



*INTER-AMERICAN DEVELOPMENT BANK
BANCO INTERAMERICANO DE DESARROLLO
BANCO INTERAMERICANO DE DESENVOLVIMENTO
BANQUE INTERAMÉRICAINNE DE DÉVELOPPEMENT
WORKING PAPER CSI-164*

LAND TITLES AND CONFLICTS IN GUATEMALA

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MARCH 2009

Abstract¹

This paper analyzes the impact of formal property rights on plot use and credit access in 20 communities in Guatemala, and shows how these impacts differ depending on the community conflict context. The paper proposes a new instrument based on detailed information about the geographic location of the plots and historical titling processes to address the endogeneity concerns that are common in the property rights literature. The paper sheds light on whether the effect of land titles on plot use and credit access varies with the prevalence of conflicts and different types of conflict resolution mechanisms. The findings suggest that these factors might be crucial to understand the potential impacts on plot use of possible titling programs.

Keywords: Land titling, Conflicts, Latin America

JEL Classifications: O12, O13

¹ This paper has benefited from comments by Steve Boucher, Michael Carter, Suzanne Duryea, Nestor Gandelmann, Hugo Ñopo, Ernesto Schargrodsky, Eduardo Zegarra, and participants at the LACEA 2007 conference. Jonathan Bartalozzi and Smriti Lakhey provided excellent research assistance. Financial support from the IADB and USAID is gratefully acknowledged. All errors are my own. Author contact information: International Economics, School of Advanced International Studies (SAIS) Johns Hopkins University, 1717 Massachusetts Avenue N.W., Washington DC 20036; Tel 202 663 5679; Fax 202 663 7718; kmacours@jhu.edu

1. Introduction

The recent empirical growth literature emphasizes property rights as the prime example of how institutions can affect growth (Acemoglu, Johnson, and Robinson, 2001; Acemoglu and Johnson, 2005). Theoretically, there are indeed a number of reasons why property rights security would have a positive effect on efficiency, and these reasons are often used to motivate land titling programs. Formal titles are believed to increase the incentives for investments, facilitate access to credit by providing collateral, and guarantee allocative efficiency by facilitating land market transactions.

The micro-evidence regarding these effects, however, is mixed. Besley (1995) finds that property rights increase plot investments in one region, but not another, and Braselle, Gaspart and Platteau (2002) find that the lack of property rights can in fact increase investment in the form of tree planting. Focusing more specifically on the effects of land titling in Latin America, Field (2005), Galiani and Schargrodsky (2006), and Di Tella, Galiani and Schargrodsky (2007) find effects on labor supply, housing investments, and beliefs, but not on credit, in urban squatting settings in Peru and Argentina. Moreover, Lanjouw and Levy (2002) find that formal and informal rights might be substitutable in urban Ecuador.

The evidence for rural settings in Latin America is also mixed. Carter and Olinto (2003) and Boucher, Barham and Carter (2005) find that the effects of formal titling might be limited in the presence of other market imperfections. Finally, Macours, de Janvry and Sadoulet (2007) find that informal property rights and conflict affect land allocation, while not finding an effect of formal titles.

Different reasons might help explain why the empirical evidence on the issue is mixed. First of all, all these studies need to make certain assumptions about the exogeneity of the titling status, or about the instruments used to identify the effects of titles, and the findings hence rely on those assumptions. But even when identification issues are resolved, it is not unlikely that the effect of titles crucially depends on several other factors that affect household decision-making, as many of the authors above have discussed. These can be factors that are specific to the household, or factors related to the community or general context in which they live. In particular, given that we expect titles to have an effect because they help guarantee security of property rights, their effect might well depend on other factors that also determine security of

property rights, such as the general rule of law in a country, the local history of conflicts, or existing conflict resolution mechanisms.

This paper contributes to this literature by proposing a new instrument to address endogeneity concerns and by focusing on the interaction between titles and the community conflict context. Specifically, this paper attempts to shed light on whether the effect of land titles on plot use and credit access varies with the prevalence of conflicts and different types of conflict resolution mechanisms. The identification strategy relies on the fact that most formal titles were granted at the end of the nineteenth century. At that point, the applications for titling were made simultaneously for large tracts of land, either by individuals or by community leaders. While much of this land was subsequently fragmented among many owners, the title status of different plots is still correlated.

This paper is motivated by the combination of widespread property rights insecurity and long-standing land conflicts that characterize large parts of rural Guatemala. Property rights insecurity in Guatemala results in part from the massive lack of formal land titles, and understanding the interaction between titles and land conflicts might be crucial to shed light on the potential pay-offs of titling programs. The question this paper addresses is hence important for its possible implications and might entail lessons for both targeting and the potential need for complementary programs focusing on conflict resolution mechanisms. Given that the prevalence of land conflicts clearly is not unique to Guatemala, this is likely to be of broader relevance for policymakers in Latin America.

The structure of the paper is as follows. In the next section, we provide more background on the historical processes that shed light on titling variation and land conflicts in Guatemala. In Section 3, we discuss the data and the outcome variables. Section 4 discusses the identification strategy, and Section 5 presents the results on the relationship between titles and several plot and household level outcomes. Section 6 then discusses how the effect of titles can be better understood once the local conflict context is taken into account. Finally, Section 7 concludes.

2. Background on Titles and Conflict

In Guatemala, most existing titles go back to the end of the nineteenth century when, because of the coffee boom, the government encouraged the transformation from community to private property. Such transformations required an application by individual owners and/or local authorities. In areas where cultural values related to common ownership were strong and no internal conflicts or outside speculators arose, the people occupying the land would not apply for title. Over time, these communities moved from common to individual ownership but without establishing formal title. Some other long-term owners, however, lost (part of) their land as a result of false applications and/or land invasions by outsiders, who were often ladino. However, not all of the new owners obtained a formal title. Overall, the fate of a plot of land (in terms of land titling and access) depended on a village's location and population, and on how quickly local leaders came to understand the new situation (McCreery, 1994; Grandin, 2000). Within a community as well, though, much variation in titling resulted because land that was of higher quality was more likely to be claimed and titled by outside parties, possibly because of false applications by outsiders, while lack of knowledge on the part of some long-term possessors also affected title status. Also, in some cases, outsiders managed to claim only part of a larger parcel (Naylor, 1967). The title status today is to a large extent driven by these historical events. While there have been various organized titling efforts by the government since the 1960s, these activities were concentrated on settlements and titling on frontier lands in the Peten, a department in the North of the country that is not part of our study. Hence in many communities, some tracts of land are titled while other tracts within the same community are not.

Lack of formal titles affects land allocation decisions in part because of legislation that allows registering an untitled plot of land in the public property registry after 10 years of peaceful and undisputed possession (the *Ley de Titulación Supletoria*). Although in principle this law should only apply to land that satisfies a very narrow set of criteria, it leaves room for false declarations, abuses and corruption, and as such has been a source of de facto property rights insecurity in the land market (Chang, 2002).

Property rights insecurity is reinforced by long-standing tensions regarding access to land. Unequal distribution of land, resulting from perceived historical injustices during the colonization and early post-colonization eras, has been recognized as one of the causes underlying the violent civil conflict of the 1980s. At the local level, conflicts over land are

extremely common and range from trespassing to squatting, inheritance-related conflicts and conflicts over common property resources. Widespread lack of confidence and trust in the national juridical system often impedes conflict resolution (Chang, 2002). Many indigenous communities have their own local mechanisms for conflict resolution. However, these mechanisms might be limited in their capacity to solve problems with people that do not live in the community. As a result, many conflicts linger for years.

3. Data and Outcome Variables

This paper relies on a micro-level dataset of 20 communities in 2 regions (Alta Verapaz and Quetzaltenango) in Guatemala. Alta Verapaz is a department in the Northeast of the country where communities of peasants border to estates of large landowners. Quetzaltenango, is a department in the central highlands, and most of the households in the sampled communities are *mini-fundistas* (see also Macours, 2007). Data on all households living in the communities (1,822 in total) and on all their plots were obtained from interviews with a key informant in each community. Households with a secondary residence in the community were also included (these are mostly large landowners who do not necessarily live year-round on their estate). In addition to the usual plot and household-level characteristics, the geographic location of all plots was identified by drawing plot-level village maps. Furthermore, extensive information about conflicts and conflict resolution mechanisms was collected at the plot, household and community level.²

Key informants, typically community leaders, were selected based on their knowledge of all households and their activities in the land market.³ The data collection relied on the use of key informants, instead of direct interviews with the household head, because the topic of land and land conflicts is extremely sensitive in Guatemala. Working with selected key informants hence prevented problems of misreporting or refusals to participation in the survey by individual households, which had been observed when land-related questions were asked in previous (unrelated) survey efforts in Guatemala. In Macours (2003), the answers of key respondents are compared with answers from households themselves for a related questionnaire in the Dominican

² Communities are geographical units (i.e., villages), typically consisting of a nucleus of houses and some more dispersed dwellings, and they were defined using existing contemporary boundaries. As such, communities differ from the historic *comunidades indígenas* that largely correspond to the current municipalities. The number of households in a community varies between 17 and 173.

³ This selection was made based on discussions with various community members, in which the type of information that would be asked for was explained.

Republic. The level of agreement between the two types of respondents on questions regarding households' assets holding, demographics, and land use was found to be relatively large.⁴

Table 1A reports a number of key individual and household characteristics of both the key informants, and of the landowning households in the sample.⁵ Compared to the average household, the key informants have all lived in the community since birth, tend to have more family in the community, and are somewhat more likely to be from the majority indigenous group, more likely to be literate, and less likely to have either a high or a low livings standard.⁶ All these characteristics are consistent with their leadership position in the communities. On the other hand, they appear to own less land, which mainly captures the fact that among the other households, there are a few large landowners that skew the distribution. Overall, the key informants do not seem extremely different from the average household in the community. In the analysis, we will test whether some of the differences between informants and households affect the findings.

To obtain the main independent variable, informants were asked whether there was a title, registered in the public registry, for each plot owned by the households in the community. Many of these titles might be outdated, and informants might not know whether titles are updated or not. Our independent variable only measures whether the plot has a formal title, registered in the public registry, not whether it is in name of the current owner.

Furthermore, while key informants are unlikely to have accurate information about plot yields or detailed input use, they do have a comparative perspective on how efficiently different plots are used in their community. They were asked therefore to evaluate whether each plot was used according to its potential or was being under-used.⁷ This will be used as our first plot-level outcome variable of interest. A second variable captures information about actual use of the plot.

⁴ The use of key informants to obtain information about other households in a community is most common in Rapid Rural Appraisal (RRA) exercises. While for RRA key informants are usually asked to provide rankings of households, Takasaki, Barham and Coomes (2000) have explored the possibility of collecting data on asset ownership from key informants. The approach discussed in this paper is related to theirs.

⁵ Landless households are not part of the analysis in this paper.

⁶ Informants were asked to classify each household according to their living standards. At the beginning of each interview, guidelines were established regarding how to evaluate income levels, and informants were asked to consider the conditions of the house, material it was build from, consumption and health levels, and access to services in their evaluation. They were specifically instructed not to take the productive potential of the households into account in this evaluation. The analysis in Macours (2003) shows that a similar approach leads to welfare variables that were highly correlated with reports of living conditions by households themselves.

⁷ The estimations exclude all small parcels (less than two *cuerdas* or about 0.09 hectares) that are used exclusively for housing.

It particular, it indicates whether the plot is being used for pasture, forest, or lies idle, which are all more extensive uses of the land (compared to commercial crops, corn, etc.).⁸ The indicators of the efficiency of use and of extensive use will allow us to test the relationship between titles and plot-level productivity and investment. To evaluate the overall relationship between titles and credit access, informants were asked whether the household would be able to obtain formal credit. When discussing the empirical results, we will return to the interpretation of the findings regarding credit access, taking into account that the information was obtained through the key informant.

While clearly informants' responses to these questions will have measurement error, this will not bias the results as long as it is not systematically related to the independent variable. All the questions about outcome variables were asked before the plot's title status was discussed in order to minimize bias. Moreover, in the empirical estimations, we control for community fixed effects, which will eliminate any systematic informant bias that is constant across households of one community. As such, our outcome variables indicate plot and household outcomes relative to the rest of the community.⁹ More generally, we conduct a number of checks to test the robustness of the results for the assumptions underlying the use of the key informant (discussed below).

Table 1B shows the means of the three outcome variables by title status of the plots, as well as an indicator of overall household welfare. As indicated in the table, 22 percent of the plots in the sample have formal registered titles, and these plots are more likely to be efficiently used, and less likely to be used extensively. Owners of such plots are more likely to have a higher living standard and are more likely to have access to credit. Yet, in order to determine whether the observed relationship between titles and these outcome variables are causal, we clearly need to account for the possible endogeneity of the title status, as will be discussed below.

⁸ In the areas studied, fallow for productivity-regenerating purposes is not a common practice.

⁹ The analysis excludes all plots that are not located in the community, as well as plots owned by households that do not have their primary or secondary residence in the community, as the key informants are less likely to have accurate information about these plots.

Background Information on Conflicts

There is an enormous variety of both conflicts and conflict resolution mechanisms in the rural communities studied (Table 2A). First of all, often the parties involved in a conflict will attempt to resolve the conflict by themselves. When outside help is sought, it is most often the (municipal) mayor, a community committee, or a judge. Sometimes the parties also resort to the mayor's liaison in the community, to lawyers, or even to specialized state institutions (such as Contierra or the Instituto Nacional de Transformación Agraria). Interestingly, there appears no clear pattern of certain institutions specializing in certain types of conflicts. For example, land right conflicts can be resolved by village elders, a community meeting, a judge, a lawyer or state institutions. Moreover, each of the conflict resolution mechanisms appears to be relied on for conflicts of different severities, both in terms of duration of the conflict and in terms of the number of parties involved.

When looking at the community level, however, we note that most communities tend to disproportionately rely on certain types of conflict resolution mechanism, but the type of mechanisms vary widely across communities. For example when considering 18 different types of conflicts, 17 out of 18 types of conflicts are typically resolved through outside authorities in one community, while in another community 12 are resolved through community mechanisms, and in a third 15 are resolved among the parties themselves (see Table 2B). The reasons for these differences are undoubtedly complex and may be related to the age and the history of the community, previous conflicts, ethnic divisions, leader personalities, etc. This paper does not aim to explain this heterogeneity. In fact, in the estimations we will control for all community fixed effects and instead focus on how the prevalence of certain types of conflict resolution mechanisms relates to the impact of titles on land use and credit access.

4. Identification

As discussed, most variation in land titling resulted from historical decisions at the end of the nineteenth century. While no systematic titling efforts have occurred in the regions of study since then, individual owners might have obtained titles, e.g., through the *Ley de Titulación Supletoria*. In fact, about five percent of all plots in the dataset obtained a formal title after the plot was transferred to the current owner (and on average current owners obtained their plot 17 years ago). Formal titles are those included in the public registry. Given that the decision to apply for such a

formal title is possibly not exogenous to other decisions related to the plot, we cannot use the current title status of the plot as an independent variable. In addition, a plot's title status might be endogenous because certain types of households might self-select into being owners of titled plots through the land sales market. In the sample under study, about 40 percent of all plots was obtained through sales, while most of the other plots were obtained through inheritance. We therefore rely on an instrumental variable estimation.

Our instruments rely on the fact that applications for titling at the end of the nineteenth century were made simultaneously for large tracts of land, either by individuals or by community leaders. While much of this land was subsequently fragmentized among many owners, the title status of the different plots is still correlated. Information was collected about the geographical location of the plots by obtaining plot-level community maps. Large estates bordering the community, which are often not considered to be part of the community, were also included. This allows calculating the average title status of the neighboring plots, excluding plots from the same owner, to obtain a prediction of the title status of the plot. We will use the predicted status of the nearest neighbor and the average title status of up to 5 neighboring plots as the instrument for formal title in the regressions.¹⁰ The first-stage regression in Table 3 shows that these two variables are indeed very good predictors of a plot's title status. This holds with and without control variables.

The validity of the instrument further depends on the plausibility of the exclusion restriction. It seems reasonable to assume that title status of neighboring plots is uncorrelated with many other plot and landlord characteristics, since these relate to plots of other landlords. Yet it is not impossible that neighboring plots share certain characteristics that are both more likely to affect their outcome today, and were important in determining their historical title status. In particular, as discussed, land with high land quality was historically more likely to be titled.

We hence control for plot characteristics that might be spatially correlated, and could affect the validity of the instrument. In particular, we include dummy variables for the quality of the plots, which was measured on a five-point scale. We also include a dummy indicating

¹⁰ For each plot, the five nearest plots were identified. If more than five plots bordered the plot, the five plots that shared the largest border were selected. If a plot had fewer than five plots with common borders, additional neighboring plots were selected based on closest distance. If among these five plots there were plots from the same owners, they were excluded, and the average title status of the remaining neighboring plots was selected.

whether the plot has irrigation potential (i.e., was located close to an irrigation water source, was sufficiently flat, etc.). We further control for distance to the owner's house and plot size, and we allow for non-linear effects. The community-fixed effects control for all community-specific characteristics.

In addition to plot-level geographical characteristics, we control for a number of household level variables. Owners of neighboring plots might share certain characteristics that not only affect their outcomes, but also relate to whether their plots have titles. This is true in particular because owners of neighboring plots are often family members, or otherwise might have similar characteristics that would affect the validity of the instrument. We therefore control for ethnicity, land ownership, age, gender, literacy and Spanish-language knowledge of the household head, household size, and machinery ownership. We also control for the number of other households that are family in the community, whether the owner lives permanently in the community, and whether the father of the owner lived in the community, which are all variables that are likely to control for possible correlations between the characteristics of owners of neighboring plots, because of past inheritance and other factors. Finally, all standard errors are corrected for clustering at the household level to control for correlation among plots from the same owner.

Given that some of the household variables indicated are possibly endogenous, we will estimate all regressions both with a more limited (exogenous) set of household variables and with the full set of household variables.¹¹ We will additionally discuss the robustness of our finding to inclusion or exclusion of the different plot and household control variables, which helps sheds light on the plausibility of the exclusion restriction.¹² More formally, we use over-identification tests to further motivate the assumption.

In addition, we also estimate the model with the subset of plots that people obtained through inheritance. If the results are driven by selection of certain types of households on titled plots, and the instrument does not correct for this, these estimates are likely to differ substantially

¹¹ In particular, the limited set of control variables excludes land and machinery ownership, household size, gender of the household head, whether the owner lives in the community, and whether he holds a leadership role in the community.

¹² Unfortunately, there is not enough variation in the dataset to use household fixed effects to further control for possible unobservables. Some 71 percent of the households have only one plot, and of the remaining households for which we have sufficient information on the neighboring plots, only 20 households have plots both with and without title.

from the full sample. Inheritance itself, in this setting, does not favor certain types, as all siblings have equal rights to the land and assets of the parents.

Another possible concern with the validity of the instruments could be that the instruments are picking up geographical boundary effects that directly affect a plot. For example, if actions on a neighbor's plot are affecting the outcomes of a plot, and if those actions themselves are correlated with the title on the neighbor's plot, the exclusion restriction would be violated. We can, however, try to test for a number of such possible effects. In particular, it could be that the intensity of cultivation, and in particular the use of fertilizer and pesticides, has spillover effects on neighboring plots. While we do not have an indicator of fertilizer or pesticide use itself, we do have information about the intensity of the use of the neighboring plots: i.e., we know whether the neighboring plots have horticulture products, which require a large amount of fertilizer, and whether the owner employs day laborers on those plots, another potential indicator of input use. We will therefore show results in which we control for these characteristics of the neighboring plots.¹³

A similar concern relates to possible spillover effects of credit access. Given the monitoring costs of the credit agencies, one could hypothesize that access to credit of neighboring plots could be correlated, if credit agents are more likely to grant credit to a number of neighbors that apply together, because of transaction costs and/or economies of scale. Or even if not simultaneously, it is possible that a neighbor's access to credit affects one's own access, if it implies that the credit agents already are coming to the communities for monitoring (Zegarra and Escobal, 2007). This would be a concern for the identification strategy, as it could suggest an alternative mechanism through which a neighbor's title could be related to one's credit access. We will therefore test for robustness and control for the credit access of the owners of the neighboring plots

Finally, it is important to point out that the identification strategy in this paper is unlikely to hold in many other settings. In many places, recent titling programs have targeted entire communities, and there is therefore little or no inter-community variation to exploit. In other settings, such as in areas where the agricultural frontier has only recently closed, present titles

¹³ Another possible spillover effect would be related to possible infrastructure (road) investments by owners of neighboring plots that have a title. Yet, in this context, where almost all the owners are mini-fundistas, such investments by individual owners are unlikely.

more directly reflect efforts by current owners, and there geographical correlation is likely to be limited.

5. The Average Impact of Titles

The first four columns in Table 4 first show the results of a linear probability model for comparison purposes. As indicated before, the efficiency of plot use is positively correlated with the plot's title status, yet the significance of the relationship fluctuates when different control variables are included. We also note that the control variables are picking up a great deal of variation in the data, and much of this variation is explained by the community fixed effects. The R^2 increases from 0.01 to 0.36. And plot and household characteristics further increase the R^2 to 0.44. We find in particular that geographical characteristics (plot quality and distance), as well as household's human capital endowment, are related to plot use, as expected.

Column 5 to 11 then presents the IV results, including the diagnostics on the potential weakness and the validity of the instruments (see Baum, Schaffer and Stillman, 2006). We can reject the null in the Anderson canonical correlations test at all levels of significance indicating that the model is identified. More importantly, the first-stage F-values, corrected for clustering at the household level, are between 14 and 19, indicating that we do not have a weak instrument problem. Furthermore, we cannot reject the null in the over-identification tests, indicating that the excluded instruments are correctly excluded (P-values between 0.46 and 0.88).

Focusing on the IV results themselves, we note that while the coefficient estimates are positive, we do not find a significant relationship between the efficiency of plot use and the plot's title status, and this result is robust across the different specifications. Hence, after accounting for the endogeneity of titles, we cannot reject that, on average, titles do not have an effect on the efficiency of plot use.

Table 5 shows the results of similar specifications for whether the plot was used only extensively. Here we do find a negative relationship between title and plot use in both the linear probability model and the IV. As expected, the plot-control variables are picking up much of the variation in plot use. P-values of the over-identification test are again high (between 0.72 to 0.96). The IV results are not significant after controlling only for plot characteristics, but becomes significant and robust after including household-level control variables. The coefficient estimates also become larger as we include more control variables. The coefficient estimates suggest that

plots with a formal title are on average 30-40 percentage points less likely to be used extensively than other plots.

Considering then the relationship between title and access to credit, we find a strong, significant and robust relationship. Households with titled plots are 30-40 percentage points more likely to have access to credit (Table 6). This is a striking finding given the lack of evidence on the effects on credit access in many other studies. One might wonder whether this is related to the reporting by the informant. In particular, it could be the case that informants have internalized the rules about credit access in their region and used that information in providing answers regarding specific households. It is important to point out, however, that even if that supposition is true, it might mainly capture a more conceptual difference between our variable of credit access, which aims at capturing potential credit supply, and variables used in the literature. Many other papers have looked at whether households with titles actually obtained access to credit, and hence capture both demand and supply effects. However, households' demand for credit might be constraint for a number of reasons, such as high transaction costs, high interest rates, and risk aversion (see, for example, Boucher, Barham and Carter, 2007). As such, it may not be surprising that we find a stronger impact of titles, when only the impact on credit supply is considered. Another potential difference is that distance to credit institutions might be lower in the regions studied than in some of the other rural settings that have been analyzed in other studies. In particular, local branches of private banks and/or credit agencies, are relatively widespread, and households are also actually taking out loans from such institutions. On average 10 households per community (the median is 6) have credit from a financial institution that demands land as collateral. This is often related to intensive horticulture production, and therefore suggests an important difference with studies in urban settings. In the context of urban squatting communities, households are often shown to invest in home improvements. In the rural setting we study however, households invest in more direct productive purposes, which could contribute to the higher credit supply response.

Finally, we also estimated the model using the household's living standard as an outcome variable. For this variable, we reject the over-identification test for the IV estimation exclusion, indicating that the exclusion restriction is not valid for this particular outcome variable. While including plot and household characteristics does decrease the Hansen J-statistic (as we would expect), it is 2.75 in the estimation with all household control variables included, which implies

that we reject the null-hypothesis at the 10 percent level. This implies that our identification strategy does not allow us to identify the overall effect of title on household welfare. This may partly be explained by the fact that household welfare is affected by many more factors than either plot use or credit access, some of which might be correlated among neighbors.

Robustness Checks

The estimates on the subset of plots that were obtained through inheritance are largely similar to the results for the full sample.¹⁴ Interestingly, the point estimates of the relationship between titles and extensive use and credit, are in fact higher in the IV than the estimates of the full sample, but the results are not significant at the 10 percent level. The later can be explained, in part, by the smaller sample sizes.

Column 8 in Tables 4-6 shows the results of the estimations that control for possible geographical spillover effects that might affect the validity of the instrument. In particular, we include as extra control variables whether the five neighboring plots (used for the IV) were used for horticulture products (which tend to be correlated with high use of fertilizer and pesticides) and whether day laborers were used on those plots (another indicator of high input use). We include variables indicating whether at least one of the neighboring plots had horticulture products or day laborers, as well as variables indicating the average outcomes of the five plots for these indicators. Column 8 of each table shows that the results are remarkably robust for inclusion of control variables to capture possible geographical spillover effects. In column 9, we additionally include a variable indicating whether at least one of the households with a neighboring plot has access to credit, as well as variables indicating the average credit outcomes of the households owning the five neighboring plots. The results are robust, suggesting that they are not driven by possible scale-economies/transaction costs in credit access. Overall, these results further support the use of the instruments.

Finally columns 10 and 11 present robustness checks related to the use of the key informant. In particular, column 10 shows an estimation that corrects the variances for the level of familiarity that the informant had with each household.¹⁵ For each household, informants were asked how well they knew the household and the situation of the household's plots. This allows

¹⁴ Estimates available from author

estimating a weighted 2SLS that accounts for the fact that the noise is likely to be larger for those households for which informants report having less good information. Alternatively, in column 11, we include an estimation that specifically adds a number of controls capturing the relationship between the informant and each household: in addition to the familiarity variable, it also includes a dummy variable to indicate whether they are from the same ethnicity, and another dummy variable to indicate whether they have the same living standard. All results are robust in both these alternative models, and are in fact sometimes more significant. This suggests that the use of the key informant itself is not driving the results in this paper.

6. Does the Impact of Titles Depend on Conflicts and Conflict Resolution Mechanisms?

Overall, the IV results present mixed evidence on the average impact of titles, suggesting titling facilitates access to credit and affects plot use in some dimensions, but not others. The impact of titles is generally believed to come from an increase in property rights security. We now analyze whether, in the sample studied, property rights conflicts on plots are indeed less likely on plots with a formal title. Table 7 shows the linear probability and the IV results indicating the relationship between titles and the present or past occurrence of a land rights conflict on a plot.¹⁵ The IV shows a strong and robust relationship, suggesting that property rights conflicts are more than 20 percentage points less likely on plots with a formal title.

Given the direct relationship between titles and plot-level conflicts, it seems important to consider whether the impact of titles might vary depending on the conflict situation in a community. In particular, given that titles seem to reduce the likelihood of a conflict on a plot, one would expect the value of title to increase the more severe the conflict situation is in a particular community. In other words, we hypothesize that the effects of titles on plot use is larger in communities where conflicts take a long time to be resolved, or in communities with recent land rights conflicts. Moreover, we also analyze whether the relationship between titles and plot use depends on the conflict resolution mechanisms that are used in a community.

¹⁵ The level of familiarity can vary across informants and households because of community size, experience of the leader, differences in ethnic composition, differences in immigration in the different communities, etc.

¹⁶ This excludes border conflicts with neighboring plots, as the identification strategy is clearly not appropriate for such conflicts.

By including interaction effects of the (instrumented) title with variables capturing the prevalence of different type of conflicts and conflict resolution mechanisms, we shed light on how the effects of title differ with these variables. For the first-stage estimation, the two instruments for title were interacted with these same community-conflict variables. The first-stage F-values for title and for the interaction effects of title are lower than before but still relatively high (F-value between 8.5 and 11)

Table 8 shows that titles do have an effect on the efficiency of plot use once community conflicts are taken into account.¹⁷ In particular, the longer the average duration of conflicts, the stronger the positive effect of titles on the efficiency of plot use, and the stronger the negative relationship between titles and extensive use. We also find some evidence that the positive effects of title are stronger in communities that had a property rights conflict in the last 10 years. In other words, in communities where conflicts tend to be resolved relatively quickly, and in communities without recent land rights conflicts, a formal title status seems to be much less important for efficient plot use. On the other hand, the effect of titles on access to credit does not appear to depend on the conflict or conflict resolution mechanisms, possibly because information on community-level conflicts is not necessarily available to lending institutions. While arguably not surprising, the plot use results potentially indicate a lesson for targeting of titling efforts. It also may indicate the importance of alternative property right enforcement mechanisms as substitutes for formal titling.

The results in column 3 to 5, and 8 to 10, shed some further, somewhat intriguing, light on this issue. We find that titles have a positive effect on efficiency in communities where property rights conflicts are typically resolved through community mechanisms, but a negative effect in communities where rights conflicts are typically resolved by outside authorities. When using information about actual resolution mechanisms used for property rights conflicts in the last 10 years, we similarly find a positive effect of titles on efficiency in communities where property rights conflicts were resolved through community mechanisms, but a negative, though insignificant, effect in communities where rights conflicts were resolved by outside authorities.

One possible interpretation of this finding is that, in the context of rural Guatemala, informal community mechanisms seem to complement, rather than substitute for, the effect of a formal title, presumably because they typically help enforce the property right in case the owner

¹⁷ Results are robust to inclusion of only the limited or the full set of household control variables.

has a formal title. Outside authorities may not play a similar role. Yet, there clearly are many possible confounding factors that make the interpretation of this finding difficult. The use of a particular of conflict resolution mechanism in a community is not exogenous and is likely to reflect the possibly long history of conflicts in those communities.¹⁸ This dataset does not allow analyzing the causal factors in more detail, given that there are only 20 communities. Including further interaction effects to control for possible confounding factors is limited for the same reason, aside from leading to weak instruments problems.

Nevertheless, the findings do suggest that the impacts of formal titles on plot use vary considerably with the conflict situation in a community, and that, even within small geographical areas there might be quite a large heterogeneity. They also suggest that the relationship between the impacts of titles and existing conflict resolution mechanisms can be complex.

7. Conclusions

This paper has analyzed the effect of titles on plot use and credit access and investigated whether the effects of titles vary with the history of conflict and existing conflict resolution mechanisms in the community. Overall, we find that the effects of titles on the efficiency of plot use depend on the conflict context of the community. This is not necessarily surprising, as a title's value and effects are likely to depend on whether a formal title helps to secure property rights, and on whether there are alternative mechanisms that might secure such rights. While it is hard to specifically identify which aspects of the conflict context might matter the most, the results indicate some intriguing patterns, and clearly suggest that community context is key to understanding the potential value of a registered title. Moreover, this context might matter more for some outcomes (efficiency) than for others (credit).

Overall, the results suggest that there is a great deal of room for future research that attempts to understand the relationship between titles and conflict in Latin America. It also indicates that the design and targeting of titling policies can benefit from carefully accounting for the existing conflict situation and the conflict resolution mechanisms, as they are likely to affect the pay-offs and trade-offs of such interventions.

¹⁸ It should be noted, however, that in this dataset, the duration of the conflict does not appear to be correlated with the conflict resolution mechanism. See also the descriptive analysis in Table 2.

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Table 1A: Characteristics informants and average landowning households

| | Informant | Landowning household |
|--|-----------|----------------------|
| | 20 | 1120 |
| Individual characteristics | | |
| Age household head (years) | 46 | 44 |
| Literate household head (%) | 75 | 64 |
| Speaks Spanish (%) | 95 | 92 |
| Male household head (%) | 95 | 86 |
| Has always lived in the community (%) | 100 | 82 |
| Father originally from the community (%) | 60 | 51 |
| Household characteristics | | |
| Land owned (cuerdas) | 43 | 176 |
| Owns agricultural tools (%) | 75 | 54 |
| Household size (number) | 4.45 | 3 |
| Number of related families in community | 3.85 | 2.58 |
| Ethnicity | | |
| Ladino (%) | 15 | 20 |
| Mam (%) | 40 | 36 |
| Qeqchi (%) | 0 | 7 |
| Poqom (%) | 40 | 31 |
| Achi (%) | 5 | 4 |
| Livingstandard | | |
| Good livingstandard (%) | 10 | 25 |
| Regular livingstandard (%) | 80 | 56 |
| Low livingstandard(%) | 10 | 19 |

Table 1B: Descriptive statistics of outcome variables

| | No title | Title | Significance difference ^a |
|--|----------|-------|--------------------------------------|
| | 1440 | 402 | |
| Plot-level outcomes | | | |
| Efficient use (used at full potential) | 0.74 | 0.86 | *** |
| Extensive use (pasture, forest, idle) | 0.13 | 0.09 | ** |
| Household-level outcomes | | | |
| Access to credit | 0.65 | 0.87 | *** |
| Good living standard | 0.22 | 0.55 | *** |

^a: standard errors corrected for clustering at household level

Table 2A: Most common conflict resolution mechanism

| | In general | | | | For actual conflicts in the last 10 years | | | | | | | |
|---|------------|------------------|-------------|-------------|---|------------------|-------------|-------------|--------------------|-----|---------------------|-----|
| | % | type of conflict | | | % | type of conflict | | | duration in months | | # families involved | |
| | | min | max | min | | max | min | max | | | | |
| Community mechanisms | | | | | | | | | | | | |
| Intervention of a community leader or council of elders | 1 | rights | inheritance | | 1 | inheritance | | | 24 | 24 | 10 | 10 |
| Through a community meeting or a conciliatory council | 2 | rights | resources | labor | 3 | resources | | | 6 | 24 | 15 | 50 |
| Intervention of the community's adjunct of mayor | 4 | misuse | trespassing | rental | 1 | trespassing | | | 2 | 2 | 9 | 9 |
| Intervention by a community committee | 12 | comun. land | resources | trespassing | 19 | trespassing | rights | resources | 0 | 122 | 1 | 105 |
| Total | 18 | | | | 24 | | | | | | | |
| Authorities | | | | | | | | | | | | |
| Intervention by the mayor or municipal authority | 16 | comun. land | invasion | resources | 12 | trespassing | resources | comun.land | 0 | 61 | 2 | 105 |
| Conciliation through judge | 5 | rights | invasion | trespassing | 4 | rights | trespassing | | 3 | 73 | 7 | 52 |
| Decision by judge | 10 | labor | invasion | trespassing | 8 | credit | invasion | inheritance | 1 | 37 | 2 | 101 |
| Juridical decision by other authorities | 0 | trespassing | | | 1 | trespassing | | | 12 | 12 | 2 | 2 |
| Through a lawyer | 4 | rights | inheritance | | | | | | | | | |
| Through a community meeting or a conciliatory council | 1 | rights | | | 1 | rights | | | 97 | 97 | 25 | 25 |
| Intervention of the labor inspection | 1 | labor | | | | | | | | | | |
| Total | 36 | | | | 26 | | | | | | | |
| Outside mediation* | | | | | | | | | | | | |
| Mediation by the "mesa de negociación de conflictos de tierras" | 1 | invasion | comun. land | | | | | | | | | |
| Contierra | 2 | rights | invasion | credit | 3 | rights | credit | | 73 | 73 | 32 | 37 |
| Total | 2 | | | | 3 | | | | | | | |
| Among themselves | | | | | | | | | | | | |
| Among parties themselves | 43 | rental | misuse | border | 47 | credit | border | trespassing | 0 | 61 | 2 | 162 |

* No conflicts were reported to be resolved by mediation of an NGO, a campesino organization, or the church

Table 2B: Within-community variation of conflict resolution mechanisms

| 20 communities: 18 types of conflicts | min | mean | max |
|---|-----|------|-----|
| Number of conflicts resolved through community mechanisms | 0 | 3 | 12 |
| Number of conflicts resolved through authorities | 0 | 5 | 17 |
| Number of conflicts resolved among parties themselves | 1 | 7 | 15 |
| Number of conflicts resolved through mediation by 3rd parties | 0 | 0 | 3 |

Table 3: First stage regression of title status plot

| | (1) | (2) | (3) |
|--|--------------------|--------------------|--------------------|
| Average title status 5 closest neighboring plots | 0.501*** (7.17) | 0.186** (2.52) | 0.222*** (3.32) |
| Title status nearest plot | 0.206*** (3.66) | 0.133*** (2.93) | 0.098** (2.23) |
| Constant | 0.051** (2.29) | -0.019 (0.17) | 0.170 (0.81) |
| Plot-control variables | no | yes | yes |
| Household-control variables | no | no | yes |
| Observations | 1348 | 1348 | 1272 |
| R-squared | 0.38 | 0.56 | 0.65 |

Standard errors corrected for clustering at household level

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Correlates of the efficiency of plot use

| | Linear Probability | | (3) | (4) | IV ^a | | | IV robustness checks | | | |
|---|--------------------|-----------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------------|--------------------|--------------------|---------------------|
| | (1) | (2) | | | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Registered title | 0.119*** (3.00) | 0.091 (1.52) | 0.110** (2.22) | 0.087** (2.07) | 0.271 (1.64) | 0.276 (1.56) | 0.169 (1.10) | 0.162 (1.15) | 0.155 (1.11) | 0.223 (1.21) | 0.187 (1.28) |
| Distance to plot (minutes) | | | -0.003* (1.94) | -0.004** (2.43) | -0.003** (2.29) | -0.004** (2.50) | -0.004** (2.58) | -0.004** (2.50) | -0.004** (2.45) | -0.004** (2.39) | -0.004*** (2.60) |
| Square distance | | | 0.000 (1.39) | 0.000* (1.82) | 0.000 (1.54) | 0.000* (1.94) | 0.000** (1.98) | 0.000* (1.92) | 0.000* (1.87) | 0.000* (1.92) | 0.000** (2.04) |
| Plot with house | | | -0.042 (1.23) | -0.054 (1.55) | -0.044 (1.29) | -0.057 (1.63) | -0.057 (1.62) | -0.055 (1.57) | -0.054 (1.53) | -0.061 (1.64) | -0.054 (1.54) |
| Plot with irrigation potential | | | -0.047 (0.89) | -0.032 (0.75) | -0.054 (0.95) | -0.081 (1.50) | -0.032 (0.74) | -0.034 (0.78) | -0.032 (0.75) | -0.036 (0.82) | -0.030 (0.69) |
| Area plot (manzanas) | | | -0.001 (0.28) | -0.004 (1.10) | -0.001 (0.60) | -0.001 (0.45) | -0.004 (1.19) | -0.004 (1.17) | -0.004 (1.13) | -0.005* (1.78) | -0.004 (1.15) |
| Area plot squared | | | 0.000 (0.35) | 0.000 (0.81) | 0.000 (0.62) | 0.000 (0.32) | 0.000 (0.91) | 0.000 (0.89) | 0.000 (0.86) | 0.000 (1.54) | 0.000 (0.84) |
| Plot of good quality | | | 0.091 (1.12) | 0.061 (0.75) | 0.091 (1.11) | 0.070 (0.85) | 0.061 (0.74) | 0.066 (0.80) | 0.067 (0.81) | 0.067 (0.82) | 0.065 (0.80) |
| Plot of medium quality | | | 0.026 (0.32) | -0.003 (0.04) | 0.036 (0.43) | 0.020 (0.25) | -0.002 (0.03) | 0.003 (0.04) | 0.004 (0.05) | 0.018 (0.21) | 0.009 (0.10) |
| Plot of bad quality | | | -0.060 (0.57) | -0.073 (0.68) | -0.024 (0.22) | -0.017 (0.16) | -0.058 (0.54) | -0.052 (0.49) | -0.050 (0.47) | -0.032 (0.30) | -0.035 (0.33) |
| Plot of very bad quality | | | -0.272** (2.02) | -0.219 (1.53) | -0.239* (1.76) | -0.190 (1.37) | -0.208 (1.46) | -0.200 (1.39) | -0.195 (1.36) | -0.174 (1.22) | -0.181 (1.26) |
| Observations | 1348 | 1348 | 1348 | 1272 | 1348 | 1314 | 1272 | 1272 | 1271 | 1270 | 1271 |
| R-squared | 0.01 | 0.36 | 0.38 | 0.44 | | | | | | | |
| Community fixed effects | no | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Plot-control variables | no | no | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Household control variables (limited) | no | no | no | yes | no | yes | yes | yes | yes | yes | yes |
| Household control variables (additional) | no | no | no | yes | no | no | yes | yes | yes | yes | yes |
| Controls for geographical spill-over | no | no | no | no | no | no | no | yes | yes | yes | yes |
| Controls for geographical spill-over including credit | no | no | no | no | no | no | no | no | yes | yes | yes |
| Variance adjusted for level of familiarity | no | no | no | no | no | no | no | no | no | yes | no |
| Controls for relationship informant-household | no | no | no | no | no | no | no | no | no | no | yes |
| First stage F-stat | | | | | 14.40 | 14.29 | 16.05 | 18.15 | 18.57 | 15.77 | 17.60 |
| P-value overidentification test (Hansen J) | | | | | 0.68 | 0.66 | 0.88 | 0.83 | 0.88 | 0.46 | 0.82 |

^a: Registered title instrumented with the average title status of upto 5 neighbouring plots, and with the title status of the nearest plot.

Robust t statistics in parentheses; standard errors clustered by household

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Correlates of the extensive of plot use (plot used for pasture, forest, or idle)

| | Linear Probability | | | | IV ^a | | | IV robustness checks | | | |
|---|--------------------|------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Registered title | -0.031 (1.32) | -0.030 (0.71) | -0.078** (1.97) | -0.093*** (3.04) | -0.201 (1.55) | -0.268* (1.92) | -0.302** (2.22) | -0.347*** (2.69) | -0.352*** (2.72) | -0.451*** (2.66) | -0.362*** (2.71) |
| Distance to plot (minutes) | | | 0.003** (2.40) | 0.005*** (2.86) | 0.004** (2.57) | 0.004*** (2.90) | 0.005*** (3.07) | 0.005*** (3.13) | 0.005*** (3.13) | 0.005*** (2.78) | 0.005*** (3.15) |
| Square distance | | | -0.000** (2.21) | -0.000** (2.42) | -0.000** (2.34) | -0.000*** (3.01) | -0.000*** (2.66) | -0.000*** (2.73) | -0.000*** (2.72) | -0.000** (2.41) | -0.000*** (2.75) |
| Plot with house | | | -0.088*** (3.13) | -0.082*** (2.73) | -0.086*** (3.01) | -0.075** (2.51) | -0.073** (2.34) | -0.073** (2.34) | -0.073** (2.32) | -0.050 (1.56) | -0.074** (2.35) |
| Plot with irrigation potential | | | -0.048 (1.47) | -0.054* (1.71) | -0.043 (1.25) | -0.042 (1.26) | -0.055* (1.68) | -0.053 (1.58) | -0.052 (1.55) | -0.061* (1.80) | -0.053 (1.59) |
| Area plot (manzanas) | | | 0.006*** (3.22) | 0.008*** (3.88) | 0.006*** (3.22) | 0.005*** (2.88) | 0.008*** (3.77) | 0.008*** (3.69) | 0.008*** (3.67) | 0.007*** (3.12) | 0.008*** (3.50) |
| Area plot squared | | | -0.000** (2.32) | -0.000*** (2.98) | -0.000** (2.32) | -0.000** (2.18) | -0.000*** (2.90) | -0.000*** (2.87) | -0.000*** (2.85) | -0.000** (2.47) | -0.000*** (2.70) |
| Plot of good quality | | | -0.136 (1.60) | -0.084 (1.08) | -0.136 (1.60) | -0.117 (1.51) | -0.083 (1.07) | -0.079 (0.98) | -0.078 (0.96) | -0.089 (1.10) | -0.074 (0.92) |
| Plot of medium quality | | | -0.088 (1.03) | -0.044 (0.56) | -0.095 (1.11) | -0.073 (0.94) | -0.046 (0.59) | -0.043 (0.52) | -0.041 (0.50) | -0.057 (0.69) | -0.038 (0.47) |
| Plot of bad quality | | | 0.126 (1.21) | 0.176* (1.77) | 0.098 (0.93) | 0.094 (0.96) | 0.138 (1.39) | 0.135 (1.34) | 0.136 (1.35) | 0.109 (1.08) | 0.129 (1.28) |
| Plot of very bad quality | | | 0.322** (2.33) | 0.316** (2.17) | 0.297** (2.13) | 0.255* (1.83) | 0.288** (2.00) | 0.283* (1.93) | 0.285* (1.95) | 0.260* (1.78) | 0.281* (1.92) |
| Observations | 1348 | 1348 | 1348 | 1272 | 1348 | 1314 | 1272 | 1272 | 1271 | 1270 | 1271 |
| R-squared | 0.00 | 0.08 | 0.21 | 0.24 | | | | | | | |
| Community fixed effects | no | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Plot-control variables | no | no | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Household control variables (limited) | no | no | no | yes | no | yes | yes | yes | yes | yes | yes |
| Household control variables (additional) | no | no | no | yes | no | no | yes | yes | yes | yes | yes |
| Controls for geographical spill-over | no | no | no | no | no | no | no | yes | yes | yes | yes |
| Controls for geographical spill-over including credit | no | no | no | no | no | no | no | no | yes | yes | yes |
| Variance adjusted for level of familiarity | no | no | no | no | no | no | no | no | no | yes | no |
| Controls for relationship informant-household | no | no | no | no | no | no | no | no | no | no | yes |
| First stage F-stat | | | | | 14.40 | 14.29 | 16.05 | 18.15 | 18.57 | 15.77 | 17.60 |
| P-value overidentification test (Hansen J) | | | | | 0.96 | 0.83 | 0.93 | 0.83 | 0.95 | 0.72 | 0.94 |

^a: Registered title instrumented with the average title status of upto 5 neighbouring plots, and with the title status of the nearest plot.

Robust t statistics in parentheses; standard errors clustered by household

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Correlates of credit access

| | Linear Probability | | | | IV ^a | | | IV robustness checks | | | |
|---|--------------------|--------------------|---------------------|--------------------|---------------------|--------------------|-------------------|----------------------|-------------------|-------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Registered title | 0.181*** (4.73) | 0.293*** (7.45) | 0.246*** (6.21) | 0.200*** (4.53) | 0.361** (2.23) | 0.360** (2.09) | 0.300** (1.97) | 0.314** (2.12) | 0.269* (1.87) | 0.375** (2.06) | 0.322** (2.14) |
| Distance to plot (minutes) | | | 0.001 (0.92) | 0.000 (0.11) | 0.001 (0.66) | 0.001 (0.99) | -0.000 (0.08) | -0.000 (0.07) | 0.000 (0.00) | -0.000 (0.22) | -0.000 (0.25) |
| Square distance | | | -0.000 (0.93) | -0.000 (0.67) | -0.000 (0.89) | -0.000 (1.29) | -0.000 (0.43) | -0.000 (0.43) | -0.000 (0.48) | -0.000 (0.20) | -0.000 (0.12) |
| Plot with house | | | -0.105*** (3.04) | -0.048 (1.43) | -0.107*** (3.08) | -0.080** (2.33) | -0.052 (1.52) | -0.052 (1.50) | -0.049 (1.43) | -0.058 (1.59) | -0.050 (1.44) |
| Plot with irrigation potential | | | 0.036 (0.87) | -0.002 (0.04) | 0.031 (0.74) | 0.012 (0.29) | -0.001 (0.04) | -0.002 (0.06) | 0.004 (0.09) | -0.002 (0.04) | 0.008 (0.21) |
| Area plot (manzanas) | | | -0.000 (0.48) | -0.001 (0.65) | -0.001 (0.84) | -0.001 (1.45) | -0.001 (0.71) | -0.001 (0.72) | -0.001 (0.55) | -0.001 (0.68) | -0.000 (0.35) |
| Area plot squared | | | 0.000 (0.87) | 0.000 (0.46) | 0.000 (1.14) | 0.000* (1.86) | 0.000 (0.61) | 0.000 (0.63) | 0.000 (0.39) | 0.000 (0.52) | 0.000 (0.10) |
| Plot of good quality | | | 0.153 (1.50) | 0.134 (1.56) | 0.153 (1.50) | 0.156* (1.65) | 0.134 (1.53) | 0.135 (1.54) | 0.146* (1.69) | 0.142 (1.61) | 0.145 (1.63) |
| Plot of medium quality | | | 0.045 (0.43) | 0.088 (1.00) | 0.052 (0.50) | 0.081 (0.85) | 0.089 (1.01) | 0.091 (1.02) | 0.108 (1.22) | 0.116 (1.28) | 0.120 (1.32) |
| Plot of bad quality | | | 0.147 (1.21) | 0.229** (2.14) | 0.173 (1.40) | 0.227** (2.01) | 0.246** (2.29) | 0.251** (2.30) | 0.256** (2.36) | 0.283** (2.53) | 0.295*** (2.64) |
| Plot of very bad quality | | | -0.133 (0.81) | -0.065 (0.50) | -0.110 (0.66) | -0.035 (0.23) | -0.051 (0.40) | -0.048 (0.37) | -0.030 (0.23) | -0.015 (0.12) | 0.000 (0.00) |
| Observations | 1344 | 1344 | 1344 | 1271 | 1344 | 1313 | 1271 | 1271 | 1270 | 1269 | 1270 |
| R-squared | 0.02 | 0.22 | 0.25 | 0.39 | | | | | | | |
| Community fixed effects | no | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Plot-control variables | no | no | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Household control variables (limited) | no | no | no | yes | no | yes | yes | yes | yes | yes | yes |
| Household control variables (additional) | no | no | no | yes | no | no | yes | yes | yes | yes | yes |
| Controls for geographical spill-over | no | no | no | no | no | no | no | yes | yes | yes | yes |
| Controls for geographical spill-over including credit | no | no | no | no | no | no | no | no | yes | yes | yes |
| Variance adjusted for level of familiarity | no | no | no | no | no | no | no | no | no | yes | no |
| Controls for relationship informant-household | no | no | no | no | no | no | no | no | no | no | yes |
| First stage F-stat | | | | | 14.31 | 14.26 | 16.03 | 18.14 | 18.55 | 15.76 | 17.59 |
| P-value overidentification test (Hansen J) | | | | | 0.64 | 0.77 | 0.33 | 0.35 | 0.26 | 0.28 | 0.27 |

^a: Registered title instrumented with the average title status of upto 5 neighbouring plots, and with the title status of the nearest plot.

Robust t statistics in parentheses; standard errors clustered by household

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Correlates of plot-level property right conflict

| | Linear Probability | | | | IV ^a | | | IV robustness checks | | | |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Registered title | -0.071*** (4.58) | -0.064*** (3.97) | -0.044*** (2.84) | -0.063*** (3.55) | -0.203*** (2.83) | -0.219*** (2.92) | -0.219*** (3.04) | -0.223*** (3.18) | -0.215*** (3.15) | -0.280*** (3.07) | -0.227*** (3.15) |
| Distance to plot (minutes) | | | -0.001** (2.45) | -0.001*** (3.13) | -0.001 (1.20) | -0.001 (0.91) | -0.001** (1.98) | -0.001* (1.85) | -0.001* (1.92) | -0.001 (1.17) | -0.001* (1.67) |
| Square distance | | | 0.000** (2.35) | 0.000*** (2.83) | 0.000 (1.58) | 0.000 (0.85) | 0.000 (1.27) | 0.000 (1.16) | 0.000 (1.21) | 0.000 (0.40) | 0.000 (0.91) |
| Plot with house | | | -0.045*** (3.57) | -0.049*** (3.79) | -0.043*** (3.20) | -0.042*** (3.00) | -0.043*** (3.19) | -0.043*** (3.15) | -0.043*** (3.20) | -0.045*** (3.00) | -0.044*** (3.25) |
| Plot with irrigation potential | | | 0.018 (1.48) | 0.017 (1.23) | 0.025* (1.71) | 0.021 (1.38) | 0.017 (1.10) | 0.017 (1.13) | 0.016 (1.06) | 0.018 (1.05) | 0.015 (0.95) |
| Area plot (manzanas) | | | -0.001 (0.78) | -0.003 (1.40) | -0.000 (0.15) | -0.000 (0.45) | -0.002 (1.04) | -0.002 (1.02) | -0.002 (1.04) | -0.003 (1.01) | -0.002 (1.04) |
| Area plot squared | | | 0.000 (0.84) | 0.000 (1.37) | 0.000 (0.26) | 0.000 (0.62) | 0.000 (0.93) | 0.000 (0.91) | 0.000 (0.95) | 0.000 (0.91) | 0.000 (0.96) |
| Plot of good quality | | | -0.040 (1.07) | -0.049 (1.30) | -0.040 (1.02) | -0.034 (0.85) | -0.049 (1.25) | -0.051 (1.29) | -0.053 (1.34) | -0.059 (1.43) | -0.050 (1.25) |
| Plot of medium quality | | | -0.045 (1.15) | -0.050 (1.27) | -0.055 (1.39) | -0.046 (1.14) | -0.052 (1.31) | -0.054 (1.34) | -0.057 (1.40) | -0.070* (1.68) | -0.055 (1.35) |
| Plot of bad quality | | | 0.100* (1.73) | 0.104* (1.74) | 0.065 (1.20) | 0.079 (1.42) | 0.076 (1.36) | 0.076 (1.35) | 0.075 (1.34) | 0.058 (1.00) | 0.071 (1.27) |
| Plot of very bad quality | | | 0.152* (1.80) | 0.161* (1.85) | 0.120 (1.54) | 0.145* (1.82) | 0.140* (1.74) | 0.137* (1.70) | 0.134* (1.65) | 0.113 (1.42) | 0.130 (1.64) |
| Observations | 1348 | 1348 | 1348 | 1272 | 1348 | 1314 | 1272 | 1272 | 1271 | 1270 | 1271 |
| R-squared | 0.09 | 0.95 | 0.95 | 0.95 | | | | | | | |
| Community fixed effects | no | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Plot-control variables | no | no | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Household control variables (limited) | no | no | no | yes | no | yes | yes | yes | yes | yes | yes |
| Household control variables (additional) | no | no | no | yes | no | no | yes | yes | yes | yes | yes |
| Controls for geographical spill-over | no | no | no | no | no | no | no | yes | yes | yes | yes |
| Controls for geographical spill-over including credit | no | no | no | no | no | no | no | no | yes | yes | yes |
| Variance adjusted for level of familiarity | no | no | no | no | no | no | no | no | no | yes | no |
| Controls for relationship informant-household | no | no | no | no | no | no | no | no | no | no | yes |
| First stage F-stat | | | | | 14.40 | 14.29 | 16.05 | 18.15 | 18.57 | 15.77 | 17.60 |
| P-value overidentification test (Hansen J) | | | | | 0.21 | 0.29 | 0.48 | 0.48 | 0.53 | 0.52 | 0.49 |

^a: Registered title instrumented with the average title status of upto 5 neighbouring plots, and with the title status of the nearest plot.

Robust t statistics in parentheses; standard errors clustered by household

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Interactions of the impact of titling with conflict-context variables: IV estimates ^a

| | Efficiency of use | | | | | Extensive use | | | | |
|---|--------------------|-------------------|--------------------|--------------------|------------------|---------------------|--------------------|---------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Registered title | -0.152 (0.81) | -0.029 (0.17) | 0.363** (2.39) | -0.255 (1.32) | 0.269 (1.23) | -0.049 (0.31) | -0.095 (0.71) | -0.483*** (3.47) | 0.081 (0.49) | -0.389** (2.00) |
| Title* Average conflict duration in the community | 0.009*** (3.35) | | | | | -0.007*** (2.87) | | | | |
| Title* Community with rights conflict in last 10 years | | 0.685** (2.06) | | | | | -0.713** (2.15) | | | |
| Title* Rights conflicts resolved by outside authorities | | | -1.030** (2.40) | | | | | 0.889** (2.53) | | |
| Title* Rights conflicts resolved through community mechanisms | | | | 1.122*** (4.17) | | | | | -0.994*** (3.87) | |
| Title* Rights conflicts resolved among parties | | | | | -0.195 (0.74) | | | | | 0.142 (0.62) |
| Observations | 1269 | 1272 | 1272 | 1272 | 1272 | 1269 | 1272 | 1272 | 1272 | 1272 |
| Community fixed effects | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Plot-control variables | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| Household control variables (limited and additional) | yes | yes | yes | yes | yes | yes | yes | yes | yes | yes |
| First-stage F-value title | 11.08 | 8.46 | 8.97 | 9.32 | 8.50 | 11.08 | 8.46 | 8.97 | 9.32 | 8.50 |
| First-stage F-value interaction effect | 10.09 | 5.64 | 4.67 | 9.68 | 5.83 | 10.09 | 5.64 | 4.67 | 9.68 | 5.83 |
| P-value overidentification test (Hansen J) | 0.96 | 0.93 | 0.57 | 0.72 | 0.69 | 0.36 | 0.77 | 0.40 | 0.21 | 0.08 |

^a: Registered title instrumented with the average title status of upto 5 neighbouring plots, and with the title status of the nearest plot

Robust t statistics in parentheses; standard errors clustered by household

* significant at 10%; ** significant at 5%; *** significant at 1%