Property rights, consumption growth and consumption volatility: Evidence from a land reform in Vietnam.

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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 growth 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 growth and volatility. We find that land certification increases consumption growth, but also consumption volatility. We show that the certification program affects consumption outcomes predominantly through the credit market channel as formal loans are used for (risky) agricultural investment rather than consumption smoothing.

Keywords: Consumption growth, consumption volatility, land certification, Vietnam.

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

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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 three channels between strengthening property rights over land and agricultural efficiency: First, land titles improve incentives for agricultural investment. Second, in land markets tradeable 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 growth consumption volatility.

There has been substantial research on efficiency outcomes of the land reform in Vietnam, in particular, 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 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 higher 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 growth and, in particular, consumption volatility of households in

rural Vietnam. First, we estimate whether the possession of land titles made household consumption more or less volatile. Given the plausible endogeneity of land titling, we instrument households' land certification status on a delay in the rollout of the certification program occurring at the district level (a subordinate unit of administration). The identification assumption is that the delay in the certification program affects consumption outcomes only through the land titling status.

Second, we attempt to identify the channel through which land titles affect consumption outcomes. Analyzing the credit market channel, we instrument an interaction term of land certification and formal borrowing from the Vietnam Bank of Agriculture and Rural Development (VBARD), a bank with a collateral-based lending policy, on the delay in program rollout. The identification assumption is that if the delay in the rollout of the certification program affects consumption outcomes, it only does so through VBARD borrowing conditional on LUC possession (given that land titles are prerequisite to borrowing from VBARD). Analyzing the land market channel, we instrument an interaction term between land certification and land market participation on the Euclidian distance between province town and district town for the districts in which households dwell (we have to take a different instrument as delay has an insignificant first-stage effect on the interaction term). The underlying identification assumption is that if Euclidian distance affects consumption outcomes, it only does so through land market participation conditional on LUC possession.

We find that a positive LUC status has a huge impact on consumption growth, but also increases consumption volatility. Furthermore, we find that these consumption outcomes are mainly affected through the credit market channel, in which households use land titles to take credit and make agricultural investment rather than using credit for consumption smoothing. Given that investment is risky, this increases the volatility of consumption. Furthermore, we find very little evidence for an impact of land markets on consumption outcomes.

There are a variety of studies on the land reform-credit sector channel elsewhere: Siamwalla (1990) and Feder and Feeny (1991) in Thailand, Pender and Kerr (1999) in India, Carter and Olinto (2003) in Paraguay, Do and Iyer (2003, 2008) in Vietnam (using earlier data than this study), Boucher et al. (2005) in Honduras and Nicaragua as well as Torero and Field (2005) in 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 describes the data used in the empirical analysis and the land certification program. Section 3 discusses the channel of impact on how land titles may affect changes in consumption expenditure and volatility. Section 4 discusses the empirical identification strategy and presents the results and section 5 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 Data and land certification program

2.1 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 forms the basis of the two welfare measures employed in this study: Yearly per-capita household consumption expenditure growth and yearly per-capita household consumption expenditures volatility).

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. Table 1 in the appendix contains descriptive statistics on outcome, treatment and instrumental variables. Appendix A contains a detailed description of all variables explained in this analysis (including control variables not described in Table 1 to save space).

2.2 Creating property rights: The land certification program

This section describes how private property over land was created in the Vietnamese transition process. After the defeat of South Vietnam (Republic of Vietnam) in 1975 and unification of the country in 1976, the socialist government attempted to collectivize land in the entire country - with varying degrees of success, however: In the North households became organized in coopera-

tives with joint cultivation of land and output sharing. In the south, 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 de Walle, 2008b: chapter 2 for a detailed historic account of land policies in Vietnam).

Collectivized agriculture, however, discontinued to exist only a decade later. 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. 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. This initiated a land market and, although not explicitly laid down in the land law, also a formal credit market with the Vietnam Bank of Agriculture and Rural Development (VBARD) on the supply side, as the VBARD came to accept LUCs as collateral for loans. LUCs therefore facilitate transactions in both credit and land markets. In our sample 83 percent of the households have at least one certified plot, 23 percent possess a LUC and borrow from VBARD and, respectively, 12 percent

possess a LUC and rent-in land and 5 percent possess a LUC and rent-out land in land markets (see **Table 1** in the appendix).

The rollout of the certification program did not start in all places at the same time but started earlier in some places and later in others. We take this as a natural experiment and consider the delay in program rollout as an exogenous variation in the empirical analysis below. The delay was a consequence of the administration of the program. Vietnam is administered on four levels: National government, provinces, districts and communes (from top to bottom). The government agency responsible for the certification program was 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 government level, the Department of Land Administration at the province, the Department of Land Administration at the district and one or two land officers at the commune level (Dang, 1997, Dang and Palmkvist, 1997). The delay came into existence at the district level, the unit of administration subordinate to households. According to Do and Iyer (2008) the issuance of LUCs by the GDLA at the district level took 1500-2000 man days and therefore explains why the the issuance of certificates did not start in all places at the same time. **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 (see Kemper et al., 2011, for more details on the instrument).

3 Land titling, consumption growth and consumption smoothing: Channels of impact

Following the seminal work by Feder and Onchan (1987) and Feder et al. (1988) on the case of 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 again should make investment and agricultural productivity increase. Third, land certificates may serve as collateral for loan transactions in formal credit markets, therefore they can improve access to the formal credit sector and can lead to more agricultural investment and higher productivity. 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, household consumption and consumption smoothing 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 hereby 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 idio-

syncratic 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.

4 Empirical identification strategy and results

4.1 Empirical identification strategy

4.1.1 Measuring the impact of LUCs on consumption growth and consumption volatility

We attempt to measure the impact of LUCs on growth and volatility of consumption expenditures. Doing so, we first compare households' change in consumption expenditures between households' possessing LUCs and households' not possessing LUCs. The basic regression is specified as follows:

$$\Delta Y_{it} = \alpha_1 + \alpha_2^t + \alpha_3 LUC_i + X_{it}A + \epsilon_{it} \tag{1}$$

where ΔY_{it} is the change in household's per-capita consumption expenditures between the waves for household i at time t, α_1 is a constant and α_2^t a is a year-fixed effect. LUC_i is a binary indicator equal to one if a household possesses a land-use certificate for at least one plot and zero if it does not and α_3 captures the average difference in outcomes between certified and uncertified households. The matrix X_{it} contains a variety of control variables (household and commune characteristics) and ϵ_{it} is some error term. Y_{it} is measured as total, food and non-food per-capita consumption expenditures.

Although we draw on panel data, a household fixed-effects methodology cannot be applied in this setting because we set LUC_i (which varies at the household level) equal to one for all waves if the household possessed a LUC_i in the first wave and zero if it did not. As a consequence, LUC_i could be represented as a linear combination of household fixed effects and therefore could not be distinguished. The reason for this specification is twofold: First, because their 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_i status. Second, transactions in credit and land markets (which require LUCs for transactions) may unfold impact on consumption outcomes in the medium and and long term rather than the short term.

While a significant estimate on α_3 in equation (1) tells us whether LUCs affect changes in consumption expenditures growth, it does not tell us whether consumption expenditures became more or less volatile as a consequence of titling. Doing so, we specify a second regression which compares household's per-capita consumption expenditure volatility between household possessing and not possessing LUCs. The base regression is specified as follows:

$$Vol(\Delta Y_i) = \beta_1 + \beta_2 LUC_i + X_i B + \epsilon_i \tag{2}$$

where $Vol(\Delta Y_i)$ is the volatility in household's per-capita consumption expenditures as in Armuedo-Dorates and Pozo (2011). They measure volatility in consumption expenditures as the standard deviation of the percentage changes in consumption expenditures over the survey period. This measure is unit-less and allows for a comparison of volatility in household consumption expenditures regardless of their expenditure level. For this specification the data set is reduced from a panel to a cross-sectional dimension.

Again, LUC_i is a binary indicator equal to one if a household possesses a land-use certificate for at least one plot and zero if it does not and β_2 captures the average difference in outcomes between certified and uncertified households. The matrix X_i contains household and commune characteristics and ϵ_i is some error term.

The greatest concern with the regressions models in (1) and (2) is that LUC_i may respectively be correlated with ϵ_{it} and or ϵ_i (even after controlling for a variety of variables in X_{it} and X_i). This endogeneity may arise due to self-selection into certification status at the household level. We deal with the potential omitted variable biases by estimating the relationship of interest under varying assumptions.

We employ the potential outcome framework (Rubin 1974, 1975) to interpret the estimated program impact: What is the impact of certification on consumption outcomes of a particular household, had the same household not been certified? Then the difference in potential consumptions outcome for this household is the causal effect of interest. However, in reality we cannot observe both outcomes for the same household. Hence we take two different approaches to identify the causal program impact in the presence of missing data.

First, estimates for program impact are said to be causal if LUC status is independent of potential outcomes, conditional on observed characteristics (conditional independence assumption). Estimating (1) and (2) with ordinary least squares (OLS), this assumption states that a causal effect is identified by holding constant all relevant variables that may be correlated with certification status and affected the outcome of interest: Conditional on X_{it} (X_i), LUC_i is independent of potential outcomes in regression equation (1) ((2)).[1]

[1] Technically speaking, we estimate an average treatment effect on the treated (ATT) if the conditional independence assumption holds.

Second, we also take an instrumental variable approach to identify program impact. That is, we employ a variable which is correlated with certification status, but is (conditionally) uncorrelated with unobserved determinants of consumption outcomes. If we think about the program impact under this approach, it tells us what the consumption outcome of a particular household would be, given alternative combinations of LUC status and the binary indicator for delay in program rollout. The difference in potential outcomes yielded after instrumenting certification status on the delay is the causal effect of interest.

Estimating (1) and (2) by two-stage least squares (2SLS) requires four assumptions for yielding causal effects: (i) The instrument must be conditionally independent of potential consumption outcomes and potential certification status, (ii) potential consumption outcomes as a certified or non-certified household has to be unchanged by living in a district without or with delay in rollout, (iii) the delay does not need to affect all households but those who are affected have to be affected in the same way, and (iv) the first-stage effect of the delay in program rollout on households potential certification status should be unequal zero.[2]

To preview one central result of our empirical analysis: We find very little program impact under the first identification approach. We presume that this is due to self-selection into certification status (which is, technically speaking, an omitted variable bias caused by unobserved factors determining consumption outcomes). However, we do find strong impact under the second identification approach. In interpreting program impact here we should remember that findings apply only to the subset of households responding to the instrument and not to households in general.

4.1.2 Identifying channels of impact

While the basic specification tells us whether or not LUCs have an impact on consumption growth and volatility, it does not reveal the channels through which impact takes place. As detailed above, LUCs facilitate transactions in formal credit and land markets, either of which could affect consumption outcomes. To identify the channel of impact, we will compare consumption outcomes for (i) households' possessing LUCs and borrowing from VBARD to all other households (that is, households who possess LUCs but do not borrow from VBARD, households who do not possess LUCs but borrow from VBARD and households neither possessing LUCs nor borrow from VBARD) as well as (ii) households' possessing LUCs and participating in land rental markets to all other households (that is, households who possess LUCs but do not participating in land markets, households who do not possess LUCs but participate in land markets and households neither possessing LUCs nor participate in land markets).The regression used to identify the channel of impact on consumption growth is specified as:

[2] Technically speaking, we estimate a local average treatment effect given that the assumptions holds (Imbens and Angrist, 1994).

$$\Delta Y_{it} = \gamma_1 + \gamma_2^t + \gamma_3 LUC_i * SMOOTH_{it} + X_{it}C + \epsilon_{it} \quad (3)$$

where $SMOOTH_{it} \epsilon [CREDIT_{it}, RENT_{it}]$ and the other variables defined as in (1). $CREDIT_{it}$ is a binary indicator equal to one if a household borrowed from the VBARD in wave 2 and/or wave 3 and zero if it did not and γ_3 captures the average difference in outcomes between certified households borrowing from VBARD and all other households. $RENT_{it}$ is a binary indicator equal to one if a household participated in rental markets in wave 2 and/or wave 3 and zero if it did not and γ_3, in this case, captures the average difference in outcomes between certified households in land rental markets and all other households (in the empirical analysis we distinguish between households renting-in and renting-out). To capture the impact of the respective channel we use the following regression:

$$Vol(\Delta Y_i) = \delta_1 + \delta_2 LUC_i * SMOOTH_i + X_i D + \epsilon_i \quad (4)$$

Variable definitions and identifying approaches here are similar to above. Namely, we attempt to hold constant all relevant variables in one approach, and instrument $LUC_i * SMOOTH_{it}$ in a second.

While the first approach is straight forward, the second approach needs further clarification. Given that LUCs are prerequisite to borrowing from VBARD, it is clear that VBARD borrowing affects consumption outcomes only conditional on LUC possession. Consequently, we assume that if $DELAY_j$, a binary indicator for delay in the rollout of the certifications program equal to one if a household dwells in a district j where the program did *not* start late and equal to zero otherwise, affects consumption outcomes, it only does so through VBARD borrowing conditional on LUC possession.

In principle, the same reasoning applies to land markets: Given that LUCs are a legal prerequisite to participate in land markets, land markets affect consumption outcomes conditional on LUC possession. However, as opposed to the credit market channel, we do not find any significant first-stage effect instrumenting $LUC_i * RENT_{it}$ on $DELAY_j$. We consider this as suggestive evidence that the certification program actually had little impact on land markets. There is anecdotal evidence about vivid informal land markets (even under socialist rule) and given that land rentals typically occur in villages among people knowing each other (relatives, neighbors etc.) might explain why the land titling program does not have strong additional effect on land markets. Consequently, we take an alternative approach and instrument $LUC_i * RENT_{it}$ on $EUCLID_j$, the Euclidian distance between province town and district town j in which the households i dwells.

In terms of potential outcomes, δ_2 is the effect of taking $CREDIT_{it}$ (conditional on a positive LUC status) on consumption outcomes in the subpopulation which would take-up credit if they lived in area without $DELAY_j$ and who would not take-up credit if the lived in an area with delay. The interpretation of δ_2 in terms of land markets is along these lines except for the interpretation of the instrument: Households would participate in land markets (conditional

on a positive LUC status) if they lived closer to/ farther from the province town and would not participate in land markets if they lived closer to/ farther from the province town (the direction of the effect differs for $RENTIN_{it}$ and $RENTOUT_{it}$).

4.2 Results

This section presents the empirical findings. Table 2 and 3 present the results from regression equations (1) and (2). Table 4 to 6 and 11 to 17 show findings from regression equation (3) and (4). All regressions are estimated for all outcome variables (yearly total, food and non-food per-capita consumption expenditure growth as well as yearly total, food and non-food per-capita consumption expenditure volatility) with 4 specifications (no controls, only controls A, only controls B and controls A and B) with both OLS and 2SLS. In 2SLS regressions LUC and $LUC * VBARD$ are instrumented on the delay in program roll-out $DELAY$. Further, $LUC * RENTIN$ and $LUC * RENTOUT$ are instrumented on $EUCLID$. In addition, the interaction terms are either held fixed or are allowed to vary over the waves (to be more precise: $VBARD$, $RENTIN$ and $RENTOUT$ are allowed to vary and LUC is held constant as explained above). Given that unobserved background characteristics of geographically clustered households may be correlated we base inference on standard errors clustered at the commune level.

Throughout the results section we loosely refer to yearly (total, food and non-food) per-capita consumption expenditures growth as (total, food and non-food) consumption growth and to yearly (total, food and non-food) per-capita consumption volatility as (total, food and non-food) consumption volatility. The Stata do-files for the reproduction of the empirical results based on VHLSS data can be downloaded from the internet. See Appendix B for further details

4.2.1 Impact of LUCs on consumption growth and volatility

As hypothesized above, the direction of the effect of LUCs on consumption growth and volatility is not clear. We first estimate the direction of the effect and then identify the channel. **Table 2** shows the estimated impact of LUC possession on consumption growth. For all outcome variables across all specifications households possessing and not possessing LUCs hardly differ in consumption growth over the survey period under OLS estimation. These estimates, however, might be biased due to self-selection into certification.

Instrumenting LUC on $DELAY$ dramatically changes the results. Total consumption growth increases between 66 and 91 percent over the survey period (depending on the specification) 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. Looking at the components of total expenditures we cannot tell whether this effect is rather driven by food than by non-food consumption growth. The bottom of Table 2 shows the estimated impact of delay on certification status on the first stage of 2SLS. It is estimated that the take-up probability is 6.4 to

8.4 percent higher for households in districts without delay than if they lived in districts with delay.

While these results imply that certification status has a positive impact on consumption growth, it does not reveal whether consumption volatility increases or decreases as a consequence of certification. **Table 3** shows the impact of LUCs on the consumption volatility. OLS impact estimates are small in magnitude and by and large insignificant. Again, the magnitudes change dramatically after instrumenting LUC on $DELAY$ in the 2SLS estimation. Total consumption volatility increases between 54 and 78 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. The effect is significant at least at the 10 percent level.

These findings show that there is a positive impact of LUCs on consumption growth, but also a clear increase in consumption volatility. This implies that the channel between certification status and consumption outcomes at work is not a smoothing channel, but direct evidence is not shown so far. The next section identifies the channel of impact.

4.2.2 Channels of impact: Credit market

We first attempt to estimate the impact of the credit market channel on consumption growth by regressing consumption growth on the interaction term $LUC * VBARD$, which is equal to one if a household possesses a land-use certificate and borrows from VBARD in any of the survey waves (treatment varies over household but not over time). **Table 4** has the results. Using OLS, the estimated effect on the three consumption measures is positive, but small in magnitude and insignificant. However, instrumenting $LUC * VBARD$ on delay yields large and significant effects. Total consumption growth increases between 74 and 86 percent over the survey period for households who borrow from VBARD conditional on LUC take-up in a district without delay and who would not borrow from VBARD conditional on no LUC take-up if they dwelled in a districts with delay. This effect is mainly driven by food consumption growth, which is estimated to increase between 53 and 63 percent for households who borrow from VBARD conditional on LUC take-up in a district without delay and who would not borrow from VBARD conditional on no LUC take-up if they dwelled in a districts with delay using 2SLS. The first-stage is highly significant at the 1 percent level across all specifications. It is estimated that the take-up probability is 6.8 and 7.7 percent higher for households in districts without delay than if they lived in districts with delay.

In **Table 5** we slightly modify and repeat these regressions by allowing $VBARD$ to vary over time in the interaction term. The findings are similar to Table 4. OLS regressions are generally insignificant, while the estimated effect under 2SLS are even stronger. Total consumption growth increases between 105 and 110 percent over the survey period for households who borrow from VBARD conditional on LUC take-up in a district without delay and who would not borrow from VBARD conditional on no LUC take-up if they dwelled in a

districts with delay. This effect seems to be driven by both food and non-food consumption growth which are significant in two out of four specifications. The first-stage effect of delay is again highly significant across all specifications.

While the $LUC * VBARD$ channel has positive impact on consumption growth, **Table 6** shows that this channel also increases consumption volatility. Using 2SLS it is estimated that total consumption volatility increases between 61 and 80 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. This effect is mainly caused by volatility in non-food consumption, which is estimated to increase between 105 and 126 of a standard deviation 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 imply that credit is used for investment rather than consumption smoothing purposes. This can also be shown in a more direct way. **Table 7** shows the results of regressing consumption expenditure growth on an triple interaction term equal to one if a household possessed an LUC, borrowed from VBARD and invested in fertilizer over the survey period (treatment varies only over households but not over waves). Instrumenting the triple interaction term on delay increases consumption growth between 74 and 86 percent for households who invest conditional on VBARD borrowing and LUC possession in a district without delay who would not invest conditional not borrowing from VBARD and no LUC take-up if they lived in districts with a delay. Again, the instrument is highly significant across all specifications. Allowing VBARD and investment to vary across households and time produces similar results although with a slightly smaller magnitude. See **Table 8** for results.

Table 9 shows that this increase in consumption growth is accompanied by an increase in volatility. Instrumenting on the triple interaction term it is estimated that consumption volatility increases between 60 and 80 of a standard deviation for households who would invest conditional on VBARD borrowing and LUC take-up in districts without delay and who would not invest, conditional on not borrowing from VBARD and not taking-up LUCs in districts with delay. The estimated effects are highly significant across all specifications.

Table 10 and **Table 11** provide some suggestive evidence that the other important source of formal credit in rural areas, the Vietnam Bank for Social Policy (VBSP), does not affect consumption outcomes through certification. OLS regressions of consumption growth and volatility on an interaction term (equal to one if a household has a positive LUC status and borrows from VBSP and zero if not) under different specifications only yields insignificant results. Estimating the relationship by 2SLS is not feasible as the first-stage is insignificant (as it should be, given that VBSP lends on group rather than an individual basis and hence does not requires LUCs as collateral).

4.2.3 Channel of impact: Land market

It was shown that the credit market channel has strong impact on consumption outcomes. This section tests whether this also holds true for the land market

channel. The impact is estimated be regressing consumption outcomes on $LUC*RENTIN$ and, in another regression, on $LUC*RENTOUT$, respectively equal to one if a household has a positive LUC status and rents-in land and zero if not and equal to one if a household has a positive LUC status and rents-out land and zero if not.

Table 12 has the results for $LUC*RENTIN$ (in which the latter only varies over households but not time). The only significant impact in OLS regressions is found on food consumption growth, which is estimated to be 6 percent lower as compared to had they not a positive LUC status and rented-in land. While it seem plausible that households might have to cut back on food consumption because of the additional expenses related to land rental, this finding is not confirmed in the 2SLS regressions.

Given that the first-stage effect of $DELAY$ is not significant (not shown), we employ $EUCLID$ as instrument for land rentals. The first stage effect is highly significant at the 1 percent level. It is estimated that the participation probability in land rent-in conditional on LUC possession is to 4.9 to 7.0 percent higher if distance increases by 100KM for households in districts further away from the province town than if they lived in districts closer to the province town. We should point out that the usage of a different instrument limits the comparability to the results in the 2SLS regressions analyzing the impact of the credit market channel, as Euclidian distance shifts another part of the variation in $LUC * RENTIN$ than $DELAY$ would. Anyhow, the 2SLS regressions of total, food, and non-food consumption growth on $LUC * RENTIN$ are all insignificant for all specifications. **Table 13** allow $RENTIN$ to vary freely in the interaction term. The absence of significant impact from Table 12 is confirmed.

Table 14 contains only insignificant results for both OLS and 2SLS estimates with the exception of food consumption volatility using 2SLS. Accordingly food consumption volatility decreases between 128 and 138 of a standard deviation for households in districts further away from the province town than if they lived in districts closer to the province town. **Table 15**, **Table 16** and **Table 17** show the results for regressions of consumption growth and volatility on $LUC * RENTOUT$. Neither OLS nor 2SLS regressions yield clear evidence of an impact of $LUC * RENTOUT$ on consumption outcomes under the different specifications.

5 Conclusion

This article examines the link between a land certification program and consumption growth and consumption volatility of households in rural Vietnam. Given that LUCs may affect consumption outcomes through both credit and land markets, we also identify the channel of impact. We find that LUCs increase consumption growth but also consumption volatility, because households typically use formal credit for agricultural investment rather than consumption smoothing. Consumption streams become subject to more risk and thus become

more volatile.

We do not find clear 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 subpopulation for which this might be the case.

The findings imply that there could be an increase in farmer's welfare through contingent markets such that consumption fluctuations due to risky investment can be insured. Suitable ex-ante financial services to do so include agricultural insurance, futures contracts or guarantee funds. Government assistance in ex-post to emergencies emerge as another opportunity (see, for instance, the collection of policy briefs in Kloeppinger-Todd and Sharma, 2010, for a discussion of a variety of financial services which may help to ease agricultural investment risk). To the day the availability of financial services like these remains low in rural Vietnam.

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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, see section 4 for details).

Outcome variables. The main outcome variables of interest are consumption outcomes such as consumption growth (ΔY) and consumption volatility $Vol(\Delta Y)$, respectively expressed in terms of three consumption measures: (i) Yearly per-capita percentage change of total consumption expenditure, (ii) yearly per-capita percentage change of food consumption expenditure and (iii) yearly per-capita percentage change of non-food consumption expenditure.

Treatment variables. The main treatment variable of interest is LUC, a binary indicator equal to one if the household has at least one certified land plot and zero otherwise. We employ a variety of interactions of LUC: (i) $LUC * VBARD$, an interaction term equal to one if a household has a positive LUC_i status and borrows from the Vietnam Bank for Agricultural and Rural Development (VBARD), (ii) $LUC * VBARD * INVEST$, an interaction term equal to one if a household has a positive LUC_i status, borrows from VBARD and invests in fertilizer, (iii) $LUC * VBSP$, an interaction term equal to one if a households has a positive LUC status and borrows from the Vietnam Bank for Social Policy (VBSP), (iv) $LUC * RENTIN$, a binary indicator equal to one if the household has a positive LUC status and rents-in land and zero otherwise and (v) $LUC * RENTOUT$, a binary indicator equal to one if the household has a positive LUC status and rents-out land and zero otherwise.

Instrumental variables. We draw on two instruments in the empirical analysis: $DELAY$ is 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, $LUC * VBARD$ and $LUC * VBARD * INVEST$ are instrumented on $DELAY$. This variable is from the VHLSS 2004. (ii) $EUCLID$ is the Euclidian distance from the district town in a district where a particular household is dwelling to the province town of the province in which this district is located (in 100km). This variable is taken from the geographic information system created for the study by Minot et al. (2003). It is constructed from the UTM coordinates for the different district towns.

Controls A. Controls A include a number of characteristic on the household and the household head such as ethnicity (a binary indicator equal to one if the household head is of non-Kinh ethnic group and zero otherwise), gender (a binary indicator equal to one if the head is female and zero otherwise), the age of the head, the squared age of head and a series of binary indicator on the educational achievements of the head.

Controls B. Controls B includes a series of binary indicators on commune characteristics equal to one if there are road connections to district or province towns, intracommune roads, bridges, irrigation systems, electricity, clean wa-

ter supply, a public waste disposal system, a health care centre, a school, a kindergarten, a (state-owned) commercial bank, access to non-farm employment, access to non-farm private employment through foreign investors and zero otherwise.

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) and a detailed description of all variables employed in the analysis (see also Appendix C on variables).

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 and treatment variables and instruments for panel and aggregate data.

	Mean	S.d.	Unit of variable	N
		Panel data		
Outcome variables				
Monthly per-capita consumption expenditures growth				
Total				
Between wave 1 and 2	46.76	59.30	Percent	1428
Between wave 2 and 3	49.35	75.19	Percent	1428
Food				
Between wave 1 and 2	49.73	58.10	Percent	1428
Between wave 2 and 3	36.27	57.75	Percent	1428
Non-food				
Between wave 1 and 2	60.37	114.59	Percent	1428
Between wave 2 and 3	80.43	161.99	Percent	1428
Treatment variables				
LUC	0.83	0.37	binary	2856
LUC*VBARD	0.21	0.41	binary	2856
LUC*RENTIN	0.09	0.29	binary	2856
LUC*RENTOUT	0.06	0.23	binary	2856
Instruments				
DELAY			binary	
EUCLID			in 100 KM	
		Aggregate data		
Outcome variables				
Monthly per-capita consumption expenditures volatility				
Total	37.71	38.60	No specific unit	1428
Food	34.94	32.57	No specific unit	1428
Non-food	65.51	87.48	No specific unit	1428
Treatment variables				
LUC	0.83	0.37	binary	1428
LUC*VBARD	0.23	0.42	binary	1428
LUC*RENTIN	0.12	0.32	binary	1428
LUC*RENTOUT	0.05	0.23	binary	1428
Instruments				
DELAY	0.61	0.49	binary	1428
EUCLID	0.28	6.33	in 100 KM	1406

Notes: Unweighted descriptive statistics for panel and aggregate data. Treatment variables are presented such that they only vary over households but not time. In the empirical analysis they are also allowed to vary over time (except for LUC).

Table 2: Impact of LUCs on per-capita consumption expenditures growth.

	(1)	(2)	(3)	(4)
OLS				
Total	3.72	2.30	2.90	1.35
	(2.424)	(2.579)	(2.402)	(2.588)
N	2856	2806	2856	2806
Food	-0.48	-1.44	-1.39	-2.48
	(2.369)	(2.414)	(2.330)	(2.391)
N	2856	2806	2856	2806
Non-food	7.53	5.88	6.56	4.81
	(6.094)	(6.229)	(6.219)	(6.310)
N	2856	2806	2856	2806
2SLS (second stage)				
Total	66.03*	73.25*	79.72*	91.44*
	(34.885)	(39.527)	(43.294)	(52.034)
N	2856	2806	2856	2806
Food	49.14	52.59	58.85	65.80
	(30.067)	(33.021)	(36.722)	(42.439)
N	2856	2806	2856	2806
Non-food	76.90	100.99	100.97	129.58
	(63.210)	(69.287)	(77.243)	(91.096)
N	2856	2806	2856	2806
2SLS (first stage)				
Delay (binary)	0.084***	0.078***	0.073***	0.064***
	(0.030)	(0.029)	(0.028)	(0.027)
N	2856	2806	2856	2806
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is a household's certification status, a binary indicator equal to one if the household possesses at least one certified plot and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 3: Impact of LUCs on per-capita consumption expenditures volatility.

	(1)	(2)	(3)	(4)
OLS				
Total	4.55**	3.50	3.80*	2.33
	(2.220)	(2.318)	(2.260)	(2.348)
N	1428	1403	1428	1403
Food	2.28	1.96	2.47	1.90
	(2.442)	(2.445)	(2.479)	(2.492)
N	1428	1403	1428	1403
Non-food	6.90	5.82	5.91	4.43
	(6.147)	(6.283)	(6.360)	(6.375)
N	1428	1403	1428	1403
2SLS (second stage)				
Total	67.32**	59.31*	77.70*	68.50
	(32.634)	(32.070)	(40.795)	(41.737)
N	1428	1403	1428	1403
Food	37.09	25.09	47.77	32.90
	(26.040)	(26.046)	(30.768)	(30.749)
N	1428	1403	1428	1403
Non-food	88.31	104.67	116.04	135.62
	(63.911)	(65.883)	(80.294)	(88.969)
N	1428	1403	1428	1403
2SLS (first stage)				
Delay (binary)	0.084***	0.078***	0.073***	0.064***
	(0.030)	(0.029)	(0.028)	(0.027)
N	1428	1403	1428	1403
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is a household's certification status, a binary indicator equal to one if the household possesses at least one certified plot and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 4: Impact of the LUC and VBARD interaction on per-capita expenditures growth (time-fixed treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	5.35*	4.59	5.06*	3.93
	(2.940)	(3.056)	(2.968)	(3.078)
N	2856	2806	2856	2806
Food	1.54	1.32	1.21	0.66
	(2.363)	(2.306)	(2.354)	(2.297)
N	2856	2806	2856	2806
Non-food	9.50	8.62	8.56	7.27
	(6.412)	(6.513)	(6.478)	(6.568)
N	2856	2806	2856	2806
2SLS (second stage)				
Total	78.44*	74.28**	85.56*	81.56*
(41.046)	(37.790)	(45.254)	(43.311)	
N	2856	2806	2856	2806
Food	58.37	53.33	63.16	58.69
	(35.751)	(32.476)	(38.440)	(35.999)
N	2856	2806	2856	2806
Non-food	91.34	102.40	108.38	115.58
	(73.661)	(67.251)	(80.753)	(77.220)
N	2856	2806	2856	2806
2SLS (first stage)				
Delay (binary)	0.071***	0.077***	0.068***	0.072***
	(0.025)	(0.025)	(0.025)	(0.026)
N	2856	2806	2856	2806
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and borrowing from VBARD, a binary indicator equal to one if the household possesses at least one certified plot and borrows from VBARD and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 5: Impact of the LUC and VBARD interaction on per-capita consumption expenditures growth (time-varying treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	4.63	3.21	4.29	2.74
	(3.804)	(3.894)	(3.788)	(3.864)
N	2856	2831	2856	2831
Food	2.18	1.10	1.66	0.53
	(2.867)	(2.855)	(2.845)	(2.820)
N	2856	2831	2856	2831
Non-food	6.47	5.28	6.28	4.90
	(7.813)	(7.845)	(7.824)	(7.856)
N	2856	2831	2856	2831
2SLS (second stage)				
Total	107.94*	110.30**	105.65*	110.33**
	(57.353)	(53.052)	(57.628)	(55.496)
	2856	2831	2856	2831
Food	77.84	76.97*	84.04	86.54*
	(48.393)	(43.918)	(51.568)	(48.659)
	2856	2831	2856	2831
Non-food	135.31	164.16*	135.67	162.96*
	(101.418)	(94.228)	(101.937)	(98.174)
	2856	2831	2856	2831
2SLS (first stage)				
Delay (binary)	0.053***	0.058***	0.053***	0.056***
	(0.020)	(0.020)	(0.020)	(0.020)
N	2856	2806	2856	2806
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and borrowing from VBARD, a binary indicator equal to one if the household possesses at least one certified plot and borrows from VBARD and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 6: Impact of LUC and VBARD interaction on per-capita consumption expenditures volatility.

	(1)	(2)	(3)	(4)
OLS				
Total	9.05***	9.20***	9.07***	9.00***
	(3.347)	(3.429)	(3.360)	(3.441)
N	1428	1403	1428	1403
Food	2.98	3.81*	3.28	3.88*
	(2.151)	(2.171)	(2.175)	(2.206)
N	1428	1403	1428	1403
Non-food	12.82*	12.70*	12.10*	11.75
	(7.031)	(7.120)	(7.078)	(7.161)
N	1428	1403	1428	1403
2SLS (second stage)				
Total	79.96**	60.14**	83.39**	61.10*
	(37.382)	(30.350)	(40.586)	(33.655)
N	1428	1403	1428	1403
Food	44.05	25.44	51.27	29.35
	(30.923)	(26.264)	(32.221)	(26.964)
N	1428	1403	1428	1403
Non-food	104.90	106.14*	124.54	120.96*
	(73.568)	(63.373)	(81.889)	(73.056)
N	1428	1403	1428	1403
2SLS (first stage)				
Delay (binary)	0.071***	0.077***	0.068***	0.072***
	(0.025)	(0.025)	(0.025)	(0.026)
N	1428	1403	1428	1403
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status and borrowing from VBARD, a binary indicator equal to one if the household possesses at least one certified plot and borrows from VBARD and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 7: Impact of LUC, VBARD and investment interaction on per-capita consumption expenditures growth (time-fixed treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	5.35*	4.59	5.06*	3.93
	(2.940)	(3.056)	(2.968)	(3.078)
N	2856	2806	2856	2806
Food	1.54	1.32	1.21	0.66
	(2.363)	(2.306)	(2.354)	(2.297)
N	2856	2806	2856	2806
Non-food	9.50	8.62	8.56	7.27
	(6.412)	(6.513)	(6.478)	(6.568)
N	2856	2806	2856	2806
2SLS (second stage)				
Total	78.44*	74.28**	85.56*	81.56*
	(41.046)	(37.790)	(45.254)	(43.311)
N	2856	2806	2856	2806
Food	58.37	53.33	63.16	58.69
	(35.751)	(32.476)	(38.440)	(35.999)
N	2856	2806	2856	2806
Non-food	91.34	102.40	108.38	115.58
	(73.661)	(67.251)	(80.753)	(77.220)
N	2856	2806	2856	2806
2SLS (first stage)				
Delay (binary)	0.071***	0.077***	0.068***	0.072***
	(0.025)	(0.025)	(0.025)	(0.026)
N	2856	2806	2856	2806
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status, borrowing from VBARD and investment, a binary indicator equal to one if the household possesses at least one certified plot, borrows from VBARD and makes an investment into land (fertilizer) and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 8: Impact of LUC, VBARD and investment interaction on per-capita consumption expenditures growth (time-varying treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	3.60	2.15	2.56	1.37
	(2.419)	(2.536)	(2.513)	(2.639)
N	2856	2831	2856	2831
Food	-0.51	-2.09	-1.66	-2.80
	(2.368)	(2.388)	(2.396)	(2.405)
N	2856	2831	2856	2831
Non-food	7.13	6.92	6.03	6.08
	(6.082)	(6.206)	(6.303)	(6.422)
N	2856	2831	2856	2831
2SLS (second stage)				
Total	68.68*	81.85**	68.85*	83.45*
	(35.273)	(40.766)	(36.402)	(42.843)
N	2856	2831	2856	2831
Food	49.53	57.11*	54.77*	65.47*
	(30.126)	(33.477)	(32.884)	(37.538)
N	2856	2831	2856	2831
Non-food	86.10	121.81*	88.41	123.27*
	(63.934)	(71.332)	(65.738)	(74.715)
N	2856	2831	2856	2831
2SLS (first stage)				
Delay (binary)	0.053***	0.058***	0.053***	0.056***
	(0.020)	(0.020)	(0.020)	(0.020)
N	2856	2806	2856	2806
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status, borrowing from VBARD and investment, a binary indicator equal to one if the household possesses at least one certified plot, borrows from VBARD and makes an investment into land (fertilizer) and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 9: Impact of LUC, VBARD and investment interaction on per-capita consumption expenditures volatility.

	(1)	(2)	(3)	(4)
OLS				
Total	9.05***	9.20***	9.07***	9.00***
	(3.347)	(3.429)	(3.360)	(3.441)
N	1428	1403	1428	1403
Food	2.98	3.81*	3.28	3.88*
	(2.151)	(2.171)	(2.175)	(2.206)
N	1428	1403	1428	1403
Non-food	12.82*	12.70*	12.10*	11.75
	(7.031)	(7.120)	(7.078)	(7.161)
N	1428	1403	1428	1403
2SLS (second stage)				
Total	79.96**	60.14**	83.39**	61.10*
	(37.382)	(30.350)	(40.586)	(33.655)
N	1428	1403	1428	1403
Food	44.05	25.44	51.27	29.35
	(30.923)	(26.264)	(32.221)	(26.964)
N	1428	1403	1428	1403
Non-food	104.90	106.14*	124.54	120.96*
	(73.568)	(63.373)	(81.889)	(73.056)
N	1428	1403	1428	1403
2SLS (first stage)				
Delay (binary)	0.071***	0.077***	0.068***	0.072***
	(0.025)	(0.025)	(0.025)	(0.026)
N	1428	1403	1428	1403
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status, borrowing from VBARD and investment, a binary indicator equal to one if the household possesses at least one certified plot, borrows from VBARD and makes an investment into land (fertilizer) and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 10: Impact of the LUC and VBSP interaction on per-capita consumption expenditures growth - control experiment(time-varying).

	(1)	(2)	(3)	(4)
OLS				
Total	6.20	5.47	6.99	6.05
	(5.543)	(5.535)	(5.575)	(5.567)
N	2856	2831	2856	2831
Food	2.72	2.67	3.55	3.18
	(4.554)	(4.611)	(4.621)	(4.682)
N	2856	2831	2856	2831
Non-food	13.01	9.61	13.53	10.40
	(9.739)	(9.826)	(9.761)	(9.815)
N	2856	2831	2856	2831
2SLS (first stage)				
Delay (binary)	-0.008	0.003	-0.006	0.004
	(0.012)	(0.012)	(0.012)	(0.012)
N	2856	2831	2856	2831
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and borrowing from VBSP, a binary indicator equal to one if the household possesses at least one certified plot and borrows from VBSP and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 11: Impact of the LUC and VBSP interaction on per-capita consumption expenditures volatility - control experiment.

	(1)	(2)	(3)	(4)
OLS				
Total	7.79	8.73	7.78	8.62
	(5.412)	(5.401)	(5.417)	(5.386)
N	1428	1403	1428	1403
Food	-0.91	0.81	-0.27	1.32
	(3.973)	(3.927)	(4.013)	(3.968)
N	1428	1403	1428	1403
Non-food 17.23	15.94	17.06	15.72	
	(11.018)	(11.089)	(11.216)	(11.227)
N	1428	1403	1428	1403
2SLS (first stage)				
Delay (binary)	0.001	0.007	0.002	0.008
	(0.013)	(0.013)	(0.013)	(0.013)
N	1428	1403	1428	1403
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) with cluster-robust standard errors in parentheses. Two-stage least squares (2SLS) regressions are not applied as no significant relationship is found for the instrument on the first stage. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status and borrowing from VBSP, a binary indicator equal to one if the household possesses at least one certified plot and borrows from VBSP and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 12: Impact of the LUC and land rent-in interaction on per-capita expenditures growth (time-fixed treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	-2.78	-2.81	-3.08	-2.99
	(3.234)	(3.395)	(3.230)	(3.358)
N	2856	2806	2856	2806
Food	-6.10**	-6.57**	-6.49**	-6.87**
	(2.947)	(3.057)	(2.986)	(3.080)
N	2856	2806	2856	2806
Non-food	2.50	5.21	1.54	4.47
	(8.340)	(8.897)	(8.372)	(8.854)
N	2856	2806	2856	2806
2SLS (second stage)				
Total	49.68	33.79	35.17	22.01
	(37.930)	(37.022)	(38.308)	(39.558)
N	2812	2762	2812	2762
Food	-3.12	-15.27	-11.88	-25.71
	(33.457)	(34.795)	(37.569)	(40.444)
N	2812	2762	2812	2762
Non-food	91.13	105.89	51.97	69.22
	(73.451)	(68.089)	(79.047)	(79.816)
N	2812	2762	2812	2762
2SLS (first stage)				
Euclidian distance	0.049**	0.058***	0.062***	0.070***
	(0.023)	(0.022)	(0.022)	(0.021)
N	2812	2762	2812	2762
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and renting-in, a binary indicator equal to one if the household possesses at least one certified plot and rents-in land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 13: Impact of the LUC and land rent-in interaction on per-capita consumption expenditures growth (time-varying treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	-4.77	-5.39	-5.54	-6.03
	(4.093)	(4.026)	(4.060)	(4.016)
N	2856	2831	2856	2831
Food	-4.73	-5.65	-5.74*	-6.46*
	(3.469)	(3.489)	(3.445)	(3.484)
N	2856	2831	2856	2831
Non-food	-8.18	-6.96	-8.93	-7.66
(7.787)	(7.625)	(7.676)	(7.512)	
N	2856	2831	2856	2831
2SLS (second stage)				
Total	68.88	55.14	44.23	37.80
	(55.721)	(53.246)	(58.802)	(55.246)
N	2812	2787	2812	2787
Food	-5.09	-22.81	-71.37	-77.53
	(49.279)	(50.238)	(59.120)	(60.381)
N	2812	2787	2812	2787
Non-food	119.11	167.20*	135.61	179.50*
	(107.662)	(101.217)	(113.023)	(106.015)
N	2812	2787	2812	2787
2SLS (first stage)				
Euclidian distance	0.049**	0.057***	0.048**	0.054***
	(0.023)	(0.022)	(0.022)	(0.021)
N	2812	2787	2812	2787
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and renting-in, a binary indicator equal to one if the household possesses at least one certified plot and rents-in land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 14: Impact of LUC and rent-in interaction on per-capita expenditures volatility.

	(1)	(2)	(3)	(4)
OLS				
Total	0.95	3.28	0.70	2.84
	(3.387)	(3.174)	(3.482)	(3.232)
N	1428	1403	1428	1403
Food	-1.59	-0.74	-2.03	-1.32
	(2.510)	(2.572)	(2.639)	(2.684)
N	1428	1403	1428	1403
Non-food	4.44	10.28	3.74	9.40
	(8.678)	(8.945)	(8.680)	(8.904)
N	1428	1403	1428	1403
2SLS (second stage)				
Total	-18.66	-47.05	-6.10	-35.04
	(36.898)	(36.849)	(40.418)	(40.499)
N	1406	1381	1406	1381
Food	-126.93*	-138.52**	-118.09	-131.63*
	(71.846)	(61.511)	(78.716)	(71.370)
N	1406	1381	1406	1381
Non-food	42.89	47.42	25.36	26.83
	(92.278)	(88.160)	(91.785)	(93.803)
N	1406	1381	1406	1381
2SLS (first stage)				
Euclidian distance	-0.051**	-0.049**	-0.049*	-0.047**
	(0.022)	(0.020)	(0.025)	(0.023)
N	1406	1381	1406	1381
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status and renting-in, a binary indicator equal to one if the household possesses at least one certified plot and rents-in land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.

Table 15: Impact of the LUC and land rent-out interaction on per-capita expenditures growth (time-fixed treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	-7.74	-5.45	-8.04	-5.44
	(5.038)	(5.264)	(5.061)	(5.298)
N	2856	2806	2856	2806
Food	-8.80**	-8.38**	-8.87**	-8.10*
	(4.224)	(4.092)	(4.246)	(4.131)
N	2856	2806	2856	2806
Non-food	-6.62	-2.14	-6.97	-2.12
	(11.568)	(11.965)	(11.387)	(11.835)
N	2856	2806	2856	2806
2SLS (second stage)				
Total	-42.07	-25.99	-31.63	-17.33
	(47.800)	(37.063)	(48.997)	(38.090)
N	2812	2762	2812	2762
Food	2.64	11.74	10.69	20.24
	(27.856)	(24.321)	(31.370)	(26.596)
N	2812	2762	2812	2762
Non-food	-77.17	-81.44	-46.74	-54.48
	(81.535)	(72.477)	(88.124)	(79.718)
N	2812	2762	2812	2762
2SLS (first stage)				
Euclidian distance	0.027*	0.033**	0.024	0.030**
	(0.015)	(0.013)	(0.015)	(0.013)
N	2812	2762	2812	2762
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and renting-out, a binary indicator equal to one if the household possesses at least one certified plot and rents-out land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 16: Impact of the LUC and land rent-out interaction on per-capita consumption expenditures growth (time-varying treatment).

	(1)	(2)	(3)	(4)
OLS				
Total	-4.99	-2.53	-5.11	-2.27
	(6.887)	(7.260)	(6.857)	(7.247)
N	2856	2831	2856	2831
Food	-8.89*	-7.96	-8.99*	-7.59
	(5.305)	(5.079)	(5.308)	(5.145)
N	2856	2831	2856	2831
Non-food	-3.67	0.75	-3.71	1.02
	(13.607)	(14.407)	(13.560)	(14.368)
N	2856	2831	2856	2831
2SLS (second stage)				
Total	-83.75	-57.24	-57.41	-41.75
	(98.424)	(70.475)	(96.856)	(73.005)
N	2812	2787	2812	2787
Food	6.19	23.68	92.63	85.64
	(58.920)	(48.830)	(81.119)	(58.279)
N	2812	2787	2812	2787
Non-food	-144.83	-173.56	-176.01	-198.28
	(164.112)	(137.622)	(198.188)	(157.601)
N	2812	2787	2812	2787
2SLS (first stage)				
Euclidian distance	0.037**	0.034**	0.035**	0.032**
	(0.015)	(0.013)	(0.015)	(0.013)
N	2812	2787	2812	2787
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure growth. Treatment variable is an interaction term between certification status and renting-out, a binary indicator equal to one if the household possesses at least one certified plot and rents-out land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=2856 and observations in the regressions in (1) to (4) are due to missing values.

Table 17: Impact of LUC and rent-out interaction on per-capita expenditures volatility.

	(1)	(2)	(3)	(4)
OLS				
Total	2.26	-1.10	1.70	-1.95
	(4.157)	(4.440)	(4.194)	(4.498)
N	1428	1403	1428	1403
Food	-1.32	-5.02	-1.37	-5.11
	(3.843)	(3.779)	(3.839)	(3.782)
N	1428	1403	1428	1403
Non-food	1.14	-0.63	0.59	-1.42
	(11.743)	(12.121)	(11.724)	(12.150)
N	1428	1403	1428	1403
2SLS (second stage)				
Total	15.80	36.19	5.49	27.58
	(34.042)	(38.630)	(36.885)	(39.273)
N	1406	1381	1406	1381
Food	107.49	106.54*	106.21	103.60
	(76.420)	(63.855)	(83.255)	(67.726)
N	1406	1381	1406	1381
Non-food	-36.32	-36.47	-22.81	-21.11
	(68.186)	(55.602)	(78.192)	(67.653)
N	1406	1381	1406	1381
2SLS (first stage)				
Euclidian distance	0.056*	0.064**	0.052*	0.059**
	(0.029)	(0.025)	(0.029)	(0.025)
N	1406	1381	1406	1381
Controls A	No	Yes	No	Yes
Controls B	No	No	Yes	Yes

Notes: Ordinary least squares (OLS) and two-stage least squares (2SLS) regressions with cluster-robust standard errors in parentheses. Dependent variable is per-capita consumption expenditure volatility. Treatment variable is an interaction term between certification status and renting-out, a binary indicator equal to one if the household possesses at least one certified plot and rents-out land in land markets and zero otherwise. Significance level at 90(*), 95(**), 99(***) percent confidence. Differences between maximum sample size N=1428 and observations in the regressions in (1) to (4) are due to missing values.