



Munich Personal RePEc Archive

# **Why do Overlapping Land Rights Discourage Investment in Agriculture?: Customary Land Tenure System in West Africa**

Kimura, Yuichi

Faculty of Economics, Oita University

25 September 2024

Online at <https://mpra.ub.uni-muenchen.de/122183/>  
MPRA Paper No. 122183, posted 24 Sep 2024 14:38 UTC

Why do Overlapping Land Rights Discourage  
Investment in Agriculture?:  
Customary Land Tenure System in West Africa\*

Yuichi Kimura

Oita University

September 2024

**Running title:** Why Overlapping Rights Deter Investment?

**Keywords:** Land tenure institution; Land titling; Investment in agriculture.

**JEL classification codes:** Q15, Q12, Q14, O13.

Address: 700 Dannoharu, Oita, Oita, 8701192 Japan.

E-mail: ykimura@oita-u.ac.jp. Phone: 81 97 554 6089.

---

\*This work was supported by JSPS KAKENHI Grant Number 26450329.

## **Abstract**

Under the customary land tenure system in Ghana, family land allocated through matrilineal ties is associated with a lower propensity to take up rubber cultivation and lower yields when they do. Land tenure insecurity is associated with lower yields, as conventional wisdom suggests. Much of the effect of tenure insecurity on rubber yields is explained by this reduced labor input of family members, rather than by the material input or lack of collateral function of land. Also, tenure insecurity stems from undefined rights between household members rather than between lineage group members. The rubber company's interventions to reconcile land tenure among lineage members had the effect of mitigating family land gaps by reducing family members' disincentives to work on family land.

# 1 Introduction

The question of whether unclear land rights under the customary land tenure system discourage investment in agriculture, and whether formalizing land tenure improves incentives to intensify land use, has been central to land policy debates in Africa. The majority of subsistence farming villages operate under a customary land tenure system, in which individuals most often gain access to land through negotiation among lineage members or through matrilineal inheritance.

On the other hand, under the customary land tenure system, cultivators' long-term access to land may be insecure. In the matrilineal inheritance system prevalent in West Africa, land is inherited from a male cultivator to his sister's son through matrilineal kinship ties. It is a system that involves many individuals within the lineage group in access to the lineage's land, so that access to land is always subject to potential renegotiation by members of the lineage group, thus implicating members in disputes over rights to land (Berry 1993, 2018; Austin 2005).

The cultivation of perennial cash crops such as cocoa, oil palm or rubber has the potential to significantly enhance the income of farming households in low-income countries (Byerlee et al. 2008). A central issue in the study of land rights and agricultural investment is whether the long-term stability of land rights is a fundamental prerequisite for securing these incentives for agricultural investment. The ability of individuals to reap the benefits of investing in land can be undermined if land tenure is unclear.

This is particularly relevant for crops that require substantial initial investment and years of maintenance before they begin to produce yields, as the potential for benefits depends on clarity of tenure. It has been recognized that ambiguous and overlapping land rights established under customary land tenure systems can impede investment incentives and limit opportunities for poverty reduction (Bruce and Migot-Adholla 1994; Platteau 1995; Deininger 2003). This recognition aligns with the property rights institution argument of

Coase (1937, 1960) and North (1981). Based on such a rationale, land tenure privatization is underway in several other places in sub-Saharan Africa.

Rubber contracting is a relatively new opportunity for farmers in the coastal region of western Ghana, the area studied in this paper. It gained prominence after the rubber plantation company set up branches as it expanded its catchment areas and sought smallholder contractors. The company's extension offices and processing facilities provided access to new agricultural technologies, in-kind credit for agricultural inputs, and market channels. Because the impact of land security depends on these market institutions (Asaaga et al. 2020), local settings that meet these conditions are ideal for testing the potential impact of land tenure security.

In the study areas, rubber is slightly less likely to be planted on land acquired through matrilineal ties. More importantly, the unit yield is much lower when rubber is planted on these lands. These are family lands inherited through the matrilineal inheritance system or allocated by the matrilineal lineage group. The first focus of the study is how loosely defined land rights on land acquired through kinship ties affect investment in agriculture and whether external interventions affect these decisions.

I study two types of interventions. The first is a formal land registration project that has been implemented in the study area. Pilot legal land tenure reforms have been initiated in large parts of the country, including the villages studied in this paper. The second is an intervention by the rubber company to reconcile land tenure agreements between its contractors and their lineage members. This is done in cases where there is a risk of conflict arising from multiple claims to rights over the land.

Studies do not agree on whether customary land tenure is a barrier to long-term investment, or whether perceived land rights are related to land use intensity. Many studies have found that perceived land rights have an insignificant effect on agricultural investment. These findings cast doubt on the need to formalize land rights. It has been interpreted to mean that customary land rights provide sufficient tenure security for investment and

that titling projects should focus on supporting the transition process of customary systems rather than replacing them outright with a formal system (Place and Hazel 1993; Migot-Adholla, Place, and Oluoch-Kosura 1994, Migot-Adholla et al. 1994; Pinckney and Kimuyu 1994; Platteau 1995; Place and Migot-Adholla 1998; Brasselle, Gaspart, and Platteau 2002; Place 2009).

Other studies have found that perceived land rights or the formalization of land rights significantly affect certain types of land investments in different parts of sub-Saharan Africa (Besley 1995; Deininger 2003; Deininger and Jin 2006; Abdulai, Owusu, and Goetz 2011; Fenske 2011; Ali et al. 2014). Lambrecht and Asare (2015) reviewed studies conducted in Ghana and found mixed results, even within the country.

When agricultural investments involve planting perennial crops, irrigation, or terracing, the very act of making these investments has the effect of increasing rights to that land. And “these rights are maintained as long as the crop grows on the land” (Austin 2005). Thus, one focus of the literature on the relationship between land rights and investment has been on identification of causal directions (Besley 1995; Place 2009; Fenske 2014; Deininger and Jin 2006; Holden and Otsuka 2014).

While the existing literature has focused primarily on whether customary land systems provide sufficient incentives for investment and whether land reform is needed, it has not necessarily been specific about the channels through which customary land systems may impede investment incentives. A number of hypotheses have been proposed about the channels through which land rights lead to investment incentives or disincentives. Besley (1995) synthesizes them in theoretical models, albeit with incomplete empirical evidence. The second objective of this study is therefore to examine the relative importance of these different hypotheses in explaining the relationship between land tenure security and investment incentives.

A possible link between land tenure and investment concerns the monopolizability of investment returns. The motive behind redistributive norms is to maintain mutual insurance

as a safeguard against unexpected shocks and to keep oneself entitled to mutual insurance (Platteau 1991; Fafchamps 1992; Platteau 1996). With a sharing obligation, economic success that stands out in the local community may be subject to envy and moral punishment under egalitarian norms (Platteau 2000; Di Falco and Bulte 2011; Di Falco et al. 2018).<sup>1</sup>

Under these circumstances, a problem of mismatch between beneficiaries and cost bearers of investments arises, where the cultivator bears the cost of the investment, but the resulting output may be subject to free riding by multiple stakeholders. This can discourage investment incentives if we assume away people's altruistic motives. Because redistributive pressures are exerted on agricultural products or money, this can occur even when land rights are stable. Therefore, I will look at the effect of redistributive pressure on output with the risk of tenure breakdown due to land tenure insecurity.

Guirkinger et al. (2015) find that collectively managed plots, typically used for food crops, are subject to the moral hazard of free riding, where household members save their efforts to reserve for their own individually managed plots. This leads to low management intensity and low productivity of collectively managed family plots. I will examine this by looking at family labor and the labor of lineage group members employed on family plots.

From the perspective of access to credit, land with clearly defined title and mortgage rights acquires collateral value when there is a functioning local credit market (Feder et al. 1988; Feder and Feeny 1991). Loosely defined and overlapping claims to land rights may discourage the provision of input credit because they undermine the collateral value of land by obscuring the debt liability and posing a risk of credit loss to the lender. I will test this by looking at the impact of mortgage rights on yield and whether the risk of land reappropriation hampers access to input credit. I examine the applicability of each of these hypotheses in understanding the productivity of rubber cultivation and the productivity gap of family land.

The rest of the paper is organized as follows. Section 2 briefly discusses the historical background of land tenure systems in West Africa. Section 3 presents the data, the expan-

sion of rubber cultivation in the study area, and the two types of land tenure interventions. Section 4 presents testable hypotheses and the empirical strategy for investigating the two focuses discussed above. The empirical results are then presented and interpreted. Section 5 concludes.

## 2 Land Rights Institution

The matrilineal inheritance system emerged and persisted under conditions of abundant land and scarce labor. Customary practices provide incentives to clear the forest and prepare the land for cultivation by granting land rights to those who undertake these efforts. Land thus prepared is held collectively by lineage groups, allocated for use by lineage members, and transferred to the next generation through matrilineal inheritance. Hypothetically, this system evolved for the benefit of attracting large numbers of individuals for future land reclamation (Austin 2005).

Over the course of economic development, customary land tenure systems evolved into more individualized land tenure systems in response to returns to investment in commercial crops and increasing population pressure (Atwood 1990; Bruce and Migot-Adholla 1994; Amanor 2001; Otsuka et al. 2001, 2003; Quisumbing et al. 2001b; Place 2009; Holden and Otsuka 2014). The changes in factor endowments from a land-abundant and labor-scarce economy to one that is land-scarce and labor-abundant were associated with the migrants who settled from northern Ghana, Burkina Faso, Togo, and Côte d'Ivoire.

Migrant settlement increased with the expansion of cocoa cultivation in the 1920s, 1950s, and especially in the late 1960s. With the increase in population pressure and the gradual emergence of land markets, the most notable institutional change has been the emergence of gift transfers, which are essentially an ordinary patrilineal inheritance. Gift transfers have gradually emerged since the enactment of the Intestate Succession Law in 1985, which aimed to address the insecurity of wives' and siblings' land rights (Quisumbing et al. 2001a).



There is concern that the commercialization of rural land institutions may lead to distress sales, resulting in a concentration of land ownership among a small elite group and an increase in the number of landless poor. In the study area, customary law prohibits the outright sale of land to outsiders, even after formal titling. Attempts to sell land within the village must be preceded by consultations with the village chief and elders. Because such requests are rejected in most cases due to the strict customary norms, land sales rarely occur in the study villages, contrary to what is observed in other studies such as Yamano et al. (2009) in Kenya and Ali et al. (2014) in Rwanda.

### **3 Data**

Data were collected from four districts in the Western Region of Ghana. Eight villages were sampled from the four districts: two villages from Ahanta West District, where Ghana Rubber Estates Limited (GREL) established a rubber company in 1962, three villages from Nzema East, three from Mpohor/Wassa East District, and one from Wassa West District. These four districts form the central catchment area where the company has expanded its contract growers. Two villages, one in the Mpohor/Wassa East District and the other in Wassa West District, are located in the interior of the Western Region, where cultivation is relatively new. The other six villages are located in the coastal areas of the same region, where rubber was first cultivated in the country.

#### **3.1 The Spread of Rubber Cultivation**

The company began contracting with smallholders in 1995, and in 2000, 449 households were registered as contract growers. This number increased to 1160 in 2005, 2832 in 2010, 5500 in 2013, and 7815 in 2015. The data for this study was sampled from these smallholders. The company started as a plantation in 1957 and expanded its plantation to 39 thousand hectares by 1962.

After 1995, the company switched to a smallholder contracting scheme (commonly known as outgrower scheme) for further expansion. The smallholder scheme allows farmers to enter production while maintaining their original land holdings and does not involve a land transaction between the farmers and the company. Behind the change in schemes is a growing recognition among cash crop companies that large-scale land acquisition associated with the establishment of plantations often leads to displacement and expropriation of farmers' land (Amanor 2001).

The data was collected through interviews with one respondent from each sampled household. It includes information from 182 households with 415 agricultural plots after dropping 170 plots managed by households that migrated in 1995 and later, which are likely to have done so to start rubber cultivation. The sample also excludes leasehold plots in most analyses, which have far fewer land rights than plots acquired through other means.<sup>2</sup> Summary statistics are presented in Table 1. The majority are Akan, for whom matrilineal inheritance is the traditional practice. Other non-Akan households are Muslim, where the patrilineal inheritance is common. Most of the main cultivators are men, with women accounting for 16%, including female-headed households.

[Table 1 Summary Statistics]

About half of the sample plots were under rubber cultivation at the time of the survey. Figure 1 shows the changes in the cultivation of rubber and other crops. The three types of cash crops have been increasing since the second half of the 1990s. Rubber cultivation has expanded rapidly since the same period. Once it begins to yield, the value per hectare of rubber is much higher than that of other cash crops and food crops such as cassava and plantain.

[Figure 1 Adoption of Rubber and Other Cash Crops]

[Figure 2 Year of Cultivator's Land Acquisition by Acquisition Mode]

Figure 2 shows the evolution over time of the land acquisition modes of current cultivators. The composition of land transfer modes changed significantly after 1995 when rubber cultivation began to expand in the region. Appropriation from the village is no longer an important means of land acquisition, replaced mainly by allocation from lineage groups, inheritance and renting. Cultivators' land tenure is prone to overlapping claims when land is allocated through kinship ties: allocation and inheritance from matrilineal clans. More than half of the plots in the data were acquired through these two modes.

### **3.2 Land Titling and the Rubber Company's Intervention**

The titling system was initiated under the Land Title Registration Act of 1986. It effectively began after a second wave of land reform under the Land Administration Project (LAP), which followed the implementation of the 1999 National Land Policy. Phase 1 of this policy was implemented from 2004 to 2010 (Kasanga and Kotey 2001; Cotula, Toulmin, and Hosse 2004). Under the new land registration system, farmers voluntarily register their land at local Lands Commission offices. The registration and issuance of title deeds ensures that title holders are granted exclusive land use rights. This guarantees the rights of the holders when conflicts over land use rights are brought to court. About half of the sample plots and more than half of rubber plots were titled.

Beyond legal land reform, Ghana Rubber Estates Limited (GREL) intervenes to assist prospective smallholder contractors through a land rights reconciliation process when their land use rights are at risk of dispute or litigation. The company mediates negotiations between the contractor and stakeholders within the lineage group to confirm the contractor's long-term access to the land. Land tenure reconciliation took place on quarter of sample plots and little less than half of rubber plots. It should be noted that this intervention is carried out with the prospect that the farmers will join the outgrower project. Almost all company interventions resulted in rubber contracts.<sup>3</sup> The company provides technical assistance for land preparation and in-kind loans for seedlings and fertilizer for initial

investment. It also provides access to market channels through its processing facility.

## 4 Empirical Analysis

### 4.1 Testable Hypotheses and Empirical Strategy

This section first discusses the methods used to empirically test the first focus of the study: whether the land rights interventions of land registration and tenure reconciliation had an impact on adoption and productivity, and whether they mitigated the disadvantages of family land on adoption and productivity. Since family land accounts for more than half of the total number of farm plots, the impact on family land will have a significant impact on rubber plots as a whole. I then discuss the methods used to investigate the second focus of the study, the channels through which the traditional land system discourages investment.

Similar to Goldstein and Udry's (2008) discussion of investment decisions in agriculture, the accessibility of the interventions: titling and reconciliation, may depend on the voice and political status of cultivators within the household and village. In asking whether the interventions promoted tree planting and unit yields, there is a concern that their endogeneity may bias estimates of their effects.

To instrument for the potential endogeneity of these variables, I use Goldstein and Udry's set of instruments that measure the political status of the cultivator and the distance of the farm plot from the residential area. The variables related to political status are: the village office holding status of the head of the household<sup>4</sup>, the number of wives of the cultivator's father, the marital order of the cultivator's mother, which takes the value of one if the mother is the first wife of the cultivator's father, and the number of siblings of the father.

Goldstein and Udry use information on political status to control for the endogeneity of fallow duration in the unit yield equation for slash-and-burn cultivation. In this study, the exclusion restriction certainly holds for the unit yield equation, but in the tree planting

equation, there is concern that political status may also affect tree planting itself.

Here, in the tree planting equation, the assumptions about this set of instrumental variables are as follows. First, a cultivator's stronger political status facilitates access to land rights interventions. Political status creates differences in interventions through this differential access, but this difference is independent of the strength of land rights, i.e. it has no direct effect on investment behavior on the left-hand side. Although the second assumption in particular may be intuitively difficult to accept, validity tests support both assumptions even in the tree planting equation.

In estimating the gap in family land in tree planting and unit yield, these differences may also be caused by the selection process by which family land is allocated to certain cultivators, besides the fact that family land is under common cultivation rights. Therefore, it is necessary to confirm the selection process by which family land is allocated to certain cultivator. I use the same set of instruments to control for this endogeneity of family land allocation.

The second focus of the study, why the traditional land system discourages investment, is explored in the following ways using the unit yield information of rubber plots. First, I make a detailed observation on the risk of tenure breakdown. Tenure breakdown due to land reallocation is most likely to occur on family plots: land acquired through matrilineal inheritance and allocation by lineage groups. The higher risk of tenure breakdown is expected to explain the lower yields on family plots. I confirm this in Table 4 by comparing the distributions of tenure duration for each mode of land acquisition with that of purchased land, where tenure is considered the most stable.

I then examine the effect of redistributive pressure on farm output and the risk of tenure breakdown on input use and rubber yields. Since redistributive pressure is a factor related to output, it can occur even when land tenure is secure and the risk of tenure breakdown is low. Therefore, I capture the effect of redistributive pressure effect separately by controlling

for tenure insecurity, which is measured by the variation of tenure duration.

In addition, the effect of redistributive pressure on output and the effect of tenure breakdown risk can be identified by comparing the effect of household size on family plots with the effect of lineage group size. For both redistributive pressure and tenure breakdown, it is generally expected that the larger the household and lineage group size, the greater the potential pressure and risk. These are measured by household and lineage group size per hectare of household rubber plot.

If the size of the lineage group explains the family land gap, then redistribution to the lineage group is a disincentive to invest. Since altruism among household members is generally assumed to be stronger than altruism toward lineage groups, redistributive pressure among household members is less likely to be a disincentive. If household size explains the family land gap, the effect should be taken as an indication of reallocation risk among household members rather than redistributive pressure. The results of these are shown in the first half of Table 5 below.

Regarding the risk of tenure breakdown in family plots, if reallocations are more likely to occur among household members and this is the source of the disincentive, then the interaction term between household size and the family land dummy should explain the negative effect of tenure insecurity, i.e., reduce the coefficient on the tenure insecurity measure. Or, if reallocations are more likely to occur among lineage group members, as most of the literature suggests, then the interaction effect of lineage group size and the family land dummy should explain the negative effect of tenure insecurity.

If the risk of tenure breakdown has a negative effect on rubber yields, it can be attributed to one of two possibilities: disincentives affecting material inputs or labor inputs. Reduced material inputs would occur either through the cultivator's own disincentives or through reduced access to input credit from rubber companies. These two possibilities are tested by examining whether the risk of land reallocation hampers access to input credit, and the

effect of the cultivators' mortgage rights on unit yield (Table 6).

The other possibility is that the risk of land reallocation reduces the incentive to expend labor on family land. I examine the effect of labor input disincentives and their impact on family land gaps to see whether labor input disincentives, if any, occur for family labor or for those employed among lineage group members (presented in the second half of Tables 5).

## 4.2 Results

The results for tree planting decisions are shown in Table 2. The table reports only the coefficients of the key variables.<sup>5</sup> Column 1 shows that rubber planting is about 15 percentage points less likely to be adopted on family land. Column 2 controls for the endogeneity of the family land dummy by instrumenting it with information on the political status of the household head. Instrumenting the family land dummy results in a smaller and statistically insignificant coefficient of the family land dummy. However, since the exogeneity of the family land dummy is far from being rejected, the negative coefficient of the family land dummy is not the result of unobserved differences in bargaining power or selectivity in the process of allocating lineage land.

[Table 2 Investment in Tree Planting]

Column 3 examines the impact of land titling on rubber adoption. The OLS estimate shows a positive association between titling and unit yield. Since the allocation of the interventions may reflect the land rights of the cultivators,<sup>6</sup> column 4 controls for the possible endogeneity of land titling using the same set of instrumental variables as in column 2. The robust score test suggests that the exogeneity of land titling should still be assumed. In columns 3 and 4, the negative coefficient of family land is not affected or slightly larger when land titling is included. Land titling does not remove the disincentives in family land.

The impact of the rubber company's tenure reconciliation is examined in columns 5 and 6. The OLS estimate indicates a positive association of the intervention with investment, which becomes insignificant when it is instrumented. The test result decisively rejects exogeneity. The reconciliation is selective for prospective outgrower contractors, implying inverse causality. And among prospective contractors, those with stronger political status are more likely to receive reconciliation. The positive correlation between reconciliation and rubber adoption is fully explained by this selectivity. The negative coefficient of the family land dummy is not affected by controlling for reconciliation, suggesting that reconciliation did not remove disincentives to invest in family land.

The IV results on titling, which indicated that it facilitated tree planting should also be interpreted with caution. The land titling project started around 1995, at about the same time as the rubber company started outgrower contracts in the region. The land titling system was virtually introduced for the purpose of expanding the outgrower scheme. Both titling and investment in rubber have begun in response to the profit opportunities created by the arrival of a rubber company. Given these considerations, land titling is not seen as a facilitator of investment per se, but rather as an intermediate factor in farmers' investment decisions, or essentially a means of meeting administrative needs in response to increased profit opportunities.

Table 3 shows the results for value per hectare.<sup>7</sup> The OLS estimate in column 1 shows that family land has a lower value per hectare. The magnitude of the perverse effect, -773 Ghana cedis per hectare, is about a 40% decrease from the sample mean of 1808 Ghana cedis. Column 2 includes an indicator for having titled the land. Titling is not found to increase productivity. Column 3 includes an indicator for having received tenure reconciliation. Tenure reconciliation is positively associated with productivity. The magnitude of the effect, 1118 Ghana cedis, is quite large compared to the sample mean of 1808 Ghana cedis.

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



When tenure reconciliation is included, the coefficient of the family land dummy becomes much smaller and statistically insignificant. This suggests that the company's intervention increased the productivity of family rubber plots, and that the productivity gap of family land is due to the fact that these plots are less likely to benefit from the intervention. As seen in column 4, family land is indeed less likely to benefit from tenure reconciliation.

A possible endogeneity of the decision to receive the intervention is considered in columns 4 and 5. In most cases, receiving tenure reconciliation leads to participation in the outgrower project,<sup>8</sup> which involves borrowing from the company to plant trees. Thus, access to the intervention may reflect that cultivators' inherent land rights are strong enough to allow them to take the risk of borrowing, and that their land rights have a stable collateral function to the extent that they allow rubber companies to provide financing. Tenure reconciliation is instrumented in column 5, using the same set of instrumental variables for political status as in Table 2.

Column 4 is the first stage regression. The instrumental variables predict tenure reconciliation at a sufficiently high level of significance and satisfy the exclusion restrictions. The coefficient of tenure reconciliation becomes statistically insignificant when it is instrumented, but standard falsification tests do not reject the exogeneity of the instruments by a very large margin. Therefore, tenure reconciliation should be treated as exogenous and the OLS estimate in column 3 is considered valid. Tenure reconciliation is treated as exogenous in what follows.

We now turn to an analysis of the redistributive pressures on output and the risk of tenure breakdown. I first look closely at the risk of tenure breakdown in Table 4. If the lower yields of family land are related to the risk of land reallocation, then family land should have greater variability in tenure duration than other land. To confirm this, I compare the distributions of tenure duration for each acquisition mode with that of purchased land, where tenure is most stable. The differences between the distributions are tested using the Kolmogorov-Smirnov test, the results of which are shown in Table 4.

[Table 4 Kolmogorov-Smirnov Test of Tenure Duration:  
Is Tenure Security Weaker in Family Land?]

The distributions of tenure duration are de-meaned to eliminate any differences between earlier and more recent acquisition periods. The first two acquisition modes, allocation by lineage group and matrilineal inheritance, are family-related modes that should be particularly subject to overlapping land claims. The top half of the table tests whether the parcels obtained through each of the acquisition modes include observations of shorter duration than purchased land; the bottom half tests whether they include observations of longer duration than purchased land.

The table shows that tenure duration is indeed shorter for family land. Column 1 measures tenure duration in years since acquisition. The group of land allocated from the lineage group (category 1) contains significantly shorter observations of tenure duration. When measured in years from the start of cultivation in column 2, matrilineal inheritance (category 2) also contains shorter durations than purchased land. These family-related modes never contain durations longer than purchased ones. Meanwhile, land allocated from village (category 4), rented (category 5), and gifted (category 3) contain longer cultivation durations than purchased land in one of the two measures.

The effects of redistributive pressures on output and land tenure insecurity are examined in the following table. Since redistributive pressure is an output-related factor, it can occur even when land rights are secure. Therefore, I control for risk of tenure breakdown to isolate the effect of pressure on output. The risk of tenure breakdown due to land reallocation is measured by the variation in tenure duration from the time the cultivator acquired the land he or she currently manages. Specifically, I measure this variation by the coefficient of variation within land acquisition modes.

I then regressed this measure of tenure insecurity on value per hectare. The results are shown in Table 5. Rented plots are much less likely to have the right to transfer or

mortgage. More than 100 observations that were acquired by renting are excluded from the estimates to prevent this from affecting the estimates.<sup>9</sup> The same set of control variables is included as in the previous tables, but their coefficients are not reported in the table.

[Table 5 Land Reallocation Risk, Redistributive Pressure]

Columns 1-4 show that tenure insecurity generally has a negative effect on unit yield. In the coefficients in column 1, the magnitude of the effect is about  $-70\%$  of the sample mean at the mean of the variables, although it does not reach statistical significance. For rubber fields as a whole, tenure insecurity is indeed a major constraint, as commonly assumed.

When controlling for household size (and the interaction effect with the family land dummy) in columns 2 and 3, the negative impact of tenure insecurity drops significantly from column 1. That is, household size explains much of the negative impact of tenure insecurity on family land. On the other hand, in column 4, lineage group size (and its interaction effect with the family land dummy) does not change the negative coefficient of tenure insecurity, suggesting that lineage group size does not explain the risk of tenure breakdown on family land. This suggests that it is the reallocation of family land among household members that creates disincentives, and not among lineage group members, as has been commonly assumed.

At the same time, looking at the effect on family land gaps, controlling for household size (and the interaction effect with the family location dummy) in columns 2 and 3 significantly reduces the negative coefficient of the family land dummy, while the lineage group size (and the interaction effect with the family location dummy) in column 4 does not explain the family land gap at all.<sup>10</sup> These results are inconsistent with the prediction made in the previous subsection that altruism is more likely to operate within households than between lineage group members, and with the conventional assumptions about the redistributive pressures that would operate across lineage group members.

The results in columns 2 and 3 still do not completely rule out the possibility that

the redistribution of output from family land among household members reduces incentives to use inputs. On the other hand, it is unlikely that altruism does not operate within households but rather towards lineage group members. It would be reasonable to interpret the effect of household size on family land as an effect of increased risk of tenure breakdown rather than redistributive pressure. The pathway through which this tenure insecurity leads to lower yields on family land is through disincentives to material or labor inputs, which will be tested in the following analysis.

The remainder of Table 5 and Table 6 below examine whether this reduced investment due to land tenure insecurity is associated with disincentives to use labor inputs on family land, or disincentives to use material inputs and access to input credit due to a loss of the collateral function of land.

Columns 5 and 6 of Table 5 look at wage expenditure with the interaction terms of household size per hectare of rubber plot and family land dummy, and lineage group size per hectare of rubber plot and family land dummy. The coefficients indicate that larger household size is associated with larger wage expenditure, but this is not the case for lineage group size. This suggests that household members are hired on family land and receive payment for their labor, but not the lineage group members.

Combined with the results in columns 2 and 3 that larger household size reduces the unit yield of total rubber plots and that on family land, the results suggest that the negative association of household size per hectare of rubber plots is due to low labor input by family members on family land.

This is further confirmed in columns 8 to 9, where the effect of tenure reconciliation is more effective for households with larger numbers of members, but the intervention is not any more effective for larger lineage groups. The effect of tenure reconciliation also accounts for family land gaps: the negative coefficient of the family land dummy is significantly lower in columns 8 and 9 than in column 7. It can be seen that tenure

reconciliation has contributed to mitigating the productivity gap on family land by reducing the disincentives to exert labor effort on family land by family members, presumably the member who manages the land.

The possibility that disincentives to material input use account for the negative effect of tenure breakdown risk is examined in Table 6. Columns 1 to 4 show the results for expenditure on seedlings and access to credit for this purpose. Household level observations are used for this. The results show no evidence of negative effects of tenure insecurity or household and lineage group size on input use and access to credit.

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

Columns 5 through 7 examine whether the collateral rights held by the cultivators affect the yield per hectare. Mortgage rights, along with other land rights, are positively and statistically significantly associated with yield in column 6. However, this is likely due to the correlation between different categories of land rights. As seen in column 7, mortgage rights alone are not positively associated with yield, nor do they account for the family land gap.<sup>11</sup>

Columns 8 and 9 confirm whether mortgage rights made contractors more likely to benefit from tenure reconciliation, which was found in Table 3 to increase yield. The answer is no, as mortgage rights are not significantly related to tenure reconciliation when instrumented, and are suspected to be endogenous. All of these results suggest against the view that disincentives to input use or the lack of collateral function of land are responsible for the reduced rubber yield due to land tenure insecurity. The results in Table 5 suggest that the lack of labor inputs, rather than material inputs, is important in explaining the negative effect of tenure insecurity.

## 5 Conclusion

Observations from southern Ghana suggest that the propensity to invest in rubber and its productivity are lower on family land, i.e. land acquired through matrilineal ties, than on land acquired through other means. The paper first examined whether land titling and rubber company interventions in land tenure reconciliation have helped to remove such disincentives.

The paper then explored why the overlapping land rights under customary land tenure systems hinder rubber productivity. Various hypotheses were tested to find out what explains the productivity of rubber on customary land in general and the low yield on family land. The generally accepted view that tenure insecurity discourages investment applies to the study sites, with the risk of land redistribution having a significant negative impact. The paper examined why this is the case.

The use of material inputs was not found to be affected by of tenure insecurity and access to credit for them. Similarly, mortgage rights do not affect productivity and access to credit either, rejecting the view that a lack of collateral function of land in the study area explains the negative effect of tenure insecurity on investment incentives.

Much of the effect of tenure insecurity on productivity is explained by disincentives to labor input by household members on family land. Since family land accounts for about half of the total sample, this also has a significant impact on total rubber area. While tenure insecurity has generally been assumed to arise from reallocation of arable land within lineage groups, our results suggest otherwise. Reallocation within lineage groups does not explain either tenure insecurity or the yield gap of family land. The results suggest that tenure insecurity arises primarily from reallocation of land among household members, which inhibits motivation for labor input.

This is supported by the fact that land tenure reconciliation by the rubber company has a significantly greater effect on households with more household members per hectare of

household rubber land. Land tenure reconciliation had its effect on unit yield by removing disincentives for family members to expend effort on family land.

## References

- Abdulai, Awudu, Victor Owusu, and Renan Goetz. 2011. "Land Tenure Differences and Investment in Land Improvement Measures: Theoretical and Empirical Analyses." *Journal of Development Economics* 96:66–78.
- Ali, Daniel Ayalew, Klaus Deininger, and Markus Goldstein. 2014. "Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot Evidence from Rwanda." *Journal of Development Economics* 110:262–275.
- Amanor, Kojo S. 2001. "Land, Labour and Family in Western Ghana: A Critique of Land Policy under Neo-Liberalism." Nordiska Afrikanstitutet Research Report no. 116.
- Asaaga, Festus A., Mark A. Hiron, and Yadvinder Malhi. 2020. "Questioning the Link between Tenure Security and Sustainable Land Management in Cocoa Landscapes in Ghana." *World Development* 130(C).
- Atwood, David A. 1990. "Land Registration in Africa: The Impact on Agricultural Production." *World Development* 18(5):659–71.
- Austin, Gareth. 2005. *Labour, Land, and Capital in Ghana: From Slavery to Free Labour in Asante, 1807–1956*. University of Rochester Press, Rochester, NY.
- Besley, Timothy. 1995. "Property Rights and Investment Incentives: Theory and Evidence from Ghana." *Journal of Political Economy* 103, no. 5:903–937.
- Berry, Sara. 1993. *No Condition is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa*. Madison, WI: The University of Wisconsin Press.
- . 2018. "Who Owns the Land? Social Relations and Conflict over Resources in Africa.?" GLOCON Working Paper no. 7.



- Brasselle, Anne-Sophie, Frédéric Gaspart, and Jean-Philippe Platteau. 2002. "Land Tenure Security and Investment Incentives: Puzzling Evidence from Burkina Faso." *Journal of Development Economics* 67:373–418.
- Bruce, John W., and Shem E. Migot-Adholla ed. 1994 "Searching for Land Tenure Security in Africa." Washington, DC: World Bank.
- Byerlee, Derek, Alain De Janvry, Elisabeth Sadoulet, Robert Townsend, and Irina Klytchnikova. 2008. *World Development Report 2008 : Agriculture for Development*. World Development Report no. 30, Washington DC: World Bank Group.
- Coase, Ronald H. 1937. "The Nature of the Firm." *Economica* 4:386–405.
- . 1960. "The Problem of Social Cost." *Journal of Law and Economics* 3:1–44.
- Cotula, Lorenzo, Camilla Toulmin, and Ced Hosse. 2004. "Land Tenure and Administration in Africa: Lessons of Experience and Emerging Issues." London: International Institute for Environment and Development.
- Deininger, Klaus. 2003. "Land Policies for Growth and Poverty Reduction." World Bank Policy Research Report. Washington, DC: World Bank and Oxford University Press.
- Deininger, Klaus, and Sonqing Jin. 2006. "Tenure Security and Land-related Investment: Evidence from Ethiopia." *European Economic Review* 50, no. 5:1245–1277.
- Di Falco, Salvatore, and Erwin Bulte. 2011. "A Dark Side of Social Capital? Kinship, Consumption and Savings." *Journal of Development Studies* 47(8):1128–1151.
- Di Falco, Salvatore, Francesco Feri, Paolo Pin, and Xavier Vollenwider. 2018 "Ties that Bind: Network Redistributive Pressure and Economic Decisions in Village Economies." *Journal of Development Economics* 131:123–131.
- Fafchamps, Marcel. 1992. "Solidarity Networks in Rural Africa: Rational Peasants with a Moral Economy?" *Economic Development and Cultural Change* 41.

Feder, Gershon, Onchan, Tongroj, Chalamwong, Yongyuth, and Chira Hongladarom. 1988. *Land Policies and Farm Productivity in Thailand*. Baltimore: Johns Hopkins University Press (for World Bank).

Feder, Gershon, and David Feeny. 1991. "Land Tenure and Property Rights: Theory and Implications for Development Policy." *World Bank Economic Review* 5, no. 1:135–153.

Fenske, James. 2011. "Land Tenure and Investment Incentives: Evidence from West Africa." *Journal of Development Economics* 95:137–156.

Goldstein, Marcus and Christopher Udry. 2008. "The Profits of Power: Land Rights and Agricultural Investment in Ghana." *Journal of Political Economy* 116, no. 6:981–1023.

Guirkinger, Catherine, Jean-Philippe Platteau, and Tatiana Goetghebuer. 2015. "Productive Inefficiency in Extended Agricultural Households: Evidence from Mali." *Journal of Development Economics* 116:17–27.

Hall, Ruth, Ian Scoones, and Dzodzi Tsikata. 2017. "Plantations, Outgrowers and Commercial Farming in Africa: Agricultural Commercialisation and Implications for Agrarian Change." *Journal of Agrarian Change* 44, no. 3: 515–537.

Holden, Stein T., and Keiji Otsuka. 2014. "The Roles of Land Tenure Reforms and Land Markets in the Context of Population Growth and Land Use Intensification in Africa." *Food Policy* 48:88–97.

Kasanga, Kasim, and Nii Ashii Kotey. 2001. *Land management in Ghana: Building on Tradition and Modernity*. International Institute for Environment and Development, London.

Lambrecht, Isabel, and Sarah Asare. 2015. "Smallholders and Land Tenure in Ghana: Aligning Context, Empirics, and Policy." IFPRI Discussion Paper 01492.

Migot-Adholla, Shem E., Frank Place, and Willis Oluoch-Kosura. 1994. "Security of Tenure and Land Productivity in Kenya." In *Searching for Land Tenure Security in Africa*, ed. John W. Bruce and Shem E. Migot-Adholla. Iowa: Kendall/ Hunt Publishing Cy.

Migot-Adholla, Shem E., George Benneh, Frank Place, and Steven Atsu 1994. "Land, Security of Tenure, and Productivity in Ghana." In *Searching for Land Tenure Security in Africa*, edited by John W. Bruce and Shem E. Migot-Adholla. Quincy, MA: Kendall Hunt.

North, Douglas C. 1981. *Structure and Change in Economic History*. New York: Norton.

Otsuka, Keijiro, S. Suyanto, Tetsushi Sonobe, and Thomas P. Tomich. 2001. "Evolution of Land Tenure Institutions and Development of Agroforestry: Evidence from Customary Land Areas of Sumatra." *Agricultural Economics* 25:85–101.

Otsuka, Keijiro, Agnes R. Quisumbing, Ellen Payongayon, and J. B. Aidoo. 2003. "Land Tenure and the Management of Land and Trees: The Case of Customary Land Area of Ghana." *Environment and Development Economics* 8, no. 1:77–104.

Pinckney, Thomas C., and Peter K. Kimuyu. 1994. "Land Tenure Reform in East Africa: Good, Bad or Unimportant?" *Journal of African Economies* 3, no. 1:1–28.

Place, Frank. 2009. "Land Tenure and Agricultural Productivity in Africa: A Comparative Analysis of the Economics Literature and Recent Policy Strategies and Reforms." *World Development* 37:1326–1336.

Place, Frank, and Peter Hazel. 1993 "Productivity Effects of Indigenous Land Tenure Systems in Sub-Saharan Africa." *American Journal of Agricultural Economics* 75:10–19.

Place, Frank, and Shem E. Migot-Adholla. 1998. "The Economic Effects of Land Registration on Smallholder Farms in Kenya: Evidence from Nyeri and Kakamega Districts." *Land Economics* 74, no. :360–373.

Platteau, Jean-Philippe. 1991. "Traditional System of Social Security and Hunger Insurance: Past Achievements and Modern Challenges." in *Social Security in Developing Countries*. ed. Ehtisham Ahmad, Jean Drèze, John Hills, and Amartya Sen. Oxford: Clarendon Press.

Platteau, Jean-Philippe. 1995. "Reforming Land Rights in Sub-Saharan Africa: Issues of Efficiency and Equity." UNRISD Discussion Paper no. 60.

———. 1996. "The Evolutionary Theory of Land Rights as Applied to Sub-Saharan Africa: A Critical Assessment." *Development and Change* 27:29–86.

———. 2000. *Institutions, Social Norms, and Economic Development*. London and New York: Routledge.

Quisumbing, Agnes R., Ellen Payongayoung, J. B. Aidoo, and Keijiro Otsuka. 2001a. "Women's Land Rights in the Transition to Individual Ownership: Implications for Tree-resource Management in Western Ghana." *Economic Development and Cultural Change* 50, no. 1:157–182.

Quisumbing, Agnes R., J. B. Aidoo, Ellen Payongayon, and Keijiro Otsuka. 2001b "Agroforestry Management in Ghana." in *Land Tenure and Natural Resource Management: A Comparative Study of Agrarian Communities in Africa and Asia*. ed. Keijiro Otsuka and Frank Place. International Food Policy Research Institute. The Johns Hopkins University Press, Baltimore and London.

Udry, Christopher. 1996. "Gender, Agricultural Production, and the Theory of the Household." *Journal of Political Economy* 104, no. 5:1010–1046.

Yamano, Takashi., Frank Place, W. Nyangena, Juliet Wanjiju, and Keijiro Otsuka. 2009. "Efficiency and Equity Impacts of land Markets in Kenya." in *The Emergence of Land Markets in Africa: Impacts on Poverty, Equity, and Efficiency*. ed. Stein T. Hoden, Keijiro Otsuka, and Frank Place. Washington DC: Resources for the Future.

# Notes

<sup>1</sup>Platteau (2000) offers a comprehensive interpretation encompassing anthropological arguments.

<sup>2</sup>See Appendix B for the relationship between land acquisition mode and vested land rights.

<sup>3</sup>See Table A1 in Appendix A for allocation of interventions in tenure reconciliation and land titling.

<sup>4</sup>Positions of traditional village office include *abusua panyin* (village chief), *okyame* (lineage head's spokesman), *tufohene* (main advisor to the chief), *mbrantehene* (chief of development issues), *asofohene* (chief of youth issues), and *obaapanin* (queen mother in Akan matrilineal clan).

<sup>5</sup>The following controls are included: gender of the cultivator, age, years of schooling, gender and marriage status of the household head, household size, lineage group size, total farmland size of the household, year of land acquisition by the household and by the cultivator, and village dummies.

<sup>6</sup>See Table A2 in Appendix A for how the interventions are related with the cultivators' land rights.

<sup>7</sup>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.

<sup>8</sup>See Table A1 in Appendix A.

<sup>9</sup>See Appendix B for the relationship between land acquisition mode and vested land rights.

<sup>10</sup>The negative and significant coefficient of the interaction term between lineage group size per hectare and the family land dummy results from correlation with the family size interaction term, as seen in column 3.

<sup>11</sup>The gift right is negatively and statistically significantly associated with yield. However, gift rights are more common on family land, so the negative coefficient of gift rights is likely due to its correlation with the family land dummy.

Table 1: Summary Statistics

	Number of	Mean	Number of	Mean
	Observations	(Percentage)	Observations	(Percentage)
Plot-level variables	Non-migrant farm plots ( $N=415$ )		Non-migrant, non-tenant rubber plots ( $N=182$ )	
Male cultivator	454	(83.9)	153	(79.6)
Female cultivator	87	(16.1)	39	(20.3)
Family land (inherited or allocated)	415	(56.2)	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	152	(25.9)	76	(41.7)
Title registration	231	(52.8)	119	(65.3)
Household-level variables			Non-migrant, non-tenant rubber households ( $M=156$ )	
Non-Akan (Moslem) household			41	(16.8)
Female headed household			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 members of the household			156	4.0
Total land size of rubber plots			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 (percent)				
For seedlings			37	(23.7)
For fertilizer			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)	(2)	(3)	(4)	(5)	(6)
	OLS	IV <sup>/1</sup>	OLS	IV <sup>/2</sup>	OLS	IV <sup>/3</sup>
Family land	-.147*** (2.77)	-.027 (.12)	-.167*** (3.28)	-.162*** (2.74)	-.038 (.77)	-.149* (1.61)
Land titled			.211*** (4.70)	.152 (.44)		
Land tenure reconciled					.453*** (11.89)	-.006 (.02)
<i>R</i> -squared	.29	.28	.33	.33	.44	.29
Robust score test of exogeneity ( <i>p</i> -value)		.60		.86		.10

Note. Heteroskedasticity-robust standard errors are shown in parenthesis.

\*\*\* $p < .01$ .

\* $p < .10$ .

<sup>/1</sup>Family land dummy is instrumented in column 2.

<sup>/2</sup>Land titling is instrumented in column 4.

<sup>/3</sup>Land tenure reconciliation is instrumented in column 6.

Table 3: Yield Value per Hectare and Family Land, Impact of Interventions (Non-tenant Rubber Plots,  $N=182$ )

	Yield per Hectare			Tenure Reconciliation	Yield per Hectare
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	IV <sup>1</sup> (5)
Family land (Inherited or allocated)	-773.4* (1.73)	-786.0* (1.72)	-421.9 (.88)	-.266*** (3.93)	-511.7 (.32)
Land titled		68.1 (.15)			
Land tenure reconciled			1118.1** (2.03)		355.4 (.32)
Distance from residence				-.037*** (3.73)	
Office holding status of household head				-.024 (.37)	
Number of wives of father				-.050* (1.92)	
Wife order of mother				-.119* (1.75)	
Number of children of father				.0006 (.12)	
<i>R</i> -squared	.26	.26	.27	.17	.31
Robust score test of exogeneity ( <i>p</i> -value)					.77

Note. Heteroskedasticity-robust *t*-statistics are shown in parentheses.

\*\*\*  $p < .01$ ,

\*\*  $p < .05$ ,

\*  $p < .10$ .

<sup>1</sup>In column 5, tenure reconciliation is instrumented.



Table 4: Kolmogorov-Smirnov Test of Tenure Duration: Is Tenure Security Weaker in Family Land?

	(1)		(2)	
	Tenure duration since acquisition		Tenure duration since starting cultivation	
	Largest difference between distributions	<i>p</i> -value	Largest difference between distributions	<i>p</i> -value
Test of whether land obtained by below modes contain observations shorter than purchased land				
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.

\*\*\*  $p < .05$ .

\*\*  $p < .05$ .

\*  $p < .10$ .

Table 7: Land Reallocation Risk, Redistributive Pressure, and Labor Input Incentives

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

Note: Absolute *t*-values are shown in parenthesis. The coefficient of variation of tenure duration is measured as the variation within each land acquisition mode.

\*\*\**p*<.05.

\*\**p*<.05.

\**p*<.10.

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

	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) <sup>/1</sup>
Family land	-145.8** (1.81)	-132.8* (1.66)	-.168* (1.70)	-.168* (1.70)	-1419.1** (2.06)	-787.2 (1.09)	-1360.9* (1.96)	-.342*** (5.14)	-.370*** (6.00)
Coefficient of variation of tenure duration	83.7 (.25)	56.3 (.17)	-.125 (.27)	-.097 (.21)					
Number of adult household members per hectare of rubber plots	83.7 (1.23)	86.7 (1.21)	-.057 (1.14)	-.048 (1.06)					
Size of lineage group per hectare of rubber plots	-15.6 (.37)	-20.7 (.37)	-.011 (.31)	-.018 (.39)					
Adult household members per ha × family land		-145.3 (.80)		.135* (1.73)					
Size of lineage group per ha × family land		76.4 (.56)		-.039 (.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** (2.12)	377.9 (.61)	.192*** (2.96)	.016 (.12)
<i>R</i> -squared	.29	.33	.14	.20	.40	.44	.41	.59	.56
Robust score test of exogeneity ( <i>p</i> -value)									.18

Note: Heteroskedasticity-robust standard errors are shown in parentheses. All other controls and correction for sample selection are included.

\*\*\**p*<.01.

\*\**p*<.05.

\**p*<.10.

<sup>/1</sup>Mortgage right is instrumented.

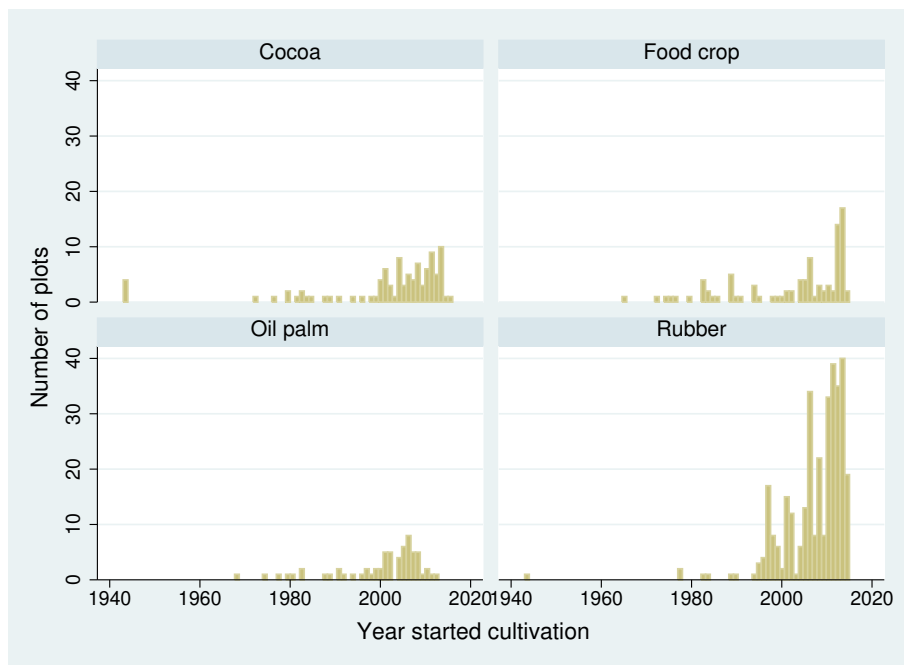


Figure 1: Adoption of Rubber and Other Cash Crop Cultivation

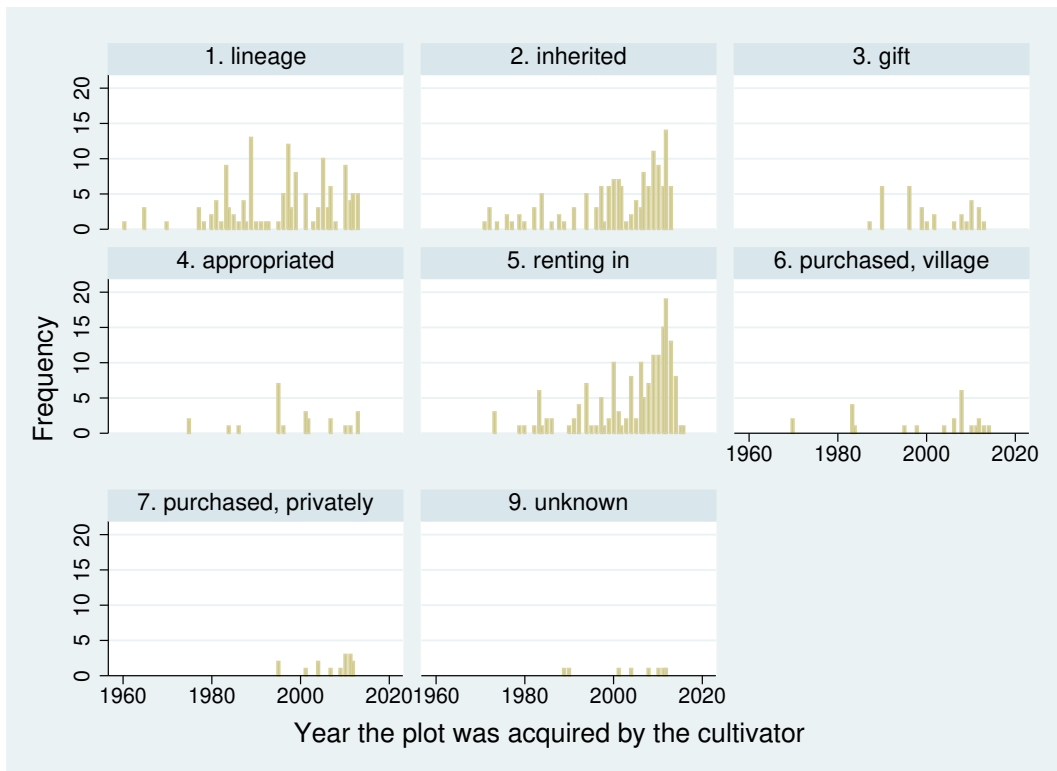


Figure 2: Year of Land Acquisition by Acquisition Mode, Cultivator

## Appendix A Interventions and Land Rights by Crops and Land Acquisition Modes

Table A1: Interventions in Land Tenure by Crop and Gender

	All Crops		Food Crop		Cocoa		Oilpalm		Rubber	
Males' plots										
Tenure reconciled	140	(26.4)	1	(0.2)	5	(1.1)	1	(0.2)	133	(29.3)
Title registered	191	(42.1)	21	(4.6)	20	(4.4)	10	(2.2)	140	(30.8)
All males	454	(100.0)	56	(12.3)	76	(16.7)	58	(12.8)	264	(58.1)
Females' plots										
Tenure reconciled	23	(26.4)	0		0		0		23	(26.4)
Title registered	40	(46.0)	1	(1.1)	1	(1.1)	3	(3.4)	35	(40.2)
All females	87	(100.0)	28	(32.2)	9	(10.3)	3	(3.4)	47	(54.0)
All cultivators	415		84	(15.5)	85	(15.7)	61	(11.2)	311	(57.4)

Note. Percentage shares within all males' plots or within all females' plots are shown in parenthesis.

Table A1 shows the distribution of interventions by the type of crop adopted and by the gender of the main cultivators.

Almost all of the land that received tenure reconciliation was planted with rubber. This means that tenure reconciliation is being applied to prospective rubber contractors. Meanwhile, of all the land that was planted with rubber, about half was the land that received tenure reconciliation. Similarly, the vast majority of plots that received land registration resulted in the adoption of rubber cultivation, suggesting that land registration is closely linked to the expansion of rubber cultivation. About half or more of all rubber plots are registered.

Women (54%) take up rubber cultivation at a similar rate to men (58%). The proportion of reconciliation interventions involving men's and women's plots is balanced: 26% for both. Title registration is also gender balanced: 42% and 46% for men and women respectively.

Table A2: 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) <sup>***</sup>	35.8	(-9.1) <sup>**</sup>
Inherited (matrilineal)	137	20.4	(-8.0) <sup>*</sup>	47.4	(6.4)
Transfer from father	31	48.4	(23.3) <sup>***</sup>	32.3	(-11.1)
Appropriated from village	24	50.0	(24.7) <sup>***</sup>	58.3	(16.4)
Rented in	168	31.5	(7.4) <sup>*</sup>	42.3	(-0.6)
Purchased	39	28.2	(1.9)	56.4	(14.8) <sup>*</sup>
Other	8	25.0	(-1.5)	12.5	(-30.7) <sup>*</sup>
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 A2 shows how land acquisition modes relate to access to these interventions. The numbers in parentheses indicate the differences between the percentage treated for the given acquisition mode and the percentage among all lands. Tenure reconciliation was less likely to be provided to cultivators of family land: those obtained via allocation or inheritance from the matrilineal clan. The same applies to titling. Purchased land is more often and inherited land is less often treated than average.

## Appendix B Perceived Land Rights according to Land Acquisition Modes

Table B1: 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 (Entire rubber sample N=294)	-.0008 (.03)	.154** (2.54)	.165*** (2.92)	.098 (1.50)	.140** (2.79)	.036 (.58)
2. Rented land (Entire rubber sample N=294)	-.021 (.64)	-.366*** (5.51)	-.228*** (4.02)	-.233*** (3.13)	-.192*** (3.62)	-.292*** (4.80)
3. Family land (Sample excluding rented land N=182)	.016 (.33)	-.042 (.58)	.069 (.87)	-.031 (.41)	.082 (1.13)	-.177** (2.43)

Note. All controls are included. Absolute values of heteroschedasticity-robust t-statistics are shown in parentheses.

\*\*\*p<.01.

\*\*p<.05

\*p<.10.

Appendix B shows how perceived land rights are related to land acquisition modes. Rather than a simple tabulation, the table presents regression coefficients with each of the six types of land rights as the dependent variable, including all control variables, using the rubber plot sample.

The first row shows each of the coefficients for family land in the six regressions. It seems that, contrary to what was assumed, family lands are not particularly less endowed with land rights. Rather, they are more likely to have some of the rights, such as the right to sell or give as gift, more often.

However, a very different picture emerges when leased land is excluded, which is much less endowed with almost all types of land rights compared to non-rented land (the second row of the table). The third row, with a sample that excludes rented land, shows that the most characteristic feature of family land is the lack of the right to mortgage.