Why and How Overlapping Land Rights Undermine Agricultural Investment: Evidence from Customary Tenure in Ghana

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Abstract

Under Ghana's customary land tenure system, family land allocated through matrilineal ties is associated with a lower propensity to take up rubber cultivation and lower yields where rubber is planted. Consistent with conventional wisdom, tenure insecurity reduces yields, but most of this effect operates through diminished labor input by family members rather than through reduced material input or lack of collateral value of land. Moreover, tenure insecurity arises primarily from undefined rights among household members, rather than from the more distant possibility of lineage-level reallocations. Company-led interventions to reconcile land rights within kin groups effectively mitigated these gaps by reducing family members' disincentives to work on shared land.

1 Introduction

Secure land rights are widely viewed as a cornerstone of agricultural investment and rural development. Yet in much of Sub-Saharan Africa, land continues to be governed under customary tenure systems where overlapping rights coexist: lineage authorities allocate land, but individual households cultivate and improve it. This institutional complexity has fueled a longstanding policy debate over whether formal land titling is necessary to promote long-term investment, a rationale grounded in the property-rights tradition of Coase (1937) and North (1981), which links secure ownership to investment incentives, or whether customary institutions already provide sufficient security.

Empirical evidence on this question remains strikingly mixed. Some studies report little or no effect of tenure security on agricultural investment (Place and Hazell 1993; Pinckney 1994; Besley 1995; Place and Migot-Adhola 1998; Brasselle, Gaspart, and Platteau 2002; Fenske 2011; Asaaga et al. 2020), while others find strong positive effects (Migot-Adholla et al. 1991; Udry 1996; Goldstein and Udry 2008; Abdulai et al. 2011; Ali, Deininger, and Goldstein 2014). Still others document both positive and null effects within the same setting (Place 2009; Lambrecht and Asare 2015). These divergent findings suggest not merely that effects are context-specific, but that different studies are identifying different mechanisms through which customary tenure influences investment incentives.

A major limitation of the existing literature is that, although each hypothesized mechanism linking land tenure to investment has some empirical support, we still know little about their relative importance. Besley (1995) is the only attempt to formally synthesizes multiple channels: redistributive pressure, collateral constraints, and labor disincentives, but he finds insufficient evidence to rank them. Subsequent studies provide robust evidence on particular channels, such as the collateral function of titled land (Feder et al. 1988; Deininger and Jin 2006), redistributive pressure arising from kinship-based sharing obligations (Platteau 1991, 1996; Di Falco and Bulte 2011), or labor disincentives in family-managed plots (Guirkinger et al. 2015), but they usually focus on a single mechanism in

isolation. As a result, the literature offers compelling demonstrations of each channel individually, this piecemeal approach leaves unresolved the question of how these mechanisms interact or which of them matter most in practice.

Taken together, these mechanisms are not simply parallel alternatives, but nested processes. Redistributive pressure can reduce the monopolizability of returns even where land rights are stable. Household or lineage reallocations compound multiple processes by directly undermining cultivators' control over land, which can erode the collateral value of land and incentives to use material inputs, or can reduce labor incentives particularly when plots are managed collectively, as is common for family plots. Clarifying the relative weight of these channels is crucial for explaining why some studies find no effect of tenure insecurity while others identify large effects for tree crops and other long-term investments.

At the same time, most prior work frames the problem as one of tenure insecurity, often assumed to operate at the lineage level through the threat of land reallocation. This paper distinguish between household-level reallocations and lineage-level reallocations of land under customary tenure. We argue that the threat of household reallocations, where land within a family may be shifted among siblings or co-wives, poses a more immediate disincentive to invest in tree crops than the more distant possibility of lineage redistribution. To test this hypothesis, we exploit a unique case: smallholder rubber cultivation in Ghana, where company-sponsored contract farming requires substantial upfront investment and offers a natural setting to observe how land tenure arrangements shape long-term agricultural decisions.

I study two institutional interventions: formal land titling, and company-led reconciliation of rights between cultivators and their lineage members, and even among household members. The latter generates interesting institutional variation: although not a formal titling program, reconciliation effectively regularizes land claims within kin groups. By highlighting the specific mechanisms through which customary tenure shapes investment incentives, our findings contribute to three debates. First, they help explain why empirical

studies of land security and investment in Africa reach divergent conclusions. Second, they show that intra-household reallocations, often overlooked in the policy debate, can be more consequential than lineage redistribution. Third, they suggest that interventions short of full land titling, such as contract-based reconciliation of rights, may enhance security in ways that promote agricultural investment without undermining customary authority.

2 Land Rights Institutions

In the study region of southern Ghana, land rights have historically been embedded in matrilineal inheritance systems, where farm plots were in principle transferred from the queen mother ' s brother to her nephew, the son of her sibling. These institutions emerged under conditions of abundant land but scarce labor. Customary practice rewarded forest clearance and initial cultivation with long-term rights, which were held collectively by lineage groups and transmitted across generations through matrilineal lines (Austin 2005). This system encouraged the mobilization of labor for land reclamation and helped secure the reproduction of lineages over time.

Economic development and demographic pressure gradually altered this equilibrium. As the cultivation of commercial crops such as cocoa expanded and land became scarce, customary tenure evolved toward more individualized systems (Atwood 1990; Bruce and Migot-Adholla 1994; Amanor 2001; Otsuka et al. 2001, 2003; Quisumbing et al. 2001b; Place 2009; Holden and Otsuka 2014). Migration from northern Ghana, Burkina Faso, Togo, and Côte d ' Ivoire further increased population density and competition for land. In this process, new forms of transfer gained importance. Of particular note is the rise of gift transfers, functionally similar to patrilineal inheritance, which have become more common since the Intestate Succession Law of 1985 sought to strengthen the rights of wives and children under customary tenure (Quisumbing et al. 2001a).

These changes raised concerns that commercialization could trigger distress sales, land

concentration and dispossession, ultimately creating a landless and impoverished population. In the study villages, however, outright land sales remain rare. Customary law prohibits sales to outsiders even after formal titling, while transactions within the village require approval from the chief and elders. Because such requests are usually rejected, land sales markets remain largely inactive, unlike what is observed in Kenya (Yamano et al. 2009) or Rwanda (Ali et al. 2014).

At the national level, the Land Title Registration Act of 1986 and the National Land Policy of 1999, implemented through the Land Administration Project (2004-2010), introduced a system of voluntary land registration. Farmers who register their plots receive formal title deeds granting exclusive use rights and legal protection in court. In principle, these reforms were intended to enhance tenure security and encourage agricultural investment.

Alongside state reform, Ghana Rubber Estates Limited (GREL) has also played an important role in shaping land tenure and agricultural opportunities. Rubber contracting is a relatively new option for farmers in the coastal region of western Ghana, and it gained prominence after GREL switched from plantation to smallholder contractor scheme in the mid-1990s to expanded its catchment areas. Through its extension offices and processing facilities, the company has provided farmers with access to new agricultural technologies, in-kind credit for inputs such as seedlings and fertilizer, and assured market outlets.

At the same time, GREL has intervened directly in land tenure arrangements. In cases where a prospective contractor's claims are disputed, GREL brokers agreements with lineage and household members to secure long-term access for the cultivator. This process of land rights reconciliation is not equivalent to formal titling, but it effectively regularizes claims within kin groups. By doing so, it reduces the risk of litigation, ensures farmers can commit to long-term investments, and facilitates their participation in the outgrower scheme.

This set of institutions (matrilineal inheritance, emergent gift transfers, restrictions on land sales, state-led titling, and company-led reconciliation) define the opportunity structure for smallholder investment in rubber. They may also generate multiple sources of insecurity,

including ambiguities within households, competing lineage claims, and uneven access to interventions. These institutional settings provide the foundation for the empirical analysis that follows.

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3 Data

GREL was established as a plantation in 1957 and adopted an outgrower scheme in 1995, which expanded from 449 registered households in 2000 to 7,815 in 2015. The study draws on data collected in eight villages located within the company's catchment area, across four districts of Ghana's Western Region: Ahanta West, Nzema East, Mpohor/Wassa East, and Wassa West. Two of the villages are located inland, where rubber cultivation is relatively recent, while six coastal villages represent the earliest sites of rubber production in Ghana.

Villages were randomly selected from the company's list of catchment communities. Within each village, interviewees were recruited through public announcements made by the village chief over loudspeakers. The announcement indicated that the study concerned agricultural practices related to rubber but invited both rubber and non-rubber farmers to participate. The resulting dataset comprises 415 agricultural plots cultivated by 182 households. Descriptive statistics at both the plot and household levels variables are reported in Table 1.

[Table 1 Summary Statistics]

This sample excludes 170 plots cultivated by households that migrated after 1995, most

likely to enter rubber farming, as well as leasehold plots with weaker land rights[1]. Most households are Akan and follow matrilineal inheritance, while a minority are Muslim and follow patrilineal inheritance. Male cultivators predominate, but women account for about 18 percent of main cultivators, including female-headed households.

At the time of the survey, about half of the plots were under rubber cultivation (Figure 1), reflecting the crop's higher returns relative to other cash and food crops. Land acquisition has shifted over time: village appropriation, once dominant, has largely disappeared, while allocation from lineage groups, matrilineal inheritance, and renting now predominate (Figure 2). Allocation and matrilineal inheritance together account for more than half the sample, and these modes are especially prone to overlapping claims.

About half of all plots, and more than half of rubber plots, are formally titled under the Land Title Registration Act (1986) and the Land Administration Project (2004-2010). In addition, roughly a quarter of all plots and nearly half of rubber plots underwent the company's land rights reconciliation process.[2]

[Figure 1 Year of Cultivator's Land Acquisition by Acquisition Mode]

[Figure 2 Adoption of Rubber and Other Cash Crops]

4 Empirical Analysis

4.1 Hypotheses and Empirical Strategy

This section outlines the empirical approach used to address two main questions. First, it examines whether land rights interventions, specifically land titling and tenure reconciliation, have influenced adoption (Table 2) and productivity (Table 3), and whether they have helped reduce the disadvantages typically associated with family land. Since family land accounts for more than half of all farm plots, any improvements on these plots have substantial implications for overall rubber cultivation. Second, the analysis investigates the

mechanisms through which the customary land system may discourages investment.

When agricultural investment takes the form of planting perennial crops, constructing irrigation or terracing, the act of making these investments itself tends to strengthen the coutivator's rights over the land. As Austin (2005) emphasized, "these rights are maintained as long as the crop grows on the land". This observation has placed the direction of causality at the center of the literature on land rights and investment, as studies have sought to determine whether secure tenure induces investment or whether investment strengthens tenure (Besley 1995; Place 2009; Fenske 2014; Deininger and Jin 2006; Holden and Otsuka 2014). This challenge continues to be relevant in the present study because access to land rights interventions is unlikely to be random.

Titling is typically more accessible to cultivators with relatively secure tenure, whereas reconciliation is designed to benefit those managing plots with overlapping rights and weaker claims, making these interventions endogenous to unobserved tenure security and cultivators' intra-household and community influence. Family land status further restricts access, particularly to reconciliation, as the company avoid intervening in family plots, implying that interventions are correlated with family land dummy, and that estimated effects on tree planting and yields risk endogeneity biases.

To address this concern, I follow the empirical strategy of Goldstein and Udry and use instrumental variables that capture the cultivator's political status along with the physical distance of the farm plot from the residential area. Political status is measured using several variables: whether the head of the household holds a village office,[3] the number of wives of the cultivator's father, whether the cultivator's mother is the first wife, and the number of siblings of the father. For both type of interventions, the assumption is that political status shapes access to interventions but does not directly affect tenure strength or investment returns. Thus, the instruments influence adoption and productivity only through their effect on access to titling and reconciliation.

The exclusion restriction is plausible for yield regressions, as argued by Goldstein and

Udry in their analysis of fallow duration in slash-and-burn systems. For tree planting, however, the exclusion restriction is more tenuous, as political status may be correlated with investment behavior, and so with unobserved tenure security. Indeed, political status variables, when including household head's office holding status, violate the exclusion restriction in the tree planting specification. Accordingly, I exclude the office holding status from the instrument set; the remaining political status measures retain strong relevance for interventions and family land allocation while satisfying the exclusion restriction (Table 2).

Another source of endogeneity may arise from the allocation of family land itself, since the observed productivity and adoption gaps on family plots could reflect selection into these plots rather than the effect of tenure insecurity. To account for this possibility, I use the same set of political-status instruments to test for and address the endogeneity of family land allocation. This allows the analysis to separate the impact of land rights interventions from potential biases linked to plot allocation under customary tenure.

The second part of the empirical strategy shifts focus from the effects of interventions to the mechanisms through which customary tenure arrangements discourages investment, using yield data from rubber plots. Here the analysis begins by examining the role of tenure insecurity associated with the risk of land reallocation. Such insecurity is expected to be most pronounced on family land, which is subject to the claims of other household and lineage members. To test this, I compare the distribution of tenure durations across different modes of land acquisition to those of purchased land, which is assumed to provide the most secure and stable tenure (Table C1). I then investigate how reallocation occurs in practice, distinguishing between reallocations within the household and those within the broader lineage group. This is done by testing whether tenure duration varies systematically with household size or lineage group size (Table 4).

Understanding whether the disadvantages of family land are driven by redistributive pressure or by tenure insecurity requires careful distinction between these mechanisms. Redistributive pressure refers to the claim that co-members of the household or lineage

may appropriate part of the output, thereby reducing incentives to invest, even if land is not reallocated. Tenure insecurity, by contrast, refers to the risk of outright reallocation or termination of tenure. Distinguishing between household- and lineage-level effects helps clarify which of the two mechanisms, redistributive pressure or tenure insecurity, is more relevant. Specifically, I examine whether the density of household or lineage group members per parcel of household rubber plot on the yield gap of family land. If lineage size matters, it is difficult to disentangle redistributive pressure from tenure insecurity, since both could plausibly operate through the lineage. If household size matters, however, the interpretation is more likely to reflect reallocation risk within the household, assuming altruism is stronger among co-resident members than across the wider lineage. In this case, household size would be less likely to represent simple redistributive obligations and more likely to signal intra-household reallocations.

If the disincentives arising from tenure insecurity is relevant, I then examine the possible channels through which they operate: disincentives related to labor inputs or to material inputs. The first is labor. I investigate whether any labor input disincentives are associated with family labor in collective management of family plots, or with workers drawn from the lineage group (Table 5). Wage payment data identify whether family or lineage members provide the bulk of labor. Reconciliation effects are also informative: stronger impacts in larger households suggest household-level insecurity, whereas stronger impacts in larger lineage groups point to lineage-level insecurity.

The second channel is material input use. Insecurity may directly reduce cultivators' willingness to apply inputs, or indirectly constrain them by limiting collateral value of land and credit access from the rubber company. I therefore test whether household or lineage size predicts input use or credit access, and whether mortgage rights are associated with higher yields (Table 6).

In sum, the empirical strategy combines instrumental variable estimation of the causal effects of land rights interventions (Tables 2-3) with tests that clarify the mechanisms through

which customary tenure arrangements shape investment (Tables 4-6). By tracing the pathways through which these disincentives operate, whether through labor effort, material input use, or limited access to credit, the analysis provides a comprehensive picture of both the structural constraints of the customary tenure system and the potential benefits of land rights interventions.

4.2 Results

The results for tree planting decisions are presented in Table 2, which reports only the coefficients of the key variables.[4] Column 1 indicates that rubber planting is about 15 percentage points less likely on family land. In column 2, the potential endogeneity of the family land dummy is addressed by instrumenting it with the political status of the household head. The instrumented estimate yields a smaller and statistically insignificant coefficient, but the null of exogeneity is not rejected, the negative association with family land is unlikely to result from unobserved bargaining power or selective allocation of lineage land.

[Table 2 Investment in Tree Planting]

Column 3 and 4 examine the role of land titling. OLS results suggest a positive association between titling and tree planting. Since access to land titling may itself reflect the underlying strength of land rights,[5] column 4 instruments titling using the same political-status variables. Wooldridge's robust score test of endogeneity suggests that the exogeneity of land titling, supporting the use of the OLS estimate.

Nevertheless, this finding should be interpreted with caution. In the study region, titling was introduced in the mid-1990s alongside the rubber outgrower scheme and was primarily developed to facilitate its expansion through administrative support. The evidence presented here therefore does not suggest that titling functioned as an independent driver of investment. This is further supported by the results in the next table, which indicate that

titling does not enhance productivity once trees are planted. More broadly, this reflects the rationale for land rights formalization across Africa: while preventing local disputes and promoting investment incentives have been part of the motives, the overarching concern has been to forestall large-scale land grabs (Deininger et al. 2011; Byamugisha 2013).

Consistent with this interpretation, the negative coefficient on family land remains unchanged or becomes slightly larger when land titling is included in Columns 3 and 4. Land titling thus does not mitigate the investment disincentives associated with family plots.

Columns 5 and 6 assess the effect of the company's tenure reconciliation intervention. Although OLS estimates indicate a positive association with adoption, this effect disappears once reconciliation is instrumented. The exogeneity test strongly rejects the OLS specification, indicating that reconciliation is selectively targeted toward prospective outgrowers, particularly those with higher political status. This suggests that OLS estimates reflect selection bias rather than a causal effect. Furthermore, controlling for reconciliation does not alter the negative family land coefficient, suggesting that the intervention did not remove the disincentives to adopting rubber on family plots.

Table 3 reports the results for value per hectare.[6] Column 1 shows that family land is associated with a 773 Ghana cedi lower value per hectare, roughly a 40% reduction relative to the sample mean of 1,808 cedis. Column 2 introduces a titling indicator, which has no significant effect. Column 3 adds the tenure reconciliation indicator, which is positively associated with value per hectare, with a substantial magnitude of 1,118 cedis relative to the sample mean.

[Table 3 Yield value per hectare and family lands, impact of interventions]

Including tenure reconciliation reduces the coefficient on the family land dummy to a small and statistically insignificant level, suggesting that the productivity gap on family plots largely reflects their lower likelihood of receiving reconciliation. Column 4 confirms this, showing that family land is indeed less likely to benefit from reconciliation.

Potential endogeneity of reconciliation is addressed in columns 4 and 5. Because reconciliation is usually linked to participation in the outgrower project, which requires borrowing from the company to finance tree planting,[7] access may reflect stronger underlying land rights. Column 5 instruments reconciliation using political status variables, as in Table 2. The first-stage regression in column 4 demonstrates that cultivators with weaker rights benefit from the intervention. Instruments satisfy exclusion restrictions and satisfy exclusion restriction. Although the IV estimate in column 5 becomes insignificant, the falsification test does not reject exogeneity of reconciliation. Based on this, we treat reconciliation as exogenous and rely on the OLS estimate in column 3.

We now turn to Table 4 to explicitly examine the tenure insecurity view. Appendix Table C1 already shows that family plots are cultivated for shorter periods than other types of land. Table 4 decomposes this difference into household versus lineage reallocations. Tenure duration is measured as the number of years since the current cultivator acquired the plot. Because matrilineal inheritance and rental arrangements, both relatively recent phenomena that expanded following the spread of the outgrower contracting of rubber (see Figure 2), tend to involve later starters, these plots are mechanically associated with shorter observed tenure durations. To account for this, the regressions control for the decade of land acquisition.

[Table 4 Reallocaion among Household Members or among Lineage Group Members?]

Panels A (all crops) and B (rubber only) indicate that shorter tenure on family land is primarily driven by intra-household renegotiation rather than lineage-wide reallocations. Panel A shows that tenure durations on family plots are significantly shorter than for non-family plots, even after controlling for the decade of land acquisition to address the mechanical shortening associated with matrilineal inheritance or rental plots. Adding household size (column 2) reduces the magnitude of the family land coefficient, while adding lineage group size (column 3) does not. These pattern suggest that plot reallocations among cultivators occur primarily within households, rather than across the broader lineage group.

Columns 5-7 further introduce interaction terms. The negative interaction between the family plot dummy and household size (columns 5 and 6) indicates that larger households intensify contestation over managerial rights, whereas no comparable effect emerges for lineage group size (columns 4 and 7). Results for the rubber-only sample are qualitatively similar, though the family land tenure gap is somewhat smaller.

Quantitatively, the coefficients imply that the tenure disadvantage of family plots varies sharply by household size. Using column 5 estimates, the disadvantage ranges from negligible at the 5th percentile of household size (one member per hectare) to about 2.6 years shorter tenure at the 95th percentile (twelve members per hectare).[8] Given that the mean tenure duration in the sample is around 15 years, the effect is substantial.

Results for the rubber-only sample are qualitatively similar. Family land is again associated with shorter tenure, though the magnitude of the gap is somewhat smaller. The interaction terms show the same pattern: household size exacerbates the family land disadvantage, while lineage size does not. Based on column 12, the estimated disadvantage ranges from about one year (no disadvantage) to nearly two years across the observed distribution of household size (from two to eight members per hectare).[9] With an average tenure of roughly 15 years in rubber, these differences remain meaningful.

These results carry an important implication. While much of the literature, including Berry (1993, 2018), Goldstein and Udry (2008), and others, emphasizes lineage-level power relations, the evidence here points instead to more immediate arenas of competition among co-resident kin. The results here, which highlights the central role of intra-household reallocations in shaping tenure insecurity on family plots, align more closely with accounts stressing shifts in intra-household bargaining and the weakening of elders' authority. For example, Amanor (2001) describes how uncle-to-nephew inheritance and the kinship-based welfare role of elders and their authority have eroded in southern Ghana,[10], while Ubink (2008) finds in her study of peri-urban Ghana similarly finds that day-to-day land use decisions are increasingly made within households rather than lineage councils.

Table 5 turns to the role of redistributive pressure and land tenure insecurity in shaping output. Redistributive pressure can arise even when land rights are secure, the analysis separates its effects from those of tenure insecurity. Tenure insecurity is proxied by the coefficient of variation in tenure duration since acquisition, calculated within each mode of land access. Output value per hectare is regressed on household and lineage group size, controlling for this measure of tenure insecurity.

[Table 5 Land Reallocation Risk, Redistributive Pressure]

Columns 1-4 examine the direct effect of tenure insecurity. In column 1, the estimated impact corresponds to about –170% of the sample mean yield of 1,808 Ghana cedis per hectare (evaluated at the mean of the tenure insecurity variable), suggesting a large potential constraint. Yet the coefficient is not statistically significant, and its inclusion does little to narrow the yield gap between family and non-family plots. Adding household size and its interaction with the family land dummy (columns 2-3) sharply reduces both the family land gap and the tenure insecurity coefficient. By contrast, introducing lineage group size and its interaction with the family land dummy (column 4) has little effect. On the basis that tenure insecurity is adequately controlled for, this pattern might suggests that household-level factors, rather than lineage-level redistributive pressure, are central.

A literal interpretation, that household members exert stronger redistributive pressure than lineage members, would be counterintuitive, since altruism is generally stronger within households. A more plausible reading, consistent with Table 4, is that household size continues to capture a dimension of tenure insecurity not fully controlled for. And this channel, rather than redistributive norms per se, drives the observed family land disadvantage.

The analysis therefore shifts to the question of which types of investment is held back by such insecurity on family plots. The remainder of Table 5 along with Table 6, explores whether the investment shortfall associated with land tenure insecurity is primarily driven by disincentives to use labor inputs on collectively managed plots, or alternatively by disincentives to use material inputs due to the weakened collateral function of land and limited

access to input credit.

Columns 5-6 turn to wage expenditures as a proxy for labor dynamics. Interaction terms between household (and lineage) size per hectare and the family land dummy reveal that larger household size is associated with higher wage expenditures, while lineage size is not. This indicates that household members are typically compensated for their work on family plots, but lineage members are not. Taken together with the negative yield effects of household size in columns 2-3, the wage expenditure results suggest that larger households dilute labor incentives: while more members are paid, their individual effort on family land declines, lowering yields. The evidence points to intra-household labor disincentives, or more generally, collective management of family land as the central mechanism depressing productivity on family land.

Columns 7-9 incorporate tenure reconciliation. The above results are reinforced by the finding that tenure reconciliation has a significantly greater positive effect for households with more members, but not for those with larger lineage groups (columns 8 and 9). The further narrowing of the family land yield gap in columns 8 and 9 relative to column 7 strengthens the conclusion that the effect operates primarily through improved labor incentives among household members, mitigating the disincentives created by intra-household reallocations.

Finally, the coefficient estimates highlight the scale of these effects. Based on column 2 (raw) coefficients, the disadvantage of family versus non-family plots is: ∂(yield value)/∂(family land dummy)=1511.4–2022.0$\times$household size per hectare. At the 10th percentile of household size per hectare (0.27), the estimated disadvantage is +956.8 cedis (i.e. no gap), while at the 90th percentile (1.78) it is –2,368.1 cedis: greater than the sample mean yield of 1,808 cedis per hectare. Household size can thus fully overturn the relative performance of family plots, underscoring its central role in shaping tenure-related disincentives.

Table 6 examines whether tenure insecurity reduces yields through lower use of material

inputs or through the loss of land ' s collateral function. Columns 1-4 use household-level data to test the relationship between tenure insecurity and input expenditures or credit access. The results show no significant associations: tenure insecurity is unrelated to either input use or credit, and neither household size nor lineage group size negatively affects expenditures on seedlings or credit access.

[Table 6 Decrease in the Use of Material Inputs
due to the Loss of the Collateral Function of Land?]

Do collateral rights improve yields or account for the family land yield gap? Mortgage rights, when grouped with other land rights, are positively associated with yield (column 6), but the effect is not found when examined separately (column 7),[1112] suggesting the effect reflects correlations across land rights categories. Columns 8-9 further test whether cultivators with mortgage rights benefited more from tenure reconciliation. Once instrumented, the results show no such effect, suggesting that the raw correlation reflects endogeneity of mortgage rights rather than its causal effect.

Taken together, the evidence in Table 6 indicates that lower yields under tenure insecurity are not explained by reduced use of material inputs or by the absence of lands' collateral value. Instead, consistent with Table 5, the main mechanism appears to operate through weaker labor incentives.

5 Conclusion

Evidence from the customary land tenure system in southern Ghana shows that both investment in rubber cultivation and its productivity are systematically lower on family land, defined as land acquired through matrilineal ties, than on land obtained through other channels. This study examined whether land titling and company-led reconciliation of tenure arrangements, mitigated these disadvantages, and then investigated mechanisms by which overlapping and uncertain rights under customary tenure constrain productivity.

The analysis confirms the widely held view that insecure rights reduces productivity. However, neither the use of material inputs nor access to credit for these inputs appears to be significantly influenced by tenure insecurity. Similarly, the absence of mortgage rights does not impact productivity or credit access, challenging the argument that the lack of land's collateral function as impediment to investment under insecure rights.

The main channel of reduced productivity is labor: household members devote less effort to family land when rights are contested or unclear.

Because family land makes up roughly half the sample, this intra-household mechanism also has substantial aggregate implications for rubber cultivation. Importantly, insecurity arises less from lineage-wide reallocations than from disincentives within households on collectively managed land, where rights are ambiguous. These findings echo Guirkinger et al. (2015) and highlight how intra-household dynamics, rather than broader lineage pressures, drive disincentives under customary tenure.

Tenure reconciliation initiatives, facilitated by the rubber company, help counteract these disincentives. Their impact is strongest in larger households, where the scope for intra-household conflict is greatest. By reducing uncertainty over use rights, such interventions foster greater labor commitment to family land and enhance overall productivity.

From a policy perspective, the findings underscore the importance of looking beyond formal titling and collateral-based approaches when addressing productivity constraints in customary tenure systems. Programs that clarify and reconcile use rights within families can directly reduce the hidden costs of tenure insecurity, especially those arising from labor disincentives. Such interventions may provide a pragmatic route for enhancing smallholder productivity without requiring complete displacement of customary tenure arrangements.

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Notes

[1]See Table A1 of Appendix A for the relationship between land acquisition mode and vested land rights.

[2]See Appendix B for interventions in land tenure by crop and gender.

[3]Traditional village offices include *abusua panyin* (clan chief), *okyame* (chief's spokesman), *tufohene* (chief's adviser), *mbrantehene* (development chief), *asofohene* (youth chief) and *obaapanin* (queen mother of Akan clans).

[4]The following controls are included: gender of cultivator, age, years of schooling, gender and marital status of household head, household size, lineage group size, total size of household farmland, year of household and cultivator land acquisition, and village dummies.

[5]See Table A2 in Appendix A for the relationship between interventions and cultivators' land rights.

[6]The regressions include control variables: gender, age, years of schooling and marital status of the cultivator, year of land acquisition, Muslim household dummy, tree age a correction for sample selection, and village dummies. Coefficients are not reported in the table.

[7]See Table A1 in Appendix A.

[8]The relative disadvantage of family plots compared to non-family plots is given by: (∂yield value/∂ family land dummy)=0.62–0.27×number of household members, where 0.62 is the raw coefficient on the family land dummy (as opposed to the marginal effect of –0.55 reported in the table).

[9]using the coefficients from column 12, 1.94 (raw coefficient on the family land dummy) and –0.47 on household size, the estimated disadvantages are 1.00 year (no disadvantage) and –1.82 years across the 5th and 95th percentiles of household size per hectare (2 and 8 members, respectively).

[10]"At Apinaman, 10% had acquired land from their mother's brother, 39% from their mothers, 17% from their mothers' mothers, 12% from their fathers; 22% stated access through their spouses' lineage," and "The matrifocal ideology challenges the authority of elders to distribute matrilineal land" as uncultivated land that elders could offer to younger members has depleted.

[11]The right to gift land is negatively and significantly significantly associated with yield. Since gift rights are more prevalent on family land, this negative coefficient likely reflects their correlation with the family land variable.

[12]Mortgage rights were also tested for effects on material input use and credit access, the results of which were insignificant and are not reported in the table.

Table 1: Summary Statistics

	Number of Observations	Mean (Percentage)	Number of Observations	Mean (Percentage)
Plot-level variables	Non-migtant farm plots (N=415)		Non-migrant, non-tenant rubber plots (N=182)	
Male cultivator=1	340	(81.9)	153	(79.6)
Female cultivator=1	75	(18.1)	39	(20.3)
Family land (inherited or allocated)=1	305	(52.1)	182	(51.8)
Land size (hectare)	415	2.9	182	3.6
Year of acquisition, family	415	1914	182	1911
Year of acquisition, cultivator	415	1999	182	2000
Value per parcel (Ghana Cedi/hectare)				
Food crop	85	1777.0		
Cocoa	84	582.3		
Oil palm	61	650.3		
Rubber	182	3458.4		
Interventions in land tenure				
Company's land tenure reconciliation=1	152	(25.9)	76	(41.7)
Title registration=1	231	(52.8)	119	(65.3)
Household-level variables			Non-migrant, non-tenant rubber households (M=156)	
Non-Akan (Moslem) household=1			41	(16.8)
Female headed household=1			29	(11.8)
Age of household head			156	46.6
Years of schooling of HH head			156	8.9
Size of lineage group (number of children of mother)			156	5.9
Number of adult household members			156	4.0
Total land size of rubber plots (hectare)			156	5.8
Input use and loans				
Farm expenses per hectare of rubber plots (Ghana Cedi)				
For seedlings			156	165.8
For fertilizer			156	130.9
For pesticides			156	125.0
For wages			156	390.4
Acquisition of loans for seedlings=1			37	(23.7)
Acquisition of loans for fertilizer=1			45	(28.8)

Note. Percentages are given in brackets for binary indicators and categorical variables. Migrant households that arrived in after 1995 are excluded from all the observations. Tenant rubber plots are excluded from the total rubber plot sample (N=294) and from the total rubber household sample (M=183) to construct a non-migrant, non-tenant sample.

Table 2: Investment in Tree Planting (Farm Plots, N=415)

	(1) OLS	(2) IV[/1]	(3) OLS	(4) IV[/2]	(5) OLS	(6) IV[/3]
Family land	–.147***	–.027	–.167***	–.162***	–.038	–.149*
	(2.77)	(.12)	(3.28)	(2.74)	(.77)	(1.61)
Land titled			.211***	.152		
			(4.70)	(.44)		
Land tenure reconciled					.453***	–.006
					(11.89)	(.02)
R-squared	.29	.28	.33	.33	.44	.29
Robust score test of exogeneity (p-value)		.60		.86		.10

Note. Heteroskedasticity-robust standard errors are shown in parenthesis.
***p<.01.
*p<.10.
[/1]Family land dummy is instrumented in column 2.
[/2]Land titling is instrumented in column 4.
[/3]Land tenure reconciliation is instrumented in column 6.

Table 3: Yield Value per Hectare and Family Land, Impact of Interventions (Rubber Plots, N=294)

	Yield per Hectare			Tenure Reconciliation	Yield per Hectare
	OLS	OLS	OLS	OLS	IV[/1]
	(1)	(2)	(3)	(4)	(5)
Family land	–798.6*	–791.2*	–461.7	–.33***	–542.7
(Inherited or allocated)	(1.87)	(1.87)	(1.02)	(6.74)	(.57)
Land titled		58.3			
		(.89)			
Land tenure reconciled			1024.4**		772.7
			(1.93)		(.35)
Office holding status of household head				–.091*	
				(1.72)	
Mother is the first wife of father				–.013*	
				(.29)	
Number of wives of father				–.003*	
				(.16)	
Number of children of father				–.0003	
				(.07)	
Distance from residence				–.025***	
				(3.52)	
R-squared	.26	.26	.27	.61	.32
Robust score test of exogeneity (p-value)					.91

Note. Heteroskedasticity-robust t-statitics are shown in parentheses.
***p<.01,
**p<.05,
*p<.10.
[/1]Tenure reconciliation is instrumented in column 5.

Table 4: Reallocaion among Household Members or among Lineage Group Members?

	Panel A Tenure duration (all crop, 415 plots)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Family land	−.65***	−.59*	−.58*	−.64*	−.55**	−.57**	−.64**
	(2.59)	(2.37)	(2.28)	(2.49)	(2.25)	(2.26)	(2.48)
Household size		.082	.082		.079	.081	
		(1.60)	(1.61)		(1.55)	(1.55)	
Lineage group size			.008	.008		−.025	−.007
			(.17)	(.16)		(.51)	(.15)
Family land ×					−.27**	−.29**	
household size					(3.14)	(3.19)	
Family land ×						.018	−.008
Lineage group size						(.18)	(.08)
Number of observations	415	415	415	415	415	415	415
R-squared	.96	.96	.96	.96	.96	.96	.96
	Panel B Tenure duration (182 non-tenant rubber plots)						
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Family land	−.48	−.35	−.41	−.54	−.19	−.26	−.59
	(.92)	(.65)	(.73)	(.99)	(.37)	(.53)	(1.09)
Household size		.10	.11		.089	.15**	
		(1.33)	(1.42)		(1.13)	(2.03)	
Lineage group size			−.097	−.087		−.15**	−.058
			(1.10)	(.99)		(1.80)	(.64)
Family land ×					−.47***	−.63***	
household size					(3.37)	(4.81)	
Family land ×						.44**	.27
Lineage group size						(2.63)	(1.45)
Number of observations	182	182	182	182	182	182	182
R-squared	.95	.95	.95	.95	.95	.95	.95

Note: Years of plot acquisition is controlled for by the decade of acquisition in all the regressions. Marginal effects of the family land dummy, household size, and lineage group size are reported for their main terms when interaction terms are included. All other controls and sample selection corrections are applied. Heteroscedasticity-robust t-values are shown in parenthesis.

***p<.05.

**p<.05.

*p<.10.

Table 5: Land Reallocation Risk, Redistributive Pressure, and Labor Input Incentives

	Value per hectare (182 non-tenant rubber plots)				Wage expenditure (156 non-tenant rubber hh's)		Value per hectare (182 non-tenant rubber plots)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Family land	–1585.5**	–651.9	–726.7	–1419.9**	671.7**	658.0**	–1059.2	–517.3	–337.7
	(2.32)	(1.05)	(1.15)	(2.29)	(2.35)	(2.29)	(1.43)	(.79)	(.52)
Coefficient of variation of tenure duration	–3591.0	–2078.7	–2706.8	–3551.7					
	(1.08)	(.71)	(.93)	(1.18)					
Adult household members per ha of rubber plots		1448.9***	1054.9***		412.5**	388.4**		1411.6***	1259.9***
		(5.60)	(3.14)		(2.27)	(2.09)		(3.85)	(3.50)
Adult household members per ha × family land		–2202.0***	–2225.4***		943.9***	1133.2***			–1062.8
		(3.93)	(2.69)		(3.44)	(2.89)			(1.00)
Size of lineage group per ha of rubber plots			509.9**	1118.1***	71.7	106.4		98.2	209.6
			(1.97)	(5.60)	(.60)	(.82)		(.36)	(.80)
Size of lineage group per ha × family land			145.7	–1372.0***		–210.5			–725.1
			(.22)	(3.04)		(.68)			(.90)
Tenure reconciled							1472.8*	1139.1*	1092.1*
							(1.91)	(1.69)	(1.68)
Tenure reconciled × Adult household members per ha								2801.5***	2537.7***
								(3.77)	(2.64)
Tenure reconciled × Lineage group size per ha								–462.8	–243.7
								(.83)	(.34)
R-squared	.31	.46	.47	.43	.44	.39	.40	.60	.60

Note: Marginal effects of the family land dummy, household members per hectare, and lineage group size per hectare are reported for their main terms when interaction terms are included. All other controls and sample selection corrections are applied. Absolute t-values are shown in parenthesis.

***p<.05.

**p<.05.

*p<.10.

Table 6: Material Inputs, Collateral Function of Land and Land Rights

	Expenditure for seedlings (156 non-tenant rubber households)		Access to credit for seedlings		Value per hectare (182 non-tenant rubber plots)			Tenure reconciliation (182 non-tenant rubber plots)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)/1
Family land	–145.8**	–132.8*	–.168*	–.168*	–1419.1**	–787.2	–1360.9*	–.342***	–.370***
	(1.81)	(1.66)	(1.70)	(1.70)	(2.06)	(1.09)	(1.96)	(5.14)	(6.00)
Coefficient of variation	83.7	56.3	–.125	–.097					
of tenure duration	(.25)	(.17)	(.27)	(.21)					
Adult household members	83.7	86.7	–.057	–.048					
per hectare of rubber plots	(1.23)	(1.21)	(1.14)	(1.06)					
Adult household members per ha		–145.3		.135*					
× family land		(.80)		(1.73)					
Size of lineage group	–15.6	–20.7	–.011	–.018					
per hectare of rubber plots	(.37)	(.37)	(.31)	(.39)					
Size of lineage group per ha		76.4		–.039					
× family land		(.56)		(.49)					
Perceived rights:									
To plant trees						–939.9			
						(.65)			
To nominate heir (matrilineal)						–68.7			
						(.07)			
To give as gift						–2620.9**			
						(2.24)			
To rent out						253.7			
						(.27)			
To sell outright						170.0			
						(.15)			
To mortgage						1795.6**	377.9	.192***	.016
						(2.12)	(.61)	(2.96)	(.12)
R-squared	.29	.33	.14	.20	.40	.44	.41	.59	.56
Robust score test of exogeneity (p-value)									.18

Note: Marginal effects of the family land dummy, household members per hectare, and lineage group size per hectare are reported for their main terms when interaction terms are included. All other controls and sample selection corrections are applied. Heteroskedasticity-robust standard errors are shown in parentheses.

***p<.01.

**p<.05.

*p<.10.

/1Mortgage right is instrumented.

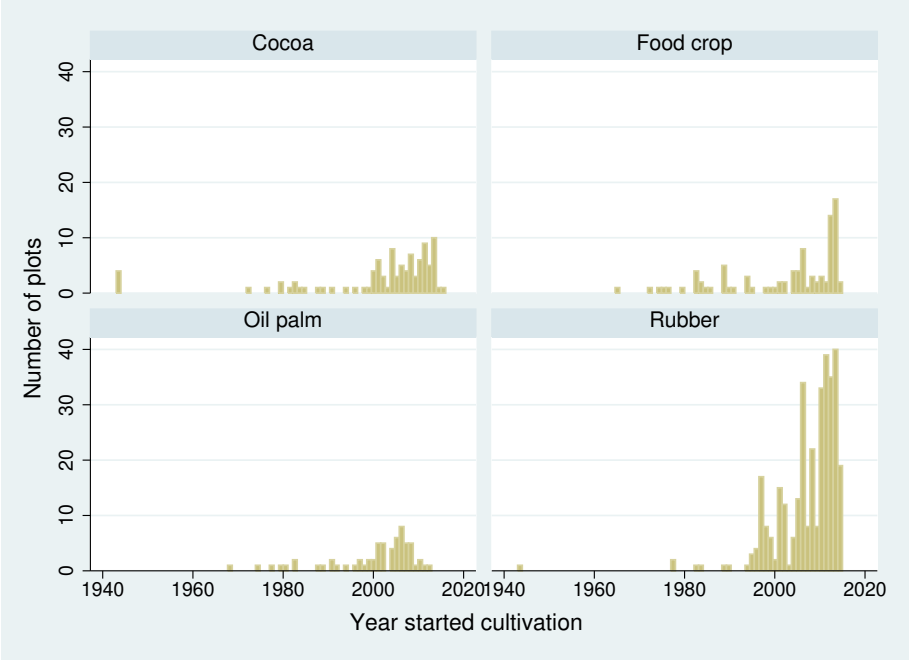

Figure 1: Adoption of Rubber and Other Cash Crop Cultivation

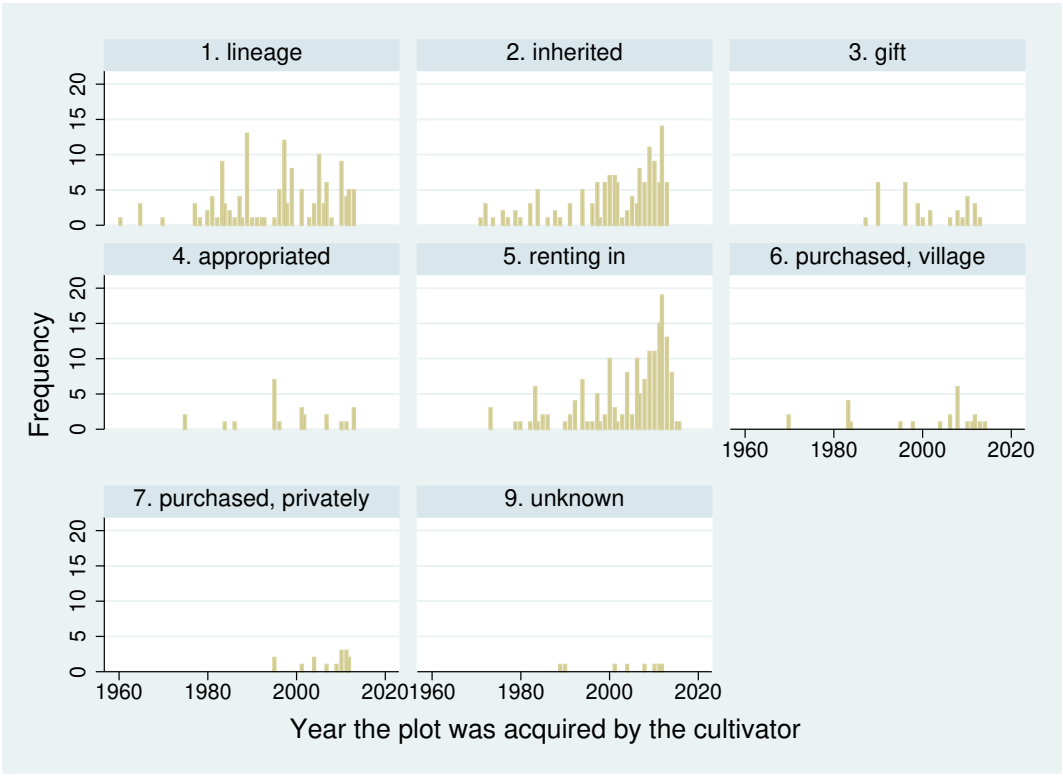

Figure 1: Year of Land Acquisition by Acquisition Mode, Cultivator

Appendix A Perceived Land Rights according to Land Acquisition Modes

Table A1: Perceived Land Rights according to Land Acquisition Modes

	DV: perceived land rights					
	(1) Plant trees	(2) Nominate heir	(3) Give as gift	(4) Rent out	(5) Sell outright	(6) Mortgage
1. Family land	–.0008	.154**	.165***	.098	.140**	.036
(Entire rubber sample N=294)	(.03)	(2.54)	(2.92)	(1.50)	(2.79)	(.58)
2. Rented land	–.021	–.366***	–.228***	–.233***	–.192***	–.292***
(Entire rubber sample N=294)	(.64)	(5.51)	(4.02)	(3.13)	(3.62)	(4.80)
3. Family land	.016	–.042	.069	–.031	.082	–.177**
(Sample excluding rented land N=182)	(.33)	(.58)	(.87)	(.41)	(1.13)	(2.43)

Note. All controls are included. Absolute values of heteroschedasticity-robust t-statistics are shown in parentheses.
***p<.01.
**p<.05
*p<.10.

Table A1 reports how perceived land rights vary with different modes of land acquisition. Each column presents regression coefficients of one of the six land rights, entered as the dependent variable, on land acquisition modes. All specifications control for the full set of covariates. The analysis is restricted to the rubber plot sample.

The first row reports the estimated coefficients on the family land dummy. Across the six specifications, family plots are not systematically disadvantaged in terms of rights allocation. On the contrary, family land is associated with higher probabilities of holding certain rights relative to other acquisition modes.

A contrasting pattern emerges when leased plots are considered. The second row shows that rented land is significantly less endowed with almost all types of land rights compared to non-rented land. Finally, the third row, where rented plots are excluded from the sample, highlights what appears to be the most distinctive feature of family land: the lack of the right to mortgage.

Appendix B Interventions and Land Rights by Crops and Land Acquisition Modes

Table B1: Interventions in Land Tenure by Crop and Gender

	All Crops		Food Crop		Cocoa		Oilpalm		Rubber	
Males' plots										
Tenurape reconciled	140	[37.8]	1	[2.0]	5	[9.6]	1	[0.2]	89	[47.1]
Title registered	178	[48.1]	18	[36.7]	22	[42.3]	20	[40.0]	118	[62.4]
All males	370	(100.0)	49	(13.2)	52	(14.1)	50	(13.5)	189	(51.1)
Females' plots										
Tenure reconciled	21	[28.0]	0		0		0		21	[48.8]
Title registered	60	[80.0]	18	[78.3]	5	[71.4]	2	[100.0]	35	[81.4]
All females	75	(100.0)	23	(30.7)	7	(9.3)	2	(2.7)	43	(57.3)
All cultivators	415	(100.0)	72	(14.2)	59	(14.2)	52	(12.5)	232	(55.9)

Note. Percentage shares within all males' plots or within all females' plots are shown in parenthesis. Percentages within crops are shown in square brackets.

Table B1 presents the distribution of interventions by crop adoption and by the gender of the main cultivator. Tenure reconciliation is overwhelmingly concentrated on rubber plots: virtually all reconciled land is planted with rubber. indicating that reconciliation is primarily targeted at prospective rubber outgrowers. A similar pattern is observed for titilng. The vast majority of titled plots are under rubber cultivation, suggesting that titling is closely linked to the expansion of rubber. Overall, about one-half of rubber plots are titled.

Gender patterns in adoption and interventions appear relatively balanced. Women cultivate rubber at a rate comparable to men (54% and 58%, respectively). The share of reconciliation interventions is identical across genders (26% for both), while titling rates are also similar, at 42% for men and 46% for women.

Table B2: Mode of Land Acquisition and Interventions in Land Tenure

Mode of land acquisition	Number of Plots	Tenure Reconciled		Title Registered	
		Percentage	Difference	Percentage	Difference
Allocated from lineage group	134	16.4	(–13.3)***	35.8	(–9.1)**
Inherited (matrilineal)	137	20.4	(–8.0)*	47.4	(6.4)
Transfer from father	31	48.4	(23.3)***	32.3	(–11.1)
Appropriated from village	24	50.0	(24.7)***	58.3	(16.4)
Rented in	168	31.5	(7.4)*	42.3	(–0.6)
Purchased	39	28.2	(1.9)	56.4	(14.8)*
Other	8	25.0	(–1.5)	12.5	(–30.7)*
All	415	26.4		42.7	

Note. Numbers in parentheses show the differences between the percentages treated within the given mode of land acquisition and those treated among all lands. The signs indicate the significance level of the t-tests performed for the differences.

***p<.01.

**p<.05.

*p<.10.

Table B2 examines how land acquisition modes relate to access to interventions. Reported figures show the proportion of plots receiving each interventions by acquisition mode, with differences from the overall sample mean in parentheses. Tenure reconciliation was significantly less likely to be provided on family land, defined as land allocated or inherited from the matrilineal clan, relative to the sample average. A similar pattern is observed for titling, where family plots are systematically underrepresented among treated plots. By contrast, purchased land exhibits a higher treatment probability than average, while inherited land is less likely to receive interventions.

Appendix C Is Tenure Security Weaker on Family Land?

If the relatively low yields observed on family land are attributable to weaker tenure security, we would expect greater instability in tenure duration on family plots compared to other acquisition modes. To evaluate this, I compare the distribution of tenure durations across acquisition types to that of purchased plots, which serves as the benchmark given their relatively secure and stable tenure.

Tenure duration is measured in two ways: one is years since acquisition (Column 1), and years since cultivation began (Column 2). For each specification, I test the equality of distributions using two-sided Kolmogorov-Smirnov tests. The upper panel of Table C1 reports tests for shorter tenure durations relative to purchased plots, while the lower panel reports tests for longer durations. To account for heterogeneity in the timing of land acquisition, the tenure measures are de-meaned by acquisition period before comparison.

The two family-related acquisition modes: allocation by the lineage group (category 1) and matrilineal inheritance (category 2), are expected to be particularly exposed to overlapping claims. The results support this expectation. In Column 1, lineage-group allocations display significantly shorter tenures than purchased plots. In Column 2, matrilineal inheritance is also associated with shorter tenure durations. Importantly, neither family-related mode shows evidence of longer tenures relative to purchased plots under either definition. These results indicate that shorter and less secure tenures are specific to family land, consistent with the hypothesis that its lower yields may be linked to weaker tenure security.

Table C1: Kolmogorov-Smirnov Test of Tenure Duration

	(1) Tenure duration since acquisition		(2) Tenure duration since starting cultivation	
Test of whether land obtained by below modes contain observations shorter than purchased land	Largest difference between distributions	p-value	Largest difference between distributions	p-value
1. Allocation from lineage group	–.19*	[.09]	–.20*	[.06]
2. Matrilineal inheritance	–.11	[.41]	–.27***	[.007]
3. Gift (non-matrilineal)	–.17	[.31]	–.09	[.73]
4. Allocation from village	–.12	[.56]	–.27*	[.06]
5. Renting in	–.08	[.41]	–.13	[.27]
Test of whether land obtained by below modes contain observations longer than purchased land				
1. Allocation from lineage group	.15	[.22]	.14	[.23]
2. Matrilineal inheritance	.09	[.56]	.13	[.29]
3. Gift (non-matrilineal)	.22	[.16]	.30**	[.03]
4. Allocation from village	.25*	[.09]	.19	[.25]
5. Renting in	.20**	[.05]	.14	[.21]

Note: Demeaned distributions of tenure duration are compared between different acquisition modes and those that were purchased (category 6 and 7). Statistical significance of the difference is tested by Kolmogorov-Smirnov test, the results of which are shown in p-values.

***p<.05.

**p<.05.

*p<.10.