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Representation of property rights and credit market outcomes: Evidence from a land reform in Vietnam*

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Abstract

This article evaluates the impact of a land certification program on credit market outcomes in rural Vietnam. We hypothesize that the representation of property increases households' participation in formal credit markets. We compare credit market outcomes for certified and non-certified households controlling for socio-economic and geographic characteristics, and use an instrumental variable approach exploiting a partial delay in program rollout. Certified households are more likely to borrow from formal banks with a collateral-based lending policy. There is no evidence for an effect on borrowing from formal sources without such a policy. Moreover, certified households pay lower interest rates on formal loans than non-certified households on formal and informal loans.

Keywords: Credit; Land reform; Vietnam

JEL classification codes: (JEL C2, O1)

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1 Introduction

The fundamental importance of property rights for economic development is well recognized. With respect to credit markets, de Soto (2003: p. 64) states: “To create credit and investment, what people encumber are not the physical assets themselves, but their property representations – the recorded titles and shares – governed by rules that can be enforced nationwide.” Besley and Ghatak (2009) call this the de Soto effect. Improving property rights increases effective wealth of households and is therefore believed to have a loan portfolio effect. At the intensive margin, households substitute informal credit with formal credit as the price of the latter is lower.

Starting in 1988 the Vietnamese government initiated agricultural reforms as part of the greater endeavor to transform Vietnam from a socialist to a market economy. As a crucial step, land-use certificates (LUCs) started to be issued from 1993 onwards to strengthen individual property rights over land and hence increase efficiency in agriculture vis-à-vis the collective mode of production. One potential efficiency outcome is to improve household access to formal credit.

The goal of this paper is to evaluate whether the land certification program has contributed to the formalization of household credit in rural Vietnam. Between 1993 and 2004 the share of households with a positive LUC status increased from roughly 6 to 72 percent. During the same period of time the share of formal loans in household borrowing (as a simple loan count of formal loans relative to the total number formal and informal loans) increased from less than 30 to almost 65 percent.¹

To understand the relationship, we develop a simple model of competition between a formal and informal lender (such as moneylender, relatives or friends). The primitives of the model are in line with the previous literature² on this topic: the formal lender has a lower refinancing rate than the informal lender and the informal lender has an informational advantage vis-à-vis the formal lender. Additionally, we introduce three new aspects that are consistent with empirical evidence: borrowers differ in their risk-preferences, the informal lender is able to smooth consumption of borrowers, and the formal lender faces both moral hazard and adverse selection on the borrowers’ ability and risk-aversion.

In the absence of collateralizable capital, the formal lender cannot distinguish between borrowers with high and low ability. Hence, it adversely selects borrowers with low ability and low risk-aversion. All other borrowers are financed by the informal lender. However, when all borrowers have capital, the formal lender can screen the borrowers’ ability by

¹Own calculation based on the Vietnam Living Standard Survey 1992 and the Vietnam Health and Living Standard Survey 2004.

²See, for example, Jain (1999), Bardhan and Udry (1999), Andersen and Malchow-Møller (2006).

offering a contract with a low loan rate and high collateral requirement (that is chosen only by high-ability borrowers) and a contract with a high loan rate and small collateral requirement (that is chosen by low-ability borrowers with low risk-aversion). The informal lender then only finances borrowers with low ability and high risk-aversion. Hence, the introduction of capital increases the share of investments that are financed by the formal lender and decreases the average loan rate of formal loans.

We estimate the relationship between certification status and credit market outcomes under two approaches. First, we least-squares estimate the relationship of interest under the conditional independence assumption. Second, we estimate the empirical relationship in an instrumental variable approach using two-stage least-squares. Our instrumentation strategy is best understood through the administrative structure of Vietnam (national level, provinces, districts and communes). There is no delay in the rollout of the program across provinces, but a clear delay within provinces. We take the delay in program rollout at the district level, the administrative unit subordinate to the communes in which households live, as instrument. Do and Iyer (2008) and Haque and Montesi (1997) argue that the delay is the result of a lack of resources by the central government devoted to the program. While this explains the existence of a delay per se, it does not explain why the program started earlier in some districts than in others. We demonstrate that the delay in the start of the program is due to geographic factors such as the distance to the province capital (as the subordinate unit of administration) as well as the size of the province.

We find that certified households are indeed more likely to borrow from the Vietnam Bank of Agriculture and Rural Development (VBARD), a bank with a clear collateral-based lending policy. We do not find evidence for an effect on borrowing from formal sources such as the Vietnam Bank for Social Policy (VBSP), the People's Credit Fund and the Job Placement Fund without such a policy. Certified households are less likely to borrow from informal sources such as family and friends and moneylender. Certified households also pay lower interest rates on formal loans as compared to both non-certified households in the formal as well as the informal sector.

Our work relates to the research on the efficiency outcomes of the Vietnamese land reform, namely the functioning of the introduced land markets and its redistributive consequences (see, for instance, Deininger and Jin, 2008, Do and Iyer, 2008 and Ravallion and de Walle, 2008) and the effects on agricultural investment behavior (Do and Iyer, 2003 and 2008).

It also relates to empirical studies on the land reform-credit sector channel in other countries (Feder and Feeny, 1991 and Siamwalla, 1990, in Thailand, Pender and Kerr, 1999, in India, Carter and Olinto, 2003, in Paraguay, Boucher et al., 2005, in Honduras and Nicaragua, Torero and Field, 2005, in Bolivia and using earlier data, Do and Iyer,

2003 and 2008, in Vietnam).

This paper is structured as follows. Section 2 relates the effect of collateral on credit market outcomes in a theoretical model. Section 3 describes data and the certification program. Section 4 describes the econometric framework and the identification strategy. Section 5 presents the results and section 6 concludes.

2 Theoretical framework

2.1 Economic theory and the effect of collateral on credit market outcomes

We develop a simple model where a formal and an informal lender compete for a borrower. The informal lender may be a moneylender as well as the borrower's relatives or neighbors. Our focus of interest is the effect of capital that can be pledged as collateral on the equilibrium outcome. The primitives of the model are in line with previous work on this topic (Jain 1999, Bardhan and Udry 1999, Andersen and Malchow-Møller 2006): the formal lender has a lower refinancing rate than the informal lender and the informal lender has an informational advantage vis-à-vis the formal lender. We introduce three new aspects that are consistent with empirical evidence on credit markets in developing countries. First, the borrower is risk-averse.³ Second, the informal lender is able to smooth consumption of the borrower.⁴ Third, the formal lender faces both a moral hazard and an adverse selection problem.⁵ One advantage of our model is that both the formal and the informal lender stay in business when capital is introduced. This feature allows us to derive a number of testable implications.

This section is structured as follows. In Section 1.1, we introduce the formal model. In Section 1.2, we characterize the equilibrium outcome when the borrower has no capital. In Section 1.3, we characterize the equilibrium outcome when the borrower has capital that can be pledged as collateral. In Section 1.4, we summarize the testable implications of the model.

2.2 The basic set-up without collateral

We consider a game with three players: a risk-averse borrower A , a risk-neutral formal lender B , and a risk-neutral informal lender M . The game consists of five stages. In stage 1, B offers loan contracts to A . In stage 2, M observes B 's decision and offers loan

³See, for instance, Tanaka et al. (2010) for Vietnam.

⁴The seminal paper that establishes this fact is Udry (1994).

⁵This is widely accepted. However, most models only consider either the moral hazard or the adverse selection problem.

contracts to A . In stage 3, A chooses at most one of M 's or B 's contracts. In stage 4, A exerts effort or not. In stage 5, payoffs are realized and transfers are made between the parties of the chosen contract. Our solution concept is Perfect Bayesian Equilibrium.

The borrower A . A has one of four types, indexed by $ij \in \{LL, LH, HL, HH\}$, where i denotes A 's risk and j denotes her risk aversion. The probability of being the ij -type is β_{ij} . Define $\beta_i = \beta_{iL} + \beta_{iH}$. A is endowed with a project that requires an initial investment I . This investment has to be financed by a loan either from B or from M . After choosing a contract, A either exerts effort ($e = 1$) or not ($e = 0$). The cost of effort is given by $c > 0$. If A exerts effort, then with probability p_i the project is successful and produces a payoff of $V > 0$; with probability $1 - p_i$ it fails and produces a payoff of 0. If A does not exert effort, the probability of success is given by \bar{p} . A is risk-averse. Her utility from a lottery \tilde{x} is given by $E(\tilde{x}) - r_j \text{Var}(\tilde{x})$, where r_j is the coefficient of absolute risk aversion of the ij -type.

The formal lender B . B 's refinancing rate is normalized to 1. It neither observes A 's type, nor the effort A exerts. As long as there is no collateral, B can request a payment from A only in case of success.⁶ Therefore, a contract is fully described by a loan rate R^B . If B finances A 's project, then in case of success B 's [A 's] payoff [net of effort cost] is $R^B - I$ [$V - R^B$], while in case of failure it is $-I$ [0].

The informal lender M . M 's refinancing rate is $1 + \gamma$, where $\gamma > 0$. It observes both A 's type and the effort A exerts. Hence, M can discriminate between different types. A contract for the ij -type takes on the form $(R_{ij}^M, W_{ij}, e_{ij})$, where R_{ij}^M is the loan rate, $W_{ij} \geq 0$ a payment from M to A in case of failure, and e_{ij} the effort A has to exert. If A has type ij and M finances A 's project, then in case of success B 's [A 's] payoff [net of effort cost] is $R_{ij}^M - (1 + \gamma)I$ [$V - R_{ij}^M$], while in case of failure it is $-W_{ij} - (1 + \gamma)I$ [W_{ij}]. A contract $(R_{ij}^M, W_{ij}, e_{ij})$ where $V - R_{ij}^M = W_{ij}$ is called full insurance contract.

Assumptions. To simplify the analysis, we make some assumptions on the parameters. Define

$$\bar{r}(V, I, p_L, \gamma) = \frac{\gamma I}{p_L(1 - p_L) \left(V - \frac{I}{p_L}\right)^2}. \quad (1)$$

Assumption (A1). $1 = p_H > p_L > \bar{p} \geq 0.5$.

Assumption (A2). $(p_L - \bar{p})V > \gamma I + c$.

⁶We implicitly assume that there are no enforcement problems.

Assumption (A3). $p_L V - (1 + \gamma)I > c$.

Assumption (A4). $(p_L - \bar{p}) \left(V - \frac{I}{p_L} \right) \geq c$.

Assumption (A5). $\frac{\beta_H + \beta_{LL}}{\beta_H + \beta_{LLPL}} > 1 + \gamma$.

Assumption (A6). $r_L \in \left[0, \min \left\{ \bar{r}(V, I, p_L, \gamma), \frac{I}{(V-I)^2} \right\} \right)$ and $r_H \in \left(\bar{r}(V, I, p_L, \gamma), \frac{1}{V-I} \right)$.

The assumption that $p_H = 1$ in (A1) simplifies the characterization of the equilibrium contracts for the HL - and HH -type. All of our results (except the details of the equilibrium contracts) hold as long as p_H is sufficiently close to 1. The rest of (A1) guarantees that effort provision decreases the variance of outcomes. (A2) enables M to match any contract from B that breaks even when the agent does not exert effort. (A3) ensures that effort provision is always efficient. (A4) enables B to offer contracts such that A exerts effort and B makes at least zero expected profits. (A5) requires that there is a substantial probability of A being the LL -type and that the interest rate that B must charge to the LL - and LH -type to break even, $\frac{1}{p_L}$, is larger than M 's refinancing rate $1 + \gamma$. (A6) confines the level of risk aversion. The upper bound on risk aversion, $\frac{1}{V-I}$, ensures that A 's expected utility always decreases in the loan rate of a contract. The role of the other restrictions in (A6) will be discussed below.

2.3 Equilibrium without capital

We now examine the equilibrium outcome. M 's advantage is that it has complete information, while B faces both moral hazard and adverse selection. Hence, M can offer contracts that implement effort provision and supply A with full insurance. On the contrary, B has lower financing costs. It therefore can offer contracts with relatively low loan rates. However, a loan from B leaves A with financial risk that reduces her expected payoff by a risk premium.

The insurance motive is especially important for the LH -type who both faces a high risk of failure and has high risk aversion. The restriction on r_H in (A6) ensures that M always can profitably make a counteroffer to the LH -type that is more attractive for her than B 's contract (that generates at least zero-profits for B). For the LL -type the insurance motive is less important as she has lower risk aversion. The HL - and HH -type can mitigate any financial risk through effort provision.

In the absence of collateral, B cannot discriminate between types with high and low risk. If it wishes to serve the HL - and HH -type by offering a low loan rate R^B , it also attracts the LL -type. (A5) implies that in this case M can make a counteroffer to the

HL - and HH -type that is more attractive for them than a contract from B that pools the HL -, HH - and LL -type. The HL - and HH -type therefore purchase contracts from M . B earns positive profits only if it charges a relatively high loan rate that adversely selects high risk types that are not too risk-averse. The restriction on r_L in (A6) ensures that B can profitably offer a contract that is more attractive for the LL -type than any of M 's contracts (that generates at least zero-profits for M) and where the LL -type exerts effort after purchasing this contract.

When B sets R^B , it has to take care of the LL -type's participation and incentive constraint. Denote by \tilde{R}^B the optimal solution. If c is relatively low (or γ relatively high), then the participation constraint binds at \tilde{R}^B while the incentive constraint does not. In this case, the LL -type is indifferent between B 's and M 's contract offers. If c is relatively high (or γ relatively low), then the incentive constraint is binding at \tilde{R}^B and the LL -type strictly prefers B 's contract to any of M 's contracts (that generate at least zero-profits for M). The following result summarizes our findings.

Proposition 1 *If (A1) – (A6) hold, then an equilibrium exists and in any equilibrium (i) the LL -type purchases a contract from B with a uniquely defined loan rate $\tilde{R}^B > I/p_L$, (ii) the LH -type purchases the full insurance contract $(\tilde{R}_{LH}^M, \tilde{W}_{LH}, 1)$ from M , where $\tilde{R}_{LH}^M = (1 - p_L)V + p_L\tilde{R}^B + r_{HP_L}(1 - p_L)(V - \tilde{R}^B)^2$, and (iii) the HL - and HH -type purchase a contract $(\tilde{R}^B, \tilde{W}_H, 1)$ from M .*

Proof. See Appendix. ■

2.4 Equilibrium with capital

Assume now that A is equipped with capital that can be pledged as collateral.⁷ Let the value of this capital be given by $K > (1 + \gamma)I$. To screen different types, B now can offer any number of contracts, $(R_1^B, C_1), (R_2^B, C_2), \dots$, where $C_k \leq M$ is the collateral to be seized in case of failure. If A purchases a contract (R^B, C) from B , then in case of success B 's [A 's] payoff [net of effort cost] is $R^B - I$ [$V - R^B$], while in case of failure it is $-I + C$ [$-C$]. Similarly, M can specify a negative payment W_{ij} to A in case of failure, where $W_{ij} \geq -K$. The rest of the model remains the same.

If A pledges capital as collateral, this may increase her exposure to financial risk. The HL - and HH -type can avoid this additional risk through effort provision. Hence, B can offer a contract with a low loan rate that is more attractive for the HL - and HH -type than any of M 's contract offers (which generate at least zero-profits for M).

⁷In the appendix, we show that our main results also obtain if agents have to exert costly effort to get capital.

If the corresponding collateral requirement is sufficiently high, this contract will not be chosen by the LL – or LH –type. Competition between B and M then drives the loan rate of this contract down to $(1 + \gamma)I$. This substantially improves the HL – and HH –type’s position in the loan market compared to the case without capital.

Things may also change for the LL – and the LH –type, but not for the better. Again, B can profitably offer a contract to the LL –type that is more attractive than any possible counteroffer by M (that generates M at least zero-profits). However, by increasing her collateral requirement, B can always ensure that the LL –type has sufficient incentives to exert effort after purchasing B ’s contract. This implies that B can extract rents from the LL –type until the participation constraint is binding. In equilibrium, the LL –type will therefore purchase a contract from B where she is indifferent between this contract and the contract from M that would be best for her and that generates zero-profits for M . If c is relatively high (or γ relatively low), then expected utility of the LL –type decreases compared to the case without capital. In this case, also the expected utility of the LH –type is lower than when there is no capital.⁸ We get the following equilibrium outcome.

Proposition 2 *Suppose that A has capital $K > (1 + \gamma)I$. If (A1) – (A6) hold, then an equilibrium exists and in any equilibrium (i) the LL –type purchases contract $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ from B , where $\tilde{R}_{LL}^B = \tilde{R}^B + \tilde{C}_{LL}$ and \tilde{C}_{LL} is uniquely defined, (ii) the LH –type purchases a full-insurance contract $(\tilde{R}_{LH}^M, \tilde{W}_{LH}, 1)$ from M , where $\tilde{R}_{LH}^M \leq (1 - p_L)V + p_L\tilde{R}_{LL}^B + (1 - p_L)\tilde{C}_{LL} + r_{HP}p_L(1 - p_L)(V - \tilde{R}_{LL}^B + \tilde{C}_{LL})^2$, and (iii) the HL – and HH –type purchase a contract $((1 + \gamma)I, C_H)$ from B , where $C_H > 0$.*

Proof. See Appendix. ■

2.5 Implications

Proposition 1 and Proposition 2 provide the basis for a number of testable implications. The introduction of capital helps the HH – and HL –type to signal their type as they are willing to accept contracts with substantial collateral requirements, while the LL – and LH –type will not purchase such contracts. Hence, the generation of capital increases the probability that B finances A from β_{LH} to $\beta_{LH} + \beta_H$. In the following, we describe the effects of capital on A ’s expected payoff, average loan rates, default rates, lender profits and the average degree of risk aversion in the formal and informal credit market.

⁸Note that B can offer a contract that serves as an outside option for the LH –type, but is not purchased in equilibrium. This contract must be designed such that it is not more attractive for the LL –type than the contract that maximizes B ’s profits with the LL –type. Hence, it must have a loan rate that exceeds \tilde{R}^B .

A's expected payoff. When there is no capital, the HH - and HL -type purchase a contract from M with a loan rate of $\tilde{R}^B > \frac{I}{p_L}$. When there is capital, they purchase a contract from B with a loan rate of $(1 + \gamma)I$, which implies a substantial improvement in expected payoffs. The effect of capital on the expected payoff of the LL - and LH -type depends on c and γ . If c is relatively low (or γ relatively high), such that only the participation constraint of the LL -type is binding when there is no capital, then the LL -type gets the same contract when there is capital. This contract also defines the outside option of the LH -type. However, if c is relatively high (or γ relatively low), such that the incentive constraint, but not the participation constraint is binding when there is no capital, then the LL -type purchases a contract with higher loan rate and positive collateral requirement when there is capital. This decreases expected payoffs of both the LL - and LH -type.

Average loan and default rates. When there is no capital, B only sells contracts to the LL -type at a rate $\tilde{R}^B > \frac{I}{p_L}$. When there is capital, the LL -type gets a contract with loan rate \tilde{R}_{LL}^B , which may exceed \tilde{R}^B . However, B then also finances the projects of the HL - and HH -type at the loan rate $(1 + \gamma)I$. Thus, the average loan rate becomes

$$\frac{\beta_{LL}\tilde{R}_{LL}^B + \beta_H(1 + \gamma)I}{\beta_{LL} + \beta_H}, \quad (2)$$

which is lower than \tilde{R}^B if β_{LL} is sufficiently small or if c is sufficiently small (such that $\tilde{R}_{LL}^B = \tilde{R}^B$). The effect of capital on default rates is unambiguous. When there is no capital, the default rate equals $1 - p_L$, while it is

$$\frac{\beta_{LL}}{\beta_{LL} + \beta_H} (1 - p_L), \quad (3)$$

when there is capital. For M , the default rate moves in the opposite direction.

Expected profits of lenders. B unambiguously benefits from the generation of capital. When there is no capital, its expected profit is $\beta_{LL}(p_L\tilde{R}^B - I)$, while it is

$$\beta_{LL}(p_L\tilde{R}_{LL}^B + (1 - p_L)\tilde{C}_{LL}) - I + \beta_H\lambda I \quad (4)$$

when there is capital, which exceeds $\beta_{LL}(p_L\tilde{R}^B - I)$ as $\tilde{R}_{LL}^B \geq \tilde{R}^B$. M loses the business with the HL - and HH -type through the introduction of capital. However, depending on the contracts B offers, it may increase its profits from business with the LH -type.

Average degree of risk-aversion. Through the introduction of capital, the average risk aversion of agents in the formal and informal credit market increases. The average risk aversion of agents in the informal credit market increases from

$$\frac{(\beta_{HH} + \beta_{LH})r_H + \beta_{HL}r_L}{\beta_H + \beta_{LH}} \quad (5)$$

to r_H , while in the formal credit market it increases from r_L to

$$\frac{(\beta_{HL} + \beta_{LL})r_L + \beta_{HH}r_H}{\beta_H + \beta_{LL}}. \quad (6)$$

3 Data and program

This section describes the data employed in this study (subsection 3.1) as well as the land reform in Vietnam (subsection 3.2 to 3.4). The individualization of use-rights to land was carried out in two subsequent steps: First, the decollectivization comprising the allocation of land to households as well as the documentation of land with long term use-rights. However, the shortcoming of this reform led, second, to the replacement of long term use-rights with land-use certificates (LUCs) in another reform. The intention was the creation of a land market, but it also allowed for the usage of LUCs as collateral. This second reform is subject to the empirical analysis below.

3.1 Data

In this study we draw on the Vietnam Health and Living Standard Survey 2004 (VHLSS 2004), a data set collected within the World Bank's Living Standard Measurement Survey (LSMS) series. The VHLSS 2004 consists of household and commune survey data. It was conducted roughly 10 years after the start of the LUC program (the law on land, enacted by Vietnam's National Assembly, came into full force and effect on October 15th, 1993).

The VHLSS 2004 combines survey data with a 1-year and 10-year recall period. While we are predominantly interested in the effect of LUC possession on credit market outcomes in 2004 (such as formal and informal borrowing, interest rates on formal and informal loans), this feature allows us to account for current conditions (age, gender and ethnicity of head, education of the head as measured by the highest degree obtained etc.) as well as initial conditions at the time the program began (the amount of land allocated to households, off-farm employment opportunities, ongoing infrastructure projects etc.). In addition, we draw on the Population and Housing Census conducted in 1999. It provides data on the population size per province and the size of the province.

Table 1-3 describe the variables used in the empirical analysis. Table 1 describes the possession of LUCs on the household and commune level. Further, it describes the incidence of borrowing from formal sources such as the Vietnam Bank for Agriculture and Rural Development (VBARD), the Vietnam Bank for Social Policy (VBSP) and other formal sources as well as the incidence of borrowing from informal sources. In 2004, 84.8 percent of the sample households had a positive LUC status. On average,

130 LUCs were issued per district. The dominant lender in rural areas is VBARD. 22.5 percent borrow from this bank, followed by 7.5 percent borrowing from VBSP. Other formal lender include the People Credit Fund and the Job Placement Fund and some other (semi-) formal financial institutions. A substantial number of loans come from informal sources, 5.5 percent of the sample households borrow from a moneylender and 14.8 percent from family and friends. Interest rates in the informal sector are higher than in the formal sector. Moneylender and family and friends charge 3.8 and 1.5 interest per month, VBARD and VBSP 0.97 and 0.58 on average.

Table 2 describes the variety of socio-economic characteristics of the sample households. In our empirical analysis we refer to these variables as controls A. These include a binary indicator equal to one if a household belongs to an ethnic minority in Vietnam, the age and gender of the head as well as head's level of education. Ethnic minorities are oversampled (18.3 percent in the VHLSS 2004). Therefore we weight all regressions with the weights provided in the data set. On average, household heads are 48.6 years of age and predominantly have primary or lower secondary level of education. At the beginning of the certification program roughly 450 square meter of land were allocated to households on average. Further, controls A includes the amount of land allocated to the household at the beginning of the reform period (we could construct this from the land section of the VHLSS 2004 which includes a section on land transactions with a 10-year recall period).

Table 3 describes a wide range of district and province characteristics. It includes the sizes of the province and population (data taken from GSO, 1999). Further, it contains a series of indicators for the presence of a bank, state enterprise, agricultural collectives, individual businesses, private enterprises, foreign enterprises as well as for infrastructure such as a road to district town, roads within the village, bridges, projects for irrigation expansion and consolidation, power, safer water, disposal capacities, land conversion and reclamation, forest plantation as well as the existence of schools and kindergartens in the districts. With the exception of bank all of the variables are evaluated at the beginning of the reform period. We refer to these variables as controls B.

3.2 Land decollectivization

Vietnam has experienced the collectivization and decollectivization of the agricultural sector within a few decades. After the socialist Revolution in 1975 land was collectivized. In the north, agricultural households became organized in cooperatives. Brigades of farmers jointly cultivated land and output was supplied to the cooperative. In the south, farmers were organized in collectives as a preliminary stage to cooperatives. In this regime households cultivated land temporarily assigned to them, shared tools and inputs and managed

outputs collectively. The process of collectivization was not completed due to farmers resistance (see Ravallion and de Walle, 2008b: chapter 2 for a detailed historic account of land policies in Vietnam on which we mainly draw in this subsection).

In the decade to follow, agricultural production was characterized by high inefficiency. Kerkvliet (1995) describes the conditions prior to land decollectivization. Accordingly, discontent with the collective organization of agriculture was widespread among peasants. They refused to pay quotas, quit their fields and circumvented the current collective system through informal transactions. Consequently, the state initiated reforms in the agricultural sector to increase efficiency.

The transition of Vietnam from a socialist to a market economy started with the Doi Moi (renovation) program in 1986. Reforms of the agricultural sector followed soon. Resolution 10 of the land law enacted by Vietnam's National Assembly in 1988 (hence LL 88) took a first step in individualizing rights over land. Land was allocated to households for a period of three to 15 years with the possibility of renewal of tenure. Decisions on the investment and the usage of output were privatized. Individual long term use-rights of households were documented. The LL 88 gave recommendations on how to allocate the land. In particular, land was allocated with respect to the household size and its labor capacity as well as historical claims to land.

There is a debate in the literature to what extent local cadres took advantage of their power in the allocation process (e.g. Pingali and Xuan, 1992). However, there is no systematic evidence of the systematic abuse of power by local cadres. Ravallion and de Walle (1988: 18) point out that their might be the "possibility for a bias in the qualitative historical account". They argue that there are four reasons for that: First, article 54 of the land law threatens to legally prosecute the abuse of power. Second, the existence of social pressure within communes. Third, the organization of farmers due to common interest and a strong preference for equitable outcomes. Fourth, the acceptance of greater freedom to press during the reform. Being affected by misuse of power or not, the land allocation and the guarantee of land-use rights made quick progress. According to Ngo (1993) it was largely completed by 1990.

However, the LL 88 had some shortcomings. Land was not tradeable and could not be used as collateral for credit. Consequently, another land law was passed a couple of years later.

3.3 The certification program

In 1993 another land law was passed (hence the LL93). It introduced land-use certificates (LUCs) allowing for buying, selling, exchanging, leasing, inheriting and mortgaging of land. Land is allocated for 20 years (annual crops) to 50 years (perennial crops) and

tenure can be renewed upon expiry. The relationship between these certificates and the formal credit sector is subject to the empirical analysis below.

Before we detail the rollout of the program, we briefly digress into governance. Vietnam is a one-party state ruled by the Communist Party. The aforementioned National Assembly is the legislature of the state. The country is administered on 4 levels: National government, provinces, districts and communes. The Communist Party reaches down to the commune level through the People's Committee.

Among other tasks the LL 93 assigned land registration, the establishment and maintenance of land registers and the granting of certificates to the right of land-use to the state (article 13). The responsible government agency was the General Department of Land Administration (GDLA) which established a countrywide four-level system consisting of the GDLA at the government level, the Department of Land Administration belonging to the People's Committee of the district and one or two land officers at the commune level (Dang, 1997, Dang and Palmkvist, 1997).

The LL 93 declared that the transfer of the rights to use land shall be determined by the people's committee of the village (article 31) in coordination with the people's committee at the district level (article 32). Land is registered after allocation and land registers must be maintained (article 33) before authorities issue the certificates (article 36).

Do and Iyer (2008) give a precise description of the implementation of the certification program. First, the commune-level People's Committee gets in touch with the district GDLA on behalf of its villagers. Second, the district GDLA then goes into the commune to make a list of all land users, train staff and check and update land-related documents such as cadastral maps and land survey records. Third, a land registration committee is set up including district GDLA staff as well as officials from the PCP on the commune, district and sometimes province level. The implementation of these steps takes 4-5 weeks.

Fifth, land-users in the commune have to list all plots allocated to them. This form has also to be signed by neighbors to demonstrate the absence of dispute over land claims. Sixth, the land registration committee checks the application in a meeting and decides whether it is eligible or not. Ten days after the meeting, eligibility of the applicants is made public.

If the figures given in Do and Iyer (2008) are accurate, the implementation up to this point takes roughly six weeks per commune. This raises the question as to where the delay comes into existence if not at the grassroot level. They argue that there is a delay on the seventh and last step of the implementation in which the list of eligible land users is sent to the district GDLA which starts with the issuance of LUCs for all land users without conflicting claims. Disputed land claims are referred to a special working group of the GDLA. However, even for the undisputed claims Do and Iyer estimate that the

issuance of the certificates takes 1500-2000 man days. Referring to Haque and Montesi (1996) they attribute the slow progress in LUC issuance at the final stage to a lack of adequate finances, trained cadres as well as interest and enthusiasm by officials as well as a lack of supervision. However, this does not explain why the delay in rollout increases with remoteness of the communes. In the next section we discuss geographic factors as the cause of the delay in program rollout.

3.4 Delay in rollout

Looking at table 4 we can see that there was no delay in rollout at the province level, but a clear delay within provinces. We define delay as a binary dummy equal to one if the program started in 1995 or later.⁹ The start of the program was dated as the year when the first LUC in a particular province was issued.

Consequently, the program started in 63 out of 64 provinces (or 98.4 percent) without delay. However, looking at the 574 districts in our sample, there was a delay in 272 districts (or 47.4 percent). Table 5 gives some suggestive evidence on reasons for the delay within provinces. In column (1) we regress the indicator for delay on a constant and the road distance to one of the major Vietnamese cities (Hanoi, Haiphong, Danang, Ho Chi Minh City). We find no statistically significant relationship. In turn, regressing delay on a constant and the road distance to the province capital we find a strong positive relationship. If the distance between district and the province capital increases by 100 km, the probability of delay increases by 7 percent. This has a twofold implication: The implementation of the reform is decentralized and remoteness within provinces matters. However, we will not overstretch the interpretation of these coefficients. Given that the distance measures are self-reported by local cadres interviewed for the VHLSS we presume significant measurement error. There is also an issue with missing values, in particular for the self-reported distance to the next major city. Hence we will not employ these measures in our empirical analysis.¹⁰

Column (3) presents the results of a regression of delay on the size of the province. We find a very strong relationship. Districts located in bigger provinces are, on average, more affected by a delay in rollout. The fact that geography matters will be considered in our regression analysis below.

⁹Remember that the law came into full force and effect on Oct. 15th, 1993. We include 1994 in the no delay category because the program started late in 1993.

¹⁰Currently we are working on GIS data which will be contained in a revised version of this paper.

4 Econometric methods

4.1 Certification status and credit market outcomes

This paper attempts to evaluate the causal relationship between the LUC status and credit market outcomes in 2004. The identification of this relationship depends on a number of controls evaluated in 2004 terms as well as the beginning of the program in 1994. We mainly concentrate on the following regression where the unit of observation is typically the household:

$$y_{ij} = \alpha + X_{ij}\beta + \gamma LUC_{ij} + u_{ij} \quad (7)$$

where the dependent variables are different credit market outcomes such as formal and informal borrowing for household i in district j . The variable $LUC = 1$ denotes the household-specific possession of a LUC for at least one plot and $LUC = 0$ denotes the absence of LUC possession of households. The matrix X_{ij} contains household and district characteristics evaluated at the year 2004 and the beginning of the project period. We are mainly interested in the coefficient γ as it captures the differences in credit market outcomes for households possessing and not possessing LUCs.

We relate the predictions of the theoretical model to the effect of collateral on credit markets. The error term u is allowed to be correlated across households within the same district.

If LUC allocation was randomized across the population, causal effects were rather trivial to estimate. In this case all households had the same probability of LUC issuance and c were statistically independent of y .

However, in the context of land certification it is hard to argue that LUC is truly randomized across the population. As demonstrated above, households had to put substantial effort into the land registration procedure. Therefore, they (at least) partly determine whether they obtain land certification. The decision to get involved in the administrative processes required for certification might be related to its benefits (such as improved access to formal credit). We cannot exclude statistical dependence between LUC and y due to self-selection of households into LUC possession.

Concerning y , we make the stable unit treatment value assumption (Rubin, 1980) stating that the treatment of a particular household affects only the borrowing outcome of this household, that is households do not compete for resources and loans will be given to all meeting the eligibility criteria of banks. This presumes the absence of a general equilibrium treatment effects (Heckman et al., 1998). Consequently, the treatment effect of the policy intervention does neither depend on other households treated nor on the market interactions between treated and untreated. That is, the effect on LUCs on

borrowing outcomes to be estimated is invariant to the number of borrowing and non-borrowing households in the economy. Below, we show in more detail why the relationship we want to estimate is rather partial than general equilibrium in nature.

4.2 The certification procedure and the instrumental variable approach

The major concern for estimation is the non-random allocation of LUCs among households which may respond to local economic conditions as well as household characteristics. We address this concern through instrumenting LUC status on the delay in the start of the program, a delay which is determined outside the empirical relationship of interest and therefore independent of (unobserved) local economic conditions and (unobserved) household characteristics. However, as we find that the assumption that the delay in rollout has a constant effect on the probability of certification to strong (consider an extreme case: a household living in district where certification program started in 1993 had same probability of a positive certification status than a household living in a district where the program started in 2003), we allow for a nonlinearity in the parameter. The first-stage of the estimation procedure relates the binary certification status (LUC) to the delay in program rollout ($DELAY$) and the squared delay ($DELAY$)² in program rollout:

$$LUC_{ij} = a + bDELAY_j + c(DELAY_j)^2 + X_{ij}\beta + e \quad (8)$$

The choice of this form of nonlinearity is not arbitrary. Table 6 and 7 show the estimation of the first stage under various specifications. Column (1) to (3) in table 6 respectively regress the LUC status on a constant and delay, delay and delay squared as well as delay, delay squared and delay cubed. We find that the specification (1) and (2) yield highly significant coefficients of interest, while in specification (3) only the cubed term is significant. We find similar evidence for adding province fixed effects (table 6, column (4) to (6)), adding controls A plus B (table 7, column (1) to (3)) and adding controls A plus B and province fixed effects (table 7, column (4) to (6)). Further, for the regressions on delay and delay plus squared delay the coefficients remain fairly stable and highly significant across all specifications. The instrument has a highly predictive power for the certification status.

The other concern for identification is whether the exclusion restriction holds, that is, the only channel through which the delay affects credit market outcomes is via certification status. One plausible channel, for instance, could be migration. Say, a farmer being in need of credit and living in a district with a delay in the program decides to move to another district where there is no delay. He could move to another district, however, he

could not transfer his documented land-use right for the land allocated to him to another district as land was not tradeable. Of course, this does not rule out the informal exchange of land between farmers living in two different districts. However, given that names were put on the land document and that land exchange was officially forbidden made informal land swapping highly unlikely.

Another channel could be that the delay in poorer districts is more pronounced or, put differently, that the program has a faster rollout in richer districts (e.g. because land officers hope for bribes). Consequently we may overestimate the effect of the program. Unfortunately we cannot control for income levels in districts at the time the program started. However, we can check whether the delay is statistically related to a number of factors most plausibly highly correlated with income levels in districts. Regressing delay on the binary indicator for the presence of state enterprise, agricultural collectives, individual businesses, private enterprises and foreign enterprises we do not find any significant statistical relationship.

A third channel could be that the delay is due to disputes over land claims among villagers. However, this is no concern for our empirical analysis. First, disputed and undisputed claims to land are treated differently in the certification procedure. While the issuance of certificates to the latter could start, unresolved disputes were referred to a special working group within the GDLA (Do and Iyer, 2003: p.8). Our identification strategy was thus affected only if *all* sample households within a district were affected by a land dispute. In fact, looking at some descriptive statistics from the VHLSS 2004 we see that only few communes were affected by disputes over land.

5 Certification status and credit market outcomes

5.1 Formal borrowing (VBARD)

The main formal source of borrowing we focus on is the Vietnam Bank of Agriculture and Rural Development (VBARD). It is the largest commercial bank in Vietnam by total assets and according to Cheshier and Penrose (2007) also the largest corporation in Vietnam. It is a state-owned corporation under a special status. The bank operates 2,200 branches nation-wide. It has a branch in virtually all of the Vietnamese districts. It offers a variety of financial services such as transaction accounts, insurance products, stock brokerage, investment banking, asset-based lending, consumer finance, trade, international payments and foreign exchange. Since Decision No. 67/1998 issued by the government in 1998, VBARD offers loans to farm households for agricultural and rural development and for the expenses of business operation in rural areas. Bigger loans require either collateral or a cosigner. However, this type of financial service accounts only for a small share of

the bank's business activity.¹¹

Table 8 shows a series of regression of a binary dummy equal to one if a household borrowed from VBARD during the reference period (and zero if it did not) on the binary LUC status under varying specifications. Column (1) shows the result of a simple regression borrowing on a constant on LUC status. Accordingly the effect of LUC possession increases the probability of borrowing from VBARD by 9.8 percent. Adding fixed effects for the respective provinces alter the estimated coefficients only marginally (column(2)). In column (3) and (4) we split the sample into what used to be north and south Vietnam. We find that the effect is much more pronounced for households dwelling in the southern part of the country.

In table 9 we subsequently add three sets of controls to the OLS regression in table 8. Generally, we see that the estimated coefficient is very stable and highly significant across the specifications in table 8 (column (3) and (4)) and table 9 (column (1) to (6)). It varies between 8.8 and 9.9 percent.

To be more specific, column (1) and (2) of table 9 show the results of a regression of the binary indicator for VBARD borrowing on LUC status and the controls A without and with province fixed effect are 9.5 and 8.8 percent. Making the same regressions with control B without and with province fixed effects (column (3) and (4)) as well as controls A plus B without and with province fixed effects reproductively estimate an effect of 9.3, 9.5, 8.8 and 8.8 percent. However the results in table 8 and 9 contain least-squares regressions. The estimated coefficients are causal under the conditional independence assumption. However, we cannot rule out the existence of omitted variables due to self-selection. Consequently, we estimate the relationship between LUC possession and VBARD borrowing instrumenting LUC on delay and squared delay in program rollout on district level.

Table 10 contains the results. Estimating the regressions by 2SLS and instrumenting on the delay and squared delay in program rollout we estimate a higher coefficient than in the OLS regressions. Estimating the relationship without controls, with controls A, with controls B, with controls A plus B and with controls A plus B and province fixed effects estimates an effect of 17.9, 18.9, 13.9, 13.1 and 8.6 percent. All specifications but the last yield significant results.

Table 11 includes some robustness checks for the regression of interest. In column (1) to (2) delay squared is dropped from the first-stage regression.

Column (3) and (4) provide some evidence on the possible existence of a general equilibrium effect of the certification program. We regress VBARD borrowing in the number of LUCs issued per commune and a constant. If there was a general equilibrium

¹¹Source: <http://www.agribank.com.vn/> (accessed on Feb 12, 2011)

effect the quantity of certificates should affect the probability of VBARD borrowing (e.g. a negative effect because the increase in the demand for credit could lead to credit rationing). However, we do not find evidence for this, This is in line with what was said above about the lending portfolio of VBARD in which households are of minor significance.

5.2 Formal borrowing (other sources)

Besides VBARD, the Vietnam Bank for Social Policy (VBSP) is the second-most important source of credit in rural areas. However, as opposed to VBARD, VBSP has a clear policy focus on the poor and disadvantaged (it used to be called Vietnam Bank for the Poor). It collaborates with mass organizations at the commune level (such as the Farmer's Union and Women's Union). Given the strict policy focus lending schemes of VBSP are group-based rather than collateral-based. We therefore distinguish VBSP and VBARD in our analysis.

Column (1) to (3) in table 12 show the results of a regression of a binary indicator equal to one if a household borrowed from the VBSP and zero if it did not. As expected, a simple OLS regression (column (1)) and 2SLS regressions without and with province fixed effects (column (2) and (3)) do not find evidence for a relationship between LUC possession and borrowing from VBSP.

Other banks are marginal in rural areas. In the VHLSS 2004, they account for less than 2.5 percent of borrowing. Therefore they are not included in our analysis.

Besides banks there are some other formal sources of credit such as the People's Credit Fund and the Job Placement Fund, none of which offers collateral-based lending. Column (4) to (6) in table 12 analyses the effect of LUCs on borrowing from these sources. Again, we estimate the relationship of interest under least-squares (column (4)) and 2SLS without and with province fixed effects (column (5) and (6)). We do not find evidence for an effect of LUC possession on borrowing from these sources.

5.3 Informal borrowing

Although the size of the informal credit sector was shrinking substantially since the beginning of the certification procedure, it still accounts for a big share of household borrowing. The two sources of informal credit are moneylender and family and friends. Column (1) to (3) in table 13 present the effect of LUC possession on borrowing from a moneylender. The dependent variable is again a binary indicator equal to one if a household borrowed from a moneylender and zero if it did not. The results we are finding are somewhat surprising. Regressing the binary indicator on certification status and constant we find a negative relationship. In line with our expectations households possessing a LUC are clearly less likely to borrow from a moneylender (column (1)). However, estimating the relationship

with 2SLS without and with province fixed effects (column (2) and (3)) actually reverts the sign of the relationship. Given that for the IV estimator the relationship of interest is driven by the exogenous variation in the instrument, one possible interpretation is that households affected by a greater delay in rollout had to maintain the credit relationship with moneylender for a longer period of time.

The other important source of informal credit are family and friends. Estimating the relationship of interest with OLS and 2SLS without and with province fixed effects (table 13, column (4) to (6)) we find a negative or no relationship. Land as collateral does not matter for borrowing from family and friends.

6 Conclusion

We find robust evidence for the effect of land certification program in Vietnam on borrowing from the Vietnam Bank of Agriculture and Rural Development, a bank with a collateral-based lending policy towards rural households. As expected, we do not find a relationship between LUC possession and borrowing from other formal sources such as the Vietnam Bank for Social Policy, the People’s Credit Fund and others. Certification has a negative effect on borrowing from informal sources such as moneylender and family and friends (however, we find a somewhat surprising reversion of the effect the effect of LUC on informal borrowing from moneylender under 2SLS). Formal loans taken from certified households charge lower interest rates as compared to both formal loans taken from non-certified households as well as informal loans.

These empirical results can be understood within the theoretical model of competition between formal and informal credit sources. With no collateralizable capital, high-ability borrowers cannot be screened from low-ability borrowers. The formal lender then adversely selects low-ability borrowers with low risk-aversion. When borrowers have collateralizable capital, the formal lender can screen high-ability borrowers from low-ability borrowers by offering contracts with low loan rate and large collateral requirement.

These findings of our study are somewhat surprising given the existing evidence on the land reform-credit sector channel in other countries. Neither Pender and Kerr (1999), nor Carter and Olinto (2003), nor Boucher et al. (2005), nor Torero and Field (2005) find evidence for a certification effect on credit market outcomes in respectively India, Paraguay, Honduras and Nicaragua as well as Bolivia. Neither do Do and Iyer (2003, 2008) using earlier data on Vietnam. Only Feder and Feeny (1991) and Siamwalla (1990) find evidence for such a relationship in Thailand.

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A Appendix

A.1 Proof of Proposition 1

We characterize the contract $(R_{ij}^M, W_{ij}, e_{ij})$ that maximizes the expected utility of the ij -type under the constraint that M earns at least zero profits. (A3) guarantees that

$e_{ij} = 1$ it is always optimal. Hence, this contract is given by the solution of the following maximization problem:

$$\max_{R_{ij}^M, W_{ij}} p_i (V - R_{ij}^M) + (1 - p_i) W_{ij} - r_j p_i (1 - p_i) (V - R_{ij}^M - W_{ij})^2 - c \quad (9)$$

$$\text{s.t. } p_i R_i^M - (1 - p_i) W_i - (1 + \gamma) I \geq 0. \quad (10)$$

Standard arguments show that the optimal contract is given by the full insurance contract $(\bar{R}_{ij}^M, \bar{W}_{ij}, 1)$, where $\bar{R}_{ij}^M = (1 - p_i)V + (1 + \gamma)I$. The expected utility of the ij -type from this contract is $p_i V - (1 + \gamma)I - c$. In the following, this term will frequently be used. (A2) ensures that if B sets R^B such that an agent does not exert effort after purchasing B 's contract, then either B makes negative expected profits or M can offer a contract each type that is more attractive for her than B 's contract and that yields M positive expected profits. Hence, if in equilibrium B earns positive expected profits, it sets R^B such that an agent, who purchases B 's contract, also exerts effort. The rest of the proof proceeds stepwise.

Step 1. We show that in equilibrium B makes positive expected profits. If B sets $R^B = \frac{I}{p_L} + \varepsilon$ and ε is sufficiently small, then (A4) ensures that each type strictly prefers to exert effort if she purchases this contract. Moreover, if ε is sufficiently small, then (A6) ensures that M cannot make a counteroffer that is more attractive for the LL -type than B 's contract and that yields M at least zero-profits. Hence, in equilibrium B earns positive expected profits.

Step 2. We show that in equilibrium B sets $R^B > \frac{I}{p_L}$, finances the project of the LL -type, and M finances the projects of the LH -, HL - and HH -type. Suppose that B sets $R^B < I$. It then either finances no projects or makes negative expected profits and would be better off by choosing $R^B = \frac{I}{p}$. Suppose that B sets $R^B \in \left[I, \frac{(\beta_H + \beta_{LL})I}{\beta_H + \beta_{LL} p_L} \right)$ and finances the projects of the HL - and HH -type. This implies that M cannot make a counteroffer to the HL -type (HH -type) that is more attractive for the HL -type (HH -type) than B 's contract and that yields M positive profits. This is the case if and only if

$$R^B \leq (1 + \gamma) I. \quad (11)$$

The LL -type would also choose B 's contract if M cannot make a counteroffer to the LL -type that is more attractive for her than the contract from B and that yields M positive profits. This is the case if and only if

$$p_L R^B + r_L p_L (1 - p_L) (V - R^B)^2 < (1 + \gamma) I. \quad (12)$$

The LHS of (11) exceeds the LHS of (12) if

$$r_L < \frac{R^B}{(V - R^B)^2}, \quad (13)$$

which is implied by $R^B \geq I$ and (A6). Thus, whenever M cannot make an attractive counteroffer to the HL - and HH -type that yields positive profits for M , this also holds for the LL -type. Consequently, if B sets $R^B \in \left[I, \frac{(\beta_H + \beta_{LL})I}{\beta_H + \beta_{LL}p_L} \right)$, it either finances no projects or earns negative expected profits. Suppose that B sets $R^B \in \left[\frac{(\beta_H + \beta_{LL})I}{\beta_H + \beta_{LL}p_L}, \frac{I}{p_L} \right)$. M cannot make a counteroffer to the HL -type (HH -type) that is more attractive for HL -type (HH -type) than B 's contract and that yields M positive profits only if

$$\frac{\beta_H + \beta_{LL}}{\beta_H + \beta_{LL}p_L} \leq (1 + \gamma), \quad (14)$$

which is ruled out by (A5). Hence, if B sets $R^B \in \left[\frac{(\beta_H + \beta_{LL})I}{\beta_H + \beta_{LL}p_L}, \frac{I}{p_L} \right)$, it either finances no projects or makes negative profits. Suppose that B sets $R^B \geq \frac{I}{p_L}$. Note that (A5) implies $\frac{1}{p_L} > 1 + \gamma$. Hence, M can make a counteroffer to the HL -type (HH -type) that is more attractive for the HL -type (HH -type) and that yields M positive profits, neither the HL - nor the HH -type purchase B 's contract in equilibrium. Define

$$F(R^B) = p_L (V - R^B) - r_H p_L (1 - p_L) (V - R^B)^2. \quad (15)$$

We have $\frac{dF(R^B)}{dR^B} < 0$ if and only if

$$r_H < \frac{1}{2(1 - p_L)(V - R^B)}. \quad (16)$$

As $R^B \geq \frac{I}{p_L}$ and $p_L > 0.5$, this inequality is implied by (A6). Hence, M can make a counteroffer to the LH -type that is more attractive for them than B 's contract and that yields M positive profits if

$$I + r_H p_L (1 - p_L) \left(V - \frac{I}{p_L} \right)^2 > (1 + \gamma) I, \quad (17)$$

which is implied by $r_H > \bar{r}(V, I, p_L, \gamma)$. Hence, if B sets $R^B \geq \frac{I}{p_L}$, then it does not finance the projects of the LH -, HL - and HH -type. It follows that B does not earn positive expected profits by setting $R^B \leq \frac{I}{p_L}$. It earns positive expected profits only if it sets $R^B = \frac{I}{p_L} + \varepsilon$ with ε sufficiently small such that the LL -type purchases B 's contract. Hence, the LL -type must purchase B 's contract in equilibrium.

Step 3. We derive the equilibrium outcome. By step 2, the contract that maximizes B 's expected profit is given by a solution of the following maximization problem:

$$\max R^B \quad (18)$$

$$\text{s.t. } (p_L - \bar{p})(V - R^B) - r_L(p_L - \bar{p})(1 - p_i - \bar{p})(V - R^B)^2 \geq c, \quad (19)$$

$$p_L(V - R^B) - r_L p_L(1 - p_L)(V - R^B)^2 \geq p_L V - (1 + \gamma)I. \quad (20)$$

One easily observes that this problem has a unique solution \tilde{R}^B . This defines the other types' outside option and hence the contract that M offers to each type. **QED**

A.2 Proof of Proposition 2

The expected utility of the ij -type from a contract (R^B, C) equals

$$\max \left\{ p_i (V - R^B) - (1 - p_i) C - r_j p_i (1 - p_i) (V - R^B + C)^2 - c, \right. \\ \left. \bar{p} (V - R^B) - (1 - \bar{p}) C - r_j \bar{p} (1 - \bar{p}) (V - R^B + C)^2 \right\}. \quad (21)$$

By (A2), the only contract that maximizes the utility of the Lj -type, $j \in \{L, H\}$, under the constraints that B earns at least zero profits and $C \geq 0$, is $\left(\frac{I}{p_L}, 0\right)$. The rest of the proof proceeds stepwise.

Step 1. We show that there is a unique contract $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ that maximizes B 's profit out of contracts with the LL -type, and that this contract takes on the form $(\tilde{R}^B + \tilde{C}_{LL}, \tilde{C}_{LL})$. $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ must be designed such that M cannot make a counteroffer to the LL -type that is more attractive for the LL -type than $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ and that yields M positive profits. Hence, $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ is a solution to the following maximization problem:

$$\max p_L R_{LL}^B + (1 - p_L) C_{LL} - I \quad (22)$$

$$\text{s.t. } (p_L - \bar{p}) (V - R_{LL}^B + C_{LL}) - r_L (p_L - \bar{p}) (1 - p_L - \bar{p}) (V - R_{LL}^B + C_{LL})^2 \geq c, \quad (23)$$

$$p_L (V - R_{LL}^B) - (1 - p_L) C_{LL} - r_L p_L (1 - p_L) (V - R_{LL}^B + C_{LL})^2 \\ \geq p_L V - (1 + \gamma) I. \quad (24)$$

(A6) ensures that a solution exists. As $p_L > \bar{p} \geq 0.5$, the LHS of (23) strictly increases in C_{LL} . Hence, (24) must be binding at a solution of the maximization problem. Otherwise, we could increase C_{LL} without violating (23) and thereby increase B 's expected profit. Assume that (23) does not bind at a solution $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ of the maximization problem. Then we must have $\tilde{C}_{LL} = 0$. Otherwise, we could decrease \tilde{C}_{LL} and increase \tilde{R}_{LL}^B such that B 's expected profits increase and no constraint is violated. Given that $\tilde{C}_{LL} = 0$, the maximization problem reduces to the one of step 3 in the proof of Proposition 1. We then must have $\tilde{R}_{LL}^B = \tilde{R}^B$. Assume now that (23) binds at a solution $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ of the maximization problem. From the definition of \tilde{R}^B it follows that

$$(p_L - \bar{p}) (V - \tilde{R}^B) - r_L (p_L - \bar{p}) (1 - p_L - \bar{p}) (V - \tilde{R}^B)^2 \geq c. \quad (25)$$

We must have $\tilde{R}_{LL}^B - \tilde{R}^B \geq \tilde{C}_{LL}$, otherwise (23) would not bind. Hence, if $\tilde{C}_{LL} > 0$, then contract $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ is strictly worse for the LL -type than $(\tilde{R}^B, 0)$. In this case, we must have

$$p_L (V - \tilde{R}^B) - r_L p_L (1 - p_L) (V - \tilde{R}^B)^2 > p_L V - (1 + \gamma) I. \quad (26)$$

From the maximization problem of step 3 in the proof of Proposition 1 it then follows that (25) holds with equality. This in turn implies that $\tilde{R}_{LL}^B - \tilde{R}^B = \tilde{C}_{LL}$. Consequently,

a solutions of the maximization problem takes on the form $(\tilde{R}^B + \tilde{C}_{LL}, \tilde{C}_{LL})$ and is therefore unique.

Step 2. We characterize a contract $(\tilde{R}_H^B, \tilde{C}_H)$ that maximizes B 's profit out of contracts with the HL - and HH -type. Again, $(\tilde{R}_H^B, \tilde{C}_H)$ must be designed such that M cannot make a counteroffer to the HL -type (HH -type) that is more attractive for the HL -type (HH -type) than $(\tilde{R}_H^B, \tilde{C}_H)$ and that yields M positive profits. Hence, we have $\tilde{R}_H^B = (1 + \gamma)I$. (A4) and the fact that $\frac{1}{p_L} > 1 + \gamma$ ensure that the HL - and HH -type exert effort after purchasing this contract.

Step 3. We show that if the LH -type purchases a contract from B , then B earns negative expected profits with it. Recall that for the LH -type $(\frac{I}{p_L}, 0)$ is the only contract that maximizes the expected utility of the LH -type under the constraint that B earns at least zero expected profits. However, the fact that $r_H > \bar{r}(V, I, p_L, \gamma)$ ensures that M can make a counteroffer that is more attractive for the LH -type than $(\frac{I}{p_L}, 0)$ and that yields M positive expected profits. Hence, if the LH -type purchases a contract from B and not from M , then B must make negative expected profits.

Step 4. We show that an equilibrium exists and that in equilibrium the LL -type purchases a contract $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ with $\tilde{R}_{LL}^B \geq \frac{I}{p_L}$ from B , the HL - and HH -type purchase a contract $((1 + \gamma)I, \tilde{C}_H)$ with $\tilde{C}_H > 0$ from B , and the LH -type purchases a contract from M . Let $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ be the solution of the maximization problem in step 1. If B offers the contracts $(\tilde{R}_{LL}^B - \varepsilon, \tilde{C}_{LL})$ and $((1 + \gamma)I - \varepsilon, (1 + \gamma)I)$ and ε is sufficiently small, then the LH -type strictly prefers $(\tilde{R}_{LL}^B - \varepsilon, \tilde{C}_{LL})$ to $((1 + \gamma)I - \varepsilon, (1 + \gamma)I)$, the HL - and HH -type strictly prefer $((1 + \gamma)I - \varepsilon, (1 + \gamma)I)$ to $(\tilde{R}_{LL}^B - \varepsilon, \tilde{C}_{LL})$ (recall from step 1 that $\tilde{R}_{LL}^B > (1 + \gamma)I$), and M cannot make a counteroffer to the LL -, HL - and HH -type that is more attractive than the respective contract and that yields M non-negative profits. Moreover, M can make a counteroffer to the LH -type that is more attractive for the LH -type than B 's contracts and that yields M positive profits. By step 1, step 2 and step 3, the contracts $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ and $((1 + \gamma)I, (1 + \gamma)I)$ maximize B 's expected profits.

Step 5. We now can complete the proof. Note that the LH -type exerts effort after purchasing $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$. By step 4, in equilibrium the LL -type purchases contract $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ from B . She weakly prefers this contract to $((1 + \gamma)I, \tilde{C}_H)$, which is purchased by the HL - and HH -type. This implies that the LH -type prefers $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ to $((1 + \gamma)I, \tilde{C}_H)$. Hence, in equilibrium, M offers a full insurance contract $(\tilde{R}_{LH}^M, \tilde{W}_{LH}, 1)$ to the LH -type, where

$$\tilde{W}_{LH} \geq p_L \left(V - \tilde{R}_{LL}^B \right) - (1 - p_L) \tilde{C}_{LL} - r_H p_L (1 - p_L) \left(V - \tilde{R}_{LL}^B + \tilde{C}_{LL} \right)^2. \quad (27)$$

This completes the proof. **QED**

A.3 Endogenous Generation of Capital

The process of getting a land title that becomes capital requires several steps and costly effort by the agent. We therefore consider an extension of the model that accounts for this fact.

Modified Framework. Assume that after M and B have made their offers, A first decides whether to exert costly effort to get capital and then chooses the contract. Denote by $\alpha > 0$ the costs of this effort. If A has capital, it can choose among all contracts offered by M and B . Otherwise, she only can choose among B 's contracts without collateral requirement and M 's contracts that do not specify a negative payment in case of failure.

Analysis. We use our previous results to derive the equilibrium outcome of this game. Consider first the HL - and HH -type. M can offer them a contract with loan rate $(1 + \gamma)I$. If and only if $\alpha \leq \gamma I$, then B can offer a contract with a positive capital requirement such that M cannot make a counteroffer to the HL -type (HH -type) that is more attractive for the HL -type (HH -type) and that yields M positive profits. Hence, if $\alpha < \gamma I$, then in equilibrium the HL - and HH -type acquire capital and purchase a contract with loan rate $(1 + \gamma)I - \alpha$ from B (recall that the capital requirement can be chosen such that the LL - and LH -type will not purchase this contract).

Consider next the LL -type. Let \tilde{R}^B be the loan rate of the contract for the LL -type when there is no capital (i.e. from Proposition 1). Let $(\tilde{R}_{LL}^B, \tilde{C}_{LL})$ be the contract for the LL -type when there is capital (i.e. from Proposition 2). Recall that B 's expected profit with the LL -type increases by \tilde{C}_{LL} when capital is introduced. Hence, if $\alpha < \tilde{C}_{LL}$, then in equilibrium the LL -type acquires capital and purchases the contract $(\tilde{R}_{LL}^B - \alpha, \tilde{C}_{LL} - \alpha)$ from B . Otherwise, it does not pay off for B to force the LH -type to acquire capital. Then in equilibrium the LL -type acquires no capital and purchases the contract $(\tilde{R}^B, 0)$ from B .

Finally, consider the LH -type. M can match any of B 's contracts that yield B at least zero profits when purchased by the LH -type. In equilibrium, the LH -type will purchase a contract from M such that it does not make sense to acquire capital. We summarize our results:

Corollary 1 *Suppose that A can acquire capital $K > (1 + \gamma)I$ at cost $\alpha < \gamma I$. If (A1) – (A6) hold, then an equilibrium exists and in any equilibrium (i) the LL -type purchases contract $(\hat{R}_{LL}^B, \hat{C}_{LL})$ from B , where $\hat{R}_{LL}^B = \tilde{R}^B + \max\{0, \tilde{C}_{LL} - \alpha\}$ and $\hat{C}_{LL} = \max\{0, \tilde{C}_{LL} - \alpha\}$, (ii) the LH -type purchases the full insurance contract $(\hat{R}_{LH}^M, \hat{W}_{LH}, 1)$ from M , where $\hat{R}_{LH}^M \leq (1 - p_L)V + p_L \hat{R}_{LL}^B + (1 - p_L)\hat{C}_{LL} + r_H p_L (1 - p_L)(V - \hat{R}_{LL}^B + \hat{C}_{LL})^2$,*

and (iii) the *HL*- and *HH*-type purchase a contract $((1 + \gamma)I - \alpha, C_H)$ from B , where $C_H > 0$.

A.4 Causality under the conditional independence assumption

Given our presumption that y depends on c and c depends on X and that c and y are statistically dependent, the conditional observed borrowing outcome of the households must consist of both a yet unobserved but true average conditional borrowing outcome of the treated and a selection bias stemming from the nonrandom LUC allocation. For the binary treatment case this is expressed as follows:

$$\begin{aligned} E(y|c = 1, X) - E(y|c = 0, X) = \\ E(y_1 - y_0|c = 1, X) + E(y_0|c = 1, X) - E(y_0|c = 0, X) \end{aligned} \quad (28)$$

where $E(y_1 - y_0|c = 1, X)$ denotes the true causal effect, also called the average treatment effect of the treated (ATT) and $E(y_0|c = 1, X) - E(y_0|c = 0, X)$ denotes the selection bias. The observed conditional borrowing outcome does only equal the true unobserved conditional borrowing outcome of the treated if the selection bias vanishes.

Typically, the effect of sample selection is nonzero in observational data and biases the estimation of a causal relationship between c and y . We attempt to solve this problem with three different approaches and varying assumptions: the least-square estimation under the conditional independence assumption and two-stage least squares using an instrumental variable.

Estimating the relationship of interest under conditional independence requires the assumption that the certification status is uncorrelated with unobservables. This assumption can be dropped in an instrumental variable approach if certain conditions hold.

To demonstrate this we start again from (7), where the last two terms capture the bias due to self-selection (which is, technically speaking, alike to an omitted variable bias). Assume that c conditional on X and y_0, y_1 are not independent anymore. Then the selection bias does not disappear: $E[y_0|c = 1, X] - E[y_0|c = 0, X] \neq 0$. To solve this, we need an instrument Z , a variable independent of outcome y_0, y_1 and c . Let $c(X, Z)$ be a nontrivial function of Z . Then,

$$E[y_0|c(X, Z) = 1, X, Z] - E[y_0|c(X, Z) = 0, X, Z] = E[y_0|X, Z] - E[y_0|X, Z] = 0 \quad (29)$$

Consequently,

$$E[y_1|c(X, Z) = 1, X, Z] - E[y_0|c(X, Z) = 0, X, Z] = E[y_1 - y_0|X, Z] = ATT \quad (30)$$

Identification in this approach depends crucially on a selection-on-observables type of assumption (Goldberger, 1972, Barnow et al., 1981): Conditional on X , c is mean

independent of outcomes in y . If LUC allocation is a function of omitted observables or unobservables the estimated certification effect is biased. However, the certification program c may depend on omitted covariates as long as they are independent of and uncorrelated with X, y_0 and y_1 . Thus,

$$y_0, y_1 \perp c | X \quad (31)$$

where y_1 is the borrowing outcome of households in possession of land-use certificates and y_0 the borrowing outcome for households without certificates. Given the defined relationship in (7) and the assumption in (8) it follows for the selection bias in the binary treatment case that

$$\begin{aligned} E[y_0 | c = 1, X] - E[y_0 | c = 0, X] &= \\ E[y_0 | X] - E[y_0 | X] &= 0 \end{aligned} \quad (32)$$

Conditional on X this implies for (7) that

$$\begin{aligned} E[y_1 | c = 1, X] - E[y_0 | c = 0, X] &= \\ = E[y_1 - y_0 | c = 1, X] &= E[y_1 - y_0 | X] = ATT \end{aligned} \quad (33)$$

The ATT can be identified conditional on X . Put differently, conditional on X the average treatment effect can be identified in the model. The ATT indicates the expected effect of land certificates on borrowing for a household that is randomly drawn from the population in 2004. As we can never observe both borrowing outcomes for a particular household, we attempt to identify the ATT parametrically in a counterfactual framework. The next section derives the population model.

A.4.1 The population model under the conditional independence assumption

The borrowing outcome for the binary treatment case is

$$y = y'_0(\iota - c) + y'_1 c \quad (34)$$

where y_0, y_1 and c are defined as above and ι is in identity vector of dimension n .

Proposition 3 *Given $E[u | c, X] = 0$, the $ATT = \alpha_1$ can be consistently estimated from the following population model*

$$y = \alpha_0 + c' \alpha_1 + X\beta + u \quad (35)$$

where y, c and X are defined as above and u is a $(n * 1)$ vector with errors and α_0, α_1 and β are the coefficients to be estimated.

Proof. Let $E(y_1|c = 1)$ and $E(y_0|c = 1)$ respectively denote the conditional borrowing outcome of the treated and the counterfactual conditional borrowing outcome of the treated. Then

$$u_1 = y_1 - E(y_1|c = 1) \quad (36)$$

$$u_0 = y_0 - E(y_0|c = 1) \quad (37)$$

denote the population error of the conditional borrowing outcomes of the treated and its counterfactual. Solving (14) and (13) for y_0 and y_1 and plugging into (11) yields after rearranging:

$$y = a_0 + c' a_1 + e \quad (38)$$

where $E(e) \neq 0$ because $e = (1 - c)' u_0 + c' u_1$ is correlated with the treatment and counterfactual error term. However, including the covariates X in the regression solves this problem. Due to X the conditional distribution of the errors of treated and untreated in parametric models are the same (Dawid, 1979). This implies for this setting that the conditional error distribution of the treated in both the factual and counterfactual outcome must be alike conditional on X . It follows that:

$$E[e|X] = E[u|X] \quad (39)$$

because $E[(1 - c)' u_0 + c' u_1|X] = E[(1 - c)' u + c' u|X] = E[u|X]$.

Hence,

$$y = \alpha_0 + c' \alpha_1 + X\beta + u \quad (40)$$

where $\alpha_0 = E[y_0|c = 1, X]$ and $\alpha_1 = [E(y_1|c = 1, X) - E[y_0|c = 1, X]]$. And, by the assumption in (8) and equation (10), $\alpha_0 = E[y_0|X]$ and $\alpha_1 = E[y_1 - y_0|X] = ATT$. ■

B Tables

Table 1: Summary statistics (LUCs and credit market outcomes)

Variable	Mean	Std. Dev.	N
Households with LUCs (binary)	0.848	0.359	6747
Issued LUCs per district	130.204	277.461	555
Borrowing (VBARD)	0.225	0.418	6938
Borrowing (VBSP)	0.062	0.24	6938
Borrowing (other formal)	0.054	0.225	6938
Borrowing (moneylender)	0.052	0.222	6938
Borrowing (family and friends)	0.148	0.355	6938
Monthly interest(VBSP)	0.579	1.171	508
Monthly interest(VBARD)	0.967	2.135	1945
Monthly interest(other banks)	0.889	1.043	171
Monthly interest(job creation fund)	0.448	0.273	77
Monthly interest(credit organizations)	1.174	2.755	168
Monthly interest(socio-political organizations)	0.842	1.941	234
Monthly interest(moneylender)	3.754	8.845	419
Monthly interest(family and friends)	1.520	2.077	237

Notes: Unweighted summary statistics. All variables taken from VHLSS 2004. The sample sizes for rural households (variables 1 and 3-7), districts (variable 2) and loans (variables 8 to 15) are respectively N=6983, N=575 and N=5233. Differences between maximum sample size and observation are due to missing values.

Table 2: Summary statistics (household characteristics)

Variable	Mean	Std. Dev.	N
Ethnic minority (binary)	0.183	0.387	6938
Age of head	48.657	14.244	6938
Head is female (binary)	0.201	0.401	6938
No education (binary)	0.017	0.128	6938
Primary education (binary)	0.269	0.443	6938
Lower secondary education (binary)	0.286	0.452	6938
Upper secondary education (binary)	0.094	0.291	6938
Higher education (binary)	0.01	0.099	6938
Allocated land in square meter	449.537	4295.022	6938

Notes: Unweighted summary statistics. Allocated land is evaluated at the beginning of the certification program in 1994. All other variables are evaluated at 2004. All variables taken from VHLSS 2004. The sample size for rural households is N=6983. Differences between maximum sample size and observation are due to missing values.

Table 3: Summary statistics (Province and district characteristics)

Variable	Mean	Std. Dev.	N
Size of province in square km	5256.157	3734.367	61
Population in province in thousand persons	1379.57	1164.435	61
Bank	0.92	0.272	575
State enterprise (binary)	0.063	0.242	575
Agricultural collective (binary)	0.028	0.165	575
Individual business (binary)	0.153	0.36	575
Private enterprises (binary)	0.205	0.404	575
Foreign enterprise (binary)	0.038	0.192	575
Road to district town (binary)	0.061	0.239	575
Road within communes (binary)	0.092	0.29	575
Bridge (binary)	0.049	0.215	575
Irrigation expansion (binary)	0.05	0.219	575
Consolidation of irrigation (binary)	0.023	0.149	575
Power (binary)	0.17	0.376	575
Safe water (binary)	0.05	0.219	575
Disposal (binary)	0.002	0.042	575
Health station (binary)	0.096	0.294	575
School (binary)	0.127	0.333	575
Kindergarden (binary)	0.05	0.219	575
Land coversion (binary)	0.021	0.143	575
Reclamation of land (binary)	0.021	0.143	575
Forest plantation (binary)	0.071	0.258	575

Notes: Unweighted summary statistics. All variables but the first three are evaluated at the beginning of the certification program in 1994. Variables taken from VHLSS 2004, with the exception of province and population size taken from GSO. The sample sizes for districts and provinces are respectively N=575 and N=64. Differences between maximum sample size and observation are due to missing values.

Table 4: Delay in rollout

	Province	District
Start in 1993/94	98.44	52.71
Later	1.56	47.29
N	64	573

Notes: Percentage values. Own calculations based on VHLSS 2004. The sample sizes for districts and provinces are respectively $N=575$ and $N=64$. Differences between maximum sample size and observation are due to missing values.

Table 5: Geography and delay on district level

	(1)	(2)	(3)
	OLS	OLS	OLS
Distance to major city (in km)	0.0002 (0.0002)		
Distance to province capital (in km)		0.0007** (0.0003)	
Province area (in 100 square km)			0.0013** (0.0005)
Constant	0.4708*** (0.0243)	0.4407*** (0.0239)	0.3996*** (0.0375)
N	484	561	544
R-squared	0.0012	0.0066	0.0108

Notes: Ordinary least squares (OLS) regressions with robust Huber-White standard errors in parentheses. Dependent variable is a binary indicator equal to one if the program started with delay on district level and zero if it did not. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size and observation are due to missing values.

Table 6: The effect of delay on certification status without controls

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Delay in district	-0.0301*** (0.0072)	0.0270*** (0.0101)	0.0051 (0.0070)	-0.0275*** (0.0053)	0.0177* (0.0098)	0.0003 (0.0063)
Delay in district (squared)		-0.0082*** (0.0011)			-0.0063*** (0.0016)	
Delay in district (cubed)			-0.0006*** (0.0001)			-0.0005*** (0.0001)
Controls A	no	no	no	no	no	no
Controls B	no	no	no	no	no	no
Controls A+B	no	no	no	no	no	no
Province fixed effects	no	no	no	yes	yes	yes
<i>N</i>	6744	6744	6744	6744	6744	6744
R-squared	0.0256	0.0481	0.0516	0.1434	0.1548	0.1554

Notes: Ordinary least squares (OLS) regressions with robust Huber-White standard errors in parentheses. Dependent variable is a binary indicator equal to one if the household has a positive LUC status and zero if it does not. Delay in district measures the number of years between the start of the program in the country and the start of the program in the district. Significance level at 90(*), 95(**), 99(***) percent confidence.

Error terms are clustered at the province level in regressions. Differences between maximum sample size and observation are due to missing values.

Table 7: The effect of delay on certification status with controls

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Delay in district	-0.0309*** (0.0072)	0.0218** (0.0097)	0.0006 (0.0069)	-0.0268*** (0.0052)	0.0190** (0.0091)	0.0005 (0.0059)
Delay in district (squared)		-0.0078*** (0.0011)			-0.0067*** (0.0015)	
Delay in district (cubed)			-0.0006*** (0.0001)			-0.0005*** (0.0001)
Controls A	no	no	no	no	no	no
Controls B	no	no	no	no	no	no
Controls A+B	yes	yes	yes	yes	yes	yes
Province fixed effects	no	no	no	yes	yes	yes
<i>N</i>	6744	6360	6360	6744	6360	6360
R-squared	0.0441	0.0752	0.0976	0.1599	0.1669	0.1846

Notes: Ordinary least squares (OLS) regressions with robust Huber-White standard errors in parentheses. Dependent variable is a binary indicator equal to one if the household has a positive LUC status and zero if it does not. Delay in district measures the number of years between the start of the program in the country and the start of the program in the district. Significance level at 90(*), 95(**), 99(***) percent confidence.

Error terms are clustered at the province level in regressions. Differences between maximum sample size and observation are due to missing values.

Table 8: Certification effect on formal borrowing without controls (VBARD)

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
LUC	0.0985*** (0.0137)	0.0946*** (0.0147)	0.0293 (0.0209)	0.1417*** (0.0191)
Controls A	no	no	no	no
Controls B	no	no	no	no
Controls A+B	no	no	no	no
Province fixed effects	no	yes	yes	yes
<i>N</i>	6747	6747	3329	3418
R-squared	0.0074	0.0536	0.0379	0.0606

Notes: Ordinary least squares (OLS) regressions with robust Huber-White standard errors in parentheses. Dependent variable is a binary indicator equal to one if the household has borrowed from the Vietnam Bank of Agriculture and Rural Development (VBARD) and zero if it did not. Regression (3) and (4) distinguish between north and south Vietnam. Significance level at 90(*), 95(**), 99(***) percent confidence. Error terms are clustered at the province level in regressions. Differences between maximum sample size and observation are due to missing values.

Table 9: Certification effect on formal borrowing with controls (VBARD)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
LUC	0.0949*** (0.0137)	0.0879*** (0.0147)	0.0928*** (0.0143)	0.0979*** (0.0150)	0.0877*** (0.0143)	0.0911*** (0.0149)
Controls A	yes	yes	no	no	no	no
Controls B	no	no	yes	yes	no	no
Controls A+B	no	no	no	no	yes	yes
Province fixed effects	no	yes	no	yes	no	yes
<i>N</i>	6747	6747	6363	6363	6363	6363
R-squared	0.0241	0.0697	0.0214	0.0543	0.0408	0.0714

Notes: Ordinary least squares (OLS) regressions with robust Huber-White standard errors in parentheses. Dependent variable is a binary indicator equal to one if the household has borrowed from the Vietnam Bank of Agriculture and Rural Development (VBARD) and zero if it did not. Significance level at 90(*), 95(**), 99(***) percent confidence. Error terms are clustered at the province level in regressions. Differences between maximum sample size and observation are due to missing values.

Table 10: Certification effect on formal borrowing (VBARD)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS	2SLS	2SLS	2SLS
LUC		0.1793*** (0.0599)	0.1889*** (0.0629)	0.1391** (0.0580)	0.1314** (0.0598)	0.0860 (0.0846)
Delay	-0.0117 (0.0082)					
Delay (squared)	0.0002 (0.0009)					
Controls A	no	no	yes	no	no	no
Controls B	no	no	no	yes	no	no
Controls A+B	no	no	no	no	yes	yes
Province fixed effects	no	no	no	no	no	yes
<i>N</i>	6932	6744	6744	6360	6360	6360
R-squared	0.0025	-	-	-	-	-

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions. Dependent variable is a binary indicator equal to one if the household has borrowed from the Vietnam Bank of Agriculture and Rural Development (VBARD) and zero if it did not. Robust Huber-White standard errors in parentheses. Significant at 90(*), 95(**), 99(***) percent confidence. Disturbance terms are clustered at the province level in regressions. The instrumental variable in regressions (2) to (6) is delay and squared delay of the certification program at the district level. Differences between maximum sample size and observation are due to missing values.

Table 11: Robustness check for certification effect on formal borrowing (VBARD)

	(1)	(2)	(3)	(4)
	2SLS	2SLS	OLS	2SLS
LUC	0.1971** (0.0971)	0.1467 (0.1135)		
LUC (per commune)			-0.0000 (0.0000)	0.0005 (0.0003)
Controls A	no	no	no	no
Controls B	no	no	no	no
Controls A+B	yes	yes	no	no
Province fixed effects	no	yes	no	no
<i>N</i>	6360	6360	6836	6836
R-squared	-	-	0.0003	-

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions.

Dependent variable is a binary indicator equal to one if the household has borrowed from the Vietnam Bank of Agriculture and Rural Development (VBARD) and zero if it did not. Robust Huber-White standard errors in parentheses. Significant at 90(*), 95(**), 99(***) percent confidence. Disturbance terms are clustered at the province level in regressions. The instrumental variable in regressions (1), (2) and (4) is delay of the certification program at the district level. Delay squared is dropped for a robustness check. In regressions (3) and (4) the binary indicator for LUC status is replaced by the number of LUCs issued on district level in 2004 to test for quantity effects of the certification program. Differences between maximum sample size and observation are due to missing values.

Table 12: Certification effect on formal borrowing (other formal sources)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
LUC	0.0020 (0.0086)	-0.0230 (0.0487)	-0.0474 (0.0574)	-0.0174 (0.0125)	-0.1215* (0.0695)	-0.1207* (0.0697)
Controls A	no	no	no	no	no	no
Controls B	no	no	no	no	no	no
Controls A+B	no	no	no	no	no	no
Province fixed effects	no	no	yes	no	no	yes
<i>N</i>	6747	6360	6360	6747	6360	6360
R-squared	0.0000	-	-	0.0008	-	-

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions. In regressions (1) to (3) the dependent variable is a binary indicator equal to one if the household has borrowed from the Vietnam Bank for Social Policy (VBSP) and zero if it did not. In regressions (4) to (6) the dependent variable is a binary indicator equal to one if the household has borrowed from the People's Credit Fund, the Job Placement Fund or some other (semi-formal) source and zero if it did not. Robust Huber-White standard errors in parentheses. Significant at 90(*), 95(**), 99(***) percent confidence. Disturbance terms are clustered at the province level in regressions. The instrumental variable in regressions (2), (3), (5) and (6) is delay and squared delay of the certification program at the district level. Differences between maximum sample size and observation are due to missing values.

Table 13: Certification effect on informal borrowing (moneylender and family)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
LUC	-0.0274*** (0.0087)	0.0636*** (0.0225)	0.0806*** (0.0280)	-0.0233* (0.0137)	-0.0854 (0.0753)	-0.0776 (0.0903)
Controls A	no	no	no	no	no	no
Controls B	no	no	no	no	no	no
Controls A+B	no	yes	yes	no	yes	yes
Province fixed effects	no	no	yes	no	no	yes
<i>N</i>	6747	6744	6744	6747	6744	6744
R-squared	0.0019	-	-	0.0006	-	-

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions. In regressions (1) to (3) the dependent variable is a binary indicator equal to one if the household has borrowed from moneylender and zero if it did not. In regressions (4) to (6) the dependent variable is a binary indicator equal to one if the household has borrowed from family and friends and zero if it did not. Robust Huber-White standard errors in parentheses. Significant at 90(*), 95(**), 99(***) percent confidence.

Disturbance terms are clustered at the province level in regressions. The instrumental variable in regressions (2), (3), (5) and (6) is delay and squared delay of the certification program at the district level. Differences between maximum sample size and observation are due to missing values.