

Land Security in Rural Thailand: Evidence from a Property Rights Reform

Xavier Giné*

The World Bank

Abstract

In the 1980s, the Thai government legalized squatters living in public land by issuing certificates that allowed self-cultivation but restricted the sale and rental of the land. Using a differences-in-differences empirical strategy, we compare the differential rental rates between titled and untitled plots in reform and non-reform areas. We find that in reform areas households are more likely to lease titled plots and cultivate untitled plots because owners feared that untitled plots would also be expropriated if leased, although the restrictions only applied to plots with reform certificates. Using land rental rates and prices, we estimate that the rental rate of untitled land in reform areas includes a 4 percent premium due to expropriation risk. In other areas, however, land rights do not influence leasing decisions nor does a risk premium exist.

Keywords: Property rights, land titling, development policy, externality.

JEL Codes: P14, Q15, Q23, Q28, O13, O17, O18.

*Email: xgine@worldbank.org. I thank Robert Townsend for permission to use the Townsend-Thai dataset and for constant encouragement. I thank Piet Buys and specially John Felkner for valuable assistance with the GIS data. I also thank Richard Akresh, Abhijit Banerjee, Paco Buera, Jishnu Das, Quy-Toan Do, Hanan Jacoby, Dean Karlan, Claudio Raddatz, Mark Rosenzweig, Chris Udry, James Vickery and seminar participants at Cornell, Oxford, UCL, World Bank and Yale for valuable comments. Finally, I thank Gershon Feder, Tongroj Onchan and Tony Zola for very helpful conversations about the intricacies of Thailand's land titling policy. All errors are my own.

1 Introduction

It is often argued that well functioning land markets play an important role in economic development. The extent to which they work, however, is determined by the environment and the specific government policies or institutions in place (de Janvry et al., 2001; World Bank, 2003, Otsuka, 2005 and Conning and Deb, 2006). Even in the absence of formal titles, an informal system of rights and obligations could lead to an efficient allocation of land. Indeed, in such a setting, new government titles could upset existing institutions, create uncertainty over existing land rights and foster inefficiencies (Atwood, 1990). Using data from Thailand, we show empirically how a government property rights reform created an unforeseen negative externality that distorted the existing land rental market.

Before the reform, most plots located in private land were secured with a full rights legal deed. Plots that were squatted in public land were by definition undocumented, but landowners were leasing plots of land irrespective of whether or not they had a legal deed (Feder et al., 1988b).

In the 1980s, the Thai government legalized squatters in officially declared forest reserves and other public land by issuing titles that allowed self-cultivation but prohibited the sale and rental of the land. Violations of these restrictions could result in expropriation of the land. Thus, the government introduced a new certificate, which we refer to as “reform title”.

We claim that by enforcing the restrictions of these reform titles, the government altered the sense of security that owners had regarding undocumented land. Suddenly, they now feared that undocumented land would also be expropriated if leased, although the leasing restrictions only applied to reform titles.

Supporting this claim, in areas where the reform took place and the restrictions were enforced, there is lower leasing activity and among leased plots, they are significantly more likely to be secured with full ownership titles. In addition, the rental rate of undocumented plots includes a premium for the risk of expropriation. In other areas, in contrast, land rights play no role on whether a plot is leased or not nor does a risk premium exist.

This example from Thailand highlights the relevance of the design of property rights reforms. The literature on property rights formalized in Besley (1995), has typically found large private benefits from tenancy reforms (Banerjee et al., 2002) and from formal titling

programs in measures such as investment on the land (Galiani and Schargrodsky, 2004), access to credit (Feder et al., 1988a) and labor supply (Field, 2003; Do and Iyer, 2004). The policy we study, not only resulted in small private benefits (Feder et al., 1988a) but it actually created large social costs by distorting the land rental market. In this sense, this paper contributes to the literature of the efficiency of land markets (Carter and Zimmerman, 2000; Macours, 2003; Goldstein and Udry, 2004) by showing that the assessment of a property rights reform should also take social costs and benefits into account. Our results suggest that the introduction of partial formal rights may do more harm than good and that full ownership rights should have been issued instead.

One could argue that the lower leasing activity that we find could be efficient if it were solving a public goods problem of over-exploitation of forest reserve resulting in damage to the environment. However, the reform was not driven by environmental concerns but rather by the need to legalize squatters. At the time of the reform, the forest cover where the reform took place had already disappeared and the land had long been used for cultivation. The reason why farmers received reform titles instead of full ownership rights was because the government agency that controlled forest reserves refused to give up jurisdiction of the land (Vandergeest, 1995).

The data in this paper come from a cross-section survey conducted in 1997 in two provinces of the Central region and two in the Northeast region of Thailand. The sample design was special in that villages inside and outside officially declared forest reserve were surveyed. Since reform titles were issued in some villages but not others, survey villages fall into one of four bins. A village can be a “Forest” village if it is inside or adjacent to officially declared forest reserves and it can be a “Program” village if it was targeted for the property rights reform. Thus, depending on the village, plots can have full ownership titles, reform titles or no title at all.¹

Program placement was not random as it targeted more developed villages. As stated in the Thai Forestry Sector Master Plan (1993, p. 64) in forest areas the program was seen as the first step towards the future privatization of the land, although this privatization never materialized. Therefore, program titles were issued in villages located in areas that were supposedly more suitable for agriculture and that would never revert back to forest

¹Sections 2 and 4 provide a detailed discussion.

reserve. If more developed villages have better functioning land markets, then our results underestimate the true negative impact of the reform.

The econometric identification uses a differences-in-differences approach by comparing across village bins whether the plot's ownership rights affect the probability that the plot is leased. We control for unobserved heterogeneity at the household level by using household fixed effects, following Shaban (1987) and Jacoby and Mansuri (2003, 2004) among others. This approach allows us to make a clear case for the fear of expropriation driving the observed behavior in the land market. While it is usually difficult to control for unobserved land quality, even with household fixed effects, any alternative story fails to rationalize why one would expect land rights to matter in program areas but not elsewhere.

The paper develops a stylized dynamic general equilibrium model which shows how, in the presence of expropriation risk, mostly –if not only– titled (i.e. secured) land is leased. In this context, only titled land is leased if it alone suffices to equate all the agents' marginal productivity. In this case, the Pareto optimum is achieved. However, if there is too little titled land, then the equilibrium is such that some untitled land –unsecured and thus subject to expropriation– is leased, and landowners and tenants cultivate land at different scales so that marginal productivity is not equalized. In this case, the expropriation risk results in a welfare loss.

In the alternative case of no expropriation risk, land rights do not predict what plots are leased and the Pareto optimum is always achieved. The findings thus confirm the predictions of the model.

In addition, we derive the equilibrium pricing equations that relate the risk of expropriation to the land rental rate and price for both titled and untitled land. Using data from the asking price of the plot and its rental price, we estimate a probability of expropriation of 4 percent in Program and Forest villages, precisely where the restriction to the reform titles were enforced. The fear of expropriation created a wedge between the marginal productivity of households that lease in and those that lease out, evidencing that the reform distorted the land market.

The rest of the paper is organized as follows. Section 2 provides background information about land rights in Thailand and the reform studied. Section 3 presents the model in greater detail. In Section 4 we describe the data used in the analysis. Section

5 presents the econometric specifications to be estimated and Section 6 the regression results. Finally, Section 7 concludes.

2 Background

Land in Thailand is classified into **private land**, extending over 19 million hectares in 1994 (40 percent of total land), and **public or government land** covering 23 million hectares and including national parks, wildlife sanctuaries and other government land.

In 1964 the National Forest Reserve Act was passed, designating various areas within Thailand as gazetted forest reserves and detailing limitations to their exploitation. The enactment of the Act, however, did little to prevent the continuing encroachment and illegal logging in forest reserves. In the mid 1980s, about a fifth of the land officially designated as forest reserve was permanently occupied and cultivated by squatters, representing 21 percent of the land under cultivation.² In many instances, it was not until the implementation of the Land Titling Program that households learned that they could not obtain a full ownership title for certain plots because they were located inside a forest reserve.³ In addition, areas officially designated as forest reserves did not have carefully delineated boundaries, and in many cases, areas not suitable for agriculture were not selected. Likewise, many areas that were designated as forest reserves were already partially or fully settled (Ministry of Agriculture and Cooperatives, 1993). The Act arbitrarily divided forest reserve from private land in identical agro-climatic zones and in areas with similar sociopolitical structures.

In our dataset, roughly 60 percent of the villages surveyed fall on the boundary or

²Feder et al. (1988b), Vandergeest (1995), Fujita (2003) and others suggest that the encroachment was due to the little enforcement by forestry officials, the squatters' lack of knowledge about the law and also the lack of clarity in the Act itself.

³From 1984 to 2004, the Thai government implemented what turned out to be a very successful Land Titling Program, whose main objective was to systematically award full ownership titles to eligible landowners (Rattanabirabongse et al., 1998). Registration under the program was undertaken on the basis of whole sub-districts. A team of surveyors would go into the field and, with the Village Head, would have land occupiers, in the presence of the people with rights to the adjoining land, indicating the positions of the boundary corners. After revisions and checks with cadastral maps, the titles would be issued. The cost of this systematic land titling was largely underwritten by the government, with landowners only charged a nominal amount for the cost of corner marks - 110 baht per title (about US\$2.55). As evidence of the success of the Land Titling Program, by the time the data used in the paper was collected in 1997, most of the surveyed plots located in private land had full ownership titles.

inside forest reserves, and roughly 20 percent of households have simultaneously plots outside the forest reserve, with full ownership titles, and inside the forest reserve, without titles and for which they would be considered illegal squatters.

This pattern of illegal occupation left the government with little or no option but to legalize squatters. The Department of Land wanted to privatize the land and issue full ownership titles, but the RFD was reluctant to give up jurisdiction over demarcated forest reserve.

In the end, the RFD was allowed to introduce a program in 1981 that would recognize the rights of agricultural landowners inside forests, with a 5-year usufruct licence (STK) that could be renewed if land had been continuously cultivated (Fujita, 2003). This certificate prohibits its conversion into a full ownership title, it restricts transfer of holding to only by inheritance and therefore prohibits the transfer of ownership or rental. More importantly, failure to comply with these conditions could result in revocation of the usufruct rights without compensation. In conjunction with this program, the RFD increased surveillance of parks with the assistance of military and police (Vandergeest, 1995 and Sato, 2000).

As a result, despite villagers initially welcomed the program because it allowed them to register with the RFD, Feder et al. (1988a) conclude that uncertainty about their coverage and the explicit threats could have reduced the sense of security acquired by squatters after years of little interference from the authorities.

The STK project ended in 1993 when all the degraded forests were transferred to the Agricultural Land Reform Office for redistribution under a land reform program. This land reform program sought to redistribute land to landless households and to provide certificates to squatters in public lands. The program, however, achieved little actual redistribution as most farmers continued to cultivate the same plots they long held, although they were no longer allowed to sell or lease the land. The restrictions to the reform certificates were only enforced inside forests due to the presence of forestry officials, even though reform areas also existed outside forest reserves. Because the restrictions in these reform certificates, known as SPK-4.01, were very similar to the ones in the STK certificates, we will refer to both certificates as “Reform Titles”. As Fujita (2003) also documents, in some places existing STKs were actually exchanged for SPK-4.01s.

Despite the land reform program being small, the SPK-4.01 certificate was issued

in roughly half of the villages in our dataset. Of these villages, about two-thirds are located inside forest areas, proving that the RFD did surrender land jurisdiction to the Agricultural Land Reform Office. The rest are villages outside gazetted forests where either private land or other government land was redistributed.

From this discussion, we classify villages in the data according to the four categories that result from the Forest – non Forest partition intersected with the Program – non Program partition. A Forest village is a village either located inside a forest protected area according to the TDRI GIS data, or has land under a protected forest as reported by a key informant in the village. The correlation between these two measures is .92.⁴ A village is classified as Program village if reform certificates were issued according to the key informant or if households interviewed reported plots in the village with such certificates.

As an example of a study province, Figure 1 contains a map of Chachoengsao in the central region displaying the land use and location of the surveyed villages. The area in light gray denotes land used for agriculture, whereas the darker area is forest cover. The map also shows, with a thick line, the official boundary of the forest area according to the Forest Reserve Act of 1964. It is clear from Figure 1 that most of the land officially declared as protected forest is used for agriculture. In addition, while some villages fall inside this forest reserve, others are located far away from it. Villages are shown in different shapes depending on whether reform certificates were reported by the households interviewed. There is a sense in which villages with STK certificates (square), or SPK-4.01 certificates (triangle), are nearby or inside forest reserve areas. There are however some villages with SPK-4.01 that are far away from protected forest areas. In these villages, government land (other than protected forest) or private land bought by the government was allocated through the land reform program. Thanks to the sampling scheme to be described in more detail in Section 4, villages are roughly split inside and outside protected forest areas, making it a unique dataset to understand the effects of government policies in forest reserve areas.

In this paper we claim that in Forest and Program villages, that is, villages where STK or SPK-4.01 certificates were issued and where forestry officials did enforce the restrictions

⁴We tried using only one variable and the intersection of both but the results reported in Section 6 do not change.

of the certificates, households not only avoided leasing reform plots (as stipulated by the reforms) but they were also reluctant to lease out *other* undocumented plots for fear of having the land expropriated, despite the restrictions only applied to reform plots.

In the following section we develop a model that explores formally the implications of expropriation risk on the land rental market. We assume that households have an endowment of titled and untitled land and derive testable implications of when each type of land will be leased. We also derive pricing equations for both types of land that can be used to compute a measure of expropriation risk.

3 The Model

Consider an economy populated by N farmers that live infinite periods and have access to a cultivation technology that uses land as the only input. There are, however, two types of land, titled, L^T and untitled L^{NT} . Both types of land are equally productive but unlike titled land that is secured, untitled land can be expropriated by the government with probability ϕ if leased. The technology $f(x)$ is increasing and concave in cultivated land x and satisfies the usual Inada conditions:

$$f(0) = 0, \quad \lim_{x \rightarrow 0} f'(x) = \infty, \quad \text{and} \quad \lim_{x \rightarrow \infty} f'(x) = 0.$$

Farmers are born with an endowment of titled and untitled land.⁵ The total stock of titled and untitled land is constant over time. Implicitly, we assume that the government allocates any expropriated land to some other farmer. More formally,

$$\sum_{j=0}^N L_{jt}^{NT} = \overline{L^{NT}} \quad \text{and} \quad \sum_{j=1}^N L_{jt}^T = \overline{L^T}, \quad \forall t, \quad \text{where } j \text{ indexes the farmer.}$$

Every period, farmers decide how much land to cultivate and how much land to purchase or sell, for the next period. Although agricultural output is perishable, land is not, and

⁵This assumption may seem overly simplistic at first, because households can *choose* to title land. As described in the previous section, however, the Land Titling Program was effective at providing titles to plots located in private land at little cost to the household. Because some households may have failed to title their plots during the Land Titling Program because they were absent, etc. , the benchmark specification includes household fixed effects.

therefore, accumulation of land is the only way to transfer resources from one period to the next. We assume farmers have linear period utility and discount the future at rate β .⁶ Let P_t^i, R_t^i for $i = T, NT$ be the price and rental rate of land of type i in period t , respectively, and let x_t^i be the land of type i cultivated in period t . Then the farmer optimization problem can be written as:

$$\begin{aligned} & \max_{\{c_t\}_{t=0}^{\infty}} E_t \left[\sum_{t=0}^{\infty} \beta^t c_t \right] \\ \text{s.t. } & c_t + P_t^T L_{t+1}^T + P_t^{NT} L_{t+1}^{NT} = \max_{x_t^T, x_t^{NT}} \{ f(x_t^T + x_t^{NT}) + (L_t^T - x_t^T) R_t^T \\ & + (L_t^{NT} - x_t^{NT}) R_t^{NT} + P_t^T L_t^T + P_t^{NT} [L_t^g + (1 - \Phi_t) L_t^{NT} + \Phi_t [(1 - \phi) L_t^{NT} + \phi x_t^{NT}]] \}, \end{aligned}$$

where L_t^g is the allocation of untitled land given by the government at the end of period t coming from land expropriated in period t , and Φ_t is a dummy variable that equals 1 if untitled land is leased, $x_t^{NT} < L_t^{NT}$. The last expression inside the first square brackets represents the end of period endowment of untitled land, taking into account the transfer of land from the government and the fact that untitled leased land may be expropriated with probability ϕ . The expectation is taken over all possible government allocations of expropriated land.

This economy has two rental rate steady state equilibria depending on the allocation of untitled land. The first equilibrium achieves the first best allocation while the second does not. To see this, one can think of the probability of expropriation as a tax to untitled land if leased. As a result, depending on the initial land allocation, farmers may initially trade untitled for titled land to avoid leasing untitled land. After trading takes place, if ownership of untitled land for some farmers is still higher than the average ownership, then the second equilibrium arises, but if after trading no farmer has more untitled land than the average ownership, then the first equilibrium is achieved.

In this equilibrium all untitled land is self-cultivated and never subject to expropriation. All farmers cultivate the same amount of land equal to the average ownership, and

⁶We are ultimately interested in steady state land prices, and thus, since consumptions are constant, the marginal utility of consumption in t and $t + 1$ cancel out in the asset pricing equation and the choice of the utility function is irrelevant.

thus only titled land is leased to equalize the marginal product of land across farmers, achieving a Pareto optimum. This equilibrium is also a steady state.

In the second equilibrium, due to the possibility of expropriation, there is a wedge between what the lessor of untitled land earns and what the lessee would pay, a situation well known in the taxation literature. Due to this price differential, the marginal returns to land will not be equalized between the land owner and the tenant. As a result, farmers who lease titled land earn a rent as it becomes a scarce factor.

Depending on the distribution of untitled land after re-trading, farmers that own more untitled land than the average ownership, may decide not to lease out the excess untitled land because what they would earn in expectation is lower than the returns to cultivating the land themselves. In this case, although there is no expropriation because all untitled land is still self-cultivated, the marginal product of land across farmers is not equalized and thus the first best is not achieved. However, if the resulting distribution of untitled land after trading is “too unequal”, some farmers may want to venture and lease some untitled land. In this case many equilibria are possible depending on the farmers’ expectations of government allocation policies and the subsequent trading. Many of these equilibria may eventually revert to the first equilibrium.⁷

We are particularly interested in the steady state equilibria as the data we have are cross-sectional. We therefore assume that if the untitled land allocation is such that untitled land is eventually leased, the government allocation policy and land endowments are such that the first best can never be achieved via land trading. With this assumption, the equilibria in this economy are given in the following proposition:

Proposition 1 *Let $L_{\max t}^{NT}$ be the maximum amount of untitled land held by any farmer. Then,*

i) If $L_{\max t}^{NT} \leq \frac{\overline{L^T} + \overline{L^{NT}}}{N}$, then, the land cultivated is given by $x_{jt}^{NT} = L_{jt}^{NT}$, $x_{jt}^T = \frac{\overline{L^T} + \overline{L^{NT}}}{N} -$

⁷If the government was to systematically redistribute expropriated land to farmers that are landless or have relatively little land, in such a way that untitled land holdings became more equal over time, then eventually untitled land would not be leased. Depending on the resulting distribution of untitled land, trading of land can achieve the first best equilibrium.

x_{jt}^{NT} , the rental rate is

$$R_t = R^{FB} = f' \left(\frac{\overline{L^T} + \overline{L^{NT}}}{N} \right) = f'(x^{FB})$$

and the price of titled land is $P^T = \frac{\beta R}{1-\beta}$.

ii) If $L_{\max t}^{NT} > \frac{\overline{L^T} + \overline{L^{NT}}}{N}$, there exists two and possibly three groups of farmers of sizes N^{RI} , N^I and N^{RO} and two land cultivation levels x^{RI} , x^{RO} such that,

$$f'(x^{RI}) = R, \quad f'(x^{RO}) = \frac{1-\beta}{1-\beta(1-\phi)} R$$

and

$$N^{RI} x^{RI} + \sum_{j=1}^{N^I} L_j^{NT} + N^{RO} x^{RO} = \overline{L^{NT}} + \overline{L^T}.$$

While $N^{RI} > 0$, $N^I > 0$ always, it may be the case that $N^{RO} = 0$. The price of titled and untitled land is given by, respectively,

$$P^T = \frac{\beta R}{1-\beta} \quad \text{and} \quad P^{NT} = \frac{\beta R}{1-\beta(1-\phi)}.$$

Figure 2 plots the marginal product of land against untitled land ownership for both cases of Proposition 1. In Case i), all farmers cultivate at the same scale. In Case ii) farmers included in N^{RI} have holdings of untitled land that satisfy $L_j^{NT} < x^{RI}$. Likewise, farmers in N^I hold untitled land that satisfy $x^{RI} < L_j^{NT} < x^{RO}$. In this case, they lease out all their titled land and only cultivate their untitled land. For these farmers, the marginal product of land is given by the amount of untitled land owned. Finally, farmers in N^{RO} have holdings of untitled land that satisfy $L_j^{NT} > x^{RO}$. In this case, they lease out all titled land and also any untitled land in excess of x^{RO} . Thus, if the agent with most untitled land has less than x^{RO} , then no agent will lease untitled land and $N^{RO} = 0$. Notice that in this case there is a positive probability of expropriation ϕ without any expropriation taking place.

We can rewrite the asset pricing equations in Proposition 1, Case ii) as capitalization

ratios (cap ratios) $\frac{R_t^i}{P_t^i}$ for $i = NT, T$, a ratio commonly used in the real estate literature.

$$\frac{R^T}{P^T} = \frac{1 - \beta}{\beta} \quad \text{and} \quad \frac{R^{NT}}{P^{NT}} = \frac{1 - \beta(1 - \phi)}{\beta}$$

If we let the discount rate $\beta = \frac{1}{1+r}$, where r denotes the interest rate, we can then write,

$$\frac{R^T}{P^T} = r \quad \text{and} \quad \frac{R^{NT}}{P^{NT}} = r + \phi. \quad (1)$$

The expression above indicates that the cap ratio for untitled land is positively related to ϕ and r . This is an important testable implication that will be explored in Section 5.

In sum, if there is a risk of expropriation $\phi > 0$, then most, if not all of the land leased will be titled. In addition, the cap ratio will be higher for untitled land. However, if there is no risk of expropriation, then agents are indifferent to leasing either type of land and the cap ratio is the same for both types of land.

3.1 Discussion

One way to avoid leasing untitled land is by hiring laborers. Since laborers would be supervised and would have no actual discretion in managerial decisions, landowners would appear to be self-cultivating the land and thus would not be subject to expropriation.

The reason why the labor market is not explicitly modelled is because most agricultural activities are undertaken by family labor, as assumed in the model. Although laborers are hired, they only perform specific tasks such as land preparation or harvesting.

The supply of agricultural laborers may be restricted for two reasons. First, because there are better paying off-farm employment opportunities, as the data seem to suggest. Second, because supervision costs may be so high (or managerial ability so low) that landowners prefer to lease land, even facing expropriation, than to become managers (Jacoby and Mansuri, 2004). Under this last interpretation, the cost of expropriation can be seen as a lower bound to these supervision costs.

4 Data

The data come from the Townsend-Thai dataset, a specialized but substantial cross sectional survey conducted in Thailand in May 1997. It contains a wealth of pre-crisis socioeconomic data on 2,880 households.⁸ The survey instruments collected current and retrospective information on landholding patterns and characteristics about all plots cultivated and owned. The sample is special in that it was restricted to two provinces in the relatively poor semi arid Northeast and two provinces in the more industrialized central corridor around Bangkok. Within each province, 48 villages were selected in a stratified clustered random sample at the sub-county level. The stratification, as described in Binford et al. (2003), ensured a representative sample of forested and non-forested sub-counties and excluded urban sub-counties. Within each village, 15 households were selected at random.

Table 1 reports the characteristics of the villages in the data. We divide the sample into Forest and non Forest on the one hand, and Program (P) and non Program on the other, as defined in Section 2, to ease comparisons across sub-samples. In the column labelled Mean, the symbols *,** and *** indicate whether there are significant differences at the 10, 5 or 1 percent significance level, respectively, between villages in Forest and Program areas and those in non Forest nor Program areas. Forest and Program villages are further away from the main road and have less access to irrigation infrastructure (presence of a canal) than non Forest nor Program villages. The reason for these differences is that Forest villages (in both Program and non Program areas), have typically been established later than Non Forest villages, evidencing the pattern of encroachment into the forest. However, most of the Forest villages were established long before the Forest Reserve Act of 1964, explaining why even inside officially declared forest areas most of the land is used for agriculture (Ministry of Agriculture and Cooperatives, 1993 p. 62). Table 1 also shows that Forest villages are less likely to have a cooperative in village as compared to non Forest village, but among Forest villages, program villages are significantly more likely to have a credit cooperative in 1997 (significance not shown). In addition, the connecting road is more likely to be paved. The comparison of Forest and Program villages to Forest and Non Program villages does not have any more significant differences,

⁸See Townsend et al. (1997) for more details on the data.

but among villages established before the Forest Reserve Act of 1964, Program villages were on average established earlier than non Program villages in Forest areas. Also, in Forest areas, more Non Program villages had common land, which is land typically forested that is managed and protected by the community. These differences in village characteristics seem consistent with the criteria used by the Forestry Department and the Agricultural Land Reform Office in deciding which villages to target for the reform (Ministry of Agriculture and Cooperatives, 1993 p. 64; Asian Development Bank, 2002 p. 61 and Fujita, 2003). Since the government believed that these programs were the first step towards future privatization of the land, STK and later SPK-4.01 certificates were issued in degraded forests suitable for agriculture, that is, land that would never revert back to being forest reserve again.

Table 2 reports the number of plots and households in the data. Panel A divides plots by the type of ownership deed. In Program villages, plots can either have full ownership titles (titled plots), STK or SPK-4.01 certificates (reform plots) or no formal document at all (untitled plots).⁹ In non Program villages, plots can either be titled or untitled. Table 2 does not distinguish between STK or SPK-4.01 plots, but by definition, there are no STK nor SPK-4.01 certificates in non Program villages, and STK certificates are never issued in non Forest villages. Titled plots are always located in private land. Untitled plots in a Forest village could be located in cleared protected forest land and in a non Forest village, they could be located in cleared government or royal land (other than protected forest).¹⁰ Under “All Plots”, Table 2 includes all the plots in the data, including those that are owned as well as those rented in (but not owned).¹¹ Under “Self-Cultivated and Rented Out Plots”, rented in plots are excluded to avoid a potential double-counting problem. If both the landlord and the tenants were in the sample, a given plot would be recorded under the landlord as rented out and under the tenant as rented in. Since no effort

⁹In Thailand there are three full ownership certificates, allowing the owner to transact freely and also being accepted indistinctively by banks as collateral. They are called NS-4, NS-3 and NS-3K. Plots with any of these certificates are *titled* plots. See Feder et al (1988b) or Giné (2007) for a detailed explanation of the different certificates of ownership.

¹⁰Untitled plots could also be located in private land if the owner failed to obtain a full ownership title during the Land Titling Program. Since unobserved household characteristics may introduce a bias, our baseline specification includes household fixed effects.

¹¹There are only 3 percent of plots that are owned and left fallow, so we treat them as if they were self-cultivated.

was made during the data collection to match landlords with tenants, the probability of double-counting is low. Despite the low probability, in the following descriptive tables and the analysis, we restrict the sample to self-cultivated and rented out plots only. Panel B divides households into those that only have titled plots, those that only have untitled plots and finally those that own at least a titled and an untitled plot. Thanks to the sampling scheme, Table 2 shows that there is a fairly even split of households living in forested and non forested villages on the one hand and program and no program villages on the other. In addition, the percentage of households with both titled and untitled land is highest in the forest and program areas, confirming the anecdotal evidence of Section 2.

Table 3 reports several characteristics of all the households in the data. Again, the column Mean also reports whether there are significant differences between households in Forest and Program villages and those in non Forest nor Program villages. Although most characteristics are significant across these two bins, when we compare among Forest villages, only the percentage of households with off-farm laborers, the number of farming adults, the number of family adults and the number of years resident in the village are significant. Thus, most differences arise from the Forest and Non Forest comparison, rather than the Program and non Program one.

Table 3 also shows that only 3 percent of households have members who are primarily employed as agricultural laborers. This number contrasts with the 38 percent of household with members employed as off-farm laborers. In addition, 62 percent of households engaged in agriculture use (unpaid) family labor. Although roughly 40 percent of households do hire agricultural laborers, the majority of them are paid on a daily basis and are only hired during short spells for specific activities. Indeed, the average number of family farming adults is similar to the total number of farming adults, including both family labor and the imputed number of hired agricultural laborers. Because the data only report the expenditure in agricultural wages, the number of hired laborers is computed dividing the total expenditures in agricultural wages by the average of the regional yearly income of an agricultural laborer.¹² All this evidence suggests that the labor markets assumption

¹²The average yearly income of a wage laborer as reported in the survey for each region was Baht 30,422 in the central region and Baht 16,859 in the Northeast. These numbers are comparable to Baht 11,040 which is the 1990 Baht value of the average yearly income for an agricultural workers from the 1996 round of the Socio-Economic Survey.

of the model in Section 3 is warranted.

The introduction of reform titles, however, may have affected labor intensity in program areas, especially in forest areas, as compared to other areas. We cannot say much about how efficiently labor is allocated across sub-samples because the share of land devoted to field crops (requiring different labor intensity) is also different across sub-samples. But when we focus on households that grow rice exclusively, we obtain some evidence of land rental market imperfections in Forest and Program areas that are not corrected by the labor market.¹³ According to Case ii) of Proposition 1 and the right panel of Figure 2, when untitled land is leased but subject to expropriation, households that lease out land will cultivate more land than those that lease it in. Table 3 reports total land cultivated per farming adult (including both family labor and imputed hired agricultural laborers) for households that only self-cultivate, lease in and self-cultivate, or lease out and self-cultivate. Everywhere but in Program and Forest areas, households that lease in land also cultivate more land than those leasing it out, possibly because they are more productive. In non Forest nor Program areas, for example, the average amount of total land cultivated per farming adult for rice farmers that rent in land is 1.83 hectares, compared to 1.48 hectares for farmers that rent out land. In Forest and Program areas we find the opposite pattern. The average amount of total land cultivated per farming adult among households that rent in land is 1.40 hectares, compared to a *higher* 1.57 hectares for farmers that rent out land. In these areas, households would like to lease more land (in and out) but the fear of expropriation prevents it.

Table 3 also reports the mean of total land owned and cultivated in hectares. Overall, 20 percent of the households in the data own more land than they cultivate, although the averages of total cultivated land are systematically higher than those of total owned land in all sub-samples. Thus, despite the random selection of households within a village, surveyed households tend to cultivate more land than they own.

The basic identification strategy of the paper can be seen in Table 4. While in Forest and Program villages the percentage of rented out plots that are titled is higher than the percentage of own cultivated plots, the reverse happens in non Forest nor Program villages. The percentage of titled plots both among self-cultivated plots and rented out

¹³Roughly two thirds of the farming households grow only rice, 15 percent only field crops and the remaining 15 percent grow both.

plots, is however higher in non Forest nor Program villages than in Forest and Program village because the number of titled plots is also larger. But when we restrict the sample of plots to those owned by households that simultaneously hold titled and untitled plots, we find that in Forest and Program areas, only 41 percent of self-cultivated plots are titled as compared to 63 percent for rented out plots. In non Forest nor Program areas, we find the opposite percentages: a full 67 percent of self-cultivated plots are titled, versus only a 46 percent of rented out plots. Table 4 therefore shows that because of the fear of expropriation, in Forest and Program areas, compared to non Forest nor Program areas, rented out plots are more likely to be titled than self-cultivated plots.

For this identification strategy to be valid, the relative difference in other plot characteristics between titled and untitled plots should be similar across sub-samples. In other words, one should check that rental decisions are not driven by something other than the type of ownership deed, as we claim here.

Table 5 reports several plot characteristics for each sub-sample broken down by the ownership deed of the plot. T refers to titled plots, R to reform plots and NT to untitled plots. Again, the symbols *,** and *** in the columns labelled Mean indicate whether for a given type of ownership deed, there are significant differences between Forest and Program areas and non Forest nor Program areas at the 10, 5 or 1 percent significance level, respectively. For all variables, titled plots (and for fewer variables, untitled plots) in Forest and Program areas are indeed significantly different from those in non Forest nor Program areas. Furthermore, in each sub-sample, titled plots are significantly different from untitled plots along most characteristics (significance not shown). But for most characteristics, the relative differences between titled and untitled plots is similar in both areas. For example, Table 5 reports that titled plots in Forest and Program areas are significantly smaller than untitled plots (1.2 versus 1.45 hectares). In non Forest nor Program areas, titled plots are *also* smaller than untitled plots (0.92 vs 1.07 hectares). Thus, because in both areas titled plots are smaller than untitled plots, even if plot size is correlated with the type of ownership deed, plot size cannot explain by itself why ownership matters in Forest and Program areas but not elsewhere. Table 5 shows that this is also the case for Type of Plot, Mode of Acquisition, Years of Ownership and Value of the Plot.

However, titled plots in Forest and Program areas, relative to untitled plots, are located

significantly further away from the house. But the reverse is true in other areas, including non Forest nor Program areas. Thus, it could be that rental decisions are driven mainly by distance from the plot to the house, rather than by security concerns (alleviated by the ownership deed) as we claim. We therefore need to control for distance to the house in the regression analysis. Finally, Table 5 shows that untitled plots and reform plots have similar characteristics in both Program areas, suggesting that both groups of plots are comparable.

We now turn to the empirical specifications that will be used to test more formally whether the restrictions in reform certificates, when enforced, distorted the rental market.

5 Econometric Framework

The discussion in the previous section and the model in Section 3 highlights the fact that the decision to lease land may be influenced by whether or not the landlord lives in a village located in Forest and Program areas. In these areas, the fact that an owner of a reform plot faces expropriation if such plot is leased may induce residents in these areas to believe that unsecured plots will also be expropriated if leased, and thus, they will avoid leasing out untitled plots.

The first regression we run to test this claim is an intent-to-treat specification of whether leasing activity is indeed lower in Forest and Program areas as compared to other areas. Specifically,

$$L_{ijv} = \alpha + \delta_{FP}F_v \times P_v + \delta_{FNP}F_v \times (1 - P_v) + \delta_{nFP}(1 - F_v) \times P_v + X'_{jv}\beta + Z'_{ijv}\gamma + \epsilon_{ijv} \quad (2)$$

where L_{ijv} denotes the leasing decision with value 1 if plot i owned by household j living in village v is leased, F_v is a dummy with value 1 if household lives in a Forest village, P_v if household lives in a Program village. Since the regression includes the constant α , the interaction $(1 - F_v) \times (1 - P_v)$ is omitted. The vector X_{jv} denotes the vector of household characteristics, which include total landholdings and household size among others, and the vector Z_{ijv} denotes plot level characteristics. In light of the discussion in the previous section, Z_{ijv} only includes distance to the house as a control.¹⁴

¹⁴We also try including size of plot, years of ownership and mode of acquisition, and as expected, the

If households living in Forest and Program areas believe that untitled leased plots may be expropriated, then we should expect lower leasing activity in Forest and Program areas so that $\delta_{FP} < 0$.

The next specification compares titled and untitled plots across sub-samples by introducing interactions between lack of ownership deed and the location of the plot. In particular, we run the following regression:

$$\begin{aligned} L_{ijv} = & \alpha + \delta_{NTFP}F_v \times P_v \times NT_{ijv} + \delta_{NTFnP}F_v \times (1 - P_v) \times NT_{ijv} \\ & + \delta_{NTnFP}(1 - F_v) \times P_v \times NT_{ijv} + \delta_{NTnFnP}(1 - F_v) \times (1 - P_v) \times NT_{ijv} \\ & + \delta_{FP}F_v \times P_v + \delta_{FnP}F_v \times (1 - P_v) + \delta_{nFP}(1 - F_v) \times P_v + X'_{jv}\beta + Z'_{ijv}\gamma + \epsilon_{ijv} \end{aligned} \quad (3)$$

where NT_{ijv} takes value 1 if plot i owned by household j living in village v does not have full ownership rights. If households living in Forest and Program areas believe that untitled leased plots may be expropriated, we would expect $\delta_{NTFP} < 0$ as titled plots are more likely to be leased in these areas.

The following two specifications add a village and household fixed effects, respectively, to the above specification in (3). The regression with village fixed effects is:

$$\begin{aligned} L_{ijv} = & \alpha_v + \delta_{NTFP}F_v \times P_v \times NT_{ijv} + \delta_{NTFnP}F_v \times (1 - P_v) \times NT_{ijv} \\ & + \delta_{NTnFP}(1 - F_v) \times P_v \times NT_{ijv} + \delta_{NTnFnP}(1 - F_v) \times (1 - P_v) \times NT_{ijv} + X'_{jv}\beta + Z'_{ijv}\gamma + \epsilon_{ijv} \end{aligned} \quad (4)$$

where α_v is village v fixed effect. Notice that the three interaction terms $F_v \times P_v$, $F_v \times (1 - P_v)$ and $(1 - F_v) \times P_v$ are absorbed by the village fixed effects and hence are omitted. The specification with household fixed effects, which we take as our benchmark, is:

$$\begin{aligned} L_{ijv} = & \alpha_{jv} + \delta_{NTFP}F_v \times P_v \times NT_{ijv} + \delta_{NTFnP}F_v \times (1 - P_v) \times NT_{ijv} \\ & + \delta_{NTnFP}(1 - F_v) \times P_v \times NT_{ijv} + \delta_{NTnFnP}(1 - F_v) \times (1 - P_v) \times NT_{ijv} + Z'_{ijv}\gamma + \epsilon_{ijv}, \end{aligned} \quad (5)$$

where α_{jv} is the fixed effect for household j in village v . In addition to the omitted interaction terms, the household characteristics X_{jv} are also omitted because they are already captured by the household fixed effects.

coefficients δ_{FP} , δ_{nFP} , δ_{FnP} preserve the sign and significance.

This differences-in-differences approach allows us to make sharper predictions about the behavior of the land rental market. Sections 2 and 4 have argued that by the time the data was collected, the allocation of land rights in rural Thailand was fairly exogenous. The Land Titling Program had successfully issued full ownership rights to most plots located in private land at a very low cost, while plots located in public land could not obtain a full ownership deed. Because some households probably failed to title their plots located in private land, this point about exogeneity is made more forcefully by introducing household fixed effects.

Our story of fear of expropriation is consistent with land rights affecting the leasing decision in Forest and Program areas but not elsewhere. In Section 6.2 we present other alternative stories that do not rely on the fear of expropriation and yet, are also consistent with the leasing patterns observed in the data. However, unlike our story, these alternative stories fail to rationalize the inclusion of a risk premium in the rental rate of untitled land in Forest and Program areas. In the spirit of Jimenez (1984), we estimate the cap ratios derived from the model in Section 3. We use available data on the asking and rental price of leased plots and estimate the following regression.^{15,16}

$$\begin{aligned} \log \left(\frac{R}{P} \right)_{ijv} = & \gamma_0 + \gamma_{NTFP} F_v \times P_v \times NT_{ijv} + \gamma_{NTFnP} F_v \times (1 - P_v) \times NT_{ijv} \\ & + \gamma_{NTnFP} (1 - F_v) \times P_v \times NT_{ijv} + \gamma_{NTnFnP} (1 - F_v) \times (1 - P_v) \times NT_{ijv} \\ & + \gamma_{FP} F_v \times P_v + \gamma_{FnP} F_v \times (1 - P_v) + \gamma_{nFP} (1 - F_v) \times P_v + \gamma_r SI_{jv} + \epsilon_{ijv} \end{aligned} \quad (6)$$

where SI is a dummy indicating access of household j to a given financial institution

¹⁵The survey asked the current value of each plot but not the rental value if it was leased. However, the survey has very detailed income and expenditure records of land rentals. Since the amounts reported are totals for all plots, we can only use plots by households that lease in and/or out at most one plot. This amounts to roughly one third of all rented plots and about half of rented plots used for agriculture. The only significant difference between plots with rental information as compared to those without is that in non-program and non-forest areas, plots with rental information are significantly larger. This difference cannot explain higher cap ratios in forest and program areas as our hypothesis suggest. More related to our story, we find no significant differences in the land value per hectare between plots with and without rental data.

¹⁶One could argue that the price data may be inaccurate because land in forest areas cannot be legally sold since it is government property. However, according to Feder et al. (1988b) and a government report (Ministry of Agriculture and Cooperatives, 1993), in practice all land in Thailand, including forest reserve land, is traded.

that collects deposits either because such institution is present in the village or because the household reports having savings in that institution. We include these dummies to control for the interest rate. If there is expropriation risk, we should expect $\gamma_{NTFP} > 0$.

6 Results

Table 6 presents the regression results for the specifications in (2) - (5). In all specifications except for (5), which includes household fixed effects, we control for the following households characteristics (coefficients not shown): total landholdings, household size, years of residence in village, age of head of household, sex of head of household and years of education of head of household. These specifications have fewer observations due to missing variables in some of these controls. Except for the intent-to-treat specification of column (1) which uses all plots in the sample, all specifications in columns (2)-(5) use the sample of owned plots to avoid the potential double-counting problem mentioned before.¹⁷ In all regressions, plots with reform certificates (STK or SPK-4.01) are excluded, because by law, they can only be self-cultivated, and if included in the regression, one would be measuring the extent to which households abide by the law. Table 6 presents the results estimated with OLS methods because they are easier to interpret. We also estimate the specifications in (2) and (3) using logits and the fixed effects specifications (4) and (5) using conditional logits. The results using these nonlinear models are very similar to the OLS results, and in all cases, the sign and significance of the variables of interest are preserved.

The intent-to-treat results of columns (1) and (2) show that the leasing rate is lower in Forest and Program areas compared to non Forest nor Program areas, but the same is true for Forest and non Program areas (and even non Forest and Program areas when only owned plots are used in the regression). In Forest areas, however, there may be less of a need to lease land because there is significantly lower inequality in total land owned per farming adult, possibly due to the pattern of encroachment into the forest.

Columns (3)-(5) show under various specifications how the estimated role of land security provided by the full ownership deed coincides with the discussion of Section 2

¹⁷When we run the specifications in (3)-(5) with all plots in the sample, the results do not change.

and the theory in Section 3: untitled plots are less likely to be leased out in Program and Forest areas. When village fixed effects are included, land rights also seem to matter in Forest and non Program areas, but this effect disappears when household fixed effects are included. In this specification, land rights only matter in enhancing the land rental market in Program and Forest areas. According to these estimates, untitled plots in areas where the restrictions to reform plots were enforced are 10 percent less likely to be leased out as compared to titled plots. In all specifications, leased plots tend to be farther away from the house.

We now turn to the regression results of the determinants of the cap ratio in (6), reported in Table 7. We use the sample of titled and untitled rented plots and exclude reform plots. We find evidence of a larger cap ratio for untitled plots in Forest and Program areas, indicating the presence of a risk of expropriation premium. A back of the envelope calculation from the estimated coefficients provides an expected probability of expropriation in Forest and Program areas of 4 or 12 percent, depending on the controls used.¹⁸ In a very different context, Jacoby et al. (2002) estimate a median (mean) hazard rate of 10 (16) percent.

The data report that 3 percent of households in Forest and Program areas have leased reform plots. This means that in the course of 20 years, and according to the estimated probability of expropriation, between 1.8 percent and 2.4 percent of households would see their program plots expropriated, depending on the assumptions made.¹⁹ Surprisingly, the data show that in Forest and Program areas, an average of 1.9 percent of households report having land expropriated over the last 20 years.²⁰

¹⁸Since the regression is run in logs, the parameter ϕ is computed as follows: $\phi = e^{\gamma_0 + \gamma_r + \gamma_{FP}} [e^{\gamma_{NTPP}} - 1]$.

¹⁹Let γ be the percentage of people in a given year that violate the special title restrictions by leasing out program plots. The upper and lower bounds on the probability of being expropriated over 20 years can be defined by assuming that a fraction γ of either *different* people violate the rules or the same fraction γ violate the rules every year. If a different percentage γ of people were to violate the rules, then one would see a percentage $[1 - (1 - \phi\gamma)^{20}]$ of people that would report having been expropriated over the course of 20 years. Notice that this fraction converges to 1 as the number of years increases to infinity. The lower bound assumes that the same percentage of people violates the rule every year. In this case, a fraction $[1 - (1 - \phi)^{20}] \gamma$ would report having been expropriated over 20 years. This fraction converges to γ as the number of years increases arbitrarily. Using the fact that $\gamma = 0.03$ from the data and that $\phi = 0.04$ as per the specification in (6) that controls for the existence of a financial institution in the village, the lower bound is 1.8 percent and the upper bound 2.4 percent.

²⁰Although the survey did not ask directly whether households had land expropriated, it does ask whether households lost land in the last 20 years. We then tabulate the “Other” category as a reason for

Thus, although the model suggests that the probability of expropriation could be compatible with much lower expropriation taking place, we find that the estimated (expected) rate of expropriation roughly coincides with the rate at which the government has expropriated land. When reform plots are included in the regressions (not shown in Table 7), the estimated risk premium is significant but only slightly higher. This suggests that the subjective risk premium may not be much higher for reform plots, and that the subjective risk premium $\phi = 0.04$ applies to both untitled and reform plots.

Using the estimated probability of expropriation we can compute the wedge between the marginal productivity of households that lease in as compared to those that lease out (see Proposition 1). If we use the implied interest rate from Table 7, we find a difference in marginal productivity of 50 percent, which assumes that households have the same productivity.²¹ Table 3 suggests that among rice growers, households that lease in land are more productive than those leasing out because on average they cultivate more land per adult. Therefore, although the true difference in marginal productivity is probably lower because households have different ability, the perceived fear of expropriation still results in a sizeable distortion.

6.1 Further Results

According to the model in Section 3, one would expect households to trade land after the reform is introduced. That is, households with excess untitled land would try to exchange it for titled land that would later be leased in order to avoid expropriation. In Forest and Program areas, therefore, one would expect (i) the land sale market to be more active after the issuance of reform certificates, and (ii) that these new sales would contribute to a more equal distribution of untitled land.

Table 8 explores the first hypothesis by reporting the percentage of households across sub-samples that bought or sold land over the last 20 years. We find a significantly higher percentage in Program and Forest areas. There are also significant differences across sub-samples in the percentage of households that only bought land and the percentage that bought only titled and only untitled land. It is reassuring to see that very few households

the loss, and find a few households who report expropriation.

²¹If instead we use the 5 percent deposit rate paid by BAAC, the difference in marginal productivity drops to 42 percent. The wedge or difference in marginal productivity is computed as $\frac{\phi}{r+\phi}$.

bought simultaneously titled and untitled land, as the majority of households that bought land, purchased one type of land only. This evidence is thus suggestive that the land sale market was more active in Program and Forest areas.

Table 9 analyzes the second hypothesis by decomposing the Theil inequality index in the distribution of ownership of untitled land before and after 1977, for households that existed in 1977.²² We use how long the household has been in possession of the plot to reconstruct from current land ownership, how much untitled land it had before and after 1980. Unfortunately, we cannot use households that sold land as we do not know the type of ownership deed that the plot had when it was sold. Table 9 shows that in all sub-samples, untitled land was more unequally distributed before the reform. In addition, untitled land is more equally distributed in Program areas as compared to non-program areas, and among Program areas, it is more equally distributed in Forest areas. It thus seems that households allocated untitled land through the market, in an effort to minimize having to lease untitled land.

6.2 Alternative Explanations

Although the evidence presented above is consistent with a fear of expropriation story, there are other explanations that are also consistent with the observed pattern of land leases.

First, if households in Program and Forest areas have mostly titled land, then, mechanically, less untitled land will be leased. However, we find that in Program and Forest areas more than 50 percent of land is untitled, so this story can be dismissed.

Second, untitled land could have been recently cleared, and therefore be more productive than older, titled land. In this case, households with excess land would cultivate the most productive land (untitled) and lease the least productive (titled). Table 5 shows that is not the case. First, the owner has been in possession of titled and untitled land in forest areas for roughly the same time.²³ Second, the value per hectare of titled land is

²²The Theil Inequality Index of variable $x_i, i = 1..N$ is computed as $I_{\text{Theil}} = \frac{1}{N} \sum_{i=1}^N \frac{x_i}{\bar{x}} \log\left(\frac{x_i}{\bar{x}}\right)$, where \bar{x} is the mean of variable x . It can be shown that the Theil index is a particular case of the Generalized Entropy Index with $\alpha = 1$. See Cowell (2003) for more details.

²³Although in Program areas titled land is significantly older than untitled land, the difference disappears when we only consider households with cultivated and rented plots (or with both titled and untitled land, not shown).

higher, not lower, than that of untitled land.

Finally, households in Program areas could cultivate untitled land simply because they are seeking to formalize it with a reform certificate. If these certificates were only granted to self-cultivated plots, then households would have an incentive to only cultivate untitled plots to demonstrate usufructuary rights. While this story seems compelling, there are several flaws with it. First, there is little evidence suggesting that reform certificates provided any real benefit (Feder et al., 1988a). Even if there were benefits, they would have to be weighted against the efficiency losses from cultivating a sub-optimal land area, since land with reform certificates cannot be leased. Second, the allocation of reform certificates was based on ownership rather than self-cultivation (Ministry of Agriculture and Cooperatives, 1993 p. 64; Asian Development Bank, 2002 p. 63). Third, even if reform certificates were only granted to self-cultivated plots, in areas where the reform had already taken place, the leasing activity should have reverted to a situation where land rights would not affect leasing decisions. Fourth, untitled plots should also be less likely to be leased out in non Forest and Program areas, but they are not. Finally, and most importantly, this story is not compatible with the risk premium found in the rental rate of leased untitled plots in Forest and Program areas.

7 Conclusions

This paper shows empirically how a property rights reform created an unforeseen negative externality. The introduction of partial rights titles was not only ineffective given the small private benefits to holders (Feder et al. 1988a) but in fact, it distorted the land market by triggering a sense of insecurity among land owners. In short, these reform titles created uncertainty over existing informal land rights that previously were sufficient to allocate land efficiently.

The lesson to be learned from Thailand is that the formalization of squatters with partial rights may have led to a worse situation than if no rights were issued at all. A more sensible policy in these areas would be to provide full ownership rights because they had long been settled, were suitable for agriculture and did not pose a threat to the environment. Needless to say, in other areas where continuing cultivation causes damage to the environment, the control may be best left to the government (Asian Development

Bank, 2002).

The findings of this paper support Banerjee’s (2000) argument that allocated land should bear the right to be leased. If reform titles allowed for this possibility, one would avoid some of the inefficiencies still currently observed in forest and program areas.

In this sense, the recent government policy that promotes “asset capitalization” is encouraging. In 2003, the Assets Capitalization Bureau was established to review the property rights of assets so that they could be used as collateral, thereby improving the access to capital of their owners. Since land is one of the assets considered, the government agencies responsible for the reform studied here have to revise the regulations in order to facilitate the transferring and leasing of land. In some instances, reform titles may be converted to full ownership titles, as the STK program intended in its origins but never implemented. Although it is still too early to assess the impact of this new policy, the findings here augur its success.

References

- [1] D. Atwood. Land Registration in Africa: The Impact of Agricultural Production. *World Development*, 18(5):659–71, 1990.
- [2] A. Banerjee. Prospects and Strategies for Land Reform. In *Annual World Bank Conference on Development Economics 1999*. The World Bank, 2000.
- [3] A. Banerjee, M. Ghatak, and P. Gertler. Empowerment and Efficiency: Tenancy Reform in West Bengal. *Journal of Political Economy*, 110(2):239–280, 2002.
- [4] Asian Development Bank. Thailand: Policy and Program Priorities for Balancing the Roles of Agriculture in Rural and Environmental Development. ADB TA 3643-THA: Development of Agricultural Sector and Policy, 2002.
- [5] T. Besley. Property Rights and Investment Incentives: Theory and Evidence from Ghana. *Journal of Political Economy*, 103(5):903–937, 1995.
- [6] M. Binford, T.J. Lee, and R. Townsend. Sampling Design for an Integrated Socio-

Economic and Ecologic Survey Using Satellite Remote Sensing and Ordination. University of Chicago, 2003.

- [7] M. Carter and F. Zimmerman. The Dynamic Cost and Persistence of Asset Inequality in an Agrarian Economy. *Journal of Development Economics*, 63(2):265–302, 2000.
- [8] Y. Chalamwong and G. Feder. The Economic Implications of Land Documents in Rural Thailand. *Agric. Admin. & Extension*, 29:123–133, 1988.
- [9] J. Conning and P. Deb. Impact Evaluation for Land Property Rights Reform. mimeographed, 2006.
- [10] F. Cowell. From Theil, Inequality and the Structure of Income Distribution. STICERD, Discussion Paper DARP 67, 2003.
- [11] A. de Janvry, G. Gordillo, J.P. Platteau, and E. Sadoulet. *Access to Land, Rural Poverty and Public Action*. Oxford University Press, Oxford, UK, 2001.
- [12] Q.T. Do and L. Iyer. Land Titling and Rural Transition in Vietnam. The World Bank, mimeo, 2004.
- [13] G. Feder, T. Onchan, and Y. Chalamwong. Land Policies and Farm Performance in Thailand’s Forest Reserve Areas. *Economic Development and Cultural Change*, 36(3):483–501, 1988a.
- [14] G. Feder, T. Onchan, Y. Chalamwong, and C. Hongladarom. *Land Policies and Farm Productivity in Thailand*. John Hopkins University Press, Baltimore, Maryland, 1988b.
- [15] D. Feeny. *The Political Economy of Productivity: Thai Agricultural Development 1880–1975*. University of British Columbia Press, Vancouver, 1982.
- [16] E. Field. Entitled to Work: Urban Property Rights and Labor Supply in Peru. Harvard University, mimeo, 2003.
- [17] W. Fujita. Dealing with Contradictions: Examining National Forest Reserves in Thailand. *Southeast Asian Studies*, 41(2):206–238, September 2003.

- [18] S. Galiani and E. Schargrodsky. Effects of Land Titling. Universidad de San Andres, mimeo, 2004.
- [19] X. Giné. Land Rights in Rural Thailand: The Case of Protected Areas. mimeographed, 2007.
- [20] M. Goldstein and C. Udry. Gender, Power and Agricultural Investment in Ghana. Yale University, mimeo, 2004.
- [21] H. Jacoby, G. Li, and S. Rozelle. Hazards of Expropriation: Tenure Insecurity and Investment in Rural China. *American Economic Review*, 92(5):1420–1447, 2002.
- [22] H. Jacoby and G. Mansuri. Incomplete Contracts and Investment: A Study of Land Tenancy in Pakistan. The World Bank, mimeo, 2003.
- [23] H. Jacoby and G. Mansuri. The (In)efficiency of Share-Tenancy Revisited: The Role of Supervision. The World Bank, mimeo, 2004.
- [24] E. Jimenez. Tenure Security and Urban Squatting. *The Review of Economics and Statistics*, 66:556–567, 1984.
- [25] K. Macours. Insecurity of Property Rights and Matching in the Tenancy Market. Job Market Paper, University of California at Berkeley, 2003.
- [26] Ministry of Agriculture and Cooperatives. Thai Forestry Sector Master Plan, volume 5. Royal Forestry Department THA/88/R51, 1993.
- [27] K. Otsuka. Efficiency and Equity Effects of Land Markets. In R. Evenson, P. Pingali, and T. Schultz, editors, *Handbook of Agricultural Economics*, volume III, chapter 9. Elsevier Science, North Holland, Amsterdam, 2005.
- [28] V. Rattanabirabongse, R. A. Eddington, A. F. Burns, and K. G. Nettle. The Thailand and Titling Project-Thirteen Years of Experience. *Land Use Policy*, 15(1):3–23, 1998.
- [29] World Bank Policy Research Report. *Land Policies for Growth and Poverty Reduction*. World Bank and Oxford University Press, Washington, DC, 2003.

- [30] J. Sato. People in Between: Conversion and Conservation of Forest Lands in Thailand. *Development and Change*, 31:155–177, 2000.
- [31] R. A. Shaban. Testing between Competing Models in Sharecropping. *Journal of Political Economy*, 95:893–920, 1987.
- [32] R. Townsend principal investigator with, A. Paulson, S. Sakuntasathien, T. Jeong Lee, and M. Binford. Questionnaire design and data collection for NICHD grant ‘Risk, Insurance and the Family’ and NSF grants. mimeographed, 1997.
- [33] P. Vandergeest. Property Rights in protected areas: obstacles to community involvement as a solution in Thailand. *Environmental Conservation*, 23(3):259–268, 1995.

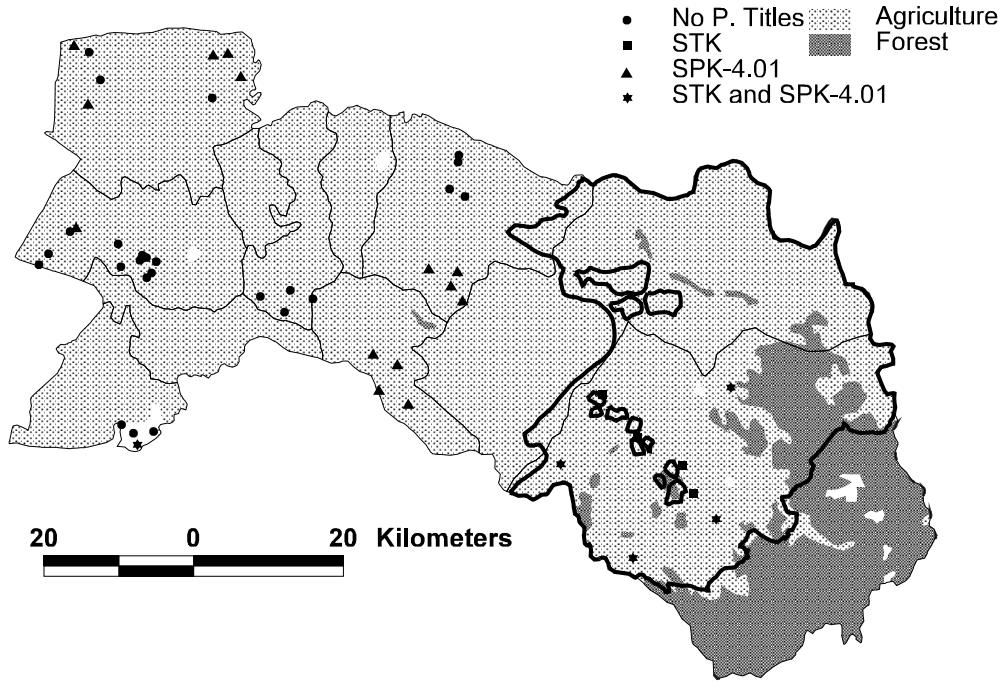


Figure 1: Land Use in Chachoengsao

Location of surveyed villages comes from Townsend-Thai data. Land use and forest reserve boundaries come from TDRI data.

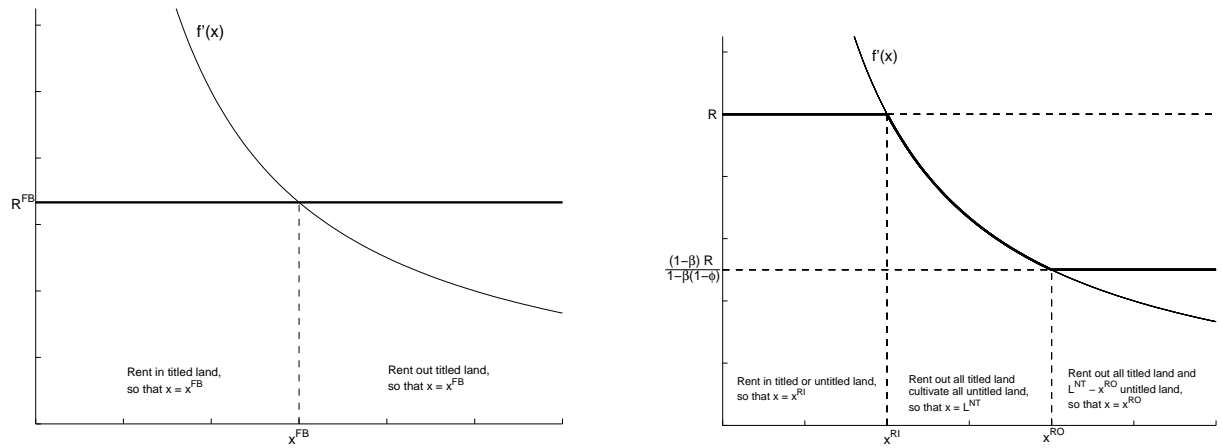


Figure 2: Marginal Product of Land in Proposition 1 Case i) (left) and Case ii) (right).

Table 1: Village Characteristics

Data come from the key informant survey of the Townsend-Thai dataset. An observation is a village established before 1980. P refers to Program village. ^a Computed excluding villages established after 1964. Presence of financial institutions in 1980 and 1997 is computed using the year of establishment in village. The symbols *, ** and *** indicate that the difference between FP and nFnP villages is significant at 10 percent, 5 percent and 1 percent, respectively.

	Whole Sample		Forest		Non_Forest	
	Mean	SD	P	non-P	P	non-P
			Means			
Years since establishment	99.9***	76.0	76.9	87.1	81.5	131.8
Years since establishment ^a	111.2***	76.1	96.6	90.4	87.9	136.3
<i>In 1980</i>						
Formal Bank in village (1=yes)	0.20	0.40	0.14	0.24	0.26	0.22
Cooperative in village (1=yes)	0.09***	0.29	0.02	-	0.14	0.14
<i>In 1997</i>						
Village Population	754.4	957.4	752.7	624.6	614.4	856.7
Common Land in village (1=yes)	0.19**	0.39	0.26	0.35	0.20	0.09
Formal Bank in village (1=yes)	0.53	0.50	0.57	0.41	0.63	0.46
Cooperative in village (1=yes)	0.20	0.40	0.17	-	0.29	0.23
Canal in village (1=yes)	0.22***	0.42	0.12	0.12	0.26	0.32
River in village (1=yes)	0.12	0.32	0.13	-	0.11	0.14
Kms. to main road	2.73**	4.55	3.95	2.24	2.46	1.95
Pct. pavement in sec. road	0.44	0.47	0.51	0.26	0.42	0.44
<i>N. of Observations</i>	179		58	17	35	69

Table 2: Number of Observations

Data come from the Townsend-Thai dataset. P stands for Program Village. Panel A reports the number of plots. The first four rows (All Plots) include all plots in the data, both owned plots (self-cultivated or rented out) and rented in plots (not owned). The last four rows in Panel A (Self-Cultivated or Rented Out Plots) include only owned plots. Titled plots are plots with full ownership rights. Reform Plots are plots with STK or SPK-4.01 certificates. Untitled plots are plots without full ownership rights nor reform certificates, mostly undocumented plots. Panel B reports the number of households in the sample. The last four rows (Households with Self-Cultivated or Rented Out Plots) report the number of households which at least own a plot and is either self-cultivated or rented out. The row "HH with both Titled and non Titled Plots" include households that own at least a titled plot and an untitled plot.

Panel A: Plot Observations					
	Forest		Non Forest		Total
	P	Non P	P	Non P	
All Plots					
Number of Titled Plots	704	516	785	2,487	4,492
Number of Reform Plots	492	-	349	-	841
Number of Untitled Plots	1,921	293	637	203	3,054
Total Number of Plots	3,117	809	1,771	2,690	8,387
Self-Cultivated or Rented Out Plots					
Number of Titled Plots	590	418	612	1,995	3,615
Number of Reform Plots	492	-	259	-	751
Number of Untitled Plots	1,642	248	465	137	2,492
Total Number of Plots	2,724	666	1,336	2,132	6,858
Panel B: Household Observations					
	Forest		Non Forest		Total
	P	Non P	P	Non P	
All Households					
HH with only Titled Plots	170	147	255	947	1,519
HH with only non Titled Plots	595	73	184	63	915
HH with both Titled and Untitled Plots	185	48	96	79	408
Total Number of Households	950	268	535	1,089	2,842
Households with Self-Cultivated or Rented Out Plots					
HH with only Titled Plots	155	132	215	838	1,340
HH with only non Titled Plots	559	67	147	51	824
HH with both Titled and Untitled Plots	178	46	96	72	392
Total Number of Households	892	245	458	961	2,556

Table 3: Household Characteristics

Data come from the household survey of the Townsend-Thai dataset. A household is an observation. P refers to Program village. A household has Agricultural Laborers if it has at least one household member whose reported main occupation is being employed as an agricultural laborer outside the own household farm. A household has Off-farm Laborers if it has at least one household member whose reported main occupation is being employed as an off-farm laborer. A household has Family Labor in Agriculture if it has at least one household member whose reported main occupation is agricultural laborer in the household farm. A household has Hired-in Laborers if it reports a positive expenditure paid in wages for agriculture. The number of Farming Adults is the sum of the farming household members and the imputed number of hired agricultural laborers, computed from total expenditures paid in wages for agriculture divided by the average annual income of an agricultural laborer. Household Wealth is the sum of the 1997 Baht value of household assets, including cars, pickup trucks boats and electronics. Agricultural Wealth is the sum of the 1997 Baht value of agricultural assets, including tractors, water pumps, mills, etc. A household has savings in a given financial institution if it reports a positive amount of savings deposited in the financial institution. Village-level institutions include village funds, buffalo or rice banks and Production and Credit Groups. Total Land Owned in hectares is the sum of the size of all reported own plots. Total Land Cultivated in hectares is the sum of the size of all reported cultivated plots, including those that are own cultivated and rented in. Total Land Cultivated per Farming Adults is Total Land Cultivated divided by the Number of Farming Adults. A sample of 1415 households exclusively growing rice is used. The symbols *, ** and *** indicate that the difference between FP and nFnP villages is significant at the 10 percent, 5 percent and 1 percent, respectively.

	Whole Sample		Forest		Non Forest	
	Mean	SD	P	non-P	P	non-P
					Means	
<i>Household Characteristics</i>						
Pct. of Households with Agric. Laborers	0.03*	0.16	0.03	0.02	0.02	0.02
Pct. of Households with Off-farm Laborers	0.38***	0.48	0.33	0.21	0.40	0.45
Pct. of Households with Family Labor in Agric.	0.62***	0.49	0.68	0.73	0.66	0.52
Pct. of Households with hired-in Laborers	0.39***	0.49	0.41	0.50	0.44	0.31
Size of Household	4.57	1.96	4.66	4.43	4.47	4.58
N. Farming Adults	2.64***	1.36	2.80	2.46	2.71	2.49
N. Farming Family Adults	2.39***	1.18	2.51	2.28	2.38	2.31
Years of Residence in Village	34.6***	19.3	28.4	32.9	35.7	40.0
Sex of Head (1=male)	0.77***	0.42	0.80	0.81	0.78	0.73
Age of Head (years)	51.4***	13.6	49.2	48.8	51.8	53.8
Education of Head (years)	4.12***	2.62	3.98	4.13	3.72	4.43
Household Wealth (in 1,000 Baht)	68.8***	140.8	48.2	37.8	68.9	94.8
Agricultural Wealth (in 1,000 Baht)	21.4	67.3	20.3	25.6	32.4	15.9
Household has savings in Com. Bank or BAAC	0.70**	0.46	0.65	0.70	0.75	0.72
Household has saving in Cooperative	0.16	0.36	0.14	0.08	0.17	0.18
Household has savings in village-level institution	0.12	0.32	0.10	0.14	0.10	0.14
<i>Land Characteristics</i>						
Total Land Owned in hectares	2.70***	4.69	3.31	2.81	3.19	1.88
Total Land Cultivated in hectares	3.15*	4.63	3.44	3.12	4.32	2.33
<i>Total Land Cultivated per Farming Adult for Rice Farmers^a</i>						
Households that only self-cultivate	1.28	1.08	1.29	1.22	1.32	1.29
Households that lease in land	1.81**	1.57	1.40	1.60	2.28	1.83
Households that lease out land	1.46	1.19	1.57	1.50	1.12	1.48

Table 4: Identification Strategy

Data come from the Townsend-Thai dataset. P refers to Program village. The first two rows use own cultivated and rented out plots owned by all households in the data. The last two rows use own cultivated and rented out plots owned by households that have at least one titled and one non titled plot. The percentage of own cultivated plots that are titled is the number of plots that are own cultivated and titled divided by the total number of plots that are own cultivated. The percentage of rented out plots that are titled is the number of plots that are rented out and titled divided by the total number of rented out plots.

	Whole Sample			Forest		Non Forest		
	N. of	Mean	SD	P	non P	P	non P	
	plots			Means				
<i>All Households</i>								
Pct. of Self-Cultivated Plots that are Titled	5,798	0.59	0.49	0.27	0.63	0.56	0.94	
Pct. of Rented Out Plots that are Titled	437	0.68	0.47	0.42	0.70	0.64	0.89	
<i>Households with both Titled and Untitled Land</i>								
Pct. of Self-Cultivated Plots that are Titled	1,000	0.50	0.50	0.41	0.53	0.54	0.67	
Pct. of Rented Out Plots that are Titled	119	0.57	0.50	0.63	0.67	0.47	0.46	

Table 5: Characteristics of Plots

Data come from the Townsend-Thai dataset. Only plots that are owned (self-cultivated or rented out) are used in the calculations. T refers to titled (full ownership) plots, R refers to reform (STK or SPK-4.01) plots and NT to untitled plots. The vertical sum across Type of Plot is less than 1 because Other category is omitted. ^a Only for owners that cultivate and rent out simultaneously (a total of 2,003 plots are used in the calculations). The symbols *, ** and *** indicate that the difference between FP and nFnP villages is significant at the 10 percent, 5 percent and 1 percent, respectively.

	Whole Sample						Forest						Non Forest			
							Program			Non Program			Program			Non Program
	T		R		NT		T	R	NT	T	NT	T	R	NT	T	NT
	Mean	SD	Mean	SD	Mean	SD	Means									
Distance to House in Km	1.36***	5.24	2.10	7.41	1.53***	5.20	2.18	2.14	1.36	0.95	1.41	1.19	2.05	1.88	1.25	2.64
Size of Plot in Hectares	1.04*	2.16	1.82	2.46	1.49	2.60	1.20	1.72	1.45	0.91	1.46	1.34	2.02	1.80	0.92	1.07
Type of Plot																
Residential	0.41***	0.49	0.31***	0.46	0.39	0.49	0.37	0.27	0.39	0.36	0.33	0.44	0.37	0.40	0.42	0.50
Paddy	0.39***	0.49	0.26***	0.44	0.27	0.44	0.46	0.32	0.26	0.49	0.32	0.30	0.16	0.27	0.37	0.29
Field	0.06***	0.24	0.34***	0.47	0.25*	0.43	0.08	0.31	0.25	0.04	0.21	0.11	0.40	0.27	0.04	0.16
Mode of Acquisition																
Purchased	0.31***	0.46	0.40**	0.49	0.42*	0.49	0.26	0.44	0.43	0.28	0.49	0.34	0.34	0.32	0.32	0.36
Inherited	0.68**	0.47	0.49	0.50	0.45***	0.50	0.73	0.49	0.42	0.72	0.45	0.57	0.49	0.52	0.69	0.61
Cleared	0.02***	0.14	0.09	0.29	0.09	0.28	0.03	0.09	0.09	0.01	0.07	0.05	0.09	0.09	0.01	0.07
Years of Ownership	19.3*	14.4	16.8**	11.8	16.6**	12.0	18.2	16.1	16.5	17.4	15.6	19.6	18.1	17.5	19.8	18.7
Years of Ownership ^a	16.7*	13.5	15.7	11.3	15.2	11.5	15.3	15.0	14.8	14.8	15.0	16.6	17.6	17.0	17.5	16.9
Value of Plot per Hectare (1,000 Baht)																
Residential	1,718.3***	2,583.0	510.5	884.4	574.8***	1,344.7	1,014.9	537.2	481.0	976.8	234.6	1,178.4	472.5	569.3	2,212.1	1,836.7
Agricultural	563.1***	1,245.7	146.1***	218.2	148.6***	350.4	208.2	124.1	121.4	303.5	209.3	465.3	192.1	176.0	774.0	275.2

Table 6: Determinants of Plot Rental

Data come from the Townsend Thai dataset. The dependent variable is a dummy variable indicating whether the plot is leased. P refers to Program village, while F to Forest village. No rights is a dummy variable with value 1 if the plot is untitled. F and P is a dummy variable that takes value 1 if the village is a Forest (F) and Program (P) village. The dummy variable non F and non P is excluded because the regressions include a constant. Column (1) uses all plots, both owned (self-cultivated and rented out) and rented in plots (not owned). Columns (2) to (5) use only owned plots. In all columns, only titled and untitled plots are used. Thus, reform plots (with STK or SPK-4.01 certificates) are excluded. The regressions in columns (1) to (4) include the following household controls: total land owned, household size, number of years in village, age of head, sex of head, years of education of head. All regressions are estimated with OLS. Robust SE are in brackets. * significant at 10 percent, ** significant at 5 percent and *** significant at 1 percent. The dummies F and P, F and non P and non F and P drop from regressions (4) and (5) due to the estimated fixed effects. F and P drop from regressions (4) and (5) due to the estimated fixed effects.

	(1)	(2)	(3)	(4)	(5)
No rights x F and P			-0.023 [0.013]*	-0.062 [0.020]***	-0.103 [0.037]***
No rights x F and non P			-0.024 [0.015]	-0.064 [0.031]**	-0.045 [0.046]
No rights x non F and P			-0.001 [0.019]	0.006 [0.024]	-0.066 [0.040]
No rights x non F nor P			0.013 [0.027]	-0.017 [0.034]	-0.044 [0.071]
F and P	-0.084 [0.013]***	-0.024 [0.008]***	-0.008 [0.013]		
F and non P	-0.076 [0.017]***	-0.032 [0.010]***	-0.022 [0.012]*		
non F and P	0.009 [0.016]	-0.028 [0.010]***	-0.027 [0.011]**		
Distance from House in Km	0.012 [0.002]***	0.012 [0.002]***	0.012 [0.002]***	0.011 [0.002]***	0.013 [0.002]***
Fixed Effects	No	No	No	Village	Household
N. Observations	6,517	5,247	5,226	5,226	5,356
R-squared	0.07	0.07	0.07	0.13	0.51

Table 7: Determinants of Cap Ratio

Data come from the Townsend-Thai dataset. The dependent variable is the log of the capitalization ratio. P refers to Program village, while F to Forest village. No rights is a dummy variable with value 1 if the plot is untitled. F and P is a dummy variable that takes value 1 if the village is a Forest (F) and Program (P) village. The other dummies are defined analogously. The dummy variable non F and non P is excluded because the regressions are run with a constant. Because the rental value for each leased plot is not reported, but only the total revenue and expenses from land rental, we only use households that lease at most one plot. Only titled and untitled plots are used. Thus, reform plots (with an STK or SPK-4.01 certificate) are excluded. All regressions are estimated with OLS. Robust SE in parenthesis. * significant at 10 percent, ** significant at 5 percent and *** significant at 1 percent.

	No Controls	Village	Household
<i>Plot Characteristics</i>			
No rights x F and P	0.692 [0.311]**	0.697 [0.322]**	0.973 [0.360]***
No rights x F and non P	0.868 [0.719]	0.63 [0.641]	0.466 [0.724]
No rights x non F and P	-0.014 [0.509]	-0.13 [0.502]	0.099 [0.544]
No rights x non F nor P	-0.054 [0.512]	0.123 [0.466]	0.062 [0.520]
F and P	1.069 [0.333]***	1.116 [0.335]***	1.151 [0.369]***
F and non P	0.028 [0.634]	0.083 [0.566]	0.45 [0.618]
non F and P	-0.034 [0.340]	-0.124 [0.320]	-0.027 [0.358]
<i>Savings Institution</i>			
Commercial Bank or BAAC branch in village		0.924 [0.219]***	
Savings Cooperative in village		-0.013 [0.296]	
Village-level Microfinance Institution		0.925 [0.234]***	
Household has savings in Com. Bank or BAAC			-0.139 [0.241]
Household has savings in Cooperative			-0.777 [0.328]**
Household has savings in village-level institution			0.965 [0.390]**
Constant	-4.722 [0.192]***	-5.36 [0.236]***	-4.756 [0.274]***
N. of Observations	425	425	364
R-squared	0.1	0.17	0.15

Table 8: Trading of Land After 1980

Data come from the Townsend-Thai dataset.						
	Whole Sample		Forest		Non-Forest	
	Mean	SD	Program	non-Prog	Program	non-Prog
			Means			
Pct. Of Households that...						
Bought or sold land	0.34	0.47	0.39	0.31	0.30	0.33
Only sold land	0.09	0.29	0.07	0.07	0.10	0.11
Only bought land	0.21	0.41	0.27	0.21	0.18	0.19
Bought Titled and untitled land	0.01	0.09	0.02	0.01	0.01	0.00
Only bought titled land	0.12	0.33	0.05	0.11	0.11	0.20
Only bought untitled land	0.12	0.33	0.25	0.13	0.09	0.02

Table 9: Owned Untitled Land Inequality

Data come from the Townsend-Thai dataset. The sample of 2,505 farming households exclusively growing rice is used. Standard errors computed using bootstrap with 500 reps.

		Forest	Non-Forest	Total
Program Areas				
Before	(1977)	1.23	1.63	1.37
After	(1997)	0.83	1.18	0.96
Non-Program Areas				
Before	(1977)	1.97	3.43	3.01
After	(1997)	1.36	2.93	2.40
Total				
Before	(1977)	1.37	2.48	1.90
After	(1997)	0.94	2.03	1.46

Appendix: Table for Referee

Extended Table 10 for Referee: Determinants of Plot Rental

Data come from the Townsend Thai dataset. The dependent variable is a dummy variable indicating whether the plot is leased. Odd-numbered columns (except for Column 9) use all plots, both owned (own cultivated and rented out) and rented in plots (not owned). They are labelled "All". Even-numbered columns and Column (9) use only owned plots, labelled "Owned". In all columns, only titled and untitled plots are used. Thus, reform plots (with STK or SPK-4.01 certificates) are excluded. The regression in columns (1) to (4) include the following household controls: household size, age of head, sex of head, years of education of head. In Panel A, regressions are estimated with OLS. In Panel B, with Logit or Conditional Logit in fixed effects specifications. Robust SE are in brackets. P refers to Program village, while F to Forest village. * significant at 10 percent, ** significant at 5 percent and *** significant at 1 percent. Other Plot Controls, included in column (9) are: Size of Plot, Mode of Acquisition and Years of Ownership.

Panel A: OLS Results									
	All	Owned	All	Owned	All	Owned	All	Owned	Owned
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
No rights x F and P			-0.034 [0.019]*	-0.023 [0.013]*	-0.09 [0.026]***	-0.062 [0.020]***	-0.194 [0.041]***	-0.103 [0.037]***	-0.095 [0.039]**
No rights x F and non P			-0.046 [0.029]	-0.024 [0.015]	0.01 [0.051]	-0.064 [0.031]**	-0.116 [0.070]*	-0.045 [0.046]	-0.057 [0.048]
No rights x non F and P			0.047 [0.032]	-0.001 [0.019]	0.074 [0.035]**	0.006 [0.024]	-0.018 [0.070]	-0.066 [0.040]	-0.075 [0.042]*
No rights x non F nor P			0.101 [0.036]***	0.013 [0.027]	0.094 [0.038]**	-0.017 [0.034]	0.08 [0.074]	-0.044 [0.071]	-0.047 [0.073]
F and P	-0.084 [0.013]***	-0.024 [0.008]***	-0.061 [0.018]***	-0.008 [0.013]					
F and non P	-0.076 [0.017]***	-0.032 [0.010]***	-0.052 [0.020]***	-0.022 [0.012]*					
non F and P	0.009 [0.016]	-0.028 [0.010]***	0.002 [0.018]	-0.027 [0.011]**					
Distance from House in Km	0.012 [0.002]***	0.012 [0.002]***	0.012 [0.002]***	0.012 [0.002]***	0.011 [0.002]***	0.011 [0.002]***	0.013 [0.002]***	0.013 [0.002]***	0.011 [0.002]***
Fixed Effects	No	No	No	No	Village	Village	HH	HH	HH
Other Plot Controls		No		No		No		No	Yes
N. Observations	6,517	5,247	6,464	5,226	6,464	5,226	6,608	5,356	5,233
R-squared	0.07	0.07	0.07	0.07	0.19	0.13	0.61	0.51	0.51
Panel B: Logit Results									
	All	Owned	All	Owned	All	Owned	All	Owned	Owned
No rights x F and P			-0.196 [0.121]	-0.467 [0.235]**	-0.655 [0.171]***	-1.346 [0.349]***	-1.888 [0.414]***	-1.707 [0.620]***	-1.733 [0.732]**
No rights x F and non P			-0.291 [0.183]	-0.518 [0.406]	0.03 [0.375]	-1.148 [0.683]*	-0.679 [0.612]	0.508 [0.805]	0.215 [0.762]
No rights x non F and P			0.18 [0.156]	-0.052 [0.425]	0.456 [0.358]	0.335 [0.430]	-0.115 [0.603]	-1.225 [0.924]	-1.144 [0.929]
No rights x non F nor P			0.423 [0.159]***	0.201 [0.350]	0.418 [0.269]	-0.204 [0.441]	0.387 [0.389]	-0.356 [0.441]	-0.436 [0.491]
F and P	-0.406 [0.077]***	-0.364 [0.144]**	-0.292 [0.106]***	-0.081 [0.196]					
F and non P	-0.377 [0.097]***	-0.557 [0.202]***	-0.247 [0.113]**	-0.37 [0.235]					
non F and P	0.049 [0.085]	-0.519 [0.202]**	0.025 [0.097]	-0.501 [0.221]**					
Distance from House in Km	0.074 [0.016]***	0.081 [0.015]***	0.07 [0.016]***	0.078 [0.015]***	0.076 [0.019]***	0.089 [0.024]***	0.132 [0.051]***	0.313 [0.135]**	0.249 [0.143]*
Fixed Effects	No	No	No	No	Village	Village	HH	HH	HH
Other Plot Controls		No		No		No		No	Yes
N. Observations	6,517	5,247	6,464	5,226	6,387	3,896	2,277	844	807