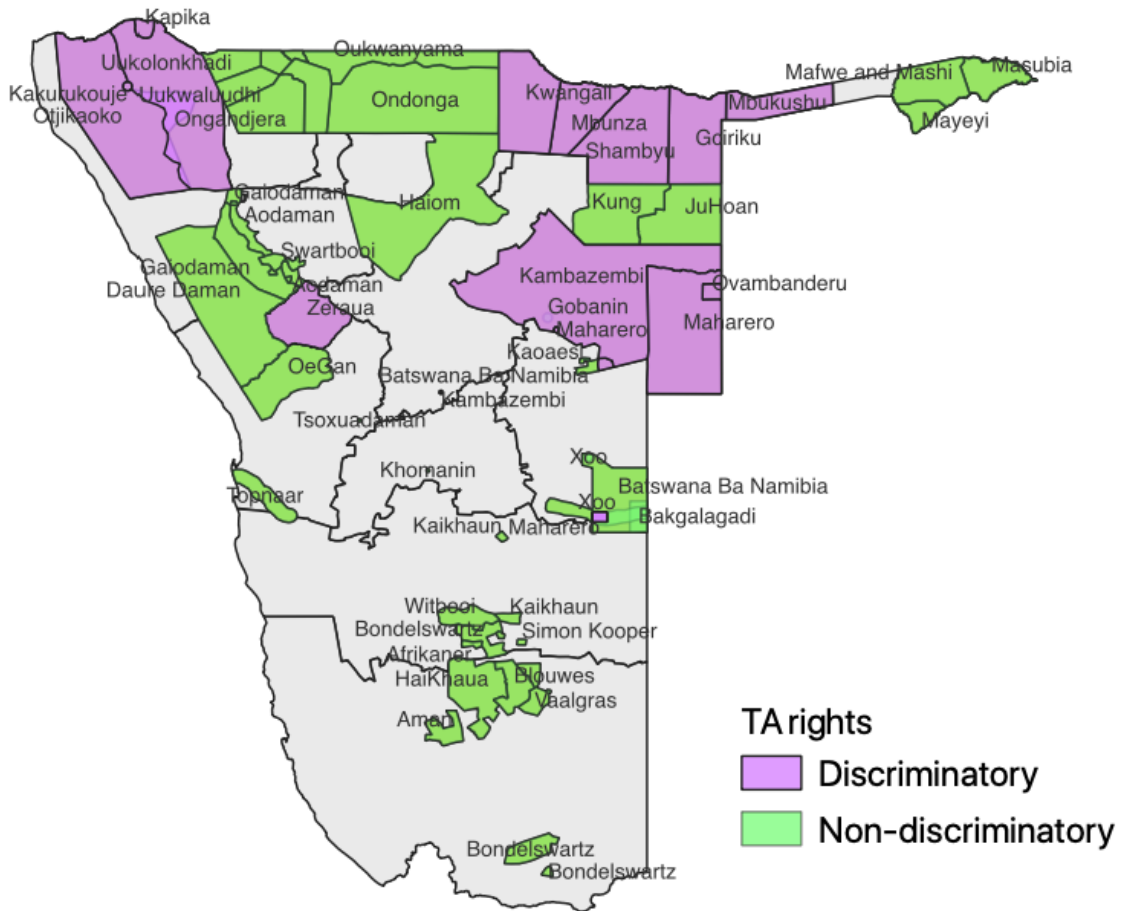
These traditions imply a high level of risk for women to be dispossessed of their land when their husband dies (LeBeau et al. (2004); Gordon (2005); Siiskonen (2009); Hubbard and Terry (2005)). In-laws may consider that they have a right to the late husband's property, and women are often vulnerable to this pressure as they are grieving and potentially isolated from their own family. In some communities, humiliating practices such as "widow cleansing" are even carried out, which further exacerbate women's vulnerability to expropriation pressures from their in-laws (Hubbard and Terry (2005); Thomas (2008)).

Given that most households in communal areas rely on subsistence farming, widows may lose their home and their means of subsistence when they are dispossessed. Therefore, widows in Namibia are a particularly destitute subgroup with potentially far-reaching consequences for their children as well (Thomas (2008); Gordon (2008)). In this context, some traditional authorities have been applying customary laws that recognize widows inheritance rights, acting against matrilineal principles (Ambunda and de Klerk (2008); Mendelsohn (2008)). For instance, the traditional leaders of the six TAs in the Owambo region decided to enshrine widows' inheritance rights over their home and land in customary law in 1993. The level of awareness and application of this new norm has been shown to be high (Ubink (2011)). However, 12 remaining TAs continue to enforce discriminatory customary laws regarding inheritance. I can therefore classify the TAs between the discriminatory (in purple) and non-discriminatory TAs (in green) (Figure 2).

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<sup>5</sup>The Herero are bifurcated descent, but wife and children are excluded from inheritance similarly as the matrilineal ethnic groups (LeBeau et al. (2004); Gordon and Ovis (2005)). The only patrilineal ethnic groups are the Nama/Damara, which represents 4.4% of the population living in communal land

Figure 2: Discriminatory and non-discriminatory TAs



Note: This map displays the 51 traditional authorities recognized by the Namibian government and classify them depending on whether the customary laws were discriminatory or not against widows before the Communal Land Reform.

## **2.3 The Communal Land Reform Act**

### **2.3.1 Objectives and Provisions**

The Communal Land reform act of 2002 is the reform I study in this paper. It was meant to improve agriculture productivity among the population that has been disadvantaged during the colonial era (Thiem (2014)) and to reduce gender-based discrimination. The reform consists of two main components. Firstly, it is a standard land titling reform that formalizes existing land titles with the objective of reducing disputes and expropriation risk (Werner (2015); Werner (2018)). The primary power for the allocation of land remains with the TAs, to whom households must apply for their land title paying a N25\$ application fee.<sup>6</sup> Prior to the reform, land applications were officially free, but some TAs were asking some financial participation. Communal land titles are limited to residential and farming purposes, and the land claimed cannot exceed 20 hectares. The second component enshrines women rights to remain on the land after the death of their spouse. This reform introduces extensive protection for widows, as both customary and civil marriages are recognized, and the right to occupation continues to be held by the surviving spouse even if she remarries. The law stipulates that a married man's land title should be automatically reallocated his widow at his death, without requiring her to pay the application fee. Additionally, Communal Land Boards are created in each region containing communal land to control and ratify the decisions of the TAs in conformity to the principles of the law.

### **2.3.2 Implementation**

Due to lack of budget and staff from the Ministry of Land reform on the one hand, and to lack of information about the CLRA in the regions on the other hand, actual implementation was delayed until 2008. Administrative data from the Ministry of Land Reform shows that no land were registered until 2008 when the process started gradually (Thiem (2014)). Studies show that the population and especially women were unaware of the reform and its provisions regarding their rights before this date. (Mandimika and Matthaei (2013); Werner (2008)) It is estimated that 245,000 land titles were registered in 2014, one year after the end of the period under study. The registration was therefore still incomplete, since 33% of land was registered on average in 2014 (Table 1).

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<sup>6</sup>The fee is negligible as it represents approximately 2% of the average monthly household income, which amounted to N\$1884 in 2003 in the rural areas of the regions under study. Computations are my own based on 2003 NHIES data.

The implementation of the Communal Land Reform Act was carried out through a two-part process. First, staff from the ministry, accompanied by local representatives of the traditional authority, informed the villages of the reform and its implications for their land rights. Then, land claims were registered through a participatory process that involved the local population and the village headmen in demarcating the land parcels and validating each claim. The land parcels were then digitally mapped and displayed in the village for a period of 7 days. After this, the main chief and the Communal Land Board validated each land claim in accordance with the principles of the law (Werner (2021)).

Table 1: Share of land digitised and registered in 2014 per region

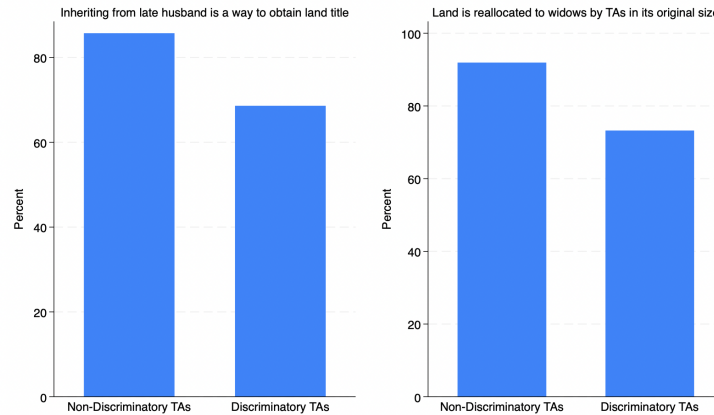
<b>Region</b>	<b>Estimate of digitised parcels (% in 2014)</b>	<b>Estimate of registered parcels (% in 2014)</b>
Caprivi	50	20
Erongo	76	73
Hardap	63	67
Karas	53	58
Kavango	0	0
Kunene	75	60
Ohangwena	57	27
Omaheke	24	19
Omusati	55	30
Oshana	91	68
Oshikoto	52	21
Otjozondjupa	64	50

Note: This table reports the share of communal land that had been digitised and registered per region in 2014. Source: Thiem (2014)

### 2.3.3 Improvement of Widows' Inheritance Rights

Data collected in 2016 by (Shapi et al., 2020) in 9 of the 13 regions including communal land provides suggestive evidence that the reform actually improved widow's inheritance rights in areas governed by Traditional authorities which were formerly discriminatory. The sample consists of 1,005 women aged 18 and older, villages and women within villages were randomly sampled and the number of women selected per region was proportionate to the regional population. Consistent with

Figure 3: Perceived Rights to Inheritance for Widows



Note: The graph on the left shows the percentage of women who cited "inheriting from a late husband" as a means of obtaining a communal land title in their own right (N=617). The graph on the right displays the percentage of women reporting that, upon a husband's death, the land is reallocated to his widow in its original size (N=641). These graphs are based on the data collected by (Shapi et al., 2020) in 2016 and restricted to the women living in the areas under study.

the dominance of agriculture in communal areas, 60% of women in the sample rely on subsistence farming as their main source of income, highlighting the critical importance of access to land. Women are on average 44, 14.8% are widows and 54.4% have not reached a level higher than primary education.

I focus on women living in formerly discriminatory TAs to examine whether the reform seems to have improved perceived and actual widow's inheritance rights over land. As displayed in figure 3, 68.6% of women living in these areas cite "inheriting from a late husband" as a means through which women can acquire communal land in their own right. In addition, 73.2% state that TAs reallocate the inherited communal land to the wife in its original size when her husband dies. Consistently with the enforcement of the law, 81% of widows living in formerly discriminatory TA are household head, 77.8% declare that they hold the right over the communal land that they live on and among them, 70.37% declare that they inherited it from their late husband.

Importantly, the land titling process was still incomplete in 2016, suggesting that partial land registration have influenced women's perceived and actual rights. Such a result supports the hypothesis of this paper that land registration, as an observable process, can influence behaviors even if its implementation remains incomplete by the end of the study period.

### **3 Data and Empirical Setting**

In this section, I first describe the data used in this study, then I display descriptive statistics about fertility and widowhood on women living in areas governed by Traditional authorities which were discriminatory and non discriminatory before the reform, as my empirical strategy leverages this pre-reform differences. Appendix table A1 displays descriptive statistics on various socio-demographic characteristics of the two subgroups.

#### **3.1 Datasets**

I combine data from three main sources: a novel dataset on communal land and Traditional authorities, the Namibian Demographic and Health Surveys, and the Namibian Household Income and Expenditure Surveys

##### **3.1.1 Data on Communal Land and Traditional Authorities**

I built a novel dataset that includes the locations of communal land, the borders of traditional authorities, and their customary laws regarding inheritance. I first georeferenced and digitized maps displaying the delimitation of communal land and the boundaries of each traditional authorities based on the historical and anthropological work of (Miescher, 2012) and (Chlouba, 2020). I then combined information about TAs' customary laws using various sources, such as institutional reports from the Ministry of Land Reform (Mendelsohn, 2008), the Ministry of Agriculture, Water and Forestry, and research works in anthropology and political sciences (Gordon and Ovis, 2005; Werner, 2008). I also conducted interviews with members of the Ministry of Land Reform and academic researchers.

##### **3.1.2 Data on Fertility**

I pool three waves of the Namibian Demographic and Health Surveys (NDHS) conducted in 2000, 2007 and 2013 by the Ministry of Health and Social Services. The DHS is a nationally representative household survey that collects detailed information on socio-demographic characteristics and extensive information on women fertility behaviors and preferences. I obtain a sample of 24,086 women who were randomly selected among eligible women in the household to be interviewed. These databases are geolocated and include women complete birth histories, which enables me to compare

fertility behaviors between traditional authorities and across time. One limitation of these data is that the last survey wave was collected in 2013. As a result, I can only observe one cohort of women who have been exposed to the treatment during their reproductive lives and whose reproductive lives are complete. I also use the 2007 household survey to describe widows household structures in the area under study the year before the implementation of the program.

### **3.1.3 Data on Namibian Households**

To control for a variety of potential confounders, I use two waves of the Namibian Household Income and Expenditure survey (NHIES) conducted in 1993-1994 and 2003-2004 by the Namibian Statistic Agency. I cannot build controls at the traditional authorities level because these databases are not geolocated. Therefore, I build variables at the region level for the 2003 wave such as the share of rural households, the share of households whose main source of income is agriculture, household wealth index, and the share of households which have access to media (radio or TV). Additionally, I include additional variables from the 1993 database which are not available in the 2003 database such as the average distance to a hospital or to a primary school. These variables are available at the ethnic group\*region level.

## **3.2 Sampling**

I restrict my analysis to women living in communal areas as the reform only affects communal land. I also exclude women living in the Kavango region from my sample as the reform has not been implemented in this region due to conflicts with traditional authorities. Moreover, I limit my sample to black women, as white women constitute only a small proportion (1.9%) of the population in communal areas. In addition, the socioeconomic characteristics of white women differ significantly from those of black women<sup>7</sup>.

Finally, I restrict my sample to women belonging to matrilineal ethnic groups, which account for 96.6% of the population residing on communal land. This paper aims to explore how women who are highly exposed to dispossession risk after the loss of their husband employ fertility as a mitigating strategy. In matrilineal traditions, neither wives nor children can inherit the household property. Instead, in patrilineal groups, a man's property is transmitted to his son. Therefore, prior to the reform, access to property after widowhood depended on fertility for women in patrilineal groups,

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<sup>7</sup>A large majority (91.6%) of white women in communal areas belong to the two highest wealth quintiles, whereas only 20% of black women fall into those categories.



but not in matrilineal groups. Consequently, the expected impact of the reform is theoretically different. This sample restriction does not compromise the external validity of the findings as discussed in section 7.1.

### 3.3 Descriptive Motivating Evidence

#### 3.3.1 Fertility Behaviours and Preferences

Before the reform's implementation, women living in discriminatory Traditional authorities had their first child at a younger age, had a higher number of births, and desired a higher number of children. Figure 4 shows that women in discriminatory TAs had their first birth on average at 18.8 and 19.1 in 2000 and 2006 respectively, about two years before women in non discriminatory TA. The age at first birth increased after the reform among women in discriminatory TAs by approximately half a year, while it slightly decreased among women in discriminatory TAs. In addition, women living in discriminatory TAs had on average one more birth than women in non-discriminatory TAs (2.9 and 1.9 respectively). This disparity seems to reflect fertility preferences as women in discriminatory TAs wanted on average 0.5 more children than women in non-discriminatory TAs (3.81 and 3.31 respectively) in 2006. The graph on the right of figure 4 suggests that the ideal number of children slightly dropped in the post-reform period in the former discriminatory TAs, while it slightly increased in the non-discriminatory TAs.

#### 3.3.2 Widowhood and Dispossession

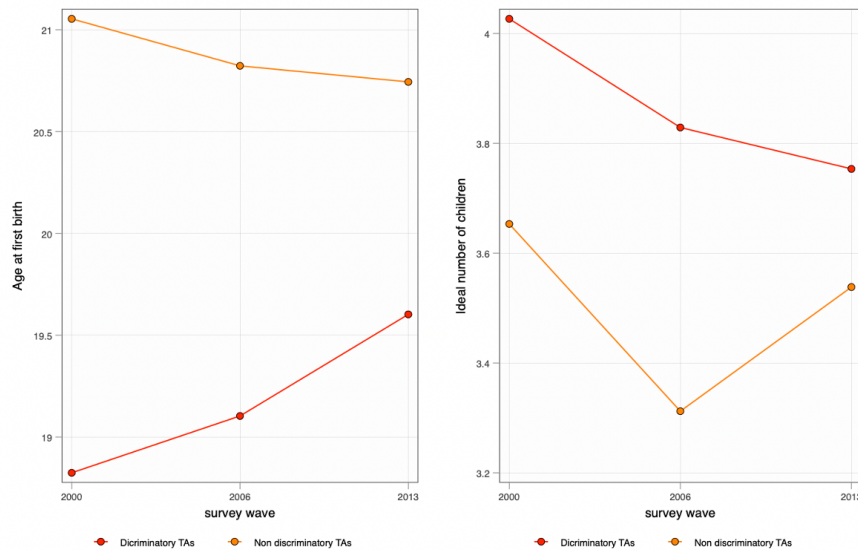
I use the question 'Who inherited most of your late husband's property?' asked in the 2006 DHS wave to identify women who have experienced widowhood in their life. Approximately one in ten women aged over 30 reported being widowed at least once and one in five among women aged 45 to 49. The graph in figure 5 displays the share of women who reported having ever experienced widowhood in the 2007 survey wave. The graph shows that the likelihood of experiencing widowhood sharply increases after age 40, which is consistent with the average age gap being 8 years between spouses in the population under study, and the disparity in life expectancy. In 2006, life expectancy for women in Namibia was 55 years, compared to 50 years for men (World Bank).<sup>8</sup>

In Namibia, 60% of women who have been widows at some point in their lives have experienced dispossession. Among them, 92% have been dispossessed by their in-laws. As expected, widows'

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<sup>8</sup>This gender gap in life expectancy remains throughout the period under study and tends to widen, reaching an 8-year gap in 2020, with women living on average 67 years and men 59.

Figure 4: Descriptive statistics



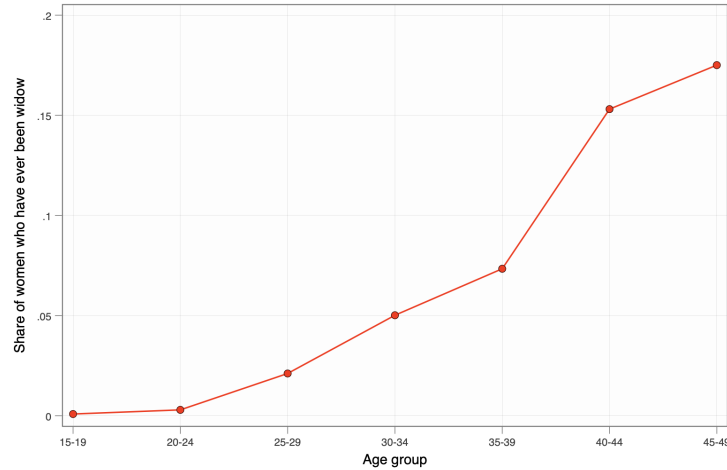
Note: These graphs plot the average ideal number of children and the average age at first birth for each survey wave in the whole sample of women aged 15 to 49. I use the sample under study and include survey weights. Data: DHS 2000, 2006-07 and 2013.

dispossession is correlated with poverty. Women who have experienced dispossession are twice as likely to belong to the poorest quintile of the population and three times less likely to belong to the richest quintile, compared to widows who have not suffered dispossession.

To describe the current widows' household structure, I built a database including all widows mentioned in the 2006-2007 DHS household roster. Importantly, women who have been widows and have remarried ever since are not taken into account in this database since their current marital status is not "widow". Women in discriminatory TAs are 17.5 pp less likely to be household head than women in non-discriminatory TAs (Figure 6). Such a gap is consistent with the differential risk to be dispossessed across TAs, as a woman is less likely to be household head if she does not own the house where she lives. In addition, widows in discriminatory TAs are more likely to live with their sibling by 4.5 pp. Finally, they are more likely to live in a household where the head is a relative—but not their husband—by 18pp. Such differences suggests that widows who are more vulnerable to land dispossession are more likely to reside in the household of a family member.

The financial support between a widow and her children may go both way. In particular, widows who live with young children who do not yet have a job are likely to be the ones providing support for their children, rather than the other way around. Therefore, I use the presence of at least one

Figure 5: Share of women who have ever been widow



Note: This graph displays the share of women who have ever been widows by age category using the question "Who inherited most of late husband property" asked in the 2006 DHS wave.

married child in the household as a proxy for a coping strategy. I make the assumption that children who are married are financially independent and that widows who reside with them are likely to be the recipient of the support. I find that 23.4% of widows in discriminatory TA live with at least one adult married child in 2006, while only 6.4% co-reside with their adult married child in TAs with rights. This substantial difference provides suggestive evidence that widows may reside with financially independent children as a mitigating strategy in the event of land dispossession. Interestingly, widows are equally likely to live with at least one married son as they are with at least one married daughter.

## 4 Empirical Strategy

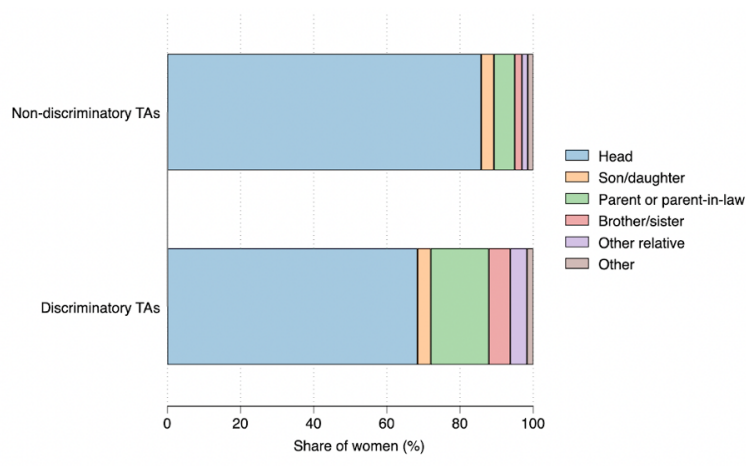
### 4.1 Identification Strategy

The Communal Land reform includes two main components:

- A land titling program aimed at improving households tenure security (Component 1)
- The protection of widows rights to inherit their late husband's property (Component 2)

Both women in discriminatory and non-discriminatory TAs were affected by Component 1 but the legal framework regarding widows inheritance rights only changed for discriminatory TAs. To isolate the impact of Component 2 on fertility, I implement a difference-in-differences strategy

Figure 6: Current Widows' Relation to Household Head



Note: This graph displays widows relations to head in discriminatory and non-discriminatory TAs using a database including all widows listed in 2006 DHS household roster. The sample includes 978 women.

combining the pre-reform variation in customary laws across TAs with a temporal variation. I include women living in the 12 discriminatory TAs in my treatment group and women living in the 39 non-discriminatory TAs in my control group. The potential effect of Component 1 on fertility is therefore canceled out in the double difference, which allows me to identify the impact of an improvement of widows' rights on fertility.

## 4.2 Econometric Specifications

I estimate the impact of an improvement of widows' right on both the number of births (the *quantum* of fertility in demographic jargon) and on their timing (the *tempo* of fertility). My first specification estimates the impact of Component 2 on the annual birth rate, and my second specification focuses on its impact on the age at first birth.

### 4.2.1 Period Specification

My first identification strategy is a difference-in-differences at the women\*year level. I exploit two sources of variation in women exposure to a legal framework which recognizes widows' inheritance rights. I compare the annual probability of birth before and after the implementation of the Communal Land reform (2008) which grants women the right to inherit their husband's property. The second source of variation results from the differential customary laws across TAs before the reform.

This strategy identifies the pre-reform disparity in annual birth rate between discriminatory and non-discriminatory TAs which was due to the absence of widows' inheritance rights.

The difference-in-differences specification writes as follows:

$$Y_{i,g,t} = \beta(T_{i,g} * Post_t) + \alpha_g + \lambda_t + \epsilon_{i,g,t} \quad (1)$$

where  $i$  denotes a woman,  $g$  the traditional authority where she lives, and  $t$  the year. The outcome of interest  $Y_{i,g,t}$  is a binary variable equal to one if women  $i$  living in TA  $g$  gave birth during year  $t$ .  $T_{i,g}$  is my treatment variable, taking the value one when the woman lives in a TA which did not guarantee widows inheritance rights before the reform.  $Post_t$  is a binary variable equal to zero from 2005 to 2007 and to one from 2008 when the implementation of the reform started. I substitute TAs fixed effects  $\alpha_g$  for the main treatment effect ( $T_{i,g}$ ) and year fixed effects  $\lambda_t$  for the time effect ( $Post_t$ ). I use survey weights and cluster the standard errors at the treatment level, i.e., at the Traditional authority level.

The TA fixed effects capture unobserved heterogeneity across TA areas and the year fixed effects controls for unobserved shocks that commonly affect women fertility observed in the same year. The coefficient of interest  $\beta$  measures the impact of the implementation of the reform on the annual probability of birth for women living in formerly discriminatory TAs.

I also estimate this specification including various sets of time-invariant individual covariates such as women education level, and region or region\*ethnic group level controls such as the share of poor, the share of people whose primary source of income is derived from agriculture, the share of people who have an access to medias, the average distance to a primary school, to an hospital, etc. In my last specification, I also include ethnic group fixed effects to show that the effects I estimate are not driven by a differential ethnic composition in the control and the treatment TA but from pre-reform differences in customary laws regarding widows inheritance rights. I use a binary treatment rather than a continuous variable reflecting the reform implementation at the end of the period under study, as the variation in implementation across TAs is likely endogenous. Consequently, I estimate an intent-to-treat effect of formalizing widows' inheritance rights on fertility.

To build a panel database with observations on fertility at the women\*year level, I use retrospective information on women birth history collected during the 2006 and 2013 DHS survey waves. Following Rossi and Godard (2022), I restrict the sample to the last 10 years before the survey date to keep the age structure constant for each year observed. With the 2006 survey, I have information

for the year 2006 on women aged 49 to 15, on the year 2005, on women from 48 to 14, on the year 2004, from 13 to 47, etc. Restricting my sample to the 10 years before the survey wave and removing women older than 40, allow me to observe women from 15 to 40 every year from 1996 to 2013.

#### 4.2.2 Identifying Assumptions

The estimation of the treatment effect would be biased if fertility in the control and the treatment group did experience differential time trends before the implementation of the reform. To test the common trend assumption, I implement two tests.

First, I interact treatment with the time variable before the implementation of the treatment to estimate the pre-reform linear annual trend in birth rate. As displayed in table 2, the coefficient is very close to the null and non statistically significant, showing that the treatment and the control group fertility were not on differential linear trends before 2008. However, the estimate would still be biased if the treatment and control groups fertility were on differential non-linear time trend before the implementation. To rule out this concern, I conduct an event study analysis including treatment leads and lags to compare the treatment and control group at multiple points in time. I use a generalization of the econometric specification (1) and estimate the following equation:

$$Y_{i,g,t} = \sum_{n=1}^{13} \beta_n (T_{i,g} * \mathbb{1}[t = n]) + \alpha_g + \lambda_t + X_i + \epsilon_{i,g,t} \quad (2)$$

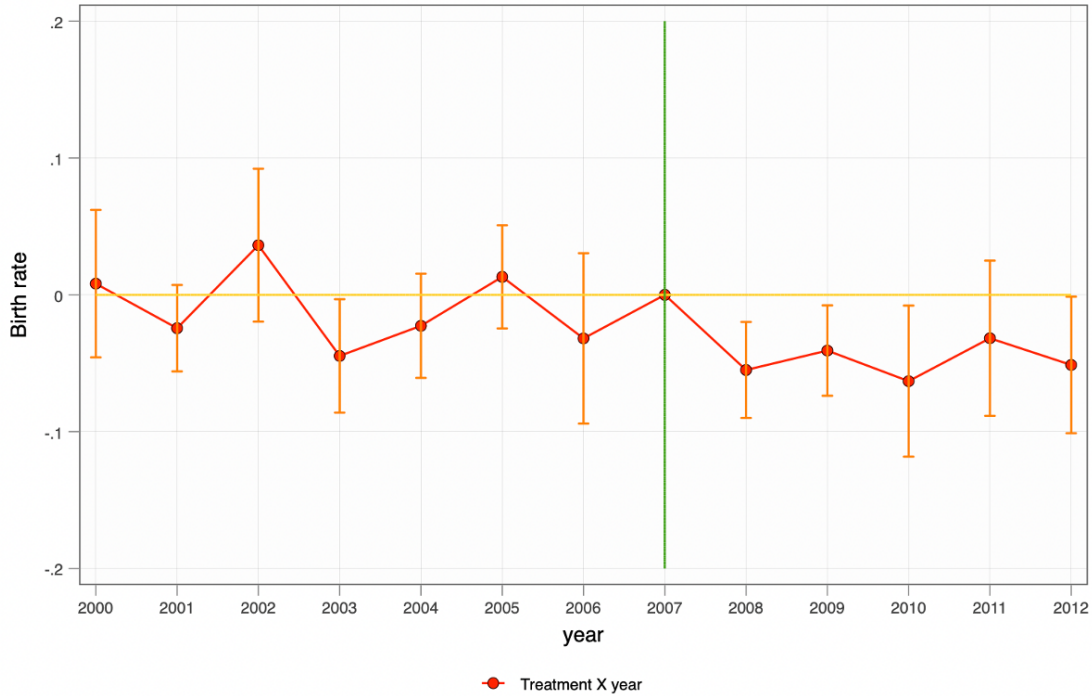
where the dependent variable is still  $Y_{i,g,t}$ , a dummy equal to one if women  $i$  in group  $g$  gave birth in year  $t$ .  $T_{i,g}$  is the treatment variable equal to one when woman  $i$  lives in a TA which did not guarantee widows' inheritance rights. I interact this variable with a year dummy  $\mathbb{1}[t = n]$  coded as 1 to 13 for years 2000 to 2012. Given that the reform has been implemented from 2008, the omitted category is the year 2007. I therefore estimate the impact of the reform each year with respect to the impact in 2007. The event study presented in figure 7 provides additional evidence in favor of the common trend assumption. The impact of the treatment is close to zero and non significant each year preceding the implementation of the reform. Only one coefficient in 2003 is marginally significant. However, I think this is not a threat to our identification strategy since the magnitude is lower than the yearly point estimates post treatment. These coefficients are statistically significant and the effect size are consistent with the findings of the TWFE regression.

Table 2: Fertility trend before the implementation of the program

Variables	Annual birth rate
years	0.000 (0.001)
Treatment	0.039** (0.017)
Treatment X years	0.001 (0.002)
Observations	32,905

Note: This table reports an OLS estimate of the linear annual trend in birth rate from 2000 to 2007. *Treatment* is a dummy equal to one when the woman is living in a TA in which the customary right did not guarantee widows rights to inherit. The sample under study is similar to the sample used for the main specification.

Figure 7: Impact of the treatment on birth rate by year



Note: This graph displays the estimated treatment impacts for each year relative to the year prior to the implementation of the treatment (2007), which serves as the omitted category. I include the year and traditional authorities fixed effects, and the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school.) The standard errors are clustered at the traditional authorities level. The graph plot  $\beta_n$  from equation (2) and the confidence interval at 95 percent.

### 4.2.3 Age at First Birth - Specifications

- **Linear regression with two-way fixed effects**

I first estimate the impact of the reform on the age at first birth by comparing the age at first birth among women who had their first child in the 5 years preceding the reform to the age of women who had their first child in the 5 years following the reform. This specification focuses on the timing of fertility as the sample is restricted to women who already have children. I use a specification that was previously used to estimate the impact of policies on the age at marriage in McGavock (2021) and Castilla (2018). The difference-in-differences specification is the following:

$$Y_{i,g,t,n} = \beta(T_{i,g} * Post_{t,n}) + \alpha_g + \lambda_t + w_n + X_i + \epsilon_{i,g,t} \quad (3)$$

where the dependent variable  $Y_{i,g,t,n}$  is the age at first birth for woman  $i$  in TA  $g$  who had her first birth in year  $t$  and was surveyed in wave  $n$ .  $T_{i,g}$  is a dummy variable equal to one for treatment TAs.  $Post_{t,n}$  is a dummy variable equal to one when the woman's first birth occurred after the reform.  $\alpha_g$  corresponds to TA fixed effects,  $\lambda_t$  corresponds to year at first birth fixed effects, and  $w_{i,t}$  corresponds to the survey round fixed effects. In my preferred specification I include the same vector of covariates as in equation (1) and (2), including women time invariant controls at the women level or at the region or region\*ethnic group level. In my last specification I include ethnic group fixed effects.

The TA fixed effects account for time-invariant unobserved factors that could influence the age at first birth for women living within the same TA. The year at first birth fixed effect control for any shock common to women who had their first birth the same year which might have influenced their age at first birth. In an additional specification, I also include ethnic group fixed effect to control for ethnic group specific norms and traditions which might influence the age at first birth of women within the same ethnic group.

- **Duration model of time to first birth**

The linear regression model compares the age at first birth of women who had their first birth in the 5 year preceding the reform to those who had their first birth within the 5 years following the the reform. This specification implies that women of reproductive age who did not have their first child within this timespan are excluded from the analysis. Therefore,



I only capture the timing of the event (the first birth) and not whether the event occurs or not. To ensure that the results hold when I take into account both dimensions of the outcome, I supplement my first specification with a duration model. A duration model is better suited to the nature of the dependent variable as it efficiently handles right-censored durations, such as cases where women have not had their first birth by the time of the survey. Right-censored observations are properly accommodated in the estimation, provided that the censoring variables are independent of the duration under study. This hypothesis is quite plausible in this context, as the date of the survey is unlikely to be correlated with fertility behaviors.

Following the literature on the determinants of time to first birth, I use a Cox proportional hazard regression model<sup>9</sup> (Logubayom and Luguterah (2013), Fagbamigbe and Idemudia (2016), Bitew et al. (2021), Miri and Moghadam (2018), Shayan et al. (2014)). The Cox model assumes that the hazard rate - the probability to have a first child at date  $t$ - is modeled as follows:

$$h(t) = h_0(t) \times \exp(X_n\beta) \quad (4)$$

The hazard rate includes two main components: the baseline hazard rate  $h_0$ , common to all women, and the hazard ratio  $\exp(X_n\beta)$ , which captures differences in hazard at any point in time between two individuals that only differ by one unit of  $X_k$ . Importantly, the model makes no assumption about the shape of the hazard rate  $h_0$ , leaving it unestimated, while  $\exp(X_n\beta)$  is derived from the data.

In this analysis,  $X_n$  includes a dummy  $T_i$ , equal to one for women living in discriminatory TAs, a dummy  $Post_{t,i}$  for the years following the reform, and an interaction of these two variables.  $\exp(\beta_T)$  measures the hazard ratio between women living in discriminatory and non-discriminatory TAs before the reform. If  $\exp(\beta_T) > 1$  (respectively  $< 1$ ), women living in discriminatory TAs have a higher hazard rate and therefore have their first child earlier (resp. later) than women in non-discriminatory TA.  $\exp(\beta_T + \beta_{Post \times T})$  measures the same hazard ratio but for the post-reform period. Therefore,  $\exp(\beta_{Post \times T})$  quantifies the impact of the reform's on the hazard ratio between women in discriminatory and non-discriminatory

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<sup>9</sup>I test the proportional hazard assumption based on the Schoenfeld partial residuals Schoenfeld (1980), and fail to reject it.

TAs. If  $\exp(\beta_{Post \times T}) < 1$  (respectively  $> 1$ ), the initial gap in the age at first birth between the two group diminishes (resp. widens) following the reform.

In addition, TA fixed effects are incorporated. In a subsequent specification, I include the same set of covariates as in equations (1), (2), and (3), at the women level or at the region or region\*ethnic group level.

#### 4.2.4 Identifying Assumptions

I test for parallel trends in age at first birth for the period 2000-2007, before the implementation of the reform (Table 3). I find that the coefficients of the interaction between the linear time trends and the treatment group is close to zero and insignificant for the 2 outcomes under study: the age at first birth in months in column 1 and the probability to have had a first birth before or at 23 -the last quartile- in column 3.

Table 3: Trend in the age at first birth before the implementation of the reform

	Age at first birth (in months) (1)	First birth before 23 (2)
Year	0.742 (0.510)	0.001 (0.005)
Treatment	-7.568 (4.982)	0.071* (0.038)
Treatment X years	-1.377 (1.015)	-0.001 (0.006)
Observations	2,032	2,033

Note: This table reports an OLS estimate of the linear annual trend in age at first birth from 2000 to 2007. *Treatment* is a dummy equal to one when the woman is living in a TA in which the customary right did not guarantee widows rights to inherit. The sample under study is similar to the sample used for the main specification. The standard errors are clustered at the traditional authorities level.

The estimated coefficient  $\beta_{Post \times T}$  in the duration model would be causal if the hazard rates of the treatment and the control group were following similar trajectories before the intervention. To assess the validity of this assumption, I introduce an interaction of the treatment indicator with a time trend into the model, focusing on the 10-years preceding the treatment. Table 4 shows that the hazard ratio between the treatment and the control group has been remarkably stable in this pre-treatment phase as the coefficient is very close to one and is not statistically significant.

Table 4: Trend in the hazard ratio before the implementation of the program

Time to first birth (hazard ratios)	(1)
Discriminatory TAs	2.15** (0.762)
Discriminatory TAs X time	0.999 (0.001)
Controls	NO
Observations	6,360

Note: Results are based on a Cox proportional hazards model with time measured in months. The dependent variable is the time to first birth. The hazard ratios  $\exp(\hat{\beta}_k)$  are displayed with robust standard errors (clustered at the women level) in parentheses. No control variables are included. The analysis is restricted to the 10 years preceding the reform (1997-2007). Significance levels (for hazard ratio = 1): \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Data: DHS

## 5 Results

### 5.1 Impact of an Improvement of Widows' Inheritance Rights on Birth Rate

Table 5 reports the difference-in-differences estimates of the impact of an improvement of widows' inheritance rights on annual birth rates. I find that the reform reduced the annual birth rate by 4.6 percentage points, a coefficient statistically significant at the 1% level. This is a sizable effect since it represents a 24% decrease over the pre-treatment annual birth rate in the treatment group and corresponds to one child over 25 years of a reproductive life. The coefficient remains remarkably stable with and without the vector of individual time-invariant and region or region\*ethnicity controls. Likewise, the coefficient remains unchanged when I add ethnic group fixed effects, which provides evidence that the effect observed is not driven by the differential ethnic composition between the treatment and the control group. My results are also robust when I interact each control variable with *Post*(Table A3). This accounts for potential time-varying influences of initial imbalances between treatment and controls on fertility outcomes.

To further address the potential composition effect, I incorporate women fixed effects into the period specification. In the main specification, I leverage the variation in birth rates both within and between women. By including women fixed effects, the identification strategy focuses solely on within-women variation, limiting the analysis to women observed both before and after 2008. While

this narrower focus reduces the statistical power of the estimation, the impact remains statistically significant at the 1% level and the effect increases by 0.01 (Table A4).

Figure 7 is informative of the dynamic impact of the treatment. The coefficient is large, comparable to the TWFE coefficient and statistically significant at 1% from the year when the program started to be implemented. The magnitude of the effect remains constant throughout the period considered. This immediate and steady effect suggests that women fertility reacted when the registration process started to be observable, even though the implementation was incomplete.

Figure A1 displays the impact of improving widows rights by women age category. The average treatment effect seems driven equally by women from all age categories from 20 years old. The treatment effect is negative but lower and not statistically significant for the youngest age category -women from 15 to 19.

Table 5: Average treatment effect on the annual birth rate

	Annual birth rate		
	(1)	(2)	(3)
Widow had no inheritance right*Post	-0.047*** (0.007)	-0.046*** (0.007)	-0.046*** (0.008)
Observations	25,868	25,868	25,671
Dep. var. mean	0.196	0.196	0.196
year FE	YES	YES	YES
TA FE	YES	YES	YES
Controls	NO	YES	YES
Ethnic group FE	NO	NO	YES

Note: This table displays an estimate of the impact of component 2 of the Communal Land reform on annual birth rate. In column (1) I include the year and traditional authorities fixed effects, in column (2) I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school and in column (3) I include ethnic group fixed effects. The standard errors are clustered at the traditional authorities level. The sample is restricted to black women from 15 to 40 living in communal land.

## 5.2 Impact of the Reform on the Age at First Birth

I find that the reform also impacts the onset of fertility. As displayed in column 2 of Table 6, I find that the reform delays the age at first birth by 5.5 months on average. Consequently, the age at first birth in the treatment group increases from 19.6 to 20 years old in the treatment group. The effect is statistically significant at 1% when I add the full set of controls to correct for sample unbalances. The impact is marginally insignificant without the controls (p-value=0.14) and not statistically

significant when I include ethnic group fixed effects (p-value=0.18). I also find a negative impact on the likelihood to have one’s first birth before or at 23 - the last quartile in the age at first birth in the sample. The impact represents a 7.3 pp decrease, which corresponds to a 8.7 percent decrease over the probability to have a first birth before or at 23 in the treatment group before the reform. The coefficient is statistically significant at 10% without controls and become significant at 1% when I add the whole set of controls. The result is robust to the inclusion of ethnic group fixed effect- with a slight reduction in the coefficient though. Given that the probability to have a first birth before or at 23 in the control group before and after the reform is about 0.76, an improvement of the reform seems to bridge the pre-reform gap between discriminatory and non-discriminatory TAs.

Table 6: Impact on the onset of fertility

	Age at first birth (in months)			First birth before 23 (last quartile)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment X Post	5.212 (3.482)	5.482*** (2.421)	4.307 (3.206)	-0.071* (0.037)	-0.073*** (0.025)	-0.065** (0.024)
Observations	2,224	2,224	2,179	2,224	2,224	2,179
Dep. var. mean	235	235	235	0.839	0.839	0.839
year FE	YES	YES	YES	YES	YES	YES
TA FE	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES
Ethnic group FE	NO	NO	YES	NO	NO	YES

Note: This table displays an estimate of the impact of component 2 of the Communal Land reform on the age at first birth in months (columns 1, 2 and 3) and on the likelihood to have a first birth before or at 23, the last quartile (columns 4, 5 and 6). In column 1 & 4, I include the year and traditional authorities fixed effects, in column 2 & 5, I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school) and in column 3 & 6, I include ethnic group fixed effects. The standard errors are clustered at the traditional authorities level.

The results of the Cox proportional hazard regression are consistent with the results of the difference-in-differences approach. Table 7 shows that prior the reform, the hazard rate of first birth for women living in discriminatory TAs was approximately twice that of the control group. I find that the reform reduces this gap by 30%, a result highly significant.

### 5.3 Threat to Identification

- **Anticipation effects**

My empirical strategy identifies the impact of an improvement of widows inheritance rights assuming that the reform was not anticipated in the years preceding the implementation.

Table 7: Cox estimation of the impact of the program on the age at first birth

Time to first birth (hazard ratios)	(1)	(2)
Discriminatory TAs	1.830*** (0.056)	2.021*** (0.26)
Post	1.189*** (0.093)	1.165*** (0.055)
Discriminatory X Post	0.705*** (0.145)	0.705*** (0.092)
Controls	NO	YES
Observations	7,171	7,045

Note: Results are based on a Cox proportional hazards model with time measured in months. The dependent variable is the time to first birth. The hazard ratios  $exp(\beta_k)$  are displayed with robust standard errors (clustered at the women level) in parentheses. Controls include: women education, the share of the population living in rural area, household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school and ethnic group fixed effects. The analysis is restricted to the 10 years preceding the reform (1997-2007). Significance levels (for hazard ratio = 1): \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Data: DHS

Various pieces of evidence from institutional reports, research papers, and interviews indicate that the population living in communal areas was not aware of the communal land reform before 2008, and even less aware of Component 2 (Mandimika and Matthaei (2013); Werner (2008)). Furthermore, the event study graph provides supporting evidence for this hypothesis showing no fertility response prior to 2008.

- **Effect of the land titling reform (component 1)**

My identification strategy relies on the assumption that the potential impact of Component 1 -land titling- on fertility is canceled out in the difference-in-differences. Since Component 1 affects both the treatment and control groups, while Component 2 -an improvement of widows rights- only affects the treatment group, the double difference should isolate the impact of Component 2. However, my estimate would be biased if fertility behaviors are affected by an interaction effect between Component 1 and 2 in the treatment group. First, such an interaction effect between land titling and an improvement of widows rights is unlikely as tenure security was already high before the reform. Various pieces of evidence indicate that the population trusted the land system, which provided a high level of tenure security, with land titles guaranteed for life (Werner (2018)). Furthermore, if such an interaction were to occur, it would not be a major concern as it would downward bias the results. These women whose husband land is formalized and learn that they will be able to retain the land in the long

term may experience a higher wealth effect compared to women only affected by Component 1 in non-discriminatory TAs. Such a wealth effect may potentially lead women to increase their fertility now that they can afford an additional child (Donald et al. (2023)). They may also increase their fertility to secure additional labor for farming the land. Considering that both of these effects go in the opposite direction compared to the effect I identify, if any of these interaction effects occur, I would underestimate the effect of improving widows' rights on fertility.

## 5.4 Robustness Checks

The estimate of the impact on birth rate remains remarkably steady when I remove regions one by one, which alleviates the concern that the effect would be driven by a shock occurring in a particular area (Table A2). In addition, the coefficients remain statistically significant at 1% when I cluster the standard errors at the women level.

I know that the implementation started in 2008, but I do not have data on the month when it started. If the land titling started in the first months of 2008, I can expect an impact from 2008, and this is actually what I observe in my event study analysis (Figure 7) Otherwise, I should not observe an impact before 2009. To make sure that my results hold under both assumptions, I run my main specification without the year 2008. The coefficients remains perfectly stable and highly statistically significant (Table A5).

## 6 Mechanisms

### 6.1 Is the Impact on Birth Rate due to Impact on Birth Spacing, Onset of Fertility or Cumulated Fertility?

The first question to examine is whether the sizeable impact on annual birth rate - a 24% decrease over the pre-treatment birth rate in the treatment group- only reflects larger birth spacing, delayed childbearing or a decrease in cumulated fertility.

The decrease in birth rate among women under 25 appears to be largely due to a delay in the onset of fertility, as the treatment resulted in an 8.7% decrease in the likelihood of having a first birth before or at the age of 23 and delayed the age at first birth by 5.5 months. In addition, the graph on the left of Figure 4 shows that women in discriminatory TAs had their first birth on average at 18.8 and 19.1 in 2000 and 2006 respectively, about two years before women in the control

group. The age at first birth increased after the reform in the treatment group by about half a year, while the age at first birth slightly decreased in the control group. This delay in the age at first birth is sizeable considering that these descriptive statistics display some inertia. Indeed, a large share of women interviewed had already experienced their first birth before the implementation of the reform.<sup>10</sup>

Regarding older women, I am unable to identify the impact on cumulated fertility due to data limitation. To properly identify the impact on cumulated fertility, I need to compare women who have been exposed to the reform during their reproductive life to women who have not, and observe them when their reproductive life is over. Since the last survey was conducted in 2013, I can only observe the cumulative fertility of one cohort comprising 82 women who were 45 in 2013 and who had been exposed to the reform for 5 years in their late reproductive age. However, given the changes in fertility preferences observed over the period in the treatment group, it seems unlikely that the impact on birth rate is solely due to larger birth spacing. On the contrary, a change in the desired number of children seems to be a more plausible explanation. The graph on the right of figure 4 shows that the ideal number of children slightly dropped in the post-treatment period in the treated group, while it slightly increased in the control group. Consistently with the widowhood insurance motive, women desired number of children have been higher in discriminatory TAs compared to non-discriminatory TAs from 2000. The curves appear to be on a path towards convergence. This change in fertility preferences is confirmed by a difference-in-differences analysis comparing the ideal number of children between the treatment and the control group, before and after the reform (Table 8). Results suggest that the ideal number of children declined by 0.3 on average, which represents a 8.4% decrease over the pre-reform average in the treatment group. The coefficient is statistically significant at the 5% level and remains robust across various specification. However, due to data limitations preventing a test for the common trend assumption, this result should not be interpreted as a causal relationship.

## 6.2 High and Early Fertility: an Insurance against Widows' Dispossession?

My results indicate that an improvement of widows' rights reduced annual birth rates and delayed the age at first birth. I find empirical evidence suggesting that the mechanism at work relates to the widowhood insurance motive for fertility.

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<sup>10</sup>Importantly, the statistics displayed on this graph consider all women in the study area aged 15 to 49. However, in my difference-in-differences specification, I narrow my sample to women who had their first child either in the five years preceding or in the five years following the reform's implementation



Table 8: Impact on fertility preferences

	Ideal number of children		
	(1)	(2)	(3)
Treatment X Post	-0.311** (0.118)	-0.298** (0.122)	-0.306** (0.128)
Observations	9,592	9,353	9,351
Dep. var. mean	3.690	3.690	3.690
Ethnic groups FE	NO	YES	YES
Control	NO	NO	YES

Note: This table displays the results of an OLS regression of the ideal number of children. In column (2), I include ethnic group fixed effects. In column (3) I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school). Traditional authorities FE are included in the three specifications. The standard errors are clustered at the traditional authorities level. The sample is composed of all widows listed in the household rosters in 2006 and 2013. Data: DHS Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The absence of widows' inheritance rights in a context where dispossession risk is high and observable may prompt women to start their fertility earlier. Women may anticipate the need to have a self-sufficient child capable of providing support if and when the risk materializes. In Namibia, the average age gap between partners is around 8 years, men have a shorter life expectancy by 5 years and an average life expectancy of 50. The risk of widowhood is therefore high and may materialize early. In the sample under study, one out of every five women had experienced widowhood in their late 40's. In this context, women are likely to observe the economic consequences of widowhood within their families and communities, including widows losing household land and, consequently, their homes and means of subsistence. They are therefore likely to anticipate this risk from a young age and develop mitigating strategies, including early childbearing to ensure the possibility of cohabitation in the future. Descriptive statistics on widows residence pattern suggest that widows who may have suffered dispossession would co-reside with their family as a coping strategy. Prior to the reform, widows in discriminatory TAs were less likely to be household head by 17.5 pp, suggesting that they were less likely to have their own house. In addition, they were more likely to reside in a household where the head is a relative by 18pp. Moreover, women in discriminatory TAs were more likely to live with at least one married child by 17 pp. Living with a married child can be considered as a mitigating strategy as they are likely to be financially independent and therefore able to provide their mothers a roof and potential financial support.

If the reform actually reduced widows dependence on their children by increasing their probability to inherit the house and the land, then one would expect a reduced likelihood of widows cohabiting with at least one married child post-reform. To test this prediction, I build a database encompassing all widows listed in the households rosters in 2006 and 2013. I employ a difference-in-differences approach in which I compare the proportion of widows living with at least one married child in the treatment to the control group, before and after the reform. I find that the probability of living with at least one married child decreases by about 5 pp after the reform for widows living in the TAs that were discriminatory (Table 9). This effect is statistically significant and remains robust across various specifications. Although this result cannot be considered causal, as the parallel trends assumption cannot be tested, it provides suggestive evidence of the evolution of widows' cohabitation patterns. Given that many widows from the 2013 sample were likely already widowed at the time of the reform's implementation, they could not have been affected. Therefore, the actual effect on cohabitation modes is probably higher than the effect estimated here.

Table 9: Impact of the reform on widows likelihood to live with at least one married child

Widows live with at least one married child			
	(1)	(2)	(3)
Treatment X Post	-0.056* (0.031)	-0.060* (0.033)	-0.047* (0.026)
Observations	1,668	1,668	1,647
Dep. var. mean	0.189	0.189	0.189
Ethnic groups FE	NO	YES	YES
Controls	NO	NO	YES

Note: This table displays the results of an OLS regression of the probability for widows to live with at least one married child. In column (2), I include ethnic group fixed effects. In column (3) I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school and in column. The standard errors are clustered at the traditional authorities level. The sample is composed of all widows listed in the household rosters in 2006 and 2013. Data: DHS Significance levels (for hazard ratio = 1): \* p<0.10, \*\*p<0.05, \*\*\*p<0.01. Data: DHS

The widowhood insurance motive may explain the impact on the **quantum** of fertility as well. Following the framework of the Lexicographic Safety First model of fertility, women exposed to a high risk of dispossession may need to have more children. As developed by Ray (1998), couples are defining their desired number of children to make sure that they will be secured in old age. This target number of children therefore depends on the risk of destitution and the risk of child default. Formally, they define their target number of children  $n$  to make sure that  $(1-s)^n \leq q$  where  $(1-s)^n$

represents the probability of child default and  $q$  the highest level of destitution risk that parents are accepting to take. Children may default in case of migration, death, poverty, neglect. Such a framework applies when the only source of support in old age are children since women cannot count on institution. Rossi and Godard (2022) have shown that an expansion of the pension system reduced fertility in Namibia. They formalize such a result by augmenting the equation decision with  $(1 - p): (1 - s)^n(1 - p) \leq q$ . Pensions provide an alternative insurance for old age and the target number of children can be reduced for a same level of risk taken. The improvement of widows rights is likely to affect women target number of children through the same channel. In our conceptual framework, the agent defining the targeted number of children would not be the household, but rather the woman who is anticipating her own future economic security.

### 6.3 Alternative Mechanisms

An improvement in widows' rights may have influenced fertility through various channels. In this sub-section, I however show that the insurance motive appears to be the most plausible explanation.

When women are granted inheritance rights, the perceived returns to investments on household land may increase. As a result women may increase their investment of labor in the land (Dillon and Voena (2018)) that they know they will be able to retain. First, they may increase their fertility in order to expand the available workforce for cultivating the land. Such a mechanism may exist but cannot be the dominant channel as I observe an overall negative effect on fertility. An alternative channel could be that the opportunity cost of having children have increased now that the returns to women's labour supply on the land have increased. In this case, women may substitute time spent with children with working time, potentially leading to a decrease in their demand for children. However, I can rule out this channel as I do not find evidence of an increase in women labour supply on the household land. In the treatment group, the share of women who declare that their main occupation is being self-employed in agriculture decreased by 2pp between 2006 and 2013.

When women gain the right to inherit the household's land, the husband's family lose the possibility to claim the household assets' after the husband's death. It may have several consequences for women. If the in-laws provided financial support and/or labor to the household production, they may reduce their investments in the household land as they are now aware that they will not be able to own the land. This potential reduction in support may represent a substantial economic loss for the household, which may in turn reduce fertility. It has indeed been shown in sub-Saharan Africa that households' fertility tend to fluctuate in response to economic shocks as a mean to

smooth consumption (Alam and Pörtner (2018); Lindstrom and Berhanu (1999); Pitt and Sigle (1998)). In this scenario, the poorest households' fertility should be the most affected as they are the most vulnerable to the shocks. If the negative effect on fertility that I estimate is partially or entirely driven by a negative economic shock resulting from the in-laws support channel, then the proportion of poor households within region should have a differential effect on fertility before and after the reform. When I include to my specification the share of poor in each region in 2003 and this variable interacted with *Post*, the two coefficients are not statistically different. In addition, my main estimate remains constant, suggesting that my effect is not driven by this channel. Furthermore, such a situation could potentially lead to conflicts with the in-laws, which may translate into violence against the women who are set to inherit. In this sample, none of the women in the treatment group declare having ever been physically hurt by any of her family members-in-law.

In addition, knowing that a son's marriage would automatically endow his wife with land rights upon his death, might incentivize families to either discourage their sons from marrying or to postpone such unions. This incentive could also negatively affect fertility rates. To explore this potential effect, I examine marital patterns within the male database. I find no evidence suggesting a significant decline in the likelihood of men having ever married across each age group in the treatment group (Appendix figure A2). Similarly, I find no evidence indicating a significant delay in the age at first marriage for men within the treatment group (Appendix figure A3).

As a result of the reform, marriage becomes a more secure institution for women. Marriage may consequently become a more appealing choice for them, potentially leading to an increase in marriage rates. However, an increase in marriage rates generally results in an increase in fertility (Godefroy (2019)). This particular channel is therefore unlikely to explain the negative impact on fertility.

## 7 Discussion

### 7.1 External Validity

In this paper, I show that the absence of widows inheritance rights contributes to high and early fertility in Namibia. In the following section I show that these findings are likely to speak to the Sub-Saharan African context more generally.

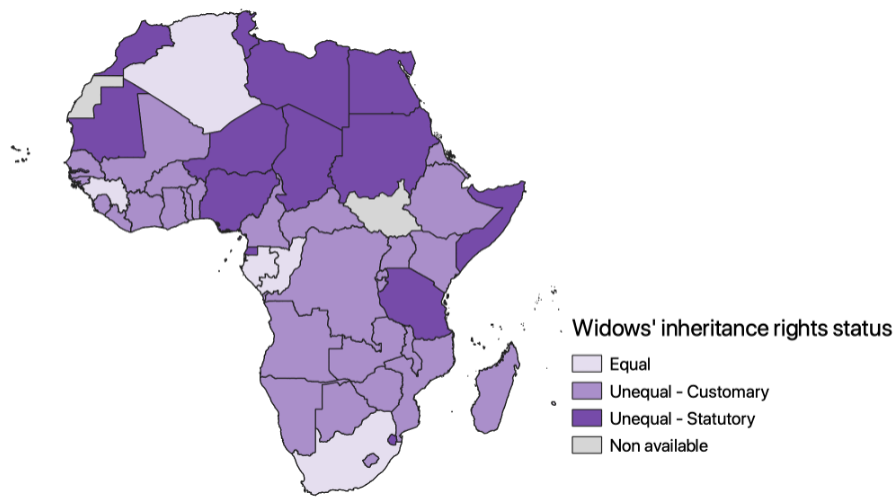
The demographic factors that contribute to a high risk of widowhood at a young age are prevalent across many African countries. For instance, sub-Saharan Africa has the widest average age

gap between partners worldwide, with a difference of 8.6 years (Pew Research Center (2019)). Furthermore, women tend to have higher survival rates compared to men in the region. Men's life expectancy is shorter by an average of four years compared to women in SSA, with men having an average life expectancy of 58 in 2022 (World Bank). Consequently, approximately one out of every five women aged 50 is widowed, and this number increases to one out of every two women at age 65 (Beegle et al., 2016; Djuikom and Van de Walle, 2022).

In addition, discriminatory inheritance practices and subsequent dispossession of widows are prevalent throughout the region (O'Sullivan, 2017; Hallward-Driemeier and Hasan, 2012). Out of the 49 African countries for which data is available, only five protect widows' inheritance rights under both statutory and customary laws (Figure:8). Qualitative and correlational evidence in SSA consistently show that the experience of widowhood is often associated with asset loss in contexts where widows lack inheritance rights (Chapoto et al., 2011; Yamano and Jayne, 2004; Mather and Donovan, 2008). Empirical evidence based on large-scale samples is however limited. As part of the DHS, the question "Who inherited most of your late husband property?" has been asked in 15 countries in SSA to women who have ever been widows. Using this data, Peterman (2012) shows that in 13 out of 15 countries surveyed, less than 40% of women inherited most of late husband property. A limited share of women -from 0.75% in Congo to 6.5% in Uganda- declare that another wife inherited most of late husband property. In the majority of cases, it is the children of the spouse (not the widow's children) and his family who inherit most of the deceased husband's property. In 11 out of 15 countries, more than 50% of widows report that the majority of their late husband's assets were inherited by his family. Interestingly, in many of these countries, the kinship system is predominantly patrilineal. This suggests that land grabbing from widows is a prevalent issue in patrilineal societies as well. For instance, despite the patrilineal systems in Benin, Congo, and Nigeria, 56%, 63%, and 57% of widows, respectively, have reported dispossession by their in-laws.

Finally, there is empirical evidence suggesting that enhancing inheritance rights for widows could potentially reduce fertility rates in African patrilineal societies as well. The need for a safety net in case of widowhood also contributes to high fertility in such contexts. In patrilineal societies, widows are often deprived of inheritance rights, with property typically inherited by their husband's sons. This lack of rights prompts women to have sons with the head of the household to ensure their continued access to the house and land. (Donald et al. (2023) provide evidence that the need for widowhood insurance partly motives fertility in patrilineal settings in Benin, Ethiopia and Togo. Lambert and Rossi (2016) present similar findings in Senegal.

Figure 8: Widows' inheritance rights in Africa



Data Source: Gender, Institutions, and Development Database 2014 (GID-DB)

## 7.2 Heterogeneous Impact between Adolescent and Young Adults

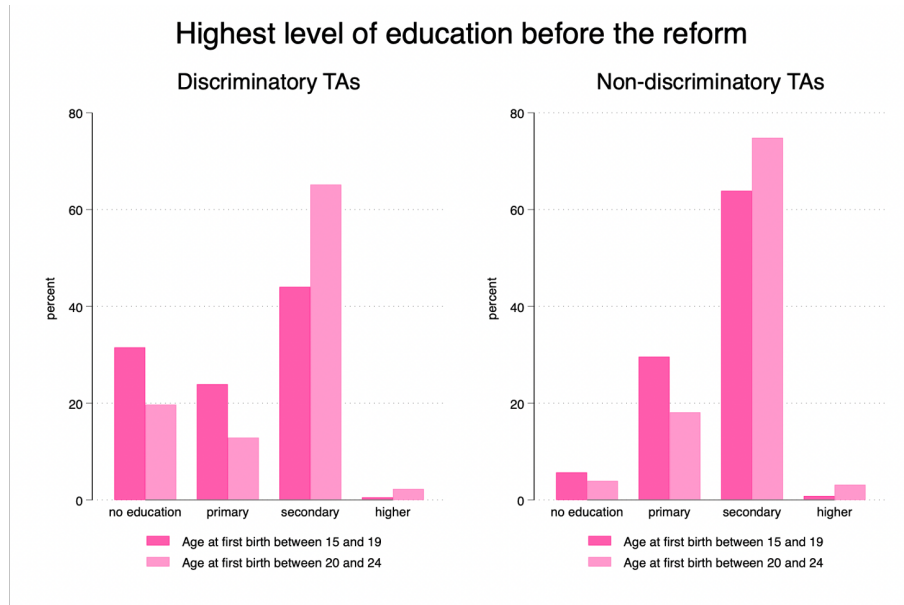
My results indicate that the improvement of widows' inheritance rights had an impact on fertility behaviors of women aged 20 and above, but not on adolescent girls. While the impact on the birth rate of women aged 20 to 24 is large and significant, the impact on adolescents (aged 15-19) is lower and not statistically significant (Figure A1). Consistently, I find no impact of the reform on the likelihood to have a first birth before 20, while the reform reduces the likelihood to have a first birth at 23 or before by 7.3 pp (Table 6). Such a heterogeneity suggests that the widowhood insurance motive is not a driver of adolescents' fertility but becomes a motive for fertility for very young adult women.

One possible explanation might be that adolescent girls are more myopic in their decisions. Strategic fertility is an investment with uncertain returns in the long term. If girls have hyperbolic preferences, then the event of widowhood is discounted at a higher rate by adolescents as they are further away from the potential event than young adults (Laibson (1997)). However, the temporal distance between the present and the widowhood event does not differ significantly between adolescents and women in their early 20s. This differential discount rate is therefore expected to be relatively small. While it may contribute to this heterogeneous effect, it is unlikely to be the only explanation.

Another reason might be that women having their first birth as adolescent have a lower opportunity cost of childbearing than women having their first birth in their early 20s, and therefore are less responsive to the reform. If we assume that all women desire to have a child at some point in their lives, they only have to determine the timing of their first birth. In a context where widows have inheritance rights, women decide when to have their first birth when their opportunity cost of childbearing is at its lowest. In a context without widows inheritance rights, women decide the timing of their first birth with an additional constraint: they need a child early to secure their future safety net. Women therefore face a limited trade-off: having a child during adolescence or during their early 20s. Women with low opportunity cost are relatively indifferent between having a child as an adolescent or slightly later. By contrast, most women with better socio-economic prospect do postpone their first child after their adolescence but are still constrained to have their first child in their early 20s. Therefore, these women with the highest opportunity cost are the most responsive to the reform and delay their first birth when the necessity of widowhood insurance is alleviated. In contrast, women with low opportunities, have less incentive to delay their fertility as a result of the reform, as having a child early is not costly for them.

If the opportunity cost channel explains the differential effect between the two age categories, I expect a larger disparity in the educational levels between women who have their first child as adolescent and those who have their first child in their early 20s in discriminatory TAs compared to non-discriminatory TAs. In discriminatory TAs, all women with high opportunity cost should have their first child before 25. This is not the case in non-discriminatory TAs where women with educational and professional prospect can postpone their first pregnancy until the optimal time for them. As a result, the relative educational level of the early 20's mothers should be higher in discriminatory TAs. Figure 9 confirms such a prediction. Before the reform, in discriminatory TAs, there is a 25pp gap in the proportion of women having completed at least some secondary between women who had their first child as adolescent and those who had their first child in their early 20s. In non-discriminatory TAs, this gap is 14pp. Such a result implies that women who postpone their fertility in response to the reform are likely to be women with high educational and professional prospect. Consequently, improving widows' inheritance rights might yield multiple economic benefits at low cost by allowing young women to accumulate more human capital in higher education or in the labor market in their early 20's.

Figure 9: Highest level of education depending on age at first birth before the reform



Note: These graphs plot the level of education of women who had their first birth between 15 and 19 and between 29 and 24 in the treatment group (on the right) and in the control group (on the right) in the 10 year preceding the the reform. I use the sample under study and include survey weights. Data: DHS.

## 8 Conclusion

In this paper, I show that the prevalent lack of inheritance rights for widows significantly contributes to high and early fertility in SSA. Women are forward looking with relation to their long term economic future, and strategically incorporate the risk of dispossession in their fertility decisions. While the old-age security motive for fertility has been documented in SSA to explain high fertility (Rossi and Godard, 2022; Donald et al., 2023; Lambert and Rossi, 2016), its implications for the timing of first births represent novel evidence. This paper additionally shows that women fertility behaviors do respond to policies providing alternative forms of long-term economic security, paving the way for new policy approaches to these major development challenges. Improving widows' inheritance rights may be a low-cost lever to reach young adult women who usually fall outside the purview of existing programs which focus on adolescents girls. Thus, the expansion of such reforms across SSA could yield multiple economic benefits, surpassing the political challenges associated with amending family laws. First, alleviating the need for widowhood insurance could enable young women to accumulate more human capital and seize more economic opportunities in their early 20s. Moreover, reducing fertility rates might shrink the dependency gap and boost the demographic



dividend. Lastly, allowing women to retain the household capital after their husbands' death might incentivize them to start economic activities thanks to this capital.

This paper raises important questions for future research regarding the manifold implications of the lack of widows' inheritance rights on women economic decisions. Given the high and observable risk of dispossession, women are likely to develop alternative strategies, beyond fertility, to guarantee their future security. For instance, they might invest time and money in maintaining good relationships with their extended family, who could potentially provide support in the event of dispossession. Moreover, the absence of inheritance rights may incentivize women to diversify their activities rather than focusing their efforts on household land, potentially leading to a loss of productivity. These mitigating strategies may divert resources from more profitable economic activities that could flourish if the need for an insurance against widowhood is alleviated. Further research could explore more broadly the extent to which improving widows' rights has the potential to enhance women autonomy throughout their life and reduce gender inequalities.

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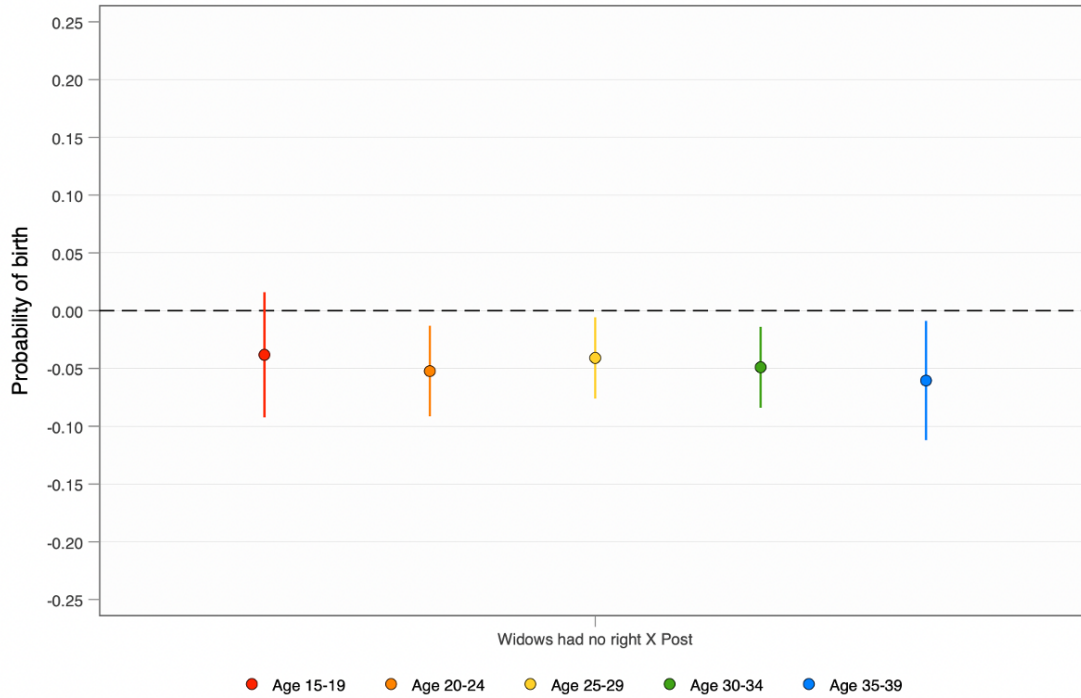
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# Online Appendix

Figure A1: Impact by age category



Note: This graph plots the coefficient of the interaction term Treatment X Post for each year women age category. I include the year and traditional authorities fixed effects, and the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school. The standard errors are clustered at the traditional authorities level. The graph plot  $\beta_1$  from equation (1) and the confidence interval at 95 percent.

Table A1: Descriptive statistics

Variables	Non-discriminatory TAs			Discriminatory TAs		
	Obs. (1)	Mean (2)	Sd. (3)	Obs. (4)	Mean (5)	Sd. (6)
<b>Panel A: Socio-economic characteristics</b>						
Age	4401	27.629	9.731	507	29.745	10.134
rural	4401	0.850	0.357	507	0.777	0.417
Poor	4401	0.604	0.489	507	0.318	0.466
Access to media	4401	0.807	0.395	507	0.856	0.351
<i>Highest level of education</i>						
No education	4401	0.048	0.213	507	0.260	0.439
Primary	4401	0.300	0.458	507	0.248	0.432
Secondary	4401	0.611	0.488	507	0.460	0.499
Higher	4401	0.042	0.200	507	0.032	0.176
<i>Women employment status</i>						
Unemployed	4363	0.485	0.500	506	0.594	0.492
Employed	4363	0.179	0.383	506	0.184	0.388
Work for family member	4363	0.153	0.360	506	0.103	0.304
Self employed	4363	0.181	0.385	506	0.119	0.324
<b>Panel B: Marriage and fertility</b>						
<i>Marital status</i>						
Married or in a relationship	4401	0.267	0.442	507	0.501	0.500
Widow	4401	0.037	0.189	507	0.015	0.122
Divorced	4401	0.009	0.096	507	0.013	0.115
Never married	4401	0.687	0.464	507	0.471	0.500
<i>Fertility</i>						
Total number of births	4401	1.900	2.254	507	2.904	2.689
Ideal number of children	4360	3.312	2.263	496	3.829	2.930
Know modern contraception methods	4401	0.973	0.163	507	0.986	0.120
Ever used modern contraception	4401	0.597	0.491	507	0.779	0.416
<b>Panel C: Health and nutrition</b>						
Infant mortality	2.193	0.524	0.223	373	0.375	0.190

Note: This table reports descriptive statistics on women in the sample under study before the implementation of the program. I use the 2006 DHS wave to build this set of variables and include sample weights. The first three columns report statistics in the TAs that were not discriminatory prior to the reform (my control group) and the last three columns on discriminatory TAs (my treatment). The variable "Poor" is defined as women belonging to households with a wealth index that is equal to or falls below the second lowest quantile. I consider that women have access to media when they listen to radio or watch TV at least once a week. Infant mortality is defined as a dummy equal to one if one child born in the five years preceding the 2006 survey died between 0 to 11 months.

Table A2: Impact of the reform on birth rate when removing regions one by one

Regions removed	(1)	(2)	(3)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
	Caprivi	Erongo	Hardap	Karas	Kunene	Ohangwena	Omaheke	Omusati	Oshana	Oshikoto	Otjozondjupa
Treatment X Post	-0.043*** (0.009)	-0.049*** (0.006)	-0.043*** (0.008)	-0.043*** (0.008)	-0.039*** (0.010)	-0.040*** (0.008)	-0.040*** (0.010)	-0.043*** (0.009)	-0.043*** (0.009)	-0.043*** (0.009)	-0.041** (0.016)
Observations	24,414	28,267	28,189	28,085	26,181	24,165	25,986	24,199	24,087	25,368	26,859
R-squared	0.014	0.014	0.013	0.013	0.013	0.015	0.013	0.014	0.011	0.013	0.013
Dep. var. mean	0.188	0.195	0.188	0.188	0.167	0.188	0.185	0.188	0.188	0.188	0.204

Note: This table displays the estimate of specification (1) when I remove each region one by one. The full set of controls are included: women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school. The standard errors are clustered at the traditional authorities level. The sample is restricted to black women from 15 to 40 living in communal land.

Table A3: Impact on birth rate when interacting controls with Post

	Birth rate						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment X Post	-0.039*** (0.007)	-0.043*** (0.008)	-0.043*** (0.009)	-0.043*** (0.008)	-0.041*** (0.012)	-0.045*** (0.007)	-0.044*** (0.008)
Level of educ X Post	X						
Share of rural X Post		X					
Share in agr. X Post			X				
Access to media X Post				X			
Share of poor X Post					X		
Distance to hosp. X Post						X	
Distance to school X Post							X
Observations	25,868	25,868	25,868	25,868	25,868	25,868	25,868
R-squared	0.015	0.014	0.014	0.014	0.007	0.007	0.007
Dep. var. mean	0.196	0.196	0.196	0.196	0.196	0.196	0.196
year FE	YES	YES	YES	YES	YES	YES	YES
TA FE	YES	YES	YES	YES	YES	YES	YES
Ethnic groups FE	NO	NO	NO	NO	NO	NO	NO
Controls	YES	YES	YES	YES	YES	YES	YES

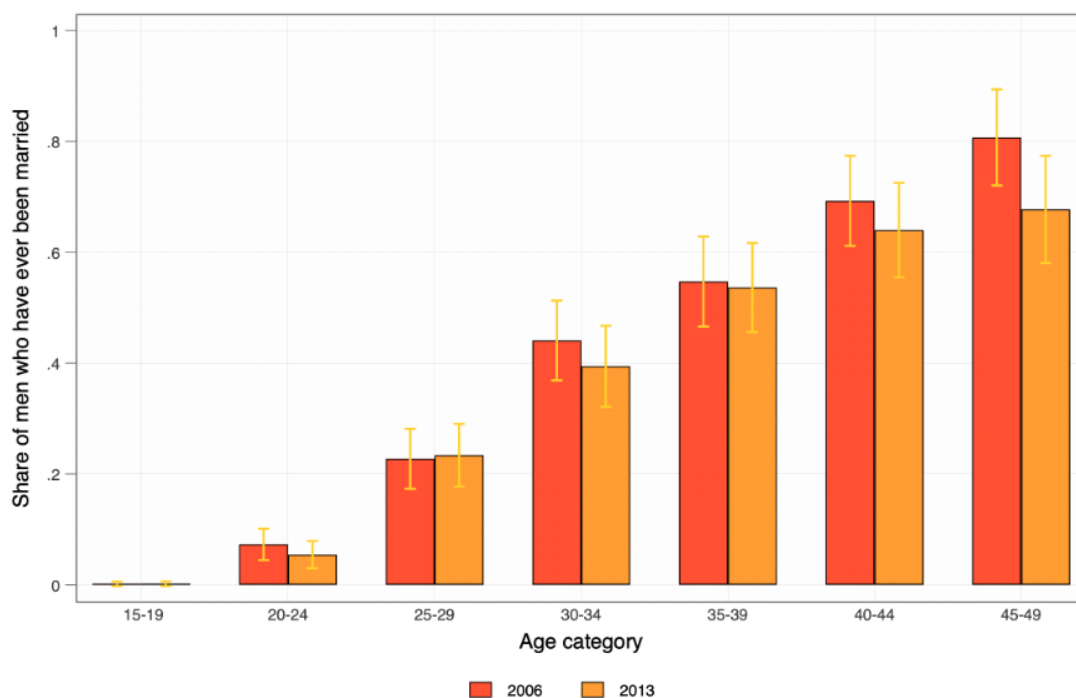
Note: This table displays the estimate of specification (1) when I include each control variable with Post. The full set of controls are included: women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school. The standard errors are clustered at the traditional authorities level. The sample is restricted to black women from 15 to 40 living in communal land.

Table A4: Period specification with women fixed effects

	Annual birth rate		
	(1)	(2)	(3)
Widows had no inheritance rights X Post	-0.057***	-0.057***	-0.057***
	(0.017)	(0.017)	(0.017)
Observations	25,868	25,868	25,671
Dep. var. mean	0.196	0.196	0.196
year FE	YES	YES	YES
Women FE	YES	YES	YES
Ethnic groups FE	NO	NO	YES
Controls	NO	YES	YES

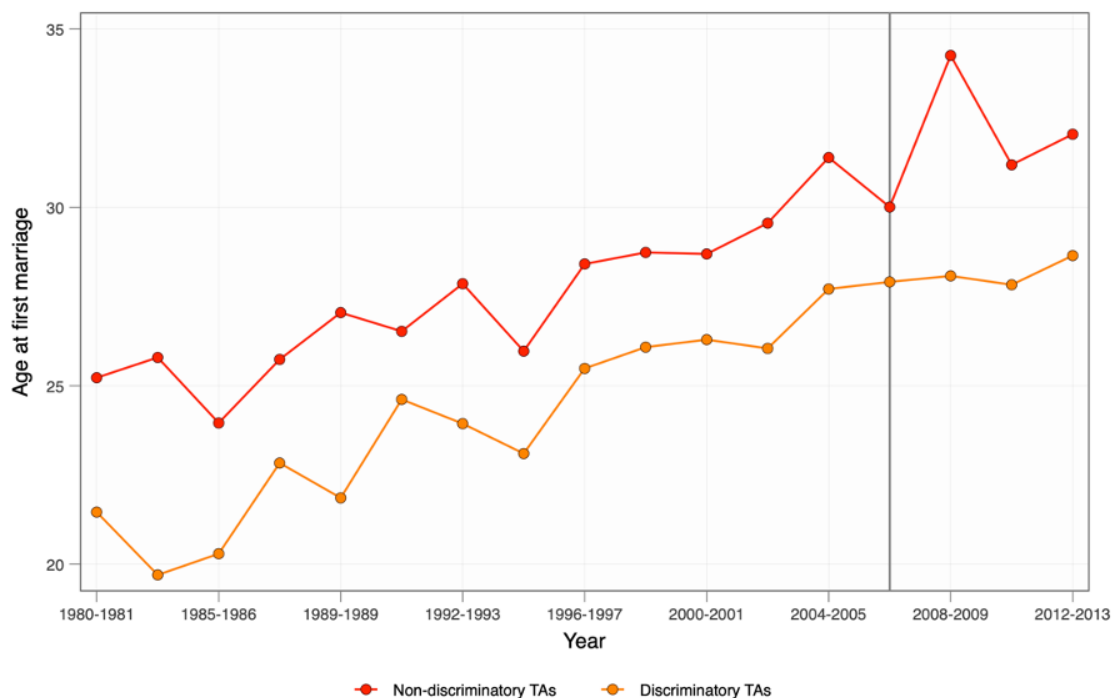
Note: This table displays an estimate of the impact of the implementation of the Communal Land reform on annual birth rate including women fixed effects. In column (1) I include the year and traditional authorities fixed effects, in column (2) I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school and in column (3) I include ethnic group fixed effects. The standard errors are clustered at the traditional authorities level. The sample is restricted to black women from 15 to 40 living in communal land.

Figure A2: Proportion of men in the treatment group who have ever been married, by age group



Note: This graph plots men likelihood to have ever been married by 5 year age group in 2006 and 2013 in the treatment group. Data: DHS

Figure A3: Men age at first marriage per year in the treatment and in the control group



Note: This graph plots men age at first marriage per year in the treatment and in the control group using DHS data collected in 2006 and 2013.

Table A5: Impact on the annual birth rate without the year when the implementation started

	Annual birth rate		
	(1)	(2)	(3)
Treatment X Post	-0.045*** (0.007)	-0.044*** (0.007)	-0.044*** (0.007)
Observations	23,171	23,170	22,974
Dep. var. mean	0.196	0.196	0.196
year FE	YES	YES	YES
Women FE	YES	YES	YES
Ethnic groups FE	NO	NO	YES
Controls	NO	YES	YES

Note: This table displays an estimate of the impact of the implementation of the Communal Land reform on annual birth rate without the year 2008. In column (1) I include the year and traditional authorities fixed effects, in column (2) I add the full set of controls (women education, share of the population living in rural area, average household asset index, share of households whose main source of income is agriculture, share of household who have access to media, distance to hospital and distance to primary school and in column (3) I include ethnic group fixed effects. The standard errors are clustered at the traditional authorities level. The sample is restricted to black women from 15 to 40 living in communal land.

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