Incomplete Property Rights and Farm Size:

Evidence from Haiti*

Craig Palsson† Parker Sonnenberg‡

September 2024

Abstract

We investigate the connection between incomplete property rights and plot size. Incomplete property rights create transaction costs in the land market, which should have two effects on plot size: (1) transaction costs reallocate land from high costs to low costs and (2) the variance in farm sizes is directly proportional to the variance in transaction costs. We test these hypotheses using archival data from Haiti. We show that Haiti's tradition of families jointly owning land creates a pattern consistent with large transaction costs distorting the land market. These results inform the discussion of small farms around the developing world and of Haiti's economic development.

* We thank Jonathan Conning, Mark Hup, Oliver Kim, Bryan Leonard, Gary Richardson, and Danilo Trupkin for their comments on this paper, as well as participants at Florida State University, Peking University, and the Society for Institutional and Organizational Economics.
† Utah State University, Huntsman School of Business (craig.palsson@usu.edu)
‡ Florida State University, Department of Economics (psonnenberg@fsu.edu)

Throughout the developing world, there are two ubiquitous phenomena. First, farms are too small, leading to lower agricultural productivity (Adamopoulos & Restuccia, 2014; Foster & Rosenzweig, 2011). Second, property rights are incomplete; specifically, many landowners have limited power to transfer land without the permission of their extended family (Palsson, 2021), their tribe (Goldstein & Udry, 2008), or their government (Chari et al., 2020; Dippel et al., 2023). These phenomena hinder economic growth and limit the ability of farmers to make efficient decisions regarding land use, ultimately contributing to persistent poverty and underdevelopment. In this paper, we explore how they are connected and argue that incomplete property rights create small farms.

The focus of this paper is how the organization of property rights affects the distribution of plot sizes in Haiti. In contrast to the rest of Latin America and the Caribbean, Haiti's agriculture is characterized almost exclusively by small farms. These small farms started early in the country's history when (after slaves successfully revolted and declared independence in 1804) the country's founding fathers redistributed plantation land. Despite many attempts to reestablish plantations over the next 150 years, Haiti remained in a small farm equilibrium. One of the most popular explanations for how small farms persisted is Haiti's property rights institutions. Landowners would inherit use rights to property, but transfer rights were held by an extensive kinship network. Any attempt to transfer the property had to be approved by this network, introducing significant transaction costs. We investigate whether these transaction costs created a misallocation in the distribution of plot sizes.

We answer this question by combining a theoretical model with new archival data. We use a model of transaction costs and farm size from Britos et. al (2022) to generate two testable predictions. First, transaction costs cause a reallocation of land from farmers with high transaction costs to farmers with low transaction costs. Second, the variance in farm sizes is directly proportional to the variance in transaction costs. We then take this model to newly collected microdata from a 1950s cadastral survey. The cadasters contain information on over 7,000 plots and provide two distinct advantages for testing this question. First, the cadaster indicates whether the plot is owned by heirs, the primary source of transaction costs. Second, the plots are grouped in 227 "habitations" (contiguous land), which allows us to observe differences in transaction costs across neighboring plots.

We find evidence that inheritance patterns affect the distribution of farm sizes consistent with the hypothesis that they create high transaction costs. This hypothesis predicts a wedge between lands acquired through low and high transaction costs. Our first finding is that farms owned by individuals—the ones facing the most transaction costs to expanding—are 25% smaller than farms jointly owned by heirs who acquire their land under low transaction costs. Once we control for unobserved differences in land quality using habitation fixed effects, the difference increases to 32%. Since individual farmers will face higher transaction costs when surrounded by jointly owned land, we add an interaction term for the share of habitation land under joint ownership. This term's coefficient is also negative and statistically significant, indicating that moving from a habitation with no jointly-owned farms to one where 50% of the farms are jointly owned reduces the average individually-owned plot by an additional 10%. These results confirm the first testable implication that transaction costs decrease farm size.

We then look at the model's second testable implication that transaction costs increase the variance of farm size. We show that the standard deviation in farm size on a habitation is increasing in the share of farms under joint ownership. A one standard deviation increase in the share of farms under joint ownership is associated with a 25% increase in the standard deviation of farm sizes. This is evidence that joint ownership creates misallocation: jointly-owned farms are too big while independently-owned farms are too small.

Our concluding analysis looks at whether these property rights are associated with fractured land ownership. If these property rights increase transaction costs, then farmers might circumvent the negotiating costs by holding multiple low-cost plots. We aggregate the data to the owner-habitation level and show that habitations with more area under joint ownership have 13% more owners with multiple plots. While not a causal estimate, the evidence for fractured ownership adds to the larger picture of transaction costs and the efficiency losses.

This paper contributes to our understanding of the relationship between property rights and misallocation. It is well established that property rights affect the efficient allocation of resources on a property, such that poor property rights reduce investment (Galiani & Schargrodsky, 2010; Goldstein & Udry, 2008; Hornbeck, 2010) and tie labor to the land (Agyei-Holmes et al., 2020; Chernina et al., 2014; De Janvry et al., 2015; Field, 2007). But most of this literature focuses on the property rights for the piece of land itself. We show that another important consideration is the property rights on neighboring plots.

But across the developing world, too much agricultural land is on small farms (Adamopoulos & Restuccia, 2014). Some of this is due to transaction costs in the labor market (Foster & Rosenzweig, 2011), but another problem is transaction costs in the land market (Bolhuis et al., 2021; Britos et al., 2022; Chari et al., 2020). We show that how property rights are organized, not just enforced, affects farm size through its effect on transaction costs in the land market.

Finally, we contribute to the growing literature on Haiti's economic history by highlighting how property rights have shaped the country's agricultural and economic outcomes. Haiti serves as a striking example of the reversal of fortune phenomenon, transitioning from one of the most productive regions in the West during the 18th century to one of the least productive today. This decline can be partly explained by political instability (Palsson, 2023a) and low state capacity (Palsson, 2023b), but a critical factor has been Haiti's complex land policy and property rights system (Lundahl, 2011; Palsson, 2021). Efforts to reform these systems, such as the failed attempt to privatize state-owned land through homesteading (Palsson & Porter, 2024), have faced significant challenges. Our findings demonstrate that improving property rights in Haiti will not only require policy changes but also overcoming the significant transaction costs associated with negotiating within extensive kinship and community networks. This underscores the importance of considering local social structures when designing property rights reforms.

Theoretical Framework

Since transaction costs are not directly observable, we rely on a model of transaction costs in the land market to generate testable implications. We follow the theoretical framework in Britos et al. (2022). A key difference between their approach and ours is that they use the model to estimate the general equilibrium effects of transaction costs and estimate counterfactual output without them, while we use the model to look at the partial equilibrium effects of transaction costs on farm size. We show two main results. First, transaction costs decrease the size of plots. Second, the variance in plot size is directly proportional to the variance in transaction costs.

We assume the agricultural good (y_i) is produced by farmer i on a farm (l_i) using his managerial skills (s_i). His production function is

$$y_i = s_i l_i^{\alpha}$$

where the parameter $\alpha \in (0,1)$ captures the land elasticity. When the farmer determines his plot size, he considers two costs. First, there is the rental price r, which he takes as given. Second, the farmer might have to pay a transaction cost on top of the rental price. The transaction cost comes from negotiating with other farmers to expand his plot. Since expanding the plot further means negotiating with more farmers, we assume transaction costs are increasing with land size. Thus, we assume the cost is a function of the size of the farm, $\tau_i(l_i)$, with $\tau_i'(.) > 0$.

The farmer chooses the size of farm that maximizes profit. His problem is then

$$\max_{l_i} \pi_i(s_i) = \{s_i l_i^{\alpha} - r l_i - \tau_i(l_i)\}$$

with non-negativity constraint $l_i \geq 0$. The optimality condition yields,

$$\alpha s_i l_i^{\alpha-1} = r + \tau_i'(l_i)$$

Without loss of generality, Britos et al (2022) assumes a quadratic transaction cost, $\tau_i(l_i) = \frac{\tau_i}{2} l_i^2$.

While we could solve this model to get the full characterization of the market, we are most interested in the implications for individual farms. To get those, we assume the farmer operates in a market. There are N farmers cultivating the amount of land L in the area. The market clearing condition for aggregate land is

$$L = \sum_{i=1}^{N} l_i$$

The market clearing condition combined with the farmer's optimality condition imply the equilibrium land choice for individual farmer i is

$$l_i = \left(\frac{s_i}{r + \tau_i l_i}\right)^{\frac{1}{1-\alpha}} \frac{L}{\tilde{S}} \tag{1}$$

where $\tilde{S} = \sum_{i=1}^{N} \left(s_i/(r + \tau_i l_i)\right)^{\frac{1}{1-\alpha}}$.

Testable Implication #1: transaction costs cause land to be reallocated from farmers with high transaction costs to farmers with low transaction costs. Since transaction costs increase the cost of land, this will push plots to be smaller. That is, $\frac{\partial l_i}{\partial \tau_i} < 0$, as proven in Appendix XX. But since the land market is zero sum, this means that farm sizes are increasing in the transaction costs of other farms ($\frac{\partial l_i}{\partial \tau_j} > 0$). This is helpful in the empirical work because it means there should be a wedge between the size of farms with low transaction costs and those with high transaction costs.

Next, we can apply a log transformation to Equation (1) to get

$$\ln(l_i) = \frac{1}{1-\alpha}\ln(s_i) - \frac{1}{1-\alpha}\ln(r + \tau_i l_i) + \ln(L) - \ln\left(\tilde{S}\right)$$

Since L and $\tilde{S}$ are constant for all plots in the same market, this implies the variance of land size is

$$Var(\ln(l_i)) = \frac{1}{(1-\alpha)^2}\left(Var(\ln(s_i)) + Var(\ln(r + \tau_i l_i)) + 2Cov(\ln(s_i), \ln(r + \tau_i l_i)\right) \tag{2}$$

Testable Implication #2: the variance in farm size is directly proportional to the variance in transaction costs. If transaction costs were absent, then the variance in farm size would depend only on the variance in skills. But with transaction costs, the variance in farm size has two extra terms: the variance in transaction costs and the covariance of transaction costs and skills. The effect of the covariance term is ambiguous because we do not know how skills interact with transaction costs. On the one hand, a skilled farmer might be better at negotiating between parties and can therefore lower his transaction costs. On the other hand, skilled farmers can produce more, and if the negotiating parties know that, they can increase transaction costs to extract rents. But since the transaction costs come from historical factors unrelated to individual farmers, we assume that transaction costs and skills are independent, such that their covariance is zero. Thus, the expression reduces to the variance in farm size being determined by the variance in skills and the variance in transaction costs. Practically, this means that in a market where everyone has the same skills and no transaction costs, then everyone would have the same plot size. But a small variance in transaction costs leads to some farmers getting a little too much land and others getting too little, and more variance leads to greater distortions. Thus, the greater the variance in transaction costs, the greater the variance in farm sizes.

The model, therefore, provides two testable implications that can be analyzed with minimal data. The first implication is that plot sizes are decreasing in transaction costs, and the second is that the variance in plot sizes is increasing in transaction costs. For both, the only data required are plot sizes and a measure of transaction costs. To understand more about how we measure transaction costs, we rely on Haiti's history.

Haitian Property Rights and Transaction Costs

Haiti is unique among Latin American and Caribbean countries for its preponderance of small farms. This unique difference began with Haiti's unique origins. In 1790, Haiti, then St. Domingue, was an incredibly profitable French colony where 90% of the population was enslaved. During the 1790s and into the early 1800s, the slaves revolted and gained their freedom. One of their primary strategies through the revolt was to directly attack the plantation system, destroying mills and burning fields (Gonzalez, 2019). Despite many early attempts to preserve the plantation system, the freed were determined to forsake large-scale agriculture in favor of subsistence farms.

Two institutions arose to reinforce this move to smaller farms. First, in 1806, the Haitian government began dividing and redistributing the plantation land. Initially, the government used the redistribution to pay fighters who had helped during the war for independence (Murray, 1977, pp. 76–77). Later, when tax revenues were scarce, it sold the land to finance itself (Murray, 1977, p. 102). This redistribution started the process that led to Haiti's agriculture being characterized by widespread ownership of small farms with few large landowners. It has been cited as one of the most decisive events in Haiti's economic history (Lundahl, 2011).

The second institution that led to small farms was inheritance patterns. Many Haitian landowners divide their land among their children (Bastien, 1985), both because there is legal protection for such divisions (Force, 2016, p. 41; Lundahl, 1979, p. 278) and because of cultural pressure to avoid the return of plantation agriculture (Dubois, 2012, pp. 109–110). Thus, each generation, the plots are subdivided, leading to smaller plots over time (Palsson, 2021). Furthermore, while use rights are passed to individuals, transfer rights are retained by the whole family. A landowner in this system can choose how he wants to farm the plot, but if he wanted to sell it, he would have to get approval from everyone who received a veto right. These veto rights were allegedly kept in the family to impede investors from restoring the plantation economy through aggregating individual purchases.

For this paper, we are interested in these inheritance patterns as a source of transaction costs. There are many examples of how these veto rights cause problems for acquiring land (Palsson, 2021). A notable anecdote is how one company trying to acquire 20 hectares had to negotiate with

180 property holders over three years (Moral, 1961, p. 185). When extensive family owns the land, not only does each transaction require talking with multiple parties, the opportunity for hold-up problems expands rapidly. These transaction costs have been blamed for misallocation in previous work (Palsson, 2021), but there were limitations to the data for exploring the hypotheses. The data in this paper allow us to go further.

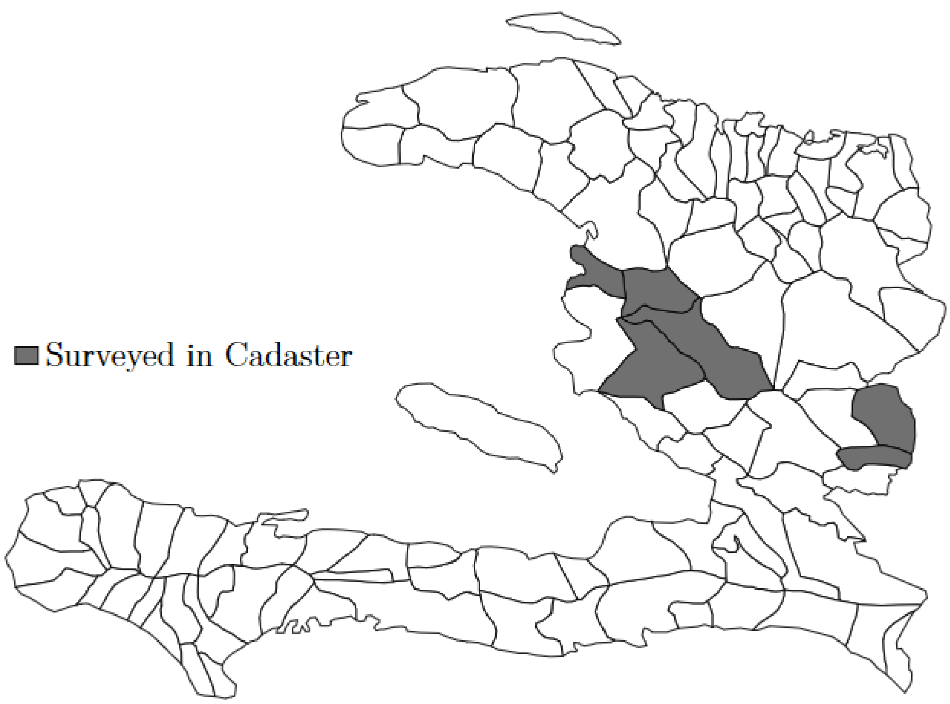
Data on Haitian farms

We collect data on Haitian farms from a cadastral survey performed in the 1950s. In October 1954, the National assembly passed a law to survey the Artibonite Valley, Haiti's most fertile region. After surveying the region, the Cadastral Office published the lists in the government's official gazette, *Le Moniteur*. We collect all lists published between 1955 and 1959 using issues of *Le Moniteur* made available through the Digital Library of the Caribbean and the Bibliothèque Haïtienne des Spiritains. The government published 227 lists detailing over 7,000 plots. After 1959, there were no more lists published.

The law behind the cadasters was part of a policy to formalize property rights in the region. The government had planned some irrigation and land improvement projects in the region, but much of the land was held without title. The law was passed to rapidly create a cadaster of the region that would grant peasant farmers legal ownership of the land and end any disputes over ownership. The cadaster had four inclusion criteria: (1) the owner was a peasant farmer; (2) the property boundaries were not disputed; (3) the property's title was insufficient to establish definitive ownership; (4) the property was smaller than 3 ha. We discuss how these criteria affect the analysis below.

The lists cover 4,981 hectares across six districts. The six surveyed districts are highlighted in Figure 1. About 35% of the area surveyed is in Dessalines, followed by Verrettes with 22%. The next three areas have similar representation: Lascahobas (14%), Petite Riviere de l'Artibonite (13%), and Grande Saline (12%). Finally, only 2% of the area surveyed was in Belladere. The cadasters are clearly incomplete: the 4,981 hectares surveyed only covers 2.5% of the six districts' area.

Figure 1. Districts that had cadastral surveys



Notes: District is highlighted if it had any properties surveyed in the cadasters.

The lists do not provide much information, but they report two key pieces of information. First, the lists name the plot's owners. Frequently this is a single person, but they will also report whether the plot is jointly owned by the heirs of a particular person. Second, the lists document where the owner lives. If they do not live on the same habitation as the property, we identify label that plot as an absentee owner.

Table 1 reports summary statistics for the farms and habitations. The average farm in the data is 0.70 ha (1.7 acres). Not only is the average farm small, the largest farms do not get bigger than 10.3 ha (25.5 acres). The smallest farm in the data is 0.022 ha (0.05 acres). These 7,130 farms are spread over 227 habitations. These habitations are in the range of average farms in rich countries. The average habitation is 21.9 ha (54 acres) which is just below half the average farm size of the richest 20% of countries in 1990 (Adamopoulos & Restuccia, 2014). The largest

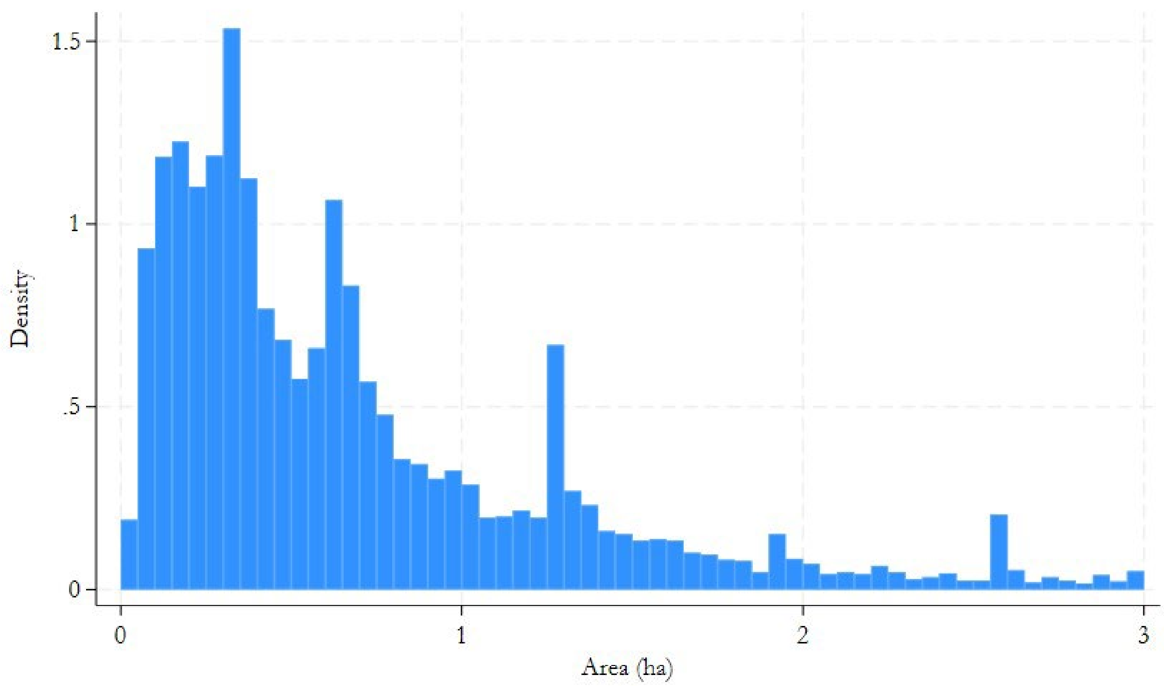
Table 1. Summary statistics for plots and habitations

	Mean	Min	Max
Farms (N = 7,130)			
Area (ha)	0.70	0.022	10.311
Joint-Ownership	0.48	0	1
Non-resident	0.54	0	1
Habitation (N = 227)			
Area (ha)	21.90	0.19	181.177
Share of Hab. Area			
Joint Ownership	0.42	0	1
Non-resident	0.67	0	1
Share of Hab. Farms			
Joint Ownership	0.37	0	1
Non-resident	0.65	0	1

habitation is 181 ha (447 acres), but it is divided across 322 farms, so the average farm is only 0.6 ha, which is smaller than the average farm.

The largest farm observed in the data is 10.3 ha. This is significantly larger than what the law deemed as the maximum plot size to include in the cadaster. Indeed, we observe 13 plots larger than 3 ha. It is unclear why these plots were included despite passing the maximum size. But they do raise a concern about the data. If the data represent only the left tail of the plot-size distribution, then we would be selecting only the smallest plots and possibly biasing our analysis. But the distribution of plot sizes suggests this criteria cuts off only the right tail of peasant farms. Figure 2 shows the distribution of plot sizes in the data, excluding the 13 plots above the cutoff. The distribution is concentrated below 1 ha, and less than 5% of plots are larger than 2 ha. While it is unfortunate that we are potentially missing larger plots, it looks like the cutoff was selected to include most peasant farmers.

Figure 2. Distribution of plot sizes



Notes: The cadastral survey was intended to include only plots under 3 hectares. Of the 7,130, only 13 were above the cutoff. Those 13 were dropped from this distribution. For the full distribution, see Appendix Figure XX.

Table 1 also shows how prevalent joint ownership is. Across the 7,130 farms, 48% are jointly owned by a family. At the habitation level, there are two ways to measure the intensity of joint ownership. The average habitation has 42% of its land under joint ownership, but only 37% of its farms. This implies that jointly-owned farms are larger, on average, from individually-owned plots. There are 13 habitations where all farms are jointly owned, but for 10 of them the habitation is a single small farm ranging from 0.3 to 2.74 ha.

Empirical Framework

The model provides two testable implications that guide our empirical work. First, transaction costs reallocate land from relatively high-cost land to relatively low-cost land. Second, the variance in farm size is directly proportional to the variance in transaction costs. In this section, we outline our strategy for testing these hypotheses.

To test the first implication, we take advantage of the historical context. The historical evidence suggests that when plots are passed to heirs, it is a low-transaction cost transfer. There is no debate over whether that family member gets it, and he can use it however they want. But if an individual outside the family tries to buy land, then she faces high transaction costs. The transaction costs come when the farmer wants to expand a plot neighboring land owned by an heir. She then must negotiate with the entire family, where every member has a veto right to the transfer. Even if the original owner of the inherited land had to go through a similar negotiation process to get the land, that original owner did it a generation earlier, when transaction costs were lower. Thus, plots owned by heirs are acquired with lower transaction costs than plots owned by individuals.

In our data, we can identify which plots are owned by heirs and which are owned by individuals. We can test the hypothesis with the following regression:

$$Size_{ih} = \beta_0 + \beta_1 Individual_{ih} + \gamma NonResident_{ih} + \delta_h + \varepsilon_{ih}. \tag{3}$$

where $Size_{ih}$ is the size of farm i on habitation h and $Individual_{ih}$ is an indicator for whether the farm is owned by an individual. The data also indicate whether the owner of the plot lives on the habitation, which could be another source of transaction costs since nonresidents might not have local knowledge of who owns the neighboring plots. To account for this, we include the binary variable $NonResident_{ih}$. We also include a habitation fixed effect (δ_h) to account for unobserved heterogeneity that could affect plot size across habitation (e.g. land quality). Since transaction costs should reallocate land from high costs (individuals) to low costs (heirs), the hypothesis predicts $\beta_1 < 0$.

We can further test this first implication by imagining the individual acquiring the plot. When the individual arrives, the jointly-owned heir plots already exist because they were first inhabited at least a generation before. Thus, he can take low-transaction-cost vacant land up until the border of the jointly-owned land, at which point expanding requires higher transaction costs. Therefore, individuals on habitations where more land is under joint ownership face higher transaction costs, and therefore their plots will be smaller. We can test this prediction with the following regression

$$\begin{gathered} Size_{ih} = \beta_0 + \beta_1 Individual_{ih} + \beta_2 Individual_{ih} \times ShareAreaJoint_h + \\ \gamma NonResident_{ih} + \delta_h + \varepsilon_{ih}. \end{gathered} \tag{4}$$

This regression adds the interaction of $Individual_{ih}$ with $ShareAreaJoint_h$, which is the share of area on habitation h that is jointly owned by heirs. The hypothesis predicts $\beta_2 < 0$.

The second testable implication is that the variance of the farm sizes is directly proportional to the variance of transaction costs. Unfortunately, we do not know the variance in transaction costs across habitations. But we hypothesize that transaction costs come from plots under joint ownership. Assume that the transaction costs on a jointly-owned plot i are a random variable T_i where $Var(T_i) \neq 0$. Without loss of generality, we assume that individually-owned plots have zero transaction costs. Then the variance in transaction costs on habitation h (T_h) where the share s of plots are jointly-owned would be $Var(T_h) = s^2 \cdot Var(T_i)$. This implies that the standard deviation of the plot-size distribution is increasing in the share of jointly-owned farms: $SD(T_h) = s \cdot SD(T_i)$. Thus, while we cannot measure variation in transaction costs across habitations, we can measure variation in the share of plots that are jointly owned, and we should see a positive relationship between the standard deviation of plot size and the share of jointly-owned plots.

To test this hypothesis, we use the following regression

$$SD(\ln(Size_{hd})) = \alpha_0 + \alpha_1 ShareFarmJoint_{hd} + \alpha_2 ShareFarmNonResident_{hd} + \Gamma_d X_d + \varepsilon_{hd} \quad (5)$$

where $SD(\ln(Size_{hd}))$ is the standard deviation of log farm size on habitation h in district d; $ShareFarmJoint_{hd}$ is the share of farms on habitation h under joint ownership; $ShareFarmNonResident_{hd}$ is the share of farms on habitation h owned by nonresidents; and X_d are district-level controls that may affect the variance of farm size. The parameter of interest is α_1, and our hypothesis predicts $\alpha_1 > 0$.

A crucial assumption to the second testable implication is that the distribution of skills is constant across habitations. Unfortunately, we have no habitation-level measures of the distribution of agricultural skills. In Appendix Table A1, we show that literacy rates across districts are comparable, and in some specifications, we will add these literacy rates as controls. But in these cases, we still have to assume that the distribution of skills across habitations within a district is constant. Thus, we have to assume that the distribution of skills is orthogonal to the prevalence of joint ownership on a habitation.

Results

First, we test for whether the transaction costs from jointly-owned properties create a wedge in farm sizes. Table 2 reports the results from comparing individually-owned plots to the jointly-owned ones. Columns (1) and (3) report the coefficients from Equation 4. They show that individually-owned farms were 0.24 ha smaller on average (significant at the 1% level). Table 1 shows that the average farm was 0.70 ha, which means the individually-owned plots were 34% smaller. Smaller plots are consistent with higher transaction costs, but it could be that individually-owned plots are more likely to be owned by farmers with less capital or family labor, which forces them to a smaller scale. Thus, in columns (2) and (4), we follow Equation 5 and interact the dummy for individually-owned with the share of the habitation's farms that are jointly owned. The results show that going from a habitation that has no jointly-owned plots to the average habitation (where approximately 0.50 plots are jointly-owned, see Table 1) is associated with an individually-owned farm that is 0.07 ha (10%) smaller. These results provide strong evidence for the transaction cost hypothesis.

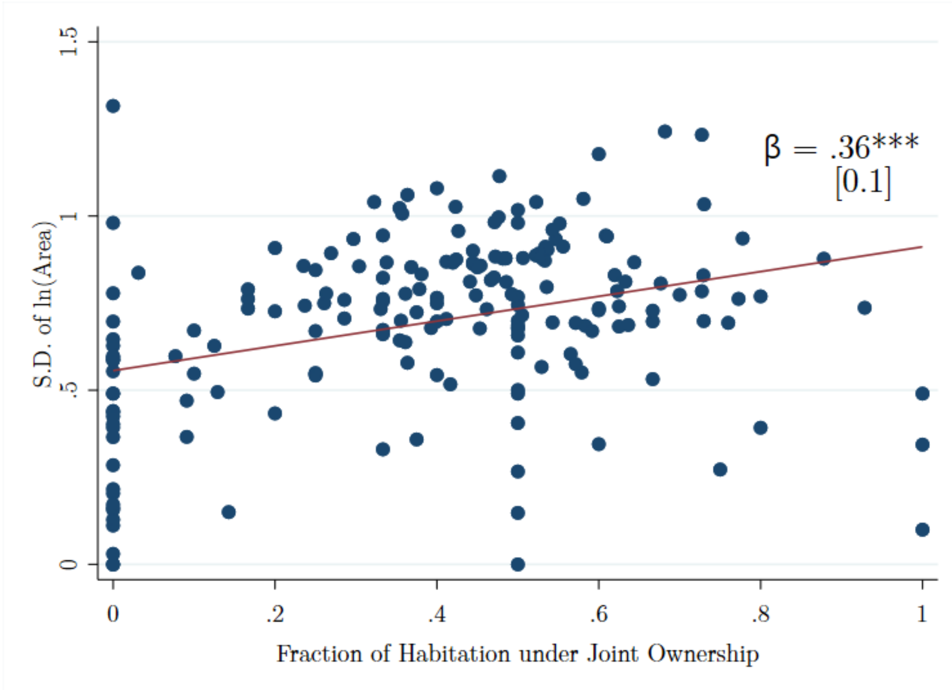
Table 2. Farm size and transaction costs

	Area		ln(Area)	
	(1)	(2)	(3)	(4)
Individually Owned	-0.24***	-0.23***	-0.38***	-0.36***
	[0.020]	[0.019]	[0.028]	[0.024]
Nonresident	0.072***	0.071***	0.17***	0.17***
	[0.019]	[0.019]	[0.035]	[0.035]
Individually Owned x Share Jointly Owned		-0.14***		-0.18***
		[0.023]		[0.027]
N	7,130	7,130	7,130	7,130
R^2	0.209	0.215	0.213	0.217

Notes: All regressions include habitation fixed effects. Standard errors clustered at the habitation level. *** p<0.01

Next, we explore the hypothesis that transaction costs affect the variance of farm sizes. The model predicts that in the absence of transaction costs, the variance in the log farm size across habitations will be a function of the variance in skill. Assuming that the distribution of skill is

Figure 3. Variation in farm size and joint ownership



Notes: The β comes from a regression of the standard deviation of log area on the fraction of the habitation under joint ownership. The regression has 189 observations. Robust standard error reported in bracket.

constant across habitations, there should be no relationship between the distribution of farm sizes and the share of farms under joint ownership. But if joint ownership introduces transaction costs, then we should see the standard deviation increase with more joint ownership. In Figure 3, we present a visual inspection of this hypothesis by plotting the standard deviation of log farm size across habitations against the share of farms under joint ownership. The scatterplot shows a strong positive association, supporting the transaction costs hypothesis.

We explore this hypothesis further through the regression analysis outlined in Equation 6. We report the results in Table 3. Column (1) estimates that α_1 is 0.36, an estimate that is statistically significant at the 1% level. Since some of the variance in farm size will be driven by the total

Table 3. Testing for transaction costs

	(1)	(2)	(3)	(4)
Share of Farms Jointly Owned	0.355***	0.216**	0.215**	0.0734
	[0.0968]	[0.0852]	[0.0857]	[0.110]
Share of Farms Nonresident Owned		-0.0533	-0.0542	-0.0386
		[0.0498]	[0.0497]	[0.0514]
log(Habitation Area)		0.0883***	0.0879***	0.0593**
		[0.0182]	[0.0189]	[0.0239]
District Literacy Rate			-0.112	
			[1.662]	
District Fixed Effects				X
Observations	189	189	189	189
R-squared	0.115	0.273	0.273	0.336

Notes: The unit of observation is the habitation and the dependent variable is the standard deviation of log farm size on the habitation. Robust standard errors in brackets. *** p<0.01, ** p<0.05

habitation area, column (2) adds a control for the habitation area. The point estimate falls to 0.22, statistically significant at the 5% level. Finally, since the model predicts that the variation in farm size is determined by the variation in skill, in column (3) we control for the district-level literacy rate, but it has no effect on our main results. This evidence provides further support for the transaction cost hypothesis.

There is a concern that variation in plot size could be related to some other unobservable factors within a district that affect the land market. Column (4) adds those fixed effects, and the point estimate falls to 0.075. While it is still positive, it is no longer statistically different from zero. Given the amount of evidence in favor of the transaction cost hypothesis, we are reluctant to point to this one result to reject it. It does, however, caution that transaction costs may be strongly correlated within district. For example, both Britos et al. (2022) and Bolhuis et al. (2021) proxy for transaction costs using how active the local level rental market is. In this case, district fixed effects may control too aggressively for heterogeneity.

Exploring the Mechanism: Fractured Holdings

We have shown empirical patterns consistent with incomplete property rights creating large transaction costs in the land market. We now want to explore evidence for the mechanism that does not directly derive from the model but connects with the ideas. Until now, we have focused on the plot- and habitation-level data, but our data allow us to analyze one other level. We can identify whether the same owners hold multiple plots on the same habitation. This allows us to test how owners respond to high transaction costs.

If transaction costs impose a significant barrier to getting the farmer's optimal amount of land in a single farm, the farmer might circumvent the costs by owning multiple farms. In Haiti, the transaction costs come as the farmer wants to expand the plot at the border of a jointly-owned plot. The habitation is like a checkboard of high- and low-transaction cost land. Thus, if a single plot of land is far enough away from the farmer's optimum, and if transaction costs make it significantly expensive to expand that particular plot, the farmer can get closer to his optimum by farming multiple plots. These fractured holdings would sacrifice gains from economies of scale on a larger contiguous plot, but that might be compensated by having more land under cultivation.

We aggregate the data to the owner-habitation level to test for whether transaction costs are associated with fractured holdings. The dependent variable of interest are whether the owner hold

Table 4. Testing whether transaction costs are associated with fractured holdings

	Has Multiple Plots		No. Plots Held	
	(1)	(2)	(3)	(4)
Share Habitation Area Jointly Owned	0.0240**	0.0201*	0.0249*	0.0234*
	[0.0114]	[0.0118]	[0.0131]	[0.0139]
Owner is Individual		-0.0274**		-0.0101
		[0.0126]		[0.0151]
Constant	0.178***	0.193***	0.211***	0.217***
	[0.0222]	[0.0225]	[0.0229]	[0.0225]

Notes: The level of observation is the owner-habitation. All regressions have 5,776 observations. The first two columns are a linear regression where the dependent variable is a dummy for whether the owner has multiple plots on that same habitation. Columns 3 and 4 are a Poisson regression where the dependent variable is the number of plots held on that habitation. The share of habitation area jointly owned has been standardized to have a mean of zero and standard deviation of one. Standard errors are clustered at the habitation level. *** p<0.01, ** p<0.05, * p<0.10

multiple plots and the number of plots they hold. Our measure of transaction costs is the share of habitation area under joint ownership. The hypothesis predicts that as the share of the area under joint ownership increases (i.e. as transaction costs increase), owners are more likely to have multiple plots. Thus, we predict a positive coefficient in the regressions.

The results are reported in Table 4. Column 1 uses a linear regression where the dependent variable is a dummy for whether the owner holds multiple plots. It shows that a one standard deviation increase in the share of habitation area under joint ownership is associated with a 2.4 percentage point increase in owning multiple plots. Since 18% of owners hold multiple plots, this is a 13% increase at the mean, statistically significant at the 5% level. Column 3 uses a Poisson regression where the dependent variable is the number of plots held. The results show that a one standard deviation increase in area under joint ownership leads to a 2.5% increase in the number of plots owned, statistically significant at the 10% level. Columns 2 and 4 add a control for whether the owner is an individual (rather than an heir). These results show that individuals are less likely to own multiple plots, but even accounting for that difference, the effect of the transaction costs hold (though the statistical significance of the linear regression is only at the 10% level).

These results confirm the hypothesis that transaction costs are associated with fractured land holdings. We cannot make a causal claim because we lack an identification strategy. But it is hard to see why fractured holdings would be associated with the share of area under joint ownership other than through transaction costs. Furthermore, we are assuming that all of the fractured ownership occurs in the same habitation. If high transaction costs and land scarcity mean fractured ownership is spread across multiple habitations, then we would be underestimating the effect of transaction costs. Nevertheless, this is more evidence that this land market is distorted by transaction costs.

Discussion

The empirical analysis has provided evidence that inheritance traditions in Haiti have created significant transaction costs in the land market. In this section, we discuss the implications of these transaction costs for Haitian agricultural productivity, Haitian development, and development around the world.

This institution has created misallocation in Haitian agriculture. While we do not have plot-level measures of agricultural output, the distortions in the distribution of farm sizes should translate into distortions in output. Instead of allocating land according to productivity, the land is allocated according to transaction costs. We can see in other contexts that this distortion in the land market lowers productivity. In China, lowering transaction costs in the land rental market led to an 8% increase in output and a 10% increase in productivity (Chari et al., 2020). In Guatemala, land market imperfections lowered maize and bean output by 19%, and coffee output by 31% (Britos et al., 2022). In India, eliminating transaction costs would increase agricultural productivity by 33%, and in some states it could increase as much as 60% (Bolhuis et al., 2021). It is natural to conclude that the distortion in farm size is carrying through to output and productivity.

Even if we had data on agricultural output and productivity, it would miss the full picture because the transaction costs are likely preventing markets from happening. Palsson (2021) assembles evidence that transaction costs in the land market prevented investors from reestablishing sugar plantations in Haiti in the early 20th century. During this time, advancements in steam technology made cane sugar profitable again in the Caribbean, but the production process required controlling and coordinating cultivation on a large scale. If transaction costs impede this coordination, then investors will search for areas with lower transaction costs. For example, in Cuba, when transaction costs on the Western part of the island were too high to establish new mills, investors moved to the East where transaction costs were low (Dye, 1994). Despite its history of leading the world in sugar production, this paper provides evidence that Haiti missed out on these advancements in part because transaction costs were too high.

Of course, part of the reason these institutions developed was to stop sugar plantations, so losing them might not be a welfare loss. There are, however, many other reasons why this institution could have stunted Haiti's development. High transaction costs can prevent investment in productive infrastructure such as irrigation canals (Rosenthal, 1990). Similarly, these costs can prevent the land from shifting into more productive uses, such as urban development (Yamasaki et al., 2022) or alternative large-scale uses (Leonard & Parker, 2018). While losing sugar plantations might have not been a significant loss, these transaction costs might have obstructed other paths to economic development. On the other hand, as with in Taiwan (Kim & Wang, 2024), the low productivity of such small farms might have helped Haiti's entry into light manufacturing.

Conclusion

In this paper, we present evidence that transaction costs from property rights institutions are creating misallocation in Haiti's farms. We show that farms facing higher transaction costs to expanding are 30% smaller, and we show that areas with higher transaction costs have greater variance in farm size. Together, these results point to an underperforming land market that fails to get land to the most productive farmers.

These findings are an important step towards understanding the abundance of small farms in the developing world. While the problem has been documented, economists are still trying to understand what causes it. Adamopoulos and Restuccia (2014) point to institutions that are biased towards small farms, such as ceilings on farm sizes and programs that subsidize small farmers. Foster and Rosenzweig (2011) emphasize the importance of transaction costs in the labor market. The results in this paper point to another candidate: incomplete property rights, a widespread phenomenon in poor countries, create transaction costs in the land market that distort farm sizes. Future research should be oriented towards exploring how incomplete property rights contribute to small farms in other countries, and how countries have overcome these problems to improve the efficiency of their markets.

In Haiti, a path for future research would be considering how these property rights regimes and small farms contributed to Haiti's poverty. Small farms could be related to two of Haiti's problems. First, distortions in the land market can lower agricultural productivity, leading to lower household incomes. Second, small farms lead to overworked land, leading to low soil fertility and higher erosion. While erosion has been hypothesized to be a central part of Haiti's problems (Lundahl, 2011), we need better empirical evidence for the connection between erosion, small farms, and property rights.

Finally, moving forward, researchers and policymakers should also consider how to address these incomplete property rights. While the standard recommendation is to title land, that would not solve the problem if all of the veto holders were put on the title. Yet, not allowing them on the title would be an expropriation of their rights. A solution will have to weigh the tradeoffs of removing those rights with the gains from lower transaction costs in the market, whether that is consistent with the goals of the society, and whether it is feasible to compensate those who lose their rights.

References

Adamopoulos, T., & Restuccia, D. (2014). The Size Distribution of Farms and International Productivity Differences. *American Economic Review*, *104*(6), 1667–1697.

Agyei-Holmes, A., Buehren, N., Goldstein, M., Osei, R., Osei-Akoto, I., & Udry, C. (2020). The Effects of Land Title Registration on Tenure Security, Investment and the Allocation of Productive Resources: Evidence from Ghana. *Policy Research Working Paper;No. 9376. World Bank*.

Bastien, R. (1985). *Le paysan haititien et sa famille: Vallee de Marbial*. Paris, ACCT.

Bolhuis, M., Rachapalli, S., & Restuccia, D. (2021). *Misallocation in Indian Agriculture* (w29363; p. w29363). National Bureau of Economic Research. https://doi.org/10.3386/w29363

Britos, B., Hernandez, M. A., Robles, M., & Trupkin, D. R. (2022). Land market distortions and aggregate agricultural productivity: Evidence from Guatemala. *Journal of Development Economics*, *155*, 102787. https://doi.org/10.1016/j.jdeveco.2021.102787

Chari, A., Liu, E. M., Wang, S.-Y., & Wang, Y. (2020). Property Rights, Land Misallocation, and Agricultural Efficiency in China. *The Review of Economic Studies*, *88*(4), 1831–1862. https://doi.org/10.1093/restud/rdaa072

Chernina, E., Dower, P. C., & Markevich, A. (2014). Property rights, land liquidity, and internal migration. *Journal of Development Economics*, *110*, 191–215.

De Janvry, A., Emerick, K., Gonzalez-Navarro, M., & Sadoulet, E. (2015). Delinking Land Rights from Land Use: Certification and Migration in Mexico. *American Economic Review*, *105*(10), 3125–3149.

Dippel, C., Frye, D., & Leonard, B. (2023). Property Rights without Transfer Rights: A Study of Indian Land Allotment. *Working Paper*.

Dubois, L. (2012). *Haiti: The Aftershocks of History*. Metropolitan Books.

Dye, A. (1994). Avoiding Holdup: Asset Specificity and Technical Change in the Cuban Sugar Industry, 1899-1929. *Journal of Economic History*, *54*(3), 628–653.

Field, E. (2007). Entitled to Work: Urban Tenure Security and Labor Supply in Peru. *Quarterly Journal of Economics*, *122*(4), 1561–1602.

Force, P. (2016). *Wealth and Disaster*. Johns Hopkins University Press.

Foster, A., & Rosenzweig, M. (2011). Are Indian Farms Too Small? Mechanization, Agency Costs and Farm Efficiency. *Working Paper*.

Galiani, S., & Schargrodsky, E. (2010). Property rights for the poor: Effects of land titling. *Journal of Public Economics*, *94*, 700–729.

Goldstein, M., & Udry, C. (2008). The Profits of Power: Land Rights and Agricultural Investment in Ghana. *Journal of Political Economy*, *116*(6), 981–1022.

Gonzalez, J. (2019). *Maroon Nation: A History of Revolutionary Haiti*. Yale University Press.

Hornbeck, R. (2010). Barbed Wire: Property Rights and Agricultural Development. *Quarterly Journal of Economics*, *125*(2), 767–810.

Kim, O., & Wang, J. K. (2024). Land Reform in Taiwan, 1950-1961: Effects on Agriculture and Structural Change. *Working Paper*.

Leonard, B., & Parker, D. (2018). Private vs. Government Ownership of Natural Resources: Evidence from the Bakken. *Working Paper*.

Lundahl, M. (1979). *Peasants and Poverty: A Study of Haiti*. Croom Helm.

Lundahl, M. (2011). *Poverty in Haiti: Essays on Underdevelopment and Post Disaster Prospects*. Palgrave Macmillan.

Moral, P. (1961). *Le Paysan Haitien Etude sur la Vie Rurale en Haiti*. G.P. Maisonneuve & Larose.

Murray, G. (1977). *The Evolution of Haitian Peasant Land Tenure: A Case Study in Agrarian Adaptation to Population Growth* [PhD Thesis]. Columbia University.

Palsson, C. (2021). Small Farms, Large Transaction Costs: Haiti's Missing Sugar. *Journal of Economic History*, *81*(2), 513–548.

Palsson, C. (2023a). "A Whirligig of Revolutionary Presidents": State Capacity, Political Stability, and Foreign Business in Haiti, 1910-1920. *European Review of Economic History*. https://doi.org/10.1093/ereh/head025

Palsson, C. (2023b). State Capacity, Property Rights, and External Revenues: Haiti, 1932–1949. *Journal of Economic History*.

Palsson, C., & Porter, S. (2024). The Inefficacy of Land Titling Programs: Homesteading in Haiti, 1933—1950. *Public Choice*.

Rosenthal, J.-L. (1990). The Development of Irrigation in Provence, 1700-1860: The French Revolution and Economic Growth. *Journal of Economic History*, *50*(3), 615–638.

Yamasaki, J., Nakajima, K., & Teshima, K. (2022). *From Samurai to Skyscrapers: How Transaction Costs Shape Tokyo*. https://hermes-ir.lib.hit-u.ac.jp/hermes/ir/re/79717/?lang=1

Appendix

A1. Proof of first testable implication

In this section, we prove that the model implies that increasing transaction costs (τ_i) will decrease farm size; that is, $\frac{\partial l_i}{\partial \tau_i} < 0$.

The optimal farm size for person i is

$$l_i = \left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}} \frac{L}{\tilde{S}}$$

with

$$\tilde{\mathrm{S}} = \sum_{j=1}^{N} \left(\frac{s_j}{r + \tau_j l_j}\right)^{\frac{1}{1-\alpha}}.$$

Since l_i is on both sides of the equation, we use the implicit function theorem to find the derivative of l_i with respect to τ_i. Our implicit function is

$$F(\tau_i, l_i) = l_i - \left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}} \frac{L}{\tilde{S}} = 0.$$

Then the term we need can be found as

$$\frac{\partial l_i}{\partial \tau_i} = -\frac{\frac{\partial F}{\partial \tau_i}}{\frac{\partial F}{\partial l_i}}.$$

Taking the derivatives, we find that

$$\frac{\partial l_i}{\partial \tau_i} = -\frac{\left(\frac{1}{1-\alpha}\right)\left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}}\left(\frac{l_i}{r + \tau_i l_i}\right)\frac{L}{\tilde{S}}\left(1 - \frac{1}{\tilde{S}}\left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}}\right)}{1 + \left(\frac{1}{1-\alpha}\right)\left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}}\left(\frac{\tau_i}{r + \tau_i l_i}\right)\frac{L}{\tilde{S}}\left(1 - \frac{1}{\tilde{S}}\left(\frac{s_i}{r \ + \tau_i l_i}\ \right)^{\frac{1}{1-\alpha}}\right)}.$$

Since all terms in both the numerator and the denominator are greater than zero, the fraction is greater than zero. But since the fraction is preceded by the negative sign, we have

$$\frac{\partial l_i}{\partial \tau_i} < 0.$$

Next, we show that farm size is increasing in the transaction costs on other plots ($\frac{\partial l_i}{\partial \tau_j} > 0$).

The derivative of the optimal farm size

$$\frac{\partial l_i}{\partial \tau_j} = -\left(\frac{s_i}{r + \tau_i l_i}\right)^{\frac{1}{1-\alpha}} \frac{L}{\widetilde{S}^2} \frac{\partial \widetilde{S}}{\partial \tau_j}$$

Note that τ_j only appears in $\tilde{S}$ in the j-th term of the summation. So

$$\frac{\partial \widetilde{S}}{\partial \tau_j} = -\frac{s_i l_i}{(1-\alpha)(r + \tau_i l_i)^2}\left(\frac{s_i}{r + \tau_i l_i}\right)^{\frac{\alpha}{1-\alpha}} < 0$$

Which means

$$\frac{\partial l_i}{\partial \tau_j} > 0.$$

Thus, an increase in transaction costs decreases the affected plot's size ($\frac{\partial l_i}{\partial \tau_i} < 0$) and increases the size of the other farms ($\frac{\partial l_i}{\partial \tau_j} > 0$).

A2. Skills across districts

Table A1. Skills across districts

	Literacy Rate
Belladere	0.048
Dessalines	0.044
Grande Saline	0.047
Lascahobas	0.061
Petite Riviere de l'Artibonite	0.067
Verrettes	0.067

Notes: Data come from the 1950 census.

Appendix Figure A1: Full distribution of cadastral plots