Property rights and consumption volatility: Evidence from a land reform in Vietnam*

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July 17, 2013

Abstract

During Vietnam's transition from a socialist to a market economy, household's property rights over agricultural land were considerably strengthened through a land certification program. This resulted in active formal credit and land markets, either of which potentially affects consumption levels and volatility. This article evaluates the program impact with respect to consumption outcomes. In particular, it identifies the channel of impact through which improved property rights affect consumption volatility. We find that land certification increases consumption levels for rural households, but also consumption volatility for a subgroup of households identified by an instrument. We show that the certification program affects consumption outcomes of this subgroup through, presumably more risky, credit-based agricultural investment at the intensive margin.

Keywords: Consumption volatility, land certification, Vietnam.

JEL classification codes: (JEL I38, O17, Q15)

1 Introduction

Vietnam's transition from a socialist to a market economy has had profound impact on the agricultural sector, most notably through a land reform during which land ownership was decollectivized and land holdings were certified with land titles. Strengthening individual property rights over land was hoped to increase agricultural efficiency. According to Feder and Onchan (1987) and Feder et al. (1988) as well as more anecdotal evidence collected by De Soto (2000) there are at least

*We would like to express our gratitude to the Stiftungsfonds Deutsche Bank as well as the German Research Foundation for funding this research. We also thank seminar participants at the World Bank's Annual Research Conference on Land and Poverty 2013 for comments. Furthermore, this research benefited from seminal discussions with Heiner Schumacher from the Goethe-University in Frankfurt and Markus Frölich and Andreas Landmann from the University of Mannheim, Germany.

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three channels between strengthening property rights over land and agricultural efficiency: First, land titles improve incentives for agricultural investment. Second, in land markets tradable land titles transfer land to the most efficient producer. Third, land certificates may serve as collateral for loan transactions in formal credit markets and therefore improve access to the formal credit sector. Consequently, land titles may affect consumption outcomes through a variety of channels. In this article we will distinguish between these channels and analyze their impact on consumption outcomes, and, in particular consumption volatility.

There has been substantial research on efficiency outcomes of the land reform in Vietnam, especially on the functioning of the newly introduced land markets and their redistributive consequences (see, for instance, Deininger and Jin (2008), Do and Iyer (2008) and Ravallion and van de Walle (2004, 2006, 2008a, 2008b)). Also, the effect of land titling on agricultural investment behavior has been examined (Do and Iyer (2003, 2008)). Further, the impact of land titles on borrowing from formal credit markets has also been studied. While Do and Iyer (2003, 2008) do not find an effect looking at the time period between 1992 and 1997, Kemper et al. (2011) find a strong effect of the land titling program on formal borrowing using more recent data, although the effect is substantially stronger in the southern than in the northern part of Vietnam due to differences in the institutional legacy of the country.

While improved property rights over land are believed to raise consumption levels, a neglected effect of land titling is that it also potentially affects consumption volatility through credit and land markets. On the one hand, land titles may be used as collateral. This improves access to formal credit markets. And credit may either be used for consumption smoothing (which should, on average, reduce consumption volatility) but may also be used for agricultural investment (which should, on average, increase consumption volatility given that agricultural investment is risky). Land markets, on the other hand, offer the possibility to rent-in land and rent-out land to smooth consumption streams (which should, on average, decrease consumption volatility if households use land markets for smoothing purposes) but may also stimulate agricultural investment on rented land (which should, on average, increase consumption volatility). However, it should also be taken into account that the functioning of newly introduced rural land and credit markets may be subject to various market failures affecting households (see Boucher et al., 2005, for examples from Central America).

It is the purpose of this paper to examine the link between land titling and consumption outcomes and, in particular, consumption volatility of households in rural Vietnam. Doing so, we estimate the program impact on consumption outcomes for both the population of rural households as well as a subgroup of this population. Impact is measured on consumption outcomes such as the per capita consumption expenditures level, the percentage point change in per capita consumption expenditure levels as well as the volatility of either of the two measured by the standard deviation. Drawing on the Vietnam Health and Living Standard Surveys from 2004, 2006 and 2008 we find that land titling increases consumption expenditures levels for the population of rural households, but not for the subgroup of this population, while volatility in either measure increases for the subgroup, but not the population. We attribute these findings to, presumably more risky, credit-based agricultural investment, proxied by the use of fertilizer, at the intensive margin of the subgroup.

To estimate program impact on the subgroup, we instrument households land titling status on (the absence of) a delay in program rollout of the certification program. The program started in roughly 60 percent of Vietnam's rural districts in 1993/94, when the program officially began, and started later in all remaining districts. While early and late program start appear to be random, it has a clear effect on households' certification status a decade later. As a consequence, households

in areas without delay are more likely to have a positive certification status in 2004, a decade after the start of the program, than households living in areas with delay. We argue that the (absence of a) delay persisted through a "fuzziness" in post-socialist property relations caused by the decollectivization of property rights over land following the Doi Moi reforms. Areas with an early program start are less likely to have conflicts over property later on, while areas with conflicts over property are more likely to have land cadastrally not measured (as precondition for the issuance of certification) which, in turn, clearly reduces the probability of a positive certification status for households living in these areas in 2004. This channel is strongly pronounced in the northern part of Vietnam where the economy was organized under a socialist property regime for several decades, while the southern part only had a relatively short-lived episode of socialist economic order (and farmers successfully resisted the full collectivization of agricultural production).

There is a variety of studies on the land reform-credit sector-investment nexus: Siamwalla (1990) and Feder and Feeny (1991) on Thailand, Pender and Kerr (1999) on India, Carter and Olinto (2003) on Paraguay, Do and Iyer (2003, 2008) on Vietnam (using earlier data than this study), Boucher et al. (2005) on Honduras and Nicaragua as well as Torero and Field (2005) on Peru. We contribute to this literature by examining the link between land certification and consumption volatility and identify the channel of impact in a country-context where land certification clearly increased participation of households in the formal credit sector.

This article is structured as follows. Section 2 discusses the relationship between the land certification program and consumption outcomes. Section 3 describes the data employed in the analysis. Section 4 examines the delay in the rollout of the certification program and explores the channels between the absence of a delay and households certification status a decade later. Section 5 discusses the identification strategy for the empirical analysis and specifies the populations of interest. Section 6 presents the empirical results and section 7 concludes. The appendix contains tables, variable definitions and information on the web appendix which contains instructions for the reproduction of the results presented here.

2 The land certification program and consumption outcomes

2.1 Creating property rights: The land certification program

This section describes how private property over land was created in the Vietnamese transition process. Collectivized agriculture discontinued to exist in the mid-1980s. The inefficiencies of collectivized agricultural production led to widespread discontent among peasants and resulted in strong pressure from peasants to reform the agricultural sector (Kerkvliet, 1995). In 1986 Vietnam started the transition from a socialist to a market economy. The Doi Moi (renovation) program included substantial reforms of the agricultural sector. The land law of 1988 (resolution 10) initiated the individualization of rights over land at the following terms: The allocation of land to households for a time period of three to 15 years (with the possible renewal of tenure) and the privatization of agricultural investment decisions and the usage of output. These individual long term use-rights of households were documented. According to observers, the allocation of land and documentation of individual land-use rights was largely completed by 1990 (Ngo, 1993).

In 1993 another land law was enacted by Vietnam's National Assembly which further strengthened property rights over land. While land officially remained property of the state, the allocation of land to households was accompanied by comprehensive long term use-rights. Up to the day land is allocated for 20 to 50 years, with the possibility of extension upon expiry. The land law states:

> Land is the property of the entire people, uniformly managed by the State. The State shall allocate land to [...] households and individuals for stable and long-term use. (Article 1 of 1993 Land Law)

These use-rights were documented in a land certification program. The law states:

> Those who are using land on a stable basis...shall be reviewed and granted certificates of land use right by authorized State bodies. (Article 5 of 1993 Land Law)

The newly created land-use certificates (LUCs) allowed for buying, selling, exchanging, leasing, inheriting and mortgaging of land. Hence LUCs aimed at increases in efficiency in land markets, but also in credit markets as commercial banks were allowed to mortgage later on in the transition process (Decree 17/1999). In rural areas the Vietnam Bank of Agriculture and Rural Development (VBARD) came to accepts LUCs as collateral for loans.

LUCs therefore facilitated transactions in both credit and land markets. In our sample 83 percent of the households have at least one certified plot, 20 percent borrow from VBARD and, respectively, 9 percent rent-in land and 5 percent rent-out land in land markets (see **Table 1** in Appendix C). All figures are for 2004, a decade after the start of the certification program.

The certification program was administered by the General Department of Land Administration (GDLA). It established a countrywide four-level system of institutions corresponding to the administrative structure of Vietnam: GDLA at the government level, the Department of Land Administration at the province level, the Department of Land Administration at the district level and one or two land officers at the commune level (Dang, 1997, Dang and Palmkvist, 1997).

2.2 Land certification and consumption outcomes: Channel of impact

Following the seminal work by Feder and Onchan (1987) and Feder et al. (1988) on Thailand as well as more anecdotal evidence collected by De Soto (2000) at least three channels between strengthening of farmers' property rights and agricultural efficiency can be identified: First, land titles improve incentives for agricultural investment, leading to higher income of rural households. Second, with tradable land titles land can be transferred to the most efficient producers which should also cause investment and agricultural productivity to increase. Third, land certificates may serve as collateral for loan transactions in formal credit markets, improving access to the formal credit sector (which leads to more agricultural investment and higher productivity if money is invested and not consumed).

However, this view has also been criticized as being too simple in the context of a developing country, where the positive impact of land titles on agricultural investment and productivity depends on the interaction of many additional factors, in particular the actual nature of input, output and credit markets (see Roth et al. (1989) and Woodruff (2001)). Recent empirical work on the land titling-investment-productivity nexus (see e.g. Place (2009) and Besley et al. (2012)) also calls for a more differentiated perspective where paradoxical effects might be caused by country-specific market imperfections even if the general positive relationship is recognized. We will take this into account when we try to identify channels which link land titling to consumption outcomes in rural Vietnam.

In a market-friendly perspective (Deininger 2003; see also Deininger and Jin 2008 for the case of Vietnam) the impact of secure individual property rights for land on consumption, in particular

of poor households, are evident. Land titles help to activate the competitiveness of small holders compared to large scale producers (or large collectives), increase agricultural productivity and contribute to rising agricultural income and consumption. However, as Boucher et al. (2005) and Boucher et al. (2008) have pointed out, the degree to which these claims are fulfilled depends on the functioning not only of the rural land markets, but also on the functioning of the complementary markets, such as the markets for agricultural products, the markets for fertilizers and other agricultural inputs, rural labor markets and, perhaps most importantly, rural credit markets. As Carter and Olinto (2003) were able to show for the case of Paraguay, if effective credit rationing continues for the poor, the more secure property rights work much more in favor total investments of the already wealthy. Poor rural households might not only experience a decrease in total investment but also a portfolio shift which reduces the share of 'movable' capital non-attached to the (risky) investment into land.

Guirkinger and Boucher (2008) demonstrate in a simple model how poor households (possessing little liquidity) wanting to invest into higher agricultural productivity are typically faced with various problems of asymmetric information. These problems do not only lead to the typical phenomenon of quantity credit rationing but also to transaction cost rationing (due to the existence of high transaction costs of getting credit) and to risk rationing (if the poor household is not sufficiently insured against additional idiosyncratic risks). The availability of secure land titles as collateral prevents quantity rationing but might not be enough to avoid also transaction cost and risk rationing. Hence, we can expect that the availability of LUC as collateral for bank credit should lead to higher agriculture investment and an increase of rural households' consumption, but this does not mean that all market failures are corrected.

The models by Carter and Olinto (2003) as well as Guirkinger and Boucher (2008) can also be used to predict that the availability of LUCs as collateral for bank credit will encourage poor rural households to undertake more risky investments in the rural production process rather than investing into movable capital in order to cope with unexpected risks. This is in particular true for non risk-rationed households as long as the production related risks are considered to be smaller than the potential income gains and are also smaller than the additional idiosyncratic risks (so that the household will not become risk-rationed). Therefore we can expect, as long as not all rural households are risk-rationed, the use of LUCs via the credit market channel to lead to higher volatility of rural households' income and consumption.

In the context of these considerations there is also no reason to predict that higher production risks (as long as they are not larger than the additional idiosyncratic risks faced by the rural household) are compensated by rent-in and rent-out activities on the land market. Given the particular market failures on the credit market, land markets are mainly used to compensate for losses due to non-production related, idiosyncratic risks. If the structure of these risks does not alter (or if these risks are insured in other ways) LUCs will be used even more as collateral on the credit market. Here we see one of the main differences in the smoothing potential of remittances vis-à-vis LUCs. As shown by Amuendo-Dorantes and Pozo (2011) remittances by providing higher liquidity for poor rural households can compensate for idiosyncratic risks and therefore lead to efficient income smoothing. Given the particular market failures on rural credit markets this is not in the same way true for LUCs. As they predominantly will be used as collateral for agricultural investments which may increase production and income risks, they most likely will increase income and consumption volatility rather than reduce it.

3 Data

The empirical analysis in this paper draws on the Vietnam Household Living Standard Survey (VHLSS) from 2004, 2006 and 2008. The VHLSS is a nationally representative survey collected by the General Statistical Office in Vietnam with technical support from the World Bank and the United Nations Development Program. The VHLSS series from 2004 to 2008 relied on a master sample for sampling. This master sample is a random sample of the 1999 Population Census enumeration areas. It has a two-stage sampling design in which communes were selected in the first stage and three enumerator areas per commune selected in the second stage.

In both stages the selection was based on probability proportionate to size, namely the number of households according to the Population Census 1999. In the master sample about 76% of the households lived in rural areas, corresponding to about 85% of the number of communes and 77% of the number of enumerated areas. In each survey half of the areas were rotated from the previous survey, and the other half were newly chosen. Namely for VHLSS 2008 50% of the enumerated areas were chosen from the areas surveyed in VHLSS 2006 (among these 50% of the areas were also surveyed in VHLSS 2004). Put differently, about 25% of the households in the sample of VHLSS 2008 were surveyed in both VHLSS 2004 and VHLSS 2006.

The VHLSS is particularly suitable for the analysis of the research question at hand because of its comprehensive measure of household consumption expenditures which form the basis for the four welfare measures employed in this study: Annual per capita household consumption expenditures levels, percentage point changes in annual per capita household consumption expenditures levels, volatility in annual per capita household consumption expenditures levels, volatility in percentage point changes in annual per capita household consumption expenditures. Further, we match the VHLSS data with the geographic information system database employed in the study by Minot et al. (2003) and draw on UTM coordinates for the different district towns.

The panel employed in this study consists of $N = 1428$ households the VHLSS followed over $T = 3$ waves. Given the research issue at hand, we only consider households classified as rural in the VHLSS. Note that, in the empirical analysis below, we generally aggregate data at the level at which the outcome variable of interest varies. Table 1 in Appendix C contains descriptive statistics on outcome, treatment and instrumental variables. Table 2 in Appendix C contains descriptive statistics on the various control variables. Appendix A contains a detailed description of all variables employed in this analysis (including data source and how they were constructed).

4 Delay in program rollout and persistence in certification

4.1 Delay in program rollout

The rollout of the certification program did not start in all places at the same time, but started earlier in some places than in others. **Table 1** shows that the issuance of certificates started in 60 percent of the districts in 1993 and 1994, when the program officially started, while it started later in 40 percent of the districts. We use this delay in program rollout as an instrumental variable in the empirical analysis below. Hence we need to explore potential causes for the delay further.

Possibly initially richer districts had no delay because they had the better administrative capacity to implement the program. Or more remote, less populated districts had a delay because less remote, more populated were served first to secure broad support for the program among rural

households. Or there was a delay because some districts were badly accessible and thus could not be reached by land officers.

At a more aggregate level, Do and Iyer (2003, 2008) look at the empirical relationship between the registration rates across provinces in 1998 and a variety of province, income, household and infrastructure characteristics. They find virtually no significant correlations. Given that variations in registration rates a couple of years after the start of the program reflect variations in delay in program rollout it is not surprising that we neither find a clear empirical pattern between delay in rollout and similar sets of control variables.

Table 4 looks at the empirical relationship between the delay in program rollout (equal to one if the program started in 1993/94 in a district and zero otherwise) as well as early, intermediate and late program start (respectively equal to one if the program started between 1993 and 1996, 1997 and 2000, 2001 and 2004 in a district and zero otherwise) and a set of control variables capturing initial conditions related to province, income and infrastructure characteristics at the district level. All regressions include region fixed effects.

We do not find any systematic pattern of variation. Population density is negatively correlated with early program start but positively correlated with intermediate program start. A dummy for districts in northern Vietnam is weekly significantly correlated with no delay, but significance disappears for the exclusion of fixed effects (not shown). Furthermore, the dummy is insignificant in all regressions with early, intermediate and late start of the program. Similarly, the existence of state investment is significantly related to no delay, but turns insignificant in all other regressions.

Neither demographic nor geographic nor economic nor infrastructural initial conditions seem to affect the delay in program rollout in a systematic way. A systematic explanation for the delay in program rollout across the whole of Vietnam cannot be observed.

4.2 Persistence in delay in program rollout

Interestingly, the program did not only start in different districts at different point in times, but the delay (or, more precisely, the absence of a delay) in program rollout also affected households' certification status nearly a decade later. **Table 5** shows that the absence of a delay in program rollout in 1993/94 has a fairly large and significant effect on households certification status in 2004, even after conditioning on initial conditions in communes when the program began in 1993/94 as well as certain household characteristics in 2004. It is estimated that the absence of a delay increases the probability of being certified between 5.7 and 6.8 percent. Regressions in Table 5 show the 2SLS first-stage results for the second-stage 2SLS regressions shown in Table 9 to 17. While the effect is considerable, it is not clear why variations in the certification program should affect certification status a decade later. This section explores "fuzziness" in post-socialist property relations as a possible channel of persistence.

Under socialism all property rights over productive assets were held by the state and allocated downward to state industries and agricultural collectives. These units repeatedly allocated resources to their members, i.e. workers or farmers. There was an intermediate level of control over property rights and use-rights over particular resources changed over time by allocative decisions. Individualizing property rights in post-socialist countries created a "fuzziness" in property relations. It arose due to conflicting and overlapping ownership claims over productive assets. Furthermore, intermediate levels of control, which became obsolete in post-socialist production processes, may still have held residual claims on exclusion and inclusion decisions over productive resources (Verdery 1999, 2004).

Analyzing the Vietnamese land reform in an ethnographic village study, Sikor (2006) finds that socialist law accommodated the existence of multiple layers of property over land. The promotion of exclusive land rights in post-socialist land registration caused conflict because of unclear borders, ownership claims and exclusion rights. In his studies of a Black Thai ethnic minority village in north-western Vietnam, Sikor (2004, 2006) demonstrates that villagers actively resist the new land registration as a consequence of this.

Conflicts over land rights possibly occurred in many places during the property transition over land. It is likely that the fuzziness in property rights is more severe in the northern part of Vietnam, which used to be under a socialist property regime for several decades. In 1954 the Geneva conference formed two separate Vietnamese states divided at the 17th parallel: The Democratic Republic of Vietnam, a centrally planned economy, in the northern part and the Republic of Vietnam, a free market economy, in the southern part. They were formed from Tonkin, Annam and Cochinchina, thee three Indochina provinces corresponding to the boundaries of Vietnam as they are today. The Republic of Vietnam adopted a constitution in a French Civil Law tradition which emphasized the protection of private rights to property. Article 20 stated:

> The State recognizes and guarantees the right of private property. The law shall fix procedures to of acquisition and enjoyment of the right of property so that everyone may become a proprietor and in order to assure to the human person a worthy and free life, and at the same time to construct a prosperous society.

In contrast, article 17 of the constitution of the Democratic Republic of Vietnam stated:

> The state strictly prohibits the use of private property to disrupt the economic life of society or to undermine the economic plan of the state.

After the reunification of Vietnam in 1975, the socialists attempted to collectivize land in the entire country - with varying degrees of success, however: In the northern part households became organized in cooperatives with joint cultivation of land and output sharing. In the southern part, farmers were organized in collectives in which households individually cultivated land temporarily assigned to them, but shared inputs and managed outputs collectively. Collectives were a preliminary stage to cooperatives as the process of collectivization in the south was not completed due to farmers resistance (see Ravallion and van de Walle, 2008b: chapter 2 for a detailed historic account of land policies in Vietnam).

We presume the fact that households were only collectively assigned to cultivate land plus the fact that the northern part of Vietnam was a centrally planned economy for several decades before the Doi Moi reforms began (as opposed to the southern part being a centrally planned economy for only a decade), resulted in a more severe fuzziness in property rights and hence conflict when the transition began. At the micro level, communes where there was no delay in program rollout had more time to settle these conflicts. This is an explanation for the persistent effect of a delay in program rollout on certification status a decade later - at least for the northern part of Vietnam.

Table 6 demonstrates the empirical relationship between no delay in program rollout and the existence of property conflicts at the commune level a decade later for either the northern and southern part of Vietnam. Depending on the measure (cadastral measurement dispute in commune, land origin dispute in commune), the incidence of property conflict in communes in 2004 is estimated to reduce between 4.8 and 6.3 percent in the northern part of Vietnam if there was no delay in program rollout. **Table 7** shows that either of the measures for property conflict is

strongly correlated with the fact that some land in the commune is still not cadastrally measured in 2004, 10 years after the start of the certification program.

Table 8, finally, shows the fact that not all land is cadastrally measured in a commune is estimated to reduce the probability of a positive certification status for households between 7.3 and 9 percent in the northern part of Vietnam. While tables 5 to 7 show that this channel of persistence is quite emphasized in the northern part of Vietnam, the channel is non-existing in the southern part of Vietnam. We attribute this to a higher instance of fuzziness over property rights as a consequence of northern part of Vietnam being under a socialist property regime for decades longer than the southern part of Vietnam.

5 Empirical procedure and populations of interest

5.1 The basic regression set

We attempt to estimate the impact of the certification program on consumption outcomes for both the population of rural households and a subgroup of this population. The regression set doing so is specified as follows:

$$Consumption_{it} = \alpha_1 + \alpha_2 LUC_i + X_{ci}A + \epsilon_{cit} \tag{1}$$

where $Consumption_{it} \epsilon [Y_{it}, \Delta Y_{it}, Vol(Y_{it}), Vol(\Delta Y_{it})]$. Y_{it} denotes the per capita consumption expenditures level of household i at time t and ΔY_{it} the percentage point change in per capita consumption expenditures level between the waves. Volatility of per capita household consumption expenditures is measured along two dimensions: First, as the standard deviation of Y_{it}, $Vol(Y_{it})$. And, second, as the standard deviation of ΔY_{it}, $Vol(\Delta Y_{it})$. We include the second measure of volatility as it is scale invariant or unit-less and allows for a comparison of volatility in household consumption expenditures regardless of their expenditure level (Armuedo-Dorates and Pozo, 2011).[1] Depending on the consumption measure, we work with a panel of $N = 4282$ (for Y_{it}), a panel of $N = 2856$ (for ΔY_{it}) and a cross-section of $N = 1428$ for the volatility measures $(Vol(Y_{it}), Vol(\Delta Y_{it}))$.

LUC_i is a binary indicator equal to one if a household possesses a land-use certificate for at least one plot in 2004 and zero if it does not. Note that, using the panel, we set LUC_i equal to one for all waves if the household possessed a certificate in the first wave and zero if it did not. The reason for this specification is twofold: First, because there is very little variation in certification status over the different waves. It changes only by 6 percent between 2004 and 2008 and a household fixed effect approach would only draw on the variation of these households changing their LUC status. Second, transactions in credit and land markets (which require LUCs for transactions) may unfold impact on consumption outcomes in the medium and long term rather than the short term.

Depending on the population of interest, the matrix X_{ci} contains either 2004 household controls and commune fixed effects (for OLS regressions) or 2004 household controls and a substantial

[1] This measure of volatility should be treated with some caution. If consumption declines by the same ΔY_{it} between wave 1 and wave 2 as well as wave 2 and wave 3 for a particular household i, $Vol(\Delta Y_{it})$ for this household is zero. Or, put more generally, households with similar negative changes in ΔY_{it} between wave 1 and wave 2 as well as wave 2 and wave 3 have a reduction in welfare which is not adequatly reflected by $Vol(\Delta Y_{it})$ as measured volatiliy for these households will be low. We thank an annonoymous referee for making us aware of this. However, we presume that this is not a severe problem for the data at hand. In our data set we have 25 households experienceing a negative $Y\Delta_{it}$ between all waves. Regressing $Y\Delta_{it=1,2}$ on $Y\Delta_{it=2,3}$ for these households using OLS we estimate a correlation of 0.1643 which is insignificant under conventional and robust standard errors.

variety of commune variables controlling for initial conditions at the beginning of the program in 1994 (for 2SLS regressions). These initial commune controls include the commune area devoted to rice production, whether investment in perennial crops took place, the existence of off-farm employment opportunities in state, Vietnamese private or foreign private enterprises, individual businesses, cooperatives as well as the existence of infrastructure such as the presence of markets, roads and clinics. In addition, a commune population measure is included as well as a variety of geographic controls such as whether or not the commune belongs to the northern part of Vietnam, the Euclidian distance between the commune and the province town.

Furthermore, at the household level we control for age, age squared, gender, literacy, as well as the ethnic group of the household head, the number of adults in the working age between 18 and 64 as well as land ownership. Finally, ϵ_{cit} is some error term.

5.2 Populations of interest

Evaluating the consumption outcomes of the certification program, we are interested in program impact on the population of rural households in Vietnam as well as a subgroup of this population. First, we are interested in the average certification effect of households which are certified - an impact measure for the population of rural households. The estimate for α_2 in equation (1) captures the average difference in consumption outcomes of certified households had they not been certified if certification status is independent of the counterfactual consumption outcomes for certified households after controlling for the relevant variables explaining certification status. We least-squares estimate equation (1) under three different specifications: (i) Regressing $Consumption_{it}$ on LUC_i and a constant, (ii) additionally including commune fixed-effects (iii) as well as household controls. All panel regressions contain additional wave dummies. Note that we cannot draw on household fixed-effects for the panel regressions because we do not allow LUC_i to vary over the waves. As a consequence, LUC_i could be represented as a linear combination of household fixed effects and therefore the two of which can not be distinguished.

Second, we draw on the delay in program rollout to estimate the certification effect on households for whom certification status is affected by the (absence of a) delay in program rollout - an impact measure for a subgroup of the population. We refer to this subgroup as compliers. Let $NODELAY$ be a binary indicator equal to one if a household lived in a commune where the certifications program started in 1993/94 and zero otherwise. Then we are interested in the average difference in consumption outcomes of certified households who take-up LUCs if they live in a commune without delay in program rollout and would not take-up LUCs if they lived in a commune with delay in program rollout.

Instrumenting LUC on $NODELAY$, we estimate equation (1) by two-stage least squares (2SLS) under three different specifications: (i) Including only LUC_i and a constant, (ii) including the commune variables to control for initial conditions at the program start in the communes (iii) and, in addition, household controls. Note that we cannot include commune controls here as the instrument varies at the district level. Hence we decided to control for commune characteristics at the beginning of the programme, rather than in 2004 values, to make sure that they are not the outcome of the programme. Panel regressions again contain additional wave dummies.

6 Empirical results

This section presents the main empirical findings. Table 9 to 13 respectively show the estimated impact of certification status on consumption outcomes Y_{it}, ΔY_{it}, $Vol(Y_{it})$ and $Vol(\Delta Y_{it})$ for both population and compliers. The remaining tables inquire the possible channels through which the certifications status may affect consumption outcomes. Table 13 look into take-up of formal credit from the Vietnam Bank of Agriculture and Rural Development, Table 14 and 15 the impact of LUCs on land market activities and Table 16 and 17 estimate the impact of certification of extensive and intensive fertilizer usage. All OLS and 2SLS regressions are respectively estimated in 3 specifications (OLS: no controls, commune fixed-effect and commune fixed-effects plus households controls; 2SLS: no controls, commune controls (for initial conditions at program start) and commune controls plus household controls). There are no commune fixed-effects in 2SLS regressions as the instrument varies at the subordinate district level. Furthermore, the 2SLS first stage explains the persistence between the (absence of a) delay in program rollout and certification status a decade later. Hence it seems more reasonable to control for initial conditions at the start of the program here. Inference in the following tables is generally based on standard errors clustered at the district level.

The Stata do-files for the reproduction of the data sets from the VHLSS and the empirical results can be downloaded. See Appendix B for further details.

6.1 Impact of LUCs on consumption outcomes

As hypothesized above, the direction of the effect of LUCs on consumption outcomes is not clear. We first estimate the direction of the effect and then identify the channel. **Table 9** shows the estimated impact of LUC possession on per capita consumption expenditures levels. Across specifications it is estimated that consumption expenditures significantly increase between 424 and 666 thd. Dong. Hence population living standards are estimated to slightly increase due to certification. Instrumenting LUC on $NODELAY$ inflates point estimates dramatically. Impact estimates for the compliers range from 4146 to 4320 thd. Dong. However, p-values range from 0.134 to 0.223 and rejects the null hypothesis in none of the specifications.

The estimated certification impact on the percentage point change in per capita consumption expenditures levels is presented in **Table 10.** There is virtually no difference between certified and uncertified households in the population. However, instrumenting LUC on $NODELAY$ dramatically changes the results. It is estimated that consumption expenditures increased between 88 and 101 percentage points between 2004 and 2008 for the compliers.

While these results imply that certification status has a positive impact on percentage point changes in consumption expenditures for the compliers, it does not reveal whether consumption volatility increases or decreases as a consequence of certification. **Table 11** shows the impact of LUCs on the volatility in consumption expenditures levels. OLS impact estimates are small in magnitude and by and large insignificant for the population. Again, the magnitudes change dramatically after instrumenting LUC on $NODELAY$ in the 2SLS estimation. Volatility in consumption expenditures levels increases between 3785 and 4120 thd. Dong of a standard deviation over the survey period for households who take-up LUCs in a district without delay and who would not take-up LUCs if they dwelled in a districts with delay. P-values range from 0.067 to 0.102 and favor a rejection of the null. **Table 12** shows that this increase in volatility for the compliers is not only found in consumption expenditure levels, but also in the percentage point change in consumption expenditure levels. Volatility increases between 118 and 126 percentage points of a

standard deviation over the survey period for households who take-up LUCs in a district without delay and who would not take-up LUCs if they dwelled in a districts with delay.

These findings show that LUCs increase consumption expenditure levels for the population of rural households but not for the subgroup of the population, while volatility in expenditures levels as well as volatility in percentage points changes in consumption expenditures increase for the subgroup but not the population.

6.2 LUCs and consumption outcomes: Channels of impact

Exploring the channels of impact, we look at credit and land markets as well as investment. **Table 13** shows the impact of land certificates on borrowing from the Vietnam Bank of Agriculture and Rural Development (VBARD), the most important bank in rural areas which accepts land titles as collateral. It is estimated that the probability of formal borrowing from VBARD increases between 9.1 and 10.9 percent in the population. All effects are highly significant with a p-value smaller than 0.01. However, the magnitude of the impact of certificates on VBARD borrowing is even stronger for the compliers. Drawing on the IV approach the probability of VBARD borrowing is estimated to increase between 0.429 and 0.711 percent with p-values of 0.059, 0.113 and 0.94.

Table 14 and 15 look at the impact on land markets. **Table 14** finds neither an increase of LUCs on the decision to rent-in land for both population and compliers. If anything, the effect is even estimated to be negative for the compliers. The decision to rent-out land is unaffected by certification status for both population and compliers as **Table 15** shows.

Furthermore, we look at the extensive and the intensive margin of fertilizer application as a proxy for agricultural investment. **Table 16** shows that, at the extensive margin, certified households are estimated to be between 24 and 37 percent more likely to take-up fertilizer in crop production. Point estimates for the compliers are large in magnitude, but p-values do not point towards the rejection of the null. **Table 17,** however, shows that at the intensive margin fertilizer application increases for the population and, even more dramatic, for the compliers. For the former, fertilizer expenditures per Ha are estimated to increase between 1273 and 1835 thd. Dong for certified households. All significant at the 1 percent level. For the latter, it is estimated that fertilizer expenditures increases between 5043 and 7562 thd. Dong per Ha. P-values, respectively, are 0.061, 0.107 and 0.107.

We are not trying to establish causality between the different channels here, but we interpret these findings such that the higher volatility of consumption expenditures levels for the subgroup of the population is caused by (presumably) more risky agricultural investment at the intensive margin which may be fueled by improved access to VBARD credit.

7 Conclusion

This article examines the link between a land certification program and consumption outcomes, especially consumption volatility, of households in rural Vietnam. Given that LUCs may affect consumption outcomes through both credit and land markets, we also try to identify the channel of impact. We find that consumption expenditures increase for the population of rural households, but not for the subgroup of this population, while volatility increases for the subgroup but not for the population. The channels at work for the subgroup seem agricultural credit and investment at the intensive margin, while land markets do not seem to effect consumption outcomes. Consumption

streams for the subgroup seem to become subject to more risk, and thus more volatile, because of agricultural credit and investment at the intensive margin.

We do not find evidence of impact of LUCs on consumption outcomes through land markets. However, we cannot ultimately exclude that rental markets may be used for consumption smoothing, in particular to compensate households for additional idiosyncratic risks. Possibly we just did not find the right instrument to identify a subgroup of the population of rural households for which this might be the case.

References

[1] Amuedo-Dorantes, C. and S. Pozo (2011) "Remittances and Income Smoothing," *American Economic Review*, 101(3), 582-87.

[2] Besley, T., Burchardi, K. and M. Ghatak (2012) "Incentives and the De Soto effect," *Quarterly Journal of Economics*, 127, 237-82.

[3] Boucher, S., Barham, B. and M. Carter (2005) "The Impact of 'Market-Friendly' Reforms on Credit and Land Markets in Honduras and Nicaragua," *World Development*, 33(1), 107-28.

[4] Boucher, S., Carter, M. and C. Guirkinger (2008) "Risk Rationing and Wealth Effects in Credit Markets: Theory and Implications for Agricultural Development," *American Journal of Agricultural Economics*, 90, 409-23.

[5] Carter, M. and P. Olinto (2003) "Getting Institutions "Right" for Whom: Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment," *American Journal of Agricultural Economics*, 63(2), 265-302.

[6] Dang, H. V. (1997) "Land Administration Reform in Vietnam," Paper presented at the Federation Internationale des Geometres (International Federation of Surveyors) Commission 7 Symposium.

[7] Dang, H.V. and G. Palmkvist (1997) "Sweden-Vietnam Cooperation on Land Administration Reform in Vietnam", Paper presented at the Federation Internationale des Geometres (International Federation of Surveyors) Commission 7 Symposium.

[8] Deaton, A. and S. Zaidi (2002) "Guidelines for Constructing Consumption Aggregates for Welfare Analysis," *LSMS Working Paper Series*, Working Paper No. 135.

[9] Deininger, K. (2003) *Land Policies for Growth and Poverty Reduction*, New York: World Bank and Oxford University Press.

[10] Deininger, K. and S. Jin (2008) "Land Sales and Rental Markets in Transition: Evidence from Rural Vietnam," *Oxford Bulletin of Economics and Statistics*, 70(1), 67-101.

[11] De Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*, New York: Basic Books.

[12] Do, Q.T and L. Iyer (2003) "Land Rights and Economic Development: Evidence from Vietnam," *World Bank Policy Research Working Paper*, 3120.

[13] Do, Q.T and L. Iyer (2008) "Land Titling and Rural Transition in Vietnam," *Economic Development and Cultural Change*, 56, 531-79.

[14] Feder, G. and D. Feeny (1991) "Land Tenure and Property Rights: Theory and Implication for Development Policy," *World Bank Economic Review*, 5(1), 135-53.

[15] Feder, G. and T. Onchan (1987) "Land Ownership Security and Farm Investment in Thailand," *American Journal of Agricultural Economics*, 69, 311-20.

[16] Feder, G., Onchan, T., Chalamwong, Y. and C. Hongladarom (1988) *Land Policies and Farm Productivity in Thailand*, Baltimore, Maryland: John Hopkins University Press.

[17] Guirkinger, C. and S. Boucher (2008) "Credit Constraints and Productivity in Peruvian Agriculture," *Agricultural Economic*s, 39, 295-308.

[18] Kemper, N., Klump, R. and H. Schumacher (2011) "Representation of Property Rights and Credit Market Outcomes: Evidence from a Land Reform in Vietnam," Manuscript.

[19] Kerkvliet, B. (1995) "Village-State Relations in Vietnam: The Effect of Everyday Politics on Decollectivization," *Journal of Asian Studies*, 54, 396-418.

[20] Minot, N., Baulch, B. and M. Epprecht (2006) "Poverty and Inequality in Vietnam: Spatial Patterns and Geographic Determinants," *Research Report of the International Food Policy Research Institute*, 148.

[21] Ngo, V. L. (1993) "Reform and Rural Development: Impact on Class, Sectoral and Regional Inequalities", in W. Turley and M. Selden (eds.) *Reinventing Vietnamese Socialism: Doi Moi in Comparative Perspectives*, 165-207, Boulder, CO: Westview Press.

[22] Pender, J. and J. Kerr (1999) "The Effects of Land Sales Restrictions: Evidence from South India," *Agricultural Economics*, 21(3), 279-94.

[23] Place, F. (2009) "Land Tenure and Agricultural Productivity in Africa: A Comparative Analysis of the Economics Literature and Recent Policy Strategies and Reforms," *World Development*, 37, 326-36.

[24] Ravallion, M. and D. van de Walle (2004) "Breaking Up the Collective Farm : Welfare Outcomes of Vietnam's massive Land Privatization," *Economics of Transition*, 12(2), 201-36.

[25] Ravallion, M. and D. van de Walle (2006) "Land Allocation in Vietnam's Agrarian Transition," *Economic Journal*, 116(514), 924-42.

[26] Ravallion, M. and D. van de Walle (2008a) "Does Rising Landlessness Signal Success or Failure for Vietnam's Agrarian Transition?" *Journal of Development Economics*, 87(2), 191-209.

[27] Ravallion, M. and D. van de Walle (2008b) *Land in Transition: Reform and Poverty in Rural Vietnam,* Palgrave Macmillan: New York.

[28] Roth, M., Barrows, R., Carter, M. and D. Kanel (1989) "Land Ownership Security and Farm Investment in Thailand: Comment," *American Journal of Agricultural Economics,* 71, 211-14.

[29] Siamwalla, A. (1990) "The Thai Rural Credit System: Public Subsidies, Private Information and Segmented Markets," *World Bank Economic Review*, 4(3), 271-95.

[30] Sikor, T. (2004) "Conflicting Concepts: Contested Land Relations in North-western Vietnam," *Conservation and Society*, 2(1), 59-79.

[31] Sikor, T. (2006) "The Politics of Rural Land Registration in Postsocialist Societies: Contested Land Titling in North-Western Vietnam," *Land Use Policy*, 23(4), 617-28.

[32] Torero, M. and E. Field (2005) "Impact of Land Titles over Rural Households," *OVE Working Papers*, 0705.

[33] Verdery, Katherine (1999) "Fuzzy Property: Rights, Power and Identity in Transylvania's Decollectivization," in M. Burawoy and K. Verdery (Eds.), *Uncertain Transition: Ethnographics of Change in the Postsocialist World*, pp. 53-82. Lanham: Rowman and Littlefield Publishers.

[34] Verdery, Katherine (2004) "The Property Regime of Socialism," *Conservation and Society*, 2(1), 59-79.

[35] Woodruff, C. (2001) "Review of de Soto's The Mystery of Capital," *Journal of Economic Literature*, 39, 1215–23.

A Variable definitions

This study employs data from the Vietnam Household Living Standard Survey in 2004, 2006 and 2008. The variables used in the empirical analysis are described here (subscripts not shown).

Main outcome variables. The main outcome variables of interest are consumption outcomes such as: (i) Annual per capita total consumption expenditures (Y), (ii) percentage point changes in annual per capita total consumption expenditures (ΔY), (iii) volatility in annual per capita total consumption expenditures ($Vol(Y)$) and (iv) volatility in percentage point changes in annual per capita total consumption expenditure ($Vol(\Delta Y)$).[2] Some other outcome variables are used to explore the possible channels of impact through which LUCs may affect consumption outcomes. They include: (i) Borrowing from $VBARD$ (a binary indicator equal to one if a household has at least one outstanding loan from the Vietnam Bank of Agriculture and Rural Development, zero otherwise), (ii) renting-in land (a binary indicator equal to one if a household used at least one plot rented-in, zero otherwise), (iii) renting-out land (a binary indicator equal to one if a household used at least one plot rented-out, zero otherwise), (iv) household agricultural investment (either measured at the extensive margin by a binary indicator equal to one if a household takes-up fertilizer, zero otherwise, or a continuous indicator of household's fertilizer expenditure per hectare).

Auxiliary outcome variables. Auxiliary outcome variables help identify the channel through which the (absence of a) delay in program rollout has had a persistent effect on certification status in 2004. These are: Property conflict 1 (a binary indicator equal to one if there are households in the commune with a dispute over cadastral measurement, zero otherwise), Property conflict 2 (a binary indicator equal to one if there are households in the commune with a land origin dispute, zero otherwise) and incomplete measurement (a binary indicator equal to one if there are households in the commune for whom land is not measured yet, zero otherwise).

Treatment variables. The treatment variable of interest is LUC, a binary indicator equal to one if the household has at least one certified land plot in 2004 and zero otherwise.

Instrumental variables. We draw on the instrument $NODELAY$ (a binary indicator equal to one if the certification program did not start late in a district where a particular household is dwelling and zero if it did start late in the district where the household is dwelling). The cut-off between late and not late was at the median of the number of years the program started late in a particular district. In 2SLS regressions LUC is instrumented on $NODELAY$.

Household controls. Controls at the household level include a number of characteristics on the household and the household head such as age of the head, the squared age of head, gender (a binary indicator equal to one if the head is female and zero otherwise), literacy (a binary indicator equal one if the head can read and write, zero otherwise), working adults (a count of household members contributing to household income), ethnicity minority (a binary indicator equal to one if the household head belongs to a non-Kinh ethnic group, zero otherwise) and land (a continuous variable indicating the amount of land cultivated by households). All controls are expressed in 2004 terms.

Commune controls. Commune controls include the following: Population (a count of households in commune where household lives), distance (the Euclidian distance in 100 KM from the commune to the province town for commune in which household lives), north (a binary indicator

[2] The VHLSS consumption aggregate is thus fundamental for the empirical analysis of this paper. VHLSS data is a part of the Living Standard Measurement Surveys series, which has a strong focus on an accurate, and very detailed, measurement of consumption expenditures (see, for instance, Deaton and Zaidi, 2002). However, measurement error in consumption expenditures, because of recall biases etc., cannot be excluded.

equal to one if household lives in a commune located north of the 17th parallel, zero otherwise), rice area (the total area in hectare devoted to rice production in commune in which household lives), perennials (a binary indicator to one if there are perennial crops in commune in which households live, zero otherwise), collective (a binary indicator to one if household lives in a commune with a collective, zero otherwise), individual (a binary indicator to one if household lives in a commune with individual businesses, zero otherwise), state (a binary indicator to one if household lives in a commune with state enterprises, zero otherwise), private (a binary indicator to one if household lives in a commune with private enterprises, zero otherwise), foreign private (a binary indicator to one if household lives in a commune with foreign private enterprises, zero otherwise), market (a binary indicator to one if household lives in a commune with a market, zero otherwise), road (a binary indicator to one if household lives in a commune with a paved road, zero otherwise) and clinic (a binary indicator to one if household lives in a commune with a clinic, zero otherwise).

The variable distance is taken from the data set in Minot et al. (2006). All other variables are taken from the commune questionnaire of the VHLSS 2004 and are expressed in 1994 terms (besides variables that do not change over time anyway such as geographic variables), the year in which the program began and are based on recall questions for these items.

District controls. District controls are build from commune controls. Regressions regarding determinants of delay on program rollout use aggregated variables at district level, namely the proportion of rice growing area over the total natural area in the district in 1994, the proportion of communes planting perennial crops in the district in 1994, the proportion of communes having non-farm employment (collective, individual, state, private, foreign private) in the district in 1994, and the proportion of communes having market, the proportion of communes having road and the proportion of communes having a health care centre in 1994 (as in Do and Iyer (2003, 2008)).

B Web appendix

All results presented in this study can be reproduced using the web appendix of the paper. It can be downloaded from:

http://froelich.vwl.uni-mannheim.de/2690.0.html. (link not active yet)

It contains a Stata Do-File producing the panel and aggregate data employed in this study from the different VHLSS data files (generate_master.do) and another Stata Do-File reproducing the empirical results presented in this paper (generate_regressions.do).

As we do not have the rights to the VHLSS data, we cannot provide the data along with the do-files. However, VHLSS data can be obtained from the General Statistical Office in Vietnam. Further information on data access policies can be found here:

http://go.worldbank.org/RJIOLEHYK0

The site also contains survey instruments (Household Questionnaire, Community Questionnaire) and further documents (Interviewers' Instruction Manual, Explanation of the Data Files).

C Tables

Table 1: Unweighted descriptive statistics for outcome, treatment and instrumental variables for panels and cross-section.

	Mean	S.d.	N	Unit of variable
		Consumption outcomes		
Annual per capita consumption expenditures:				
Level	5058.30	3618.82	4284	Thd. Dong
Change	47.97	67.04	2856	Percentage point
Volatility in level	2002.80	1987.18	1428	Not defined
Volatility in change	53.10	53.55	1428	Not defined
		Other outcomes		
Land rental (in)	0.0910	0.2877	2856	Binary
Land rental (out)	0.0546	0.2272	2856	Binary
VBARD	0.1965	0.3974	4284	Binary
Fertilizer (extensive)	0.7931	0.4051	4284	Binary
Fertilizer (intensive)	3442.63	3912.37	4284	Thd. Dong/Ha
		Treatment		
LUC	0.8333	0.3728	1428	Binary
		Instrument		
No delay	0.6057	0.4889	1428	Binary
Early start (in 1993-96)	0.8396	0.3671	1428	Binary
Intermediate start (in 1997-00)	0.1289	0.3351	1428	Binary
Late start (in 2001-04)	0.0210	0.1435	1428	Binary

Notes: Unweighted descriptive statistics for panels and cross-section. Note that data on land rental is only available for VHLSS 2006 and 2008.

Table 2: Unweighted descriptive statistics for controls at district level (upper panel) and commune level (lower panel).

	Mean	Standard deviation	N	Unit of variable
		Population and geography		
Population	32808	28286	570	Households
Distance	0.3149	0.3547	560	In 100 KM
North	0.4842	0.5002	570	Binary
		Agricultural income		
Rice area	2197.99	3713.34	570	Ha
Perennials	0.9052	0.2931	570	Binary
		Off-farm emplyoment opportunities		
Collective	0.0315	0.1750	570	Binary
Individual	0.1543	0.3616	570	Binary
State	0.0631	0.2434	570	Binary
Private	0.1982	0.3990	570	Binary
Foreign private	0.0368	0.1885	570	Binary
		Infrastructure		
Market	0.4590	0.3445	570	Binary
Roads	0.8620	0.2697	570	Binary
Clinic	0.9966	0.0479	570	Binary
		Population and geography		
Population	8557.32	4721.81	2216	Households
Distance	0.2955	0.4177	2156	In 100 KM
North	0.4873	0.4999	2216	Binary
		Agricultural income		
Rice area	573.30	1016.57	2216	Ha
Perennials	0.7527	0.4315	2216	Binary
		Off-farm emplyoment opportunities		
Collective	0.0081	0.0897	2216	Binary
Individual	0.0555	0.2290	2216	Binary
State	0.0181	0.1331	2216	Binary
Private	0.0704	0.2558	2216	Binary
Foreign private	0.0099	0.0991	2216	Binary
		Infrastructure		
Market	0.4765	0.4995	2216	Binary
Road	0.8691	0.3373	2216	Binary
Clinic	0.9977	0.0474	2216	Binary

Notes: Unweighted descriptive statistics for controls at district level (upper panel) and commune level (lower panel). District level data is build from commune level data (see Appendix A for details). These variables are employed as controls in regressions in table 4 (district controls) and tables 5 to 17 (commune controls). The total number of districts is N=578 and the total number of communes is N=2224. Differences between the maximum sample sizes and observations in descriptive statistics are due to missing values.

Table 3: Unweighted descriptive statistics for household controls.

	Mean	Standard deviation	N	Unit of variable
Age	49.35	13.32	4253	Years
Age squared	2.61	1.43	4253	Years
Gender	0.2117	0.4086	4278	Binary
Literacy	0.8945	0.3071	4278	Binary
Working adults in household	2.54	1.24	4278	Count
Ethnic minority	0.0411	0.1986	4278	Binary
Land ownership	0.7833	1.708	4278	Ha

Unweighted descriptive statistics for household controls. These variables are employed as controls in regressions in table 5 to 17.

Table 4: Determinants of program start.

	(1)	(2)	(3)	(4)
		Early start	Intermediate start	Late start
	No delay	in 1993-96	1997-00	2001-04
Population	-0.000	-0.000***	0.000***	-0.000
	(0.130)	(0.007)	(0.007)	(0.869)
Distance	-0.056	-0.091	0.023	-0.000
	(0.232)	(0.125)	(0.481)	(0.975)
North	0.087*	0.084	-0.048	-0.028
	(0.088)	(0.143)	(0.330)	(0.122)
Rice area	0.059	0.037	-0.068	0.015
	(0.465)	(0.524)	(0.232)	(0.228)
Perennials	0.043	0.080*	-0.045	-0.019
	(0.431)	(0.076)	(0.268)	(0.385)
Collective	0.054	-0.107	0.113	-0.003
	(0.693)	(0.337)	(0.311)	(0.770)
Individual	0.072	0.010	0.003	-0.012*
	(0.256)	(0.846)	(0.951)	(0.059)
State	0.240***	0.096	-0.055	-0.013
	(0.005)	(0.113)	(0.380)	(0.123)
Private	0.001	0.056	-0.049	-0.015**
	(0.992)	(0.212)	(0.265)	(0.038)
Foreign private	-0.083	-0.108	0.132	-0.016*
	(0.448)	(0.295)	(0.165)	(0.083)
Market	0.053	0.020	-0.059	0.005
	(0.432)	(0.732)	(0.319)	(0.833)
Road	-0.125	-0.102	0.071	0.021
	(0.131)	(0.104)	(0.262)	(0.546)
Clinic	0.221	0.567**	-0.617**	0.014
	(0.555)	(0.044)	(0.028)	(0.474)
Region FE	Yes	Yes	Yes	Yes
District N	553	553	553	553
R-squared	0.115	0.113	0.072	0.055

Notes: Ordinary least squares regressions with province cluster-robust p-values in parentheses. Outcome variables are no delay in program rollout, program start between 1993-1996, program start between 1997-2000 and program start between 2001-2004, all binary indicators equal to one if there was no delay in program rollout or equal to one if the the program started in a particular time period, and zero otherwise. District controls are aggregated from commune controls. Data is aggregated to the level of variation of outcome variables (see appendix A for details). Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=570 districts and observations in the regressions in (1) to (4) are due to missing values.

Table 5: Persistance of no delay on certification status (2SLS first-stage).

	(1) LUC	(2) LUC	(3) LUC
No	0.062**	0.068**	0.057**
delay	(0.021)	(0.012)	(0.033)
Age			0.013**
			(0.041)
Age			-0.080
squared			(0.176)
Gender			-0.062**
			(0.029)
Literacy			0.137***
			(0.002)
Working			0.005
adults			(0.619)
Ethnic			-0.202**
minority			(0.023)
Land			0.018**
			(0.016)
Population		-0.017	-0.050*
		(0.583)	(0.062)
North		0.090***	0.058**
		(0.005)	(0.043)
Distance		0.024	0.037**
		(0.179)	(0.037)
Rice area		-0.000	0.000
		(0.774)	(0.617)
Perennials		-0.000	0.001
		(0.989)	(0.957)
Collective		-0.111	-0.125
		(0.349)	(0.239)
Individual		0.138***	0.117***
		(0.000)	(0.003)
State		0.033	0.046
		(0.766)	(0.669)
Private		-0.097*	-0.098*
		(0.092)	(0.087)
Foreign private		-0.337**	-0.344**
		(0.016)	(0.011)
Market		-0.061**	-0.057**
		(0.015)	(0.019)
Road		-0.014	0.011
		(0.749)	(0.770)
Clinic		0.078	0.073
		(0.706)	(0.679)
Commune FE	No	No	No
Household N	1428	1313	1292
R-squared	0.007	0.062	0.119

Notes: 2SLS first-stage regressions with district cluster-robust p-values in parentheses. Treatment variable is household's LUC status, a binary indicator equal to one if a particular househld has at least one certified plot, and zero otherwise. These are the first-stage regressions for the 2SLS second-stage regressions in Tables 9-17 below. Regressions include commune and household controls. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size N=1428 households and observations in the regressions in (1) to (3) are due to missing values.

Table 6: Persistence of no delay on certification status (through effect of no delay on property conflict).

	(1) North=1 Property conflict 1	(2) North=1 Property conflict 2	(3) North=0 Property conflict 1	(4) North=0 Property conflict 2
No delay	-0.048*	-0.063**	-0.002	-0.007
	(0.078)	(0.036)	(0.967)	(0.853)
Population	0.000	0.000**	0.000**	0.000**
	(0.132)	(0.036)	(0.021)	(0.017)
Distance	-0.098	-0.107*	-0.011	0.005
	(0.150)	(0.072)	(0.457)	(0.674)
Rice area	0.000	0.000	-0.000	0.000*
	(0.814)	(0.515)	(0.956)	(0.066)
Perennials	0.011	-0.037	-0.090***	-0.129***
	(0.754)	(0.357)	(0.001)	(0.003)
Collective	0.106	0.236	0.443***	0.025
	(0.443)	(0.250)	(0.003)	(0.879)
Individual	-0.009	0.016	0.124*	0.178**
	(0.872)	(0.762)	(0.071)	(0.031)
State	0.002	-0.034	-0.005	0.043
	(0.983)	(0.626)	(0.955)	(0.693)
Private	0.032	0.080	-0.040	-0.009
	(0.503)	(0.230)	(0.431)	(0.851)
Foreign private	0.143	0.140	-0.007	-0.139
	(0.205)	(0.210)	(0.964)	(0.219)
Market	0.002	0.011	0.014	0.009
	(0.928)	(0.735)	(0.649)	(0.780)
Road	-0.023	-0.028	0.015	-0.085
	(0.561)	(0.484)	(0.743)	(0.131)
Clinic	-	-	-0.165	0.181
	-	-	(0.448)	(0.312)
Region FE	Yes	Yes	Yes	Yes
Commune N	1059	1059	1088	1088
R-squared	0.017	0.035	0.066	0.109

Notes: Ordinary least squares regressions with province cluster-robust p-values in parentheses. Outcome variables are two different binary indicators for property conflict, respectively equal to one if there were conflicts over property in a particular commune, and zero otherwise. The sample is split into northern and southern Vietnam along the 17th parallel. Regressions include commune controls. Data is aggregated to the level of variation of outcome variables (see appendix A for details) . Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=1080 communes for north=1 and N=1136 communes for north=0 and observations in the regressions in (1) to (4) are due to missing values.

Table 7: Persistence of no delay on certification status (through effect of property conflict on incomplete cadestral measurment).

	(1) North=1 Incomplete measured	(2) North=1 Incomplete measured	(3) North=0 Incomplete measured	(4) North=0 Incomplete measured
Property	0.187***		0.072*	
conflict 1	(0.000)		(0.079)	
Property		0.268***		0.073*
conflict 2		(0.000)		(0.053)
Population	0.000	0.000	0.000	0.000
	(0.213)	(0.260)	(0.386)	(0.375)
Distance	-0.100	-0.089	-0.031**	-0.032**
	(0.382)	(0.438)	(0.042)	(0.034)
Rice area	0.000	0.000	-0.000	-0.000
	(0.488)	(0.568)	(0.467)	(0.363)
Perennials	-0.023	-0.011	0.048	0.052
	(0.632)	(0.811)	(0.285)	(0.241)
Collective	-0.162	-0.205*	-0.085	-0.055
	(0.172)	(0.066)	(0.669)	(0.791)
Individual	0.027	0.021	0.048	0.044
	(0.784)	(0.835)	(0.412)	(0.451)
State	-0.025	-0.014	0.122	0.119
	(0.850)	(0.918)	(0.278)	(0.289)
Private	-0.056	-0.072	0.008	0.006
	(0.391)	(0.243)	(0.874)	(0.909)
Foreign private	0.291*	0.276	0.162**	0.172**
	(0.093)	(0.117)	(0.036)	(0.034)
Market	0.048	0.045	-0.024	-0.024
	(0.151)	(0.170)	(0.407)	(0.413)
Road	-0.071	-0.068	0.057	0.064
	(0.230)	(0.253)	(0.201)	(0.143)
Clinic	-	-	-0.033	-0.058
	-	-	(0.877)	(0.781)
Region FE	Yes	Yes	Yes	Yes
Commune N	1060	1060	1089	1089
R-squared	0.085	0.102	0.051	0.052

Notes: Ordinary least squares regressions with province cluster-robust p-values in parentheses. Outcome variable is a binary indicator equal to one if not all land is cadestrally measured in a commune, and zero otherwise, The sample is split into northern and southern Vietnam along the 17th parallel. Regressions include commune controls. Data is aggregated to the level of variation of outcome variables (see appendix A for details) . Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=1080 communes for north=1 and N=1136 communes for north=0 and observations in the regressions in (1) to (4) are due to missing values.

Table 8: Persistence of no delay on certification status (through effect of incomplete cadestral measurment on certification status).

	(1) OLS North=1 LUC	(2) OLS North=1 LUC	(3) OLS North=1 LUC	(4) OLS North=0 LUC	(5) OLS North=0 LUC	(6) OLS North=0 LUC
Incomplete	-0.073**	-0.090***	-0.088***	-0.028	0.008	0.002
measured	(0.035)	(0.009)	(0.010)	(0.427)	(0.856)	(0.969)
Population		-0.004	-0.018		-0.014	-0.062
		(0.925)	(0.648)		(0.750)	(0.123)
Distance		0.011	0.057		0.023	0.031
		(0.915)	(0.603)		(0.210)	(0.119)
Rice area		-0.000	-0.000		0.000	0.000
		(0.274)	(0.247)		(0.866)	(0.454)
Perennials		0.011	0.014		-0.006	0.002
		(0.774)	(0.727)		(0.891)	(0.956)
Collective		0.094**	0.063		-0.263	-0.237*
		(0.014)	(0.211)		(0.106)	(0.085)
Individual		0.137***	0.131***		0.148**	0.117*
		(0.000)	(0.000)		(0.016)	(0.063)
State		-	-		0.066	0.089
		-	-		(0.510)	(0.368)
Private		-0.164*	-0.176*		-0.064	-0.038
		(0.086)	(0.067)		(0.394)	(0.616)
Foreign		-0.128	-0.119		-0.413**	-0.428**
private		(0.337)	(0.351)		(0.028)	(0.011)
Market		-0.031	-0.036		-0.089**	-0.073**
		(0.333)	(0.273)		(0.018)	(0.045)
Road		-0.055	-0.031		0.022	0.043
		(0.100)	(0.408)		(0.738)	(0.444)
Clinic		-	-		0.069	0.084
		-	-		(0.742)	(0.636)
Age			0.007			0.019**
			(0.398)			(0.032)
Age			-0.042			-0.132
squared			(0.586)			(0.131)
Gender			-0.042			-0.075*
			(0.289)			(0.065)
Literacy			0.096			0.143**
			(0.162)			(0.015)
Working			-0.003			0.005
adults			(0.834)			(0.722)
ethnic			-0.155			-0.255**
			(0.209)			(0.031)
Land			0.004			0.048***
			(0.199)			(0.000)
Household N	632	625	622	794	688	670
R-squared	0.013	0.056	0.080	0.001	0.049	0.154

Notes: Ordinary least squares regressions with district cluster-robustp-values in parentheses. Outcome variable is household's LUC status, a binary indicator equal to one if a particular househld has at least one certified plot, and zero otherwise. The sample is split into northern and southern Vietnam at the 17th parallel. Regressions include commune and household controls. Data is aggregated to the level of variation of outcome variables (see appendix A for details). Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=632 households for north=1 and N=794 households for north=0 and observations in the regressions in (1) to (4) are due to missing values.

Table 9: Impact of LUC on per capita consumption expenditures level.

	(1) (OLS) Y_{it}	(2) (OLS) Y_{it}	(3) (OLS) Y_{it}	(4) (2SLS) Y_{it}	(5) (2SLS) Y_{it}	(6) (2SLS) Y_{it}
LUC	424.38*	665.99**	573.50**	4292.03	4146.71	4320.94
	(0.080)	(0.021)	(0.048)	(0.223)	(0.134)	(0.173)
Age			225.06***			189.49***
			(0.000)			(0.000)
Age			-2057.09***			-1799.49***
squared			(0.000)			(0.000)
Gender			-262.21			419.02
			(0.263)			(0.138)
Literacy			785.64***			883.20*
			(0.000)			(0.073)
Working			-242.11***			-138.12
adults			(0.002)			(0.134)
Ethnic			-971.84			-433.56
minority			(0.108)			(0.614)
Land			87.86			0.48
			(0.113)			(0.994)
Population					1244.49***	1104.37***
					(0.000)	(0.000)
North					-514.67	-675.45**
					(0.115)	(0.018)
Distance					-242.31	-233.05
					(0.398)	(0.425)
Rice area					-0.14	-0.16*
					(0.108)	(0.068)
Perennials					-386.79*	-368.52*
					(0.051)	(0.061)
Collective					-75.82	-201.91
					(0.855)	(0.682)
Individual					-430.93	-500.19
					(0.463)	(0.399)
State					-51.31	-219.12
					(0.946)	(0.759)
Private					947.22**	937.92*
					(0.032)	(0.054)
Foreign					3400.36**	3293.44**
private					(0.012)	(0.028)
Market					506.44**	480.31*
					(0.042)	(0.061)
Road					523.96*	405.51
					(0.057)	(0.149)
Clinic					883.34*	943.37*
					(0.100)	(0.079)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	4278	4278	4253	4278	3939	3918
R-squared	0.123	0.468	0.482	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Outcome variable is household's per capita expenditure level. OLS regressions include commune and household controls. Besides household controls, 2SLS regressions include commune FE rather than commune controls because the instrument varies at the district level. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=4278 households and observations in the

Table 10: Impact of LUC on change in per capita consumption expenditures level (in percentage points).

	(1) (OLS) ΔY_{it}	(2) (OLS) ΔY_{it}	(3) (OLS) ΔY_{it}	(4) (2SLS) ΔY_{it}	(5) (2SLS) ΔY_{it}	(6) (2SLS) ΔY_{it}
LUC	1.639	2.958	4.413	92.043*	88.019*	100.944*
	(0.543)	(0.568)	(0.405)	(0.092)	(0.071)	(0.079)
Age			1.882**			1.623**
			(0.040)			(0.038)
Age			-16.257*			-19.662**
squared			(0.067)			(0.012)
Gender			0.958			9.606*
			(0.839)			(0.079)
Literacy			8.763*			-5.082
			(0.076)			(0.559)
Working			-4.158**			-4.912***
adults			(0.012)			(0.006)
Ethnic			24.670			32.289*
minority			(0.282)			(0.062)
Land			-0.751			-1.981
			(0.650)			(0.181)
Population					0.000	0.001
					(0.699)	(0.341)
North					-5.929	-4.000
					(0.238)	(0.390)
Distance					-4.679**	-6.410**
					(0.050)	(0.040)
Rice area					0.000	0.000
					(0.970)	(0.975)
Perennials					-2.275	-2.245
					(0.524)	(0.546)
Collective					12.348	12.863
					(0.159)	(0.158)
Individual					-15.169*	-16.266*
					(0.069)	(0.072)
State					1.963	-0.583
					(0.844)	(0.951)
Private					7.911	11.180
					(0.289)	(0.220)
Foreign					31.204	35.366
private					(0.166)	(0.165)
Market					4.008	3.901
					(0.383)	(0.427)
Road					0.252	-4.360
					(0.967)	(0.467)
Clinic					9.493	5.995
					(0.738)	(0.841)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	2856	2856	2856	2856	2630	2630
R-squared	0.000	0.162	0.168	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Outcome variable is household's change in per capita consumption expenditures level (in percentage points) expenditure level. OLS regressions include commune and household controls. Besides household controls, 2SLS regressions include commune FE rather than commune controls because the instrument varies at the district level.

Table 11: Impact of LUC on volatility in per capita consumption expenditures level.

	(1) (OLS) $Vol(Y_{it})$	(2) (OLS) $Vol(Y_{it})$	(3) (OLS) $Vol(Y_{it})$	(4) (2SLS) $Vol(Y_{it})$	(5) (2SLS) $Vol(Y_{it})$	(6) (2SLS) $Vol(Y_{it})$
LUC	288.16**	301.47	231.01	3942.85	3785.43*	4130.88*
	(0.021)	(0.186)	(0.349)	(0.102)	(0.067)	(0.097)
Age			111.66**			66.60
			(0.015)			(0.123)
Age			-1005.48**			-736.02**
squared			(0.024)			(0.042)
Gender			-317.58			257.77
			(0.260)			(0.243)
Literacy			335.96			-222.81
			(0.191)			(0.608)
Working			-17.08			-15.39
adults			(0.828)			(0.837)
Ethnic			-344.81			78.46
minority			(0.246)			(0.902)
Land			-20.57			-59.96
			(0.786)			(0.256)
Population					0.058***	0.055**
					(0.006)	(0.047)
North					-366.60*	-395.75*
					(0.098)	(0.060)
Distance					-311.61**	-320.83*
					(0.031)	(0.051)
Rice area					-0.070	-0.096
					(0.313)	(0.246)
Perennials					-255.39*	-276.21*
					(0.086)	(0.077)
Collective					211.50	207.62
					(0.454)	(0.551)
Individual					-582.54	-604.70
					(0.132)	(0.123)
State					178.94	129.83
					(0.763)	(0.825)
Private					616.33*	599.10
					(0.053)	(0.100)
Foreign					2031.23**	2108.84**
private					(0.019)	(0.040)
Market					186.90	174.50
					(0.321)	(0.388)
Road					170.62	113.77
					(0.495)	(0.649)
Clinic					799.13	779.49
					(0.381)	(0.416)
Commune FE	Yes	Yes	Yes	No	No	No
Household N	1428	1428	1403	1428	1315	1294
R-squared	0.003	0.448	0.460	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Outcome variables is household's volatility in per capita expenditure level. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=1428 households and observations in the regressions in (1) to (6) are due to missing values.

Table 12: Impact of LUC on volatility in percentage point change in per capita consumption expenditures level.

	(1) (OLS) $Vol(\Delta Y_{it})$	(2) (OLS) $Vol(\Delta Y_{it})$	(3) (OLS) $Vol(\Delta Y_{it})$	(4) (2SLS) $Vol(\Delta Y_{it})$	(5) (2SLS) $Vol(\Delta Y_{it})$	(6) (2SLS) $Vol(\Delta Y_{it})$
LUC	4.476	4.372	1.943	126.27*	118.07**	118.22*
	(0.157)	(0.549)	(0.803)	(0.066)	(0.048)	(0.084)
Age			1.259			-0.494
			(0.334)			(0.679)
Age			-6.576			4.541
squared			(0.612)			(0.661)
Gender			-7.654			3.676
			(0.318)			(0.567)
Literacy			8.363			-16.063
			(0.368)			(0.165)
Working			2.116			0.581
adults			(0.359)			(0.779)
Ethnic			25.670			20.390
minority			(0.513)			(0.289)
Land			-0.790			-1.722
			(0.750)			(0.326)
Population					0.000	0.000
					(0.653)	(0.560)
North					-12.760**	-9.091
					(0.046)	(0.115)
Distance					-3.782	-4.084
					(0.254)	(0.288)
Rice area					0.001	0.001
					(0.632)	(0.856)
Perennials					-4.252	-5.366
					(0.331)	(0.229)
Collective					29.155**	31.460**
					(0.036)	(0.033)
Individual					-26.021**	-23.898**
					(0.021)	(0.032)
State					-12.978	-10.824
					(0.368)	(0.454)
Private					15.123	12.547
					(0.101)	(0.196)
Foreign					43.488	45.104
private					(0.107)	(0.127)
Market					6.160	6.098
					(0.250)	(0.269)
Road					-0.281	-2.113
					(0.966)	(0.740)
Clinic					10.201	7.720
					(0.771)	(0.818)
Commune FE	Yes	Yes	Yes	No	No	No
Household N	1428	1428	1403	1428	1315	1294
R-squared	0.001	0.376	0.390	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Outcome variables is household's volatility in percentage point change in per capita expenditure level. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=1428 households

Table 13: Impact of LUC on VBARD credit.

	(1) (OLS) VBARD	(2) (OLS) VBARD	(3) (OLS) VBARD	(4) (2SLS) VBARD	(5) (2SLS) VBARD	(6) (2SLS) VBARD
LUC	0.109***	0.099***	0.091***	0.711*	0.429	0.563*
	(0.000)	(0.000)	(0.001)	(0.059)	(0.113)	(0.094)
Age			-0.001			0.000
			(0.784)			(0.956)
Age			0.006			-0.029
squared			(0.902)			(0.515)
gender			-0.014			0.035
			(0.576)			(0.260)
Literacy			0.036			-0.022
			(0.203)			(0.657)
Working			0.032***			0.024**
adults			(0.000)			(0.014)
Ethnic			0.024			0.004
minority			(0.755)			(0.964)
Land			0.007			-0.003
			(0.444)			(0.707)
Population					-0.000	-0.000
					(0.179)	(0.332)
North					-0.116***	-0.129***
					(0.000)	(0.000)
Distance					-0.042***	-0.049**
					(0.002)	(0.013)
Rice area					0.000**	0.000**
					(0.030)	(0.046)
Perennials					-0.022	-0.023
					(0.286)	(0.296)
Collective					-0.013	0.006
					(0.866)	(0.938)
Individual					-0.094	-0.115*
					(0.103)	(0.066)
State					0.071	0.069
					(0.517)	(0.549)
Private					0.001	0.021
					(0.989)	(0.705)
Foreign					0.175	0.209
private					(0.129)	(0.134)
Market					-0.017	-0.009
					(0.492)	(0.733)
Road					-0.060**	-0.056*
					(0.037)	(0.070)
Clinic					-0.247	-0.249
					(0.310)	(0.351)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	4284	4284	4259	4284	3945	3924
R-squared	0.016	0.280	0.290	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Outcome variables is a binary indicator equal to one if households borrowed from VBARD, zero otherwise. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=4284

Table 14: Impact of LUC on renting land in.

	(1) (OLS) Rent in	(2) (OLS) Rent in	(3) (OLS) Rent in	(4) (2SLS) Rent in	(5) (2SLS) Rent in	(6) (2SLS) Rent in
LUC	0.003	0.014	0.022	-0.413	-0.491*	-0.485
	(0.830)	(0.601)	(0.399)	(0.150)	(0.090)	(0.138)
Age			-0.013***			-0.004
			(0.000)			(0.328)
Age			0.089***			0.037
squared			(0.006)			(0.303)
Gender			0.010			-0.024
			(0.589)			(0.412)
Literacy			-0.025			0.036
			(0.328)			(0.474)
Working			0.004			0.009
adults			(0.486)			(0.260)
Ethnic			-0.127			-0.162*
minority			(0.313)			(0.065)
Land			-0.001			0.010
			(0.798)			(0.153)
Population					0.000	-0.000
					(0.840)	(0.882)
North					0.052*	0.037
					(0.097)	(0.172)
Distance					-0.018	-0.017
					(0.341)	(0.435)
Rice area					-0.000	0.000
					(0.981)	(0.805)
Perennials					0.019	0.023
					(0.370)	(0.276)
Collective					-0.045	-0.045
					(0.646)	(0.655)
Individual					0.074	0.067
					(0.217)	(0.275)
State					0.049	0.042
					(0.478)	(0.558)
Private					-0.083*	-0.079
					(0.073)	(0.122)
Foreign					-0.159	-0.162
private					(0.200)	(0.231)
Market					-0.037	-0.032
					(0.125)	(0.196)
Road					-0.011	0.004
					(0.709)	(0.892)
Clinic					-0.077*	-0.060
					(0.099)	(0.249)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	2856	2856	2831	2856	2630	2609
R-squared	0.009	0.285	0.300	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Dependent variables is a binary indicator equal to one if a household rented-in land, zero otherwise. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at

Table 15: Impact of LUC on renting land out.

	(1) (OLS) Rent out	(2) (OLS) Rent out	(3) (OLS) Rent out	(4) (2SLS) Rent out	(5) (2SLS) Rent out	(6) (2SLS) Rent out
LUC	0.035***	0.023	0.023	0.201	0.050	-0.051
	(0.000)	(0.238)	(0.258)	(0.222)	(0.732)	(0.755)
Age			-0.003			-0.000
			(0.510)			(0.960)
Age			0.038			0.021
squared			(0.305)			(0.534)
Gender			0.023			0.021
			(0.202)			(0.215)
Literacy			0.021			0.026
			(0.276)			(0.305)
Working			-0.008*			-0.013***
adults			(0.094)			(0.007)
Ethnic			-0.019			-0.023
minority			(0.496)			(0.547)
Land			-0.002			0.000
			(0.678)			(0.893)
Population					0.000	-0.000
					(0.907)	(0.833)
North					-0.004	0.006
					(0.823)	(0.654)
Distance					0.028*	0.030**
					(0.088)	(0.040)
Rice area					0.000	0.000
					(0.622)	(0.488)
Perennials					-0.016	-0.014
					(0.178)	(0.225)
Collective					0.019	0.006
					(0.596)	(0.881)
Individual					0.006	0.023
					(0.880)	(0.525)
State					-0.021	-0.027
					(0.472)	(0.325)
Private					0.002	-0.015
					(0.914)	(0.558)
Foreign					-0.014	-0.046
private					(0.794)	(0.445)
Market					-0.002	-0.008
					(0.894)	(0.534)
Road					0.015	0.006
					(0.322)	(0.716)
Clinic					0.048**	0.055**
					(0.031)	(0.014)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	2856	2856	2831	2856	2630	2609
R-squared	0.003	0.240	0.257	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Dependent variables is a binary indicator equal to one if a household rented-out land, zero otherwise. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at

Table 16: Impact of LUC on investment (extensive margin: fertilizer).

	(1) (OLS) Invest take-up	(2) (OLS) Invest take-up	(3) (OLS) Invest take-up	(4) (2SLS) Invest take-up	(5) (2SLS) Invest take-up	(6) (2SLS) Invest take-up
LUC	0.370***	0.259***	0.240***	0.263	0.355	0.487
	(0.000)	(0.000)	(0.000)	(0.521)	(0.313)	(0.225)
Age			0.002			0.007
			(0.749)			(0.197)
Age			-0.026			-0.088*
squared			(0.613)			(0.089)
Gender			-0.024			-0.018
			(0.312)			(0.638)
Literacy			0.007			0.035
			(0.821)			(0.573)
Working			0.025***			0.019*
adults			(0.000)			(0.076)
Ethnic			0.018			-0.010
minority			(0.784)			(0.934)
Land			0.018**			0.011
			(0.038)			(0.257)
Population					-0.000*	-0.000
					(0.053)	(0.136)
North					0.146***	0.129***
					(0.000)	(0.000)
Distance					-0.016	-0.019
					(0.530)	(0.550)
Rice area					0.000	0.000
					(0.417)	(0.434)
Perennials					0.042	0.046*
					(0.113)	(0.080)
Collective					-0.127	-0.112
					(0.392)	(0.440)
Individual					0.090	0.063
					(0.204)	(0.373)
State					0.104*	0.110**
					(0.071)	(0.022)
Private					-0.030	-0.007
					(0.607)	(0.915)
Foreign					-0.095	-0.066
private					(0.490)	(0.658)
Market					-0.050	-0.039
					(0.133)	(0.242)
Road					-0.009	0.006
					(0.839)	(0.879)
Clinic					-0.158***	-0.159***
					(0.005)	(0.002)
Commune FE	Yes	Yes	Yes	No	No	No
Household N	4284	4284	4259	4284	3945	3924
R-squared	0.117	0.598	0.608	0.107	0.184	0.175

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Dependent variables is a binary indicator equal to one if household's take-up fertilizer, zero otherwise. OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at 10(*), 5(**), 1(***) percent. Differences between maximum sample size of N=4284

Table 17: Impact of LUC on investment (intensive margin: fertilizer).

	(1) (OLS) Invest amount	(2) (OLS) Invest amount	(3) (OLS) Invest amount	(4) (2SLS) Invest amount	(5) (2SLS) Invest amount	(6) (2SLS) Invest amount
LUC	1835.81***	1321.51***	1273.92***	7562.41*	5043.66	6039.83
	(0.000)	(0.000)	(0.000)	(0.061)	(0.107)	(0.107)
Age			18.422			12.955
			(0.660)			(0.797)
Age			-348.020			-369.288
squared			(0.374)			(0.420)
Gender			-167.784			-38.377
			(0.408)			(0.914)
Literacy			-126.024			316.941
			(0.565)			(0.567)
Working			180.848***			94.570
adults			(0.002)			(0.315)
Ethnic			222.950			-371.435
minority			(0.759)			(0.732)
Land			110.193*			-43.295
			(0.055)			(0.643)
Population					0.065**	0.063
					(0.040)	(0.118)
North					239.13	53.52
					(0.496)	(0.872)
Distance					-417.93**	-445.63*
					(0.036)	(0.073)
Rice area					0.109	0.103
					(0.332)	(0.388)
Perennials					424.11*	424.28*
					(0.074)	(0.088)
Collective					232.55	317.22
					(0.867)	(0.820)
Individual					-46.77	-243.96
					(0.934)	(0.687)
State					887.42**	800.12*
					(0.023)	(0.073)
Private					254.11	397.19
					(0.631)	(0.523)
Foreign					77.05	290.38
private					(0.945)	(0.833)
Market					248.54	299.70
					(0.368)	(0.304)
Road					364.84	403.93
					(0.275)	(0.264)
Clinic					-1361.43***	-1326.46***
					(0.000)	(0.005)
Commune FE	Yes	Yes	Yes	No	No	No
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household N	4284	4284	4259	4284	3945	3924
R-squared	0.116	0.451	0.458	-	-	-

Notes: Ordinary least squares regressions (OLS) and two-stage least squares regressions (2SLS) with district cluster-robust p-values in parentheses. Dependent variables is the household*s fertilizer expenditure per Ha (in thd. Dong). OLS regressions include commune FE and household controls. Besides household controls, 2SLS regressions include commune controls rather than commune FE because the instrument varies at the district level. Significance level at 10(*), 5(**),