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Certified to Stay? Long-Run Experimental Evidence on Land Formalization and Widows' Tenure Security in Benin*

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Abstract. In settings where women's land rights are informal, the death of a husband can severely limit a widow's access to land and her ability to remain in her home—especially in the absence of a male heir. This paper examines whether large-scale land formalization programs can improve widows' land access. Using data from a randomized controlled trial in rural Benin, the analysis finds that widows in villages with land formalization are more likely to stay in their homes four years after the program, with the strongest effects among those without a male heir. The paper identifies two key mechanisms: enhanced community recognition of women's land rights and greater decision-making power over land resources. These findings highlight the potential of land formalization to strengthen women's tenure security and promote their long-term economic stability in similar settings.

Keywords: property rights, land administration, gender, widowhood, intra-household insurance

JEL Classification: D23, I31, J12, J16, O17

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1 Introduction

Most women outlive their husbands, a pattern especially common in Sub-Saharan Africa, where the age gap between spouses is among the largest worldwide (Barbieri and Hertrich, 2005; Pew Research Center, 2019). This demographic reality is particularly concerning in contexts where women's property rights are not formally recognized, leaving them at risk of losing land and property they depend on, sometimes even being forced to leave their homes by relatives (Lambert *et al.*, 2018; Peterman, 2012). Although having a son can reduce the likelihood of property loss, it may not completely eliminate the risk (Lambert and Rossi, 2016). Furthermore, when widows do retain access to property, the lack of formal documentation makes them susceptible to disputes and challenges over ownership (Deininger and Jin, 2006), which can result in the loss of land and even forced migration (Izumi, 2007; Ntozi, 1997). The economic consequences of widowhood are stark, with widowed households often faring worse than male-headed households or other women's households in the region (Appleton, 1996; Horrell and Krishnan, 2007; van de Walle, 2013), and this disadvantage persists even when widows integrate into male-headed households (Lambert *et al.*, 2018).

Can large-scale land formalization programs—designed to codify and certify property rights and create elected local land institutions with mandated female representation—effectively safeguard widows' claims to their land?

In a previous study, we examined a randomized land formalization intervention in Benin and found that women in villages selected for the intervention were more likely to leave their land fallow (Goldstein *et al.*, 2018). Fallowing is a low-cost method to restore soil fertility, often avoided due to increased tenure insecurity, as the land can be perceived as vacant and then be reallocated to extended family members and permanently lost (Goldstein and Udry, 2008). However, the impact of property rights formalization on widows' ability to assert their land rights beyond direct investments in their plots remains ambiguous. There are also concerns that such formalization programs might inadvertently exacerbate gender inequalities by consolidating intra-household

rights into private ownership in the name of men (Lastarria-Cornhiel, 1997). These concerns are particularly relevant for widows whose rights might be contested during the land adjudication and delimitation process.

In this study, we follow up with households sampled in the large-scale randomized controlled trial of land formalization in rural Benin (Goldstein *et al.*, 2018) to examine the impact of the program on land tenure security among widowed households 4 years after the issuance of land certificates. Specifically, by tracking treatment and control villages over time, we are able to estimate the impact of the land registration program on the propensity of widowed households to remain in their village of origin.

We find that land registration increased the likelihood that widows remained in their villages. Married women who lost their husbands after the registration process were 23% more likely to stay in treated villages compared to those in control villages, four years after the intervention. Among women who were already widowed before the registration concluded, the likelihood of staying was 15% higher in treated villages – an effect primarily driven by those who lost their husbands shortly before or during the process. Notably, the fact that land formalization also increased tenure security for women who were widowed before the intervention suggests that the observed effect is not driven by increased male mortality. Instead, land registration appears to have strengthened widows' ability to retain their land and remain in their communities.

These results align with the institutional changes introduced by the land formalization process in treated villages. Our analysis shows that land formalization replaced village institutions responsible for land governance, making them more democratic and inclusive of women, particularly in leadership roles. Moreover, we find evidence that community perceptions of women's land rights and decision-making power over land resources improved in treated villages.

Consistent with these patterns, we find that the effect of land registration on widows' ability to remain in their communities is strongest among those without cohabiting male children. The magnitude of this effect is comparable to the protection tradition-

ally provided by sons in control villages. This suggests that the newly established formal institutions successfully substituted for the customary safeguards that widows previously relied on through male kin.

This study offers new insights across several key strands of literature. First, it improves our understanding of gender dynamics and property rights within Africa (Ali *et al.*, 2014; Goldstein *et al.*, 2018; Goldstein and Udry, 2008; Harari, 2019), and other developing regions (Deininger *et al.*, 2013; Heath and Tan, 2020). It notably addresses the understudied long-term effects of land formalization initiatives, particularly focusing on how such formalization influences the migration choices of women, taking into account their marital status and the gender composition of their children.

Second, the paper contributes to the literature on property rights and their interplay with formal and customary institutions (Aldashev *et al.*, 2012; Pande and Udry, 2006). It highlights how the formalization process can safeguard the land rights of those typically vulnerable under customary laws. In addition, it sheds light on the role of inheritance in passing wealth between generations within customary settings (Fafchamps and Quisumbing, 2002; La Ferrara and Milazzo, 2017; Milazzo and Van De Walle, 2018).

Third, the study builds on existing research on the effects of formalizing land rights on migration patterns. Previous research, such as de Janvry *et al.* (2015), identified that households obtaining formal documentation of their land rights were more likely to have a migrant member. Our research takes this further by illustrating how land registration specifically enables widowed households to remain in their villages.

Last but not least, the paper presents causal evidence on interventions that mitigate the impacts of widowhood and marital dissolution in Sub-Saharan Africa (Dillon and Voena, 2018; Kudo, 2021; Lambert and Rossi, 2016; Milazzo and van de Walle, 2017; van de Walle, 2013). This aspect is particularly crucial, as it offers strategies to cushion the shock of such life-changing events.

The remainder of this paper is structured as follows. Section 2 offers an overview of the context and describes the experimental design and data. In Section 3, we detail the

empirical framework used to estimate the impact of land formalization on the probability that widows will remain on their land and present the results. In Section 4, we discuss the potential mechanisms that underlie the findings and we make concluding remarks in Section 5.

2 Context, data, and empirical strategy

2.1 Widowhood in Benin

In Benin, women face obstacles to land access and ownership similar to those faced by women in other contexts across Sub-Saharan Africa. Most of the country's rural land is held by customary law, with lineages controlling the land under patrilocal systems (Mama, 2005). Typically, women migrate from their natal community to marry, gaining secondary use rights to their husband's family land, which they often lose after a marital breakup.

Widowhood practices, while varying across communities, share several common features. Widows and the remaining of their household are usually integrated into the family of their husband's natural heir to preserve their access to lineage-controlled resources following their spouse's death. This integration often involves the widow marrying a younger brother of her deceased husband, a custom known as levirate (see Kudo, 2021, for a discussion of the theoretical impacts of levirate and its ban), or joining the family of her husband's eldest son in cases of polygamy. Failure to comply with these practices could require the widow to reimburse her in-laws for the bride price paid at the time of marriage (Médénouvo, 2004).

In 2004, the Government of Benin introduced a new "Family Code" with two significant changes for widows. First, the surviving spouse, whether male or female, is recognized as a heir and should receive at least one-fourth of the market value of the deceased spouse's estate. Second, levirate is now prohibited. Benin's Family Code allows for spouses' (and sons' and daughters') inheritance rights to property, while recognizing customary law as valid under the Constitution, provided that it does not

violate nondiscrimination provisions (World Bank, 2018). In practice, these new laws reflect changes in family structures and dynamics in urban areas, where widows are more likely to use legal provisions to voice their concerns and negotiate a fair distribution of the estate (Andreetta, 2019). However, across the country, widows still rarely retain household assets after their spouse's death. In 2006, only 27% of ever-widowed Beninese women reported inheriting assets from their deceased husband (Peterman, 2012). Consequently, bereaved women in Benin spend a relatively short amount of time as widows before remarrying, especially when they are young (INSAE and Macro International, 2007).

Table 1: Practices and beliefs around widowhood and access to land for women across villages in Benin

	Group discussions			
	Women		Men	
	Obs	Mean	Obs	Mean
Cases of levirate exist in the village	71	0.79	71	0.83
Levirate gives access to land and housing	71	0.77	71	0.79
Having a son helps access to inheritance	71	0.70	71	0.56
Following the death of their husband:				
- *most wives got poorer*	71	0.94	71	0.86
- *some wives were accused of witchcraft*	71	0.83	71	0.87
- *most widows moved home*	71	0.15	71	0.20
Women must be obedient to escape poverty	71	0.82	71	0.87
Awareness of the Family Code	71	0.06	71	0.30

Note: The results presented in this table are based on data collected during a 2021 survey across 71 villages in Benin that volunteered to participate in a land registration program. Community questionnaires were administered separately to male and female groups in each village. These questionnaires aimed to assess general perceptions of widowhood practices in their communities and awareness of the Family Code. The first row of the table shows that in 79% of the 71 villages sampled from those that volunteered for the *Plan Foncier Rural* (PFR) land registration lottery, female respondents reported awareness of levirate practices in their community. In comparison, male respondents in 83% of the surveyed villages acknowledged the presence of levirate cases.

To improve our understanding of widowhood experiences in Benin, we conducted a survey in 2021 with groups of men and women in 71 villages throughout the country (see Table 1). These discussions highlighted a general lack of awareness of the Family Code, particularly among women. Levirate practices were reported in most of the

villages surveyed and were perceived as a mechanism for widows to retain land access. Furthermore, there was a consensus among women in most villages that having a cohabiting son who inherits the husband's land simplifies access to land. Echoing findings from a nationally representative survey that widow-headed households are among the poorest in Benin (INSAE and World Bank, 2014), the discussions also consistently reported that widows frequently experience poverty after their husband's death. This poverty is compounded by discrimination, including accusations of witchcraft and, in some instances, forced relocation.

2.2 Land formalization intervention

We investigate whether the formalization of land rights can improve a widow's ability to stay (i.e., not relocate) in the context of a randomized evaluation of the Rural Landholding Plans (*Plans Fonciers Ruraux* or PFR) program in Benin. Implemented from 2006 to 2011 with funding from the Millennium Challenge Corporation (MCC), the PFR program was innovative in its approach to formalizing the existing customary land rights of individual landholders. The primary objectives of the project were to improve the security of land tenure and to encourage agricultural investments in rural areas through two key steps. First, the program conducted land parcel demarcation in all participating communities, assessed land rights through comprehensive land surveys, and laid cornerstones to serve as clear markers of property boundaries (see Goldstein *et al.*, 2018, for more details). According to MCC administrative data, land demarcation activities were completed in 283 of the 300 PFR villages by the end of the MCC Compact in 2011. Second, the program issued land certificates to households and by 2015, 19% (14,558 of 65,175) of the expected certificates had been delivered.[1]

Although it did not have an explicit gender focus, the PFR program incorporated several design elements aimed at promoting women's empowerment. Villages in 40

[1] As of March 2015, another 6,144 certificates had been requested but not yet processed, and 33,956 certificates had been issued but not delivered. Interviews with land management officers revealed several reasons for the low rates of certificate delivery, including high out-of-pocket costs, long distances between villages and city halls, lack of information, and refusal to recognize certificates by some institutions (e.g., microfinance banks, tax authorities).

districts (corresponding to *communes* in Benin) were targeted for an information campaign, received encouragement to apply for participation in the PFR, and were required to support women's and girls' rights, particularly the right to inherit land, as a prerequisite for PFR eligibility (see Goldstein *et al.*, 2018; NORC, 2012, for more details).[2] Of the 1,543 targeted villages, 1,235 applied for the program and 576 met the eligibility criteria to participate in commune lottery programs to select the 300 PFR villages. After the lotteries, selected villages were offered workshops and seminars on the new landholding system, which included a module that stressed equal access to land, equal protection, and the rights of women as landholders (Giovarelli *et al.*, 2015).

The PFR program also helped secure women's land access by recognizing and documenting secondary rights to land, in addition to primary rights. To prevent marginalization of groups with limited land rights, including women, the program developed contract forms and processes to document secondary rights not covered in rural plans (Giovarelli *et al.*, 2015) and provided paralegal assistance to help women's groups negotiate land use and occupancy agreements under the PFR. Most importantly, the PFR communes ensured that women and the community were aware of their rights, that the process was transparent, and that any decisions negatively impacting women were made public and criticized.

2.3 Experimental design and data

To investigate the impact of land rights formalization on widows, our study takes advantage of a unique feature of the program's roll-out. The 300 PFR villages were chosen from the 576 that met the eligibility criteria through public lottery events organized at the commune level, ensuring a transparent and randomized selection process for the program. We conducted two waves of data collection (in 2011 and 2015) from a total of 3,507 households, including 3,276 households that were part of both waves. Our

[2]The mandatory criteria for villages included: (i) Villages with high levels of poverty with the potential for short-term economic growth; (ii) Support for the rights of women and girls in the village, in particular their right to inherit land; (iii) The existence of organizations or groups within the village prepared to profit from economic development; (iv) Demand for the PFR among village residents and leaders; (v) Rural villages; and (vi) The village could not be one that was developed or subdivided for development.

sample covers households in 193 PFR villages and 98 control villages surveyed by the Benin National Institute of Statistics as part of the national household living standard survey or *Enquête Modulaire Intégrée sur les Conditions de Vie des Ménages* (EMICoV) conducted in 2010. The selection of villages covered by the EMICoV was done randomly and stratified at the commune level, with on average seven villages surveyed per commune.[3] The geographic coverage of our survey spans a wide geographic area, encompassing data from nine of Benin's twelve regions.

We examine whether the intervention, which formalized land rights, strengthened the land rights of two groups: (1) 310 households headed by widows in 2011 and (2) 2,912 households with married women in 2011, some of whom became widow-headed between 2011 and 2015. We focus on two primary outcomes. The first identifies households headed by widows in 2011 that were still living in the same village four years later. The second identifies households with married women in 2011 who became widowed between the two surveys and were still residing in the same village in 2015. We consider a household surveyed in 2011 to have relocated if none of its members could be found within the village for interviews in 2015.[4] Furthermore, we are interested in the presence of a cohabiting son in each set of households and seek to use this information to explore the heterogeneous effects of formalization on the likelihood that widows remain in their villages.

Table 2 presents the descriptive statistics at the household level as observed in 2011. A notable observation is that widow-headed households tend to be smaller, averaging 3.8 members, compared to 6.7 members in households headed by married couples. This difference is indicative of the labor constraints faced by widow-headed households. About 46% of widows report living with at least one male child, while this figure rises to 78% for married households, which are more likely to have younger sons cohabiting. In terms of property ownership, 80% of widow-headed households own their homes,

[3] Please refer to Goldstein *et al.* (2018) for more details about the EMICoV survey.

[4] Between 2011 and 2015, 231 of 3,507 households relocated, resulting in an attrition rate of 6.59%. Despite intensive tracking efforts in 2015 to locate households that migrated within the same commune, we were able to find and interview only 32 relocated households, while 199 could not be found and were lost to follow-up. In the subsequent analysis, we focus on the 3,276 households that remained in their original village.

Table 2: Descriptive statistics on widow-headed and married couple households in 2011

	Widowed		Married	
	Obs	Mean	Obs	Mean
A. Household characteristics				
Age of household head (years)	310	60.18	2,912	45.39
Education (years)	310	0.14	2,912	1.61
Household size	310	3.84	2,912	6.66
Household head with a cohabiting son	310	0.46	2,912	0.77
B. Characteristics of widows and wives				
Age (years)	307	60.22	2,831	37.38
Education (years)	307	0.14	2,831	0.40
Has been previously married	307	1.00	2,831	0.07
- Divorced	307	0.00	2,831	0.04
- Widowed	307	1.00	2,831	0.02
Widow during or after ETF	307	0.76	2,831	0.02
Widow lived in this village with late spouse	307	0.78	76	0.43
C. Type of homestead				
Household is homeowner	310	0.80	2,912	0.89
Materials:				
- roof made of cement/tiles	310	0.02	2,912	0.02
- wall made of cement	310	0.15	2,912	0.16
D. Landholdings				
Household is a landholder	310	0.83	2,912	0.96
Number of parcels held	310	1.47	2,912	1.97

Note: The table presents descriptive statistics of widow-headed and married households as observed in 2011.

and 83% own at least one land parcel. These rates are slightly lower than those reported by married households, where 96% own land and 89% own their homes. Widows typically have smaller landholdings and more limited rights to their land compared to their married counterparts.

These characteristics are evenly distributed between the treated and control villages. A smaller sample focusing on households with complete spousal age data suggests that husbands are generally at least 8 years older than their wives (see Table A.1).[5] Given the generally higher life expectancy of women compared to men, this age gap suggests that women in marital relationships in 2011 were more likely to experience

[5]For context, in a broader sample of women in marital relationships where spousal age data were available, the average age gap between husbands and wives was estimated to be 9.9 years in 2011.

widowhood.

2.4 Formalization and local land management institutions

Land formalization programs can refashion local land governance by transferring authority from traditional village and elder councils to newly established institutions. In many rural settings, customary land governance remains informal, predominantly male-dominated, with limited institutional mechanisms for recognizing women's land rights. By introducing formalized land registration, these programs can establish new governance bodies that redefine decision-making processes and increase women's participation in land management.

Table 3 presents the effect of selection into the PFR on local land management institutions. We find that land formalization activities led to the creation of local land management committees in villages selected for a PFR, marking a significant shift from the traditional land governance system, which was primarily managed by village and elder councils.

These newly formed committees are particularly notable for their inclusion of women, especially in leadership roles. They are responsible for overseeing land registration processes, maintaining documentary records of land rights, and adjudicating land-related disputes. In villages selected for a PFR, the probability that land management institutions include at least one female member has increased by 44.5 percentage points (p.p.). Furthermore, the likelihood of a woman holding a leadership position in these institutions has risen by 7.4 p.p., up from a baseline of just 1% of villages. We now investigate the extent to which these institutional changes affected women's ability to inherit land from their husband after the passing of their spouses.

3 Results

We start by assessing the impact of land formalization on the likelihood that households headed by widows and households that transitioned into widow-headed status

Table 3: Effects of land registration activities on local land management

	Obs.	Control Mean	ITT	FWER p-value
Village has institution(s) in charge of land use management	291	0.343	0.351***	0.006
		(0.04)	(0.05)	
Land issues are primarily handled by:				
- village land committee	291	0.051	0.521***	0.006
		(0.04)	(0.05)	
- village council	291	0.141	-0.091**	0.034
		(0.03)	(0.04)	
- council of elders	291	0.131	-0.073*	0.094
		(0.03)	(0.04)	
Members of primary land institution are elected	291	0.152	0.398***	0.006
		(0.04)	(0.05)	
Primary land institution has at least:				
- one female member	291	0.081	0.445***	0.006
		(0.04)	(0.05)	
- one female member in a leading position	291	0.010	0.074***	0.033
		(0.03)	(0.03)	
Primary land institution:				
- coordinates land registration activities	291	0.051	0.448***	0.006
		(0.04)	(0.05)	
- preserves documentation about land registration	291	0.051	0.416***	0.006
		(0.04)	(0.05)	
- helps register land transactions	291	0.172	0.323***	0.006
		(0.05)	(0.06)	
- arbitrates land conflicts	291	0.333	0.335***	0.006
		(0.05)	(0.05)	
- is responsible of land use management	291	0.071	0.162***	0.009
		(0.04)	(0.04)	
- allocates land to village members	291	0.040	0.087**	0.034
		(0.03)	(0.03)	
- coordinates tax collection	291	0.010	0.023	0.242
		(0.02)	(0.02)	

Note: The table shows estimates of intent to formalize land rights on various dimensions of land management at the village level based on responses from the 2011 survey. This information was elicited from a survey addressed to a group of village representatives and this analysis uses responses from the 291 villages covered by the study. To address the family-wise error rate (FWER) resulting from multiple hypothesis testing, we applied the Romano-Wolf correction to adjust the p-value associated with each estimate (see Clarke *et al.*, 2020). The corrected p-values for multiple testing are presented in the column labeled "FWER p-value". Each estimation includes the lottery pool fixed effects. Standard errors are adjusted for heteroskedasticity and are reported in parentheses. Significance levels are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.

remain in their village of residence four years after the intervention. To do so, we estimate a linear probability model as follows:

$$\mathbf{y}_{ijk} = \alpha + \beta \cdot \mathbf{t}_{jk} + \phi \cdot \mathbf{x}_{ijk} + \gamma_k + \varepsilon_{ijk} \tag{1}$$

In this equation, $\mathbf{y}_{ijk}$ is a binary variable (equal to one if a given household i in village j assigned to lottery pool k was still residing in village j in 2015, and zero otherwise), $\mathbf{t}_{jk}$

is a binary variable (equal to one if village j in lottery pool k was randomly selected for the PFR), $\mathbf{x}_{ijk}$ is a vector of control variables likely to influence the decision to relocate,[6] γ_k is a fixed effect specific to the lottery pool, and ε_{ijk} is a random error component. To account for the potential correlation within the village in the results of interest, we adjusted all standard errors for autocorrelation in the randomization unit, which is the village (Duflo *et al.*, 2007). Land registration activities were completed in all PFR villages except three. We interpret the estimates of β as the intention-to-treat (ITT) effect of formalization of land rights.

Next, we explore variations in the impact of formalized land rights depending on the presence of a co-residing son, given the role sons can play in safeguarding a widow's property claims. In practice, we expand Equation 1 as follows:

$$\mathbf{y}_{ijk} = \alpha + \beta \cdot \mathbf{t}_{jk} + \psi \cdot \mathbf{son}_{ijk} + \lambda \cdot \mathbf{t}_{jk} \times \mathbf{son}_{ijk} + \phi \cdot \mathbf{x}_{ijk} + \gamma_k + \varepsilon_{ijk} \tag{2}$$

In this equation, $\mathbf{son}_{ijk}$ takes a value of 1 if household i had a cohabiting son in 2011. A significant coefficient for λ indicates that the program had different effects on the probability of staying for households with or without a cohabiting son. We also report estimates of the average effect ψ of having a cohabiting son in control villages and calculate estimates of the total effect of formalization in households with cohabiting sons ($\beta + \lambda$) along with the corresponding standard error and significance level.

Estimates of β, the average effect of the intention to formalize land rights on the likelihood of staying for households that were already headed by widows in 2011 and the likelihood of observing a household where both spouses were alive in 2011 becoming widow-headed in 2015, are, respectively, reported under the headings "Widowed in 2011" and "Married in 2011" in column (1) of Table 4. In column (2), we investigate how the effect of treatment varies depending on whether the household had a cohabiting son and provide estimates for the coefficients β, ψ, and λ for our results of interest.

[6] Control variables include characteristics such as the age and education level of the household head, household size, and the household head's status in the village (e.g., village leader or member of a village group).

Table 4: Land registration and likelihood that widows stay.

Dependent variable: Widowed-headed households remaining in the village by 2015				
	Panel A: Widowed in 2011		Panel B: Married in 2011	
	(1)	(2)	(1)	(2)
Lives in a PFR village (β)	0.124**	0.214**	0.012	0.054**
	(0.06)	(0.09)	(0.01)	(0.02)
$\times$ *Has a cohabiting son* (λ)		-0.183*		-0.055**
		(0.10)		(0.02)
Has a cohabiting son (ψ)		0.174*		0.024
		(0.10)		(0.02)
$\beta + \lambda$		0.031		-0.001
		(0.07)		(0.01)
Number of households	310	310	2,912	2,912
Likelihood to remain in the control villages	0.805	0.805	0.053	0.053

Note: This table presents estimates of the intent-to-treat (ITT) effect of the PFR on the likelihood that different groups of households remained in their village of residence from the 2011 survey. Results are reported separately for two groups: Panel A focuses on households headed by widows in 2011, while Panel B examines households headed by married couples in 2011. In Panel A, Column (1) reports the average ITT effect of the PFR on the likelihood that a household headed by a widow in 2011 remained in the village four years later. Column (2) examines how this effect varies based on whether the household had a cohabiting son. The coefficient β represents the average effect for households without a cohabiting son, while λ captures the differential impact for households with a cohabiting son. The coefficient ψ measures how the presence of a son influences the likelihood of staying in control villages, and we also report $\beta + \lambda$, the total average effect for households with a cohabiting son. In Panel B, Column (1) reports the ITT effect of the PFR on the likelihood that a household headed by a married couple in 2011 became widow-headed and remained in the same village by 2015. Column (2) further examines this effect based on the presence of a cohabiting son, where β represents the average effect for households without a cohabiting son, λ captures the differential impact for households with a cohabiting son, and ψ measures how the presence of a son influences the likelihood that a married household in 2011 became widow-headed and remained in the control villages four years later. Finally, we report $\beta + \lambda$, the total average effect for households with a cohabiting son. Standard errors are clustered at the village level and are reported in parentheses. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

Panel A of Table 4 reveals three key results. First, widow-headed households in treated villages had a 12 percentage points (p.p.) higher likelihood of remaining in their village of residence four years after the intervention had ended, relative to a mean of 80.5% in control villages (or a 15% change). Second, consistent with existing literature that highlights the importance of sons for widows in maintaining their claims to land and other assets in customary settings (Lambert and Rossi, 2016), we find that widows

with cohabiting sons are less susceptible to expropriation and are 17 p.p. more likely to remain in their village of residence relative to those without a son. Third, we show that the impact of land certification on widows' propensity to remain in the village is concentrated among widows who do not live with a son. The sum of the interaction coefficient and the treatment coefficient ($\beta + \lambda$) is not statistically different from zero for widow-headed households. Instead, widows without cohabiting sons are 21 p.p. more likely to stay compared to their counterparts in control villages (a 26% increase).

Next, we show similar results in the sample of non-widowed (at baseline), married households in 2011 (Panel B, Table 4). In control villages, only 5.3% of these households experienced widowhood and remained in the village between 2011 and 2015. Receiving the land certification intervention increased the propensity of widowed households to remain in the village by 1.2 p.p., representing a 23% increase. However, our study is underpowered to detect this effect size with statistical significance. Importantly, as with the pre-existing widows, this impact is concentrated among households without a cohabiting son, where the effect is statistically significant. Among married households without a cohabiting son that became widow-headed, the intent to formalize land rights increased the probability of staying by 5.4 p.p. compared to similar households in control villages.

Taken together, these results suggest that the land formalization program increased widows' ability to remain in their village, acting as a perfect substitute for having a male child living in the household.

4 Discussion of mechanisms and welfare implications

The results presented in Table 4 suggest that the intent-to-treat effect of land rights formalization primarily benefits widows without a cohabiting son. Among households already headed by a widow at the time of the baseline survey in 2011, further analysis of the subsample of widows who reported the date of their husband's death indicates that the impact of land registration on the probability of staying in the village by 2015

is concentrated among widows who lost their husbands shortly before or during the land formalization process (see Table A.2).

Moreover, when considering the sample of women surveyed in 2015 who had experienced widowhood, we find that widows in villages selected for a PFR were less likely to remarry (see Table A.3). This finding supports concerns that, in the absence of land registration, widows without cohabiting sons face a higher risk of losing access to their late husband's properties. As a result, they are more likely to migrate or enter levirate marriages to maintain their residence and property rights.

Although our data includes a limited number of households led by widowers, since cases of husbands outliving their wives are relatively rare, we find no statistically significant impact of land formalization on the ability of widower-headed households to remain in their village of residence.[7] This finding aligns with the broader pattern of gendered disparities in property rights, where men face a lower risk of dispossession after the death of their spouse.

The rest of this section examines potential reasons why formalizing land rights may be crucial in enabling widows to remain within their communities.

To achieve this, we analyzed household dynamics from 2011, examining how residing in a village selected for a PFR influenced wives' expectations regarding land inheritance and their decision-making power over land resources. Furthermore, in 2021, we revisited 71 villages from the original 2011 sample, conducting detailed group discussions with both women and men. These discussions provided further insight into the community's perception of Benin's Family Code and experiences of widowhood.

Table 5 presents married women's expectations across treated and control villages as surveyed in 2011, following land formalization. Notably, fewer married women in treated villages expected not to inherit any land after their husband's death, with a 5 p.p. decrease over a mean of 57.8% in the control. Conversely, uncertainty about in-

[7]For further details, Table A.4 provides descriptive statistics on households led by widowers, while Table A.5 presents ITT estimates for both households headed by widowers in 2011 and married couples where the wife passed away between 2011 and 2015

Table 5: Treatment effect on married women's land bequest expectations in the event of widowhood

	Obs.	Control Mean	ITT	FWER *p*-value
Wife expects she will inherit:				
- *at least some land*	2,831	0.066	0.016	0.108
		(0.01)	(0.01)	
- *nothing*	2,831	0.579	-0.054**	0.011
		(0.03)	(0.03)	
- *don't know*	2,831	0.309	0.052**	0.008
		(0.03)	(0.02)	
Wife expects her children will inherit				
- *at least some land*	2,831	0.683	0.020	0.431
		(0.03)	(0.02)	
- *nothing*	2,831	0.013	0.000	0.940
		(0.00)	(0.01)	
- *don't know*	2,831	0.256	-0.011	0.740
		(0.02)	(0.02)	

Note: The table shows estimates of the intent to formalize land rights on perceptions of wives about land inheritance in the event of widowhood. For each married household in which the wife was present at the time of the survey, we asked her questions about expectations about land inheritance for herself and her children in the event of the loss of her husband. Overall, we collected responses from 2,831 wives out of 2,912 married households. To address the family-wise error rate (FWER) resulting from multiple hypothesis testing, we applied the Romano-Wolf correction to adjust the *p*-value associated with each estimate (see Clarke *et al.*, 2020). The corrected *p*-values for multiple testing are presented in the column labeled "FWER *p*-value".

The standard errors are clustered at the village level and are reported in parentheses. Each estimation includes the lottery pool fixed effects. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

heritance rights increased by the same token following land formalization. In line with the interpretation of our results on sons, we find no significant change in women's expectations about their children's inheritance rights. These findings suggest that formalizing land rights has reduced women's concerns about losing access to land upon their husband's death.

Findings from the 2021 group discussions indicate that men living in villages selected for a PFR had greater awareness of Benin's Family Code (see Table A.7). More significantly, as documented in Table 6, male heads of households in villages selected for a PFR were more likely to perceive that land registration efforts had improved land tenure security for landowners and women. In contrast, we find no evidence that land

Table 6: Treatment effect on expectations of male respondents

	Obs.	Control Mean	ITT	FWER *p*-value
Respondent heard about the PFR	2,856	0.261	0.597***	0.001
		(0.03)	(0.03)	
Respondent thinks that PFR improves:				
- *land tenure security for landlord*	1,910	0.813	0.064**	0.004
		(0.03)	(0.03)	
- *land tenure security for tenants*	1,910	0.490	0.032	0.308
		(0.04)	(0.05)	
- *land tenure security for women*	1,910	0.554	0.121***	0.002
		(0.04)	(0.04)	
- *land tenure security for migrants*	1,910	0.402	0.040	0.308
		(0.05)	(0.05)	

Note: The table shows estimates of intent to formalize land rights on various dimensions of perceptions of land tenure security by male household heads based on responses from the 2011 survey. This information was elicited from household heads and this analysis uses responses from 2,856 male household heads. To address the family-wise error rate (FWER) resulting from multiple hypothesis testing, we applied the Romano-Wolf correction to adjust the *p*-value associated with each estimate (see Clarke *et al.*, 2020). The corrected *p*-values for multiple testing are presented in the column labeled "FWER *p*-value".

Standard errors are clustered at the village level and are reported in parentheses. Each estimation includes the lottery pool fixed effects. Significance levels are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.

registration activities changed perceptions about the security of the tenure of tenants and migrants.

These shifts in perceptions among both men and women, reinforced by the establishment of new land management institutions, appear to have strengthened women's bargaining power in land-related matters. While women are now better represented in village-level land management institutions, our findings indicate that land registration activities also increased their participation in household land-related decision-making (see Table A.6). However, we find no evidence that these changes translated into broader empowerment outcomes, such as an increased share of agricultural revenue or greater personal autonomy.

5 Conclusion

Our analysis of a large-scale randomized controlled trial shows that customary land formalization significantly improved widows' ability to remain on their land long after the intervention. Between 2011 and 2015, widow-headed households in treated communities were 15% more likely to stay in their original homes, while those that became widow-headed during this period were 23% more likely to remain in villages where land registration took place. While these findings stem from a specific context – villages that voluntarily participated in land registration activities and explicitly supported women's and girls' rights – they suggest that formalizing land rights can serve as a protective mechanism against expropriation, allowing widows to secure their homes even after their husband's passing. The intervention substituted for traditional safeguards, particularly benefiting widows who lacked protection under customary norms. While those with cohabiting male children were already more likely to retain land due to prevailing inheritance practices, land registration enabled widows without male kin to remain in their villages. This underscores the critical role of land formalization in extending tenure security to those previously left vulnerable.

Beyond land registration itself, the intervention also established new land management committees with mandated gender inclusion, shifting perceptions of women's land rights within communities. Awareness of legal protections for women increased, and married women in treated villages reported fewer concerns about losing land upon their husband's death. Men in these communities were significantly more likely to perceive improved tenure security for women, and a greater share of married women actively participated in household land management decisions. Just as legal reforms can act as a "magnet", drawing customary norms toward more equitable outcomes (see Aldashev *et al.*, 2012), our findings highlight the potential of land formalization to strengthen property rights and reduce gender disparities in land tenure security.

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Appendices

Table A.1: Descriptive statistics on widow-headed and married households in 2011 across treatment arms

	Widowed		Married	
	Control Mean	ITT	Control Mean	ITT
A. Characteristics of Household Head				
Age of household head (years)	60.439	2.722	45.690	-0.295
		(2.61)		(0.61)
Education of household head (years)	0.159	-0.179	1.517	0.141
		(0.13)		(0.16)
Household size	4.049	-0.270	6.693	0.018
		(0.32)		(0.14)
Household head with a cohabiting son	0.500	-0.097	0.780	-0.010
		(0.08)		(0.02)
B. Characteristics of Widows and Wives				
Age (years)	60.543	2.765	37.618	-0.387
		(2.68)		(0.53)
Education (years)	0.160	-0.183	0.416	-0.024
		(0.13)		(0.07)
Previously Married	1.000	0.000	0.068	-0.004
		(.)		(0.01)
- Divorced	0.000	0.000	0.039	-0.001
		(.)		(0.01)
- Widowed	1.000	0.000	0.024	-0.006
		(.)		(0.01)
Husband died before land registration started	0.753	0.073	0.026	-0.006
		(0.07)		(0.01)
Widow lived in this village with late spouse	0.753	0.106	0.429	-0.083
		(0.08)		(0.16)
C. Type of homestead				
Household is homeowner	0.756	0.053	0.884	-0.004
		(0.07)		(0.02)
Materials:				
- roof made of cement/tiles	0.000	0.018	0.020	0.005
		(0.01)		(0.01)
- wall made of cement	0.134	0.086	0.172	-0.024
		(0.06)		(0.02)
D. Landholdings				
Household is a landholder	0.805	0.017	0.962	0.006
		(0.07)		(0.01)
Number of parcels held	1.524	-0.073	1.972	0.052
		(0.14)		(0.07)
Number of households	82	310	992	2,912

Note: The table compares descriptive statistics of widow-headed households and those headed by married spouses across treated and control villages. The standard errors are clustered at village level and are reported in parentheses. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table A.2: Land registration and likelihood to stay in 2015 by son presence and widowhood timing

	(1)	(2)	(3)	(4)
Lives in a PFR village (β)	0.161**	0.248**	0.374*	0.666***
	(0.07)	(0.10)	(0.21)	(0.17)
$\times$ *Has a cohabiting son* (τ)		-0.165		-0.567**
		(0.10)		(0.24)
$\times$ *Lost husband before PFR* (λ)			-0.232	-0.468**
			(0.21)	(0.19)
$\times$ *Lost husband before PFR* $\times$ *Has a cohabiting son* (δ)				0.444*
				(0.26)
Has a cohabiting son (γ)		0.183*		0.669***
		(0.10)		(0.23)
Lost husband before PFR (ψ)			0.235	0.518***
			(0.21)	(0.16)
$\times$ *Has a cohabiting son* (ω)				-0.539**
				(0.24)
$\beta + \tau + \lambda + \delta$		0.083	0.143**	0.076
		(0.07)	(0.07)	(0.07)
Number of households	265	265	265	265
Likelihood to remain in the control villages	0.805	0.805	0.805	0.805

Note: The table displays estimates of the intent-to-treat effect of the PFR on the probability of households, led by widows in 2011, to stay in their village. The analysis is restricted to the limited sample of the households of the widows observed in 2011 and for whom we have information on the year when they lost their husbands. First, in column (1) and (2) we reproduce the main results of the paper for this limited sample. Namely, column (1) reports the intent-to-treat effect of the PFR on the likelihood to stay in the village four years after the end of the land registration activities. In column (2) we contrast how the effect varies depending on the presence of a young cohabiting son in the household at the time of the survey in 2011. Second, in column (3) and (4) we study how the intent-to-treat effect varies with the timing of the death of the husband relative to the start of the land registration activities. More specifically, in column (3) we contrast, on one hand, the effect of selection into the PFR on the probability to stay for the widow-headed households where the husband died right before or following the start of the land registration activities (see the coefficient β) and, on the other hand, the effects measured for the widow-headed households where the husband had died more than two years before the land registration activities started (see the coefficient $\beta + \lambda$). In column (4), the coefficient β represents the average intent-to-treat effect of the land registration activities on the likelihood to stay for widow-headed households where the husband died during or after the land registration started and that had no cohabiting son. The coefficient τ represents the average additional differential effect of selection into the PFR for widow-headed households that had a cohabiting son in 2011, λ is the differential intent-to-treat effect for households where the husband died before the land registration activities started, and δ is the additional differential effect for the widow-headed households where the husband died before the land registration activities had started and there is a cohabiting son. Standard errors, clustered at the village level, are provided in parentheses. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table A.3: Land registration and likelihood to remarry by 2015 for widows depending on son presence and widowhood timing

	(1)	(2)	(3)	(4)
Lives in a PFR village (β)	-0.095**	-0.093	-0.062	-0.155*
	(0.05)	(0.07)	(0.06)	(0.09)
$\times$ *Has a cohabiting son* (τ)		-0.001		0.122
		(0.09)		(0.12)
$\times$ *Lost husband before PFR* (λ)			-0.064	0.092
			(0.09)	(0.13)
$\times$ *Lost husband before PFR* $\times$ *Has a cohabiting son* (δ)				-0.223
				(0.19)
Has a cohabiting son (γ)		0.028		-0.158
		(0.09)		(0.11)
Lost husband before PFR (ψ)			0.224***	0.020
			(0.08)	(0.13)
$\times$ *Has a cohabiting son* (ω)				0.306*
				(0.17)
$\beta + \tau + \lambda + \delta$		-0.094	-0.126*	-0.164*
		(0.06)	(0.07)	(0.10)
Number of households	464	464	464	464
Likelihood to remarry in the control villages	0.240	0.240	0.240	0.240

Note: The table presents estimates of the intent-to-treat effect of the PFR on the probability of remarriage among women who have experienced widowhood. The analysis is based on a sample of women interviewed in 2015 who reported that they have experienced widowhood and for whom we have information on the year of their husbands' death. Column (1) reports the intent-to-treat effect of the PFR on the likelihood of reporting being married at the time of the 2015 survey for this sample. In column (2), we examine how this effect varies based on the presence of a young cohabiting son in the household at the time of the 2015 survey. In column (3), we contrast the effect of selection into the PFR on the probability of remarriage when the previous husband died after the land registration started (represented by the coefficient β) with the effects observed when the previous husband died before land registration activities began (represented by the coefficient $\beta + \lambda$). Column (4) presents the average intent-to-treat effect of land registration activities on the likelihood of remarriage for widows whose husbands died during or after land registration started and who had no cohabiting son (β). The coefficient τ represents the average additional differential effect of selection into the PFR for widows with a cohabiting son in 2011, λ indicates the differential intent-to-treat effect for widows whose husbands died before land registration activities started, and δ represents the additional differential effect for widows whose previous husbands died before the land registration activities started and who had a cohabiting son. Standard errors, clustered at the village level, are provided in parentheses. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table A.4: Descriptive statistics on widowers and husbands in married couple households in 2011

	Widowed		Married	
	Obs	Mean	Obs	Mean
A. Characteristics of Household Heads				
Age of household head (years)	49	65.57	2,912	45.39
Education (years)	49	1.12	2,912	1.61
Household size	49	4.29	2,912	6.66
Has cohabiting young boys	49	0.39	2,912	0.77
B. Characteristics of Widowers and Husbands				
Age (years)	48	65.27	2,649	45.80
Education (years)	48	1.15	2,649	1.68
Has been previously married	48	0.73	2,649	0.19
- Divorced	48	0.10	2,649	0.12
- Widowed	48	0.60	2,649	0.05
Widower during or after ETF	48	0.50	2,649	0.05
Widower lived in this village with late spouse	30	0.97	178	0.87
C. Type of homestead				
Household is homeowner	49	0.92	2,912	0.89
Materials:				
- roof made of cement/tiles	49	0.00	2,912	0.02
- wall made of cement	49	0.16	2,912	0.16
D. Landholdings				
Household is a landholder	49	1.00	2,912	0.96
Number of parcels held	49	1.51	2,912	1.97

Note: The table presents descriptive statistics of male respondents in households headed by a widower and in married couple households as observed in 2011.

Table A.5: Land registration and likelihood that widowers stay

Dependent variable: Widower-headed households remaining in the village by 2015				
	Panel A: Widower in 2011		Panel B: Married in 2011	
	(1)	(2)	(1)	(2)
Lives in a PFR village (β)	0.1632	0.1447	0.0002	0.0004
	(0.250)	(0.587)	(0.004)	(0.008)
$\times$ *Has a cohabiting son* (λ)		0.1310		-0.0002
		(0.678)		(0.008)
Has a cohabiting son (ψ)		0.0151		0.0035
		(0.753)		(0.007)
$\beta + \lambda$		0.2757		0.0002
		(0.193)		(0.004)
Number of households	49	49	2,912	2,912
Likelihood to remain in the control villages	0.824	0.824	0.008	0.008

Note: This table presents estimates of the intent-to-treat (ITT) effect of the PFR on the likelihood that different groups of households remained in their village of residence from the 2011 survey. Results are reported separately for two groups: Panel A focuses on households headed by widowers in 2011, while Panel B examines households headed by married couples in 2011. In Panel A, Column (1) reports the average ITT effect of the PFR on the likelihood that a household headed by a widower in 2011 remained in the village four years later. Column (2) examines how this effect varies based on whether the household had a cohabiting son. The coefficient β represents the average effect for households without a cohabiting son, while λ captures the differential impact for households with a cohabiting son. The coefficient ψ measures how the presence of a son influences the likelihood of staying in control villages, and we also report $\beta + \lambda$, the total average effect for households with a cohabiting son. In Panel B, Column (1) reports the ITT effect of the PFR on the likelihood that a household headed by a married couple in 2011 became widower-headed and remained in the same village by 2015. Column (2) further examines this effect based on the presence of a cohabiting son, where β represents the average effect for households without a cohabiting son, λ captures the differential impact for households with a cohabiting son, and ψ measures how the presence of a son influences the likelihood that a married household in 2011 became widower-headed and remained in the control villages four years later. Finally, we report $\beta + \lambda$, the total average effect for households with a cohabiting son. Standard errors are clustered at the village level and are reported in parentheses. Significance levels are denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

Table A.6: Treatment effect on women's empowerment

	Obs.	Control Mean	ITT	FWER *p*-value
Wife is involved in household's land decisions†	2,831	0.345	0.058**	0.007
		(0.03)	(0.03)	
Wife receives share of HH's ag. revenue†	2,831	0.212	0.038	0.039
		(0.02)	(0.02)	
Political involvement index	2,831	2.437	0.040	0.111
		(0.04)	(0.03)	
Women's autonomy index	2,831	0.798	0.008	0.851
		(0.07)	(0.06)	

Note: The table shows estimates of intent to formalize land rights on various dimensions of empowerment for married women based on responses from the 2011 survey. This information was elicited in private from married women and we collected responses from 2,831 wives out of 2,912 married households. To address the family-wise error rate (FWER) resulting from multiple hypothesis testing, we applied the Romano-Wolf correction to adjust the *p*-value associated with each estimate (see Clarke *et al.*, 2020). The corrected *p*-values for multiple testing are presented in the column labeled "FWER *p*-value".

Standard errors are clustered at the village level and are reported in parentheses. Each estimation includes the lottery pool fixed effects. Significance levels are indicated as follows: * p<0.10, ** p<0.05, *** p<0.01.

† Indicates dummy variables.

Table A.7: Opinions about the effects of land registration on gender dynamics

	Group discussions			
	Women		Men	
	Control Mean	ITT	Control Mean	ITT
Awareness of the Family Code	0.030	0.021	0.182	0.222**
		(0.06)		(0.10)
Land registration:				
- *empowers widows*	0.606	0.004	0.697	0.077
		(0.07)		(0.10)
- *dissuades in-laws*	0.576	0.035	0.697	0.075
		(0.06)		(0.10)
- *safeguards rights of married women*	0.636	-0.027	0.697	0.032
		(0.06)		(0.11)
Most widows get poorer	0.970	-0.049	0.909	-0.097
		(0.04)		(0.07)
Number of villages	33	71	33	71