

# Rural Vietnam in Transition\*

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## Abstract

This paper examines the impact of the 1993 Land Law of Vietnam which gave households the power to exchange, transfer, lease, inherit and mortgage their land-use rights. We use household surveys before and after the law was passed, together with the considerable variation across provinces in the speed of implementation of the reform to identify the impact of the land law. Our difference-in-differences estimates indicate that the additional land rights led to significant increases in the share of total area devoted to long-term crops and in labor devoted to non-farm activities. We then attempt to identify the channels involved in the observed transformation of the Vietnamese rural sector; we thus find little evidence that increased access to credit or higher land market participation were the driving forces of such mutation.

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# 1 Introduction

This paper investigates the impact of a specific legal change to land rights in Vietnam. Land rights are an important issue in developing countries where land is a major asset for most people and agriculture accounts for a large share of national income. For the case of Vietnam, more than three-fourths of the population lives in rural areas, and agricultural activities employ two-thirds of the workforce. Agricultural production grew at a rate of 4.1% over the period 1998-2000 and accounted for 25% of total non-oil exports in 2003.<sup>1</sup> Vietnam is a major world exporter of several agricultural products; for instance, in 2002, Vietnam was the third largest exporter of rice, and the second largest exporter of coffee, pepper, and cashew.

Since the mid-1980s, Vietnam has progressively moved towards a market economy. In 1988, agricultural land was decollectivized and land use rights were granted to households. We analyze the land law of 1993, which laid the foundations for the growth of a market for land in rural Vietnam. This law instituted the issuance of land use certificates to all rural households in the country, enabling them to inherit, transfer, exchange, lease and mortgage their land use rights. By 2000, nearly 11 million land titles had been issued, making this one of the largest titling programs in the developing world, not only in scale but also in speed of implementation.<sup>2</sup> Hence it is important to investigate the consequences of such a large reform on economic outcomes.

There is a certain amount of consensus among economists that better property rights institutions lead to improved economic outcomes (see Knack and Keefer, 1995, North and Thomas, 1973 or Acemoglu et al, 2001 for analyses of general property rights institutions). Scholars such as De Soto (2000) have argued that the major barrier to prosperity in developing countries is the inability to convert property into usable assets, because of a lack of clear-cut legally recognized rights. However, the empirical evidence on the importance of formal property rights in land is inconclusive, both on the overall effect of having property titles and on which dimensions of land rights are crucial. Alston et al (1996) find that investments in land as well as land values are positively associated with possession of formal titles in Brazil; an analysis of land titling in Indonesia reached similar conclusions (SMERU, 2002). On the other hand, Braselle et al. (2002) review a number of studies in African countries which show very little impact of land titling on investment. In many countries, property rights in land are not formally granted by the government and are established through custom or informal mechanisms. In such situations, it is often the case that households undertake investments in land to safeguard their property rights, as shown in work by Besley (1995) on Ghana and Braselle et al. (2002) on Burkina Faso. On the credit side, Feder et al. (1986) find that possession of legal titles leads to a significant increase in credit access for the poor in Thailand; however, Boucher et al (2002) in Nicaragua and Honduras, and Field and Torero (2002) in Peru show that access to credit remains low even after land reforms have been implemented. We thus do not have complete answers to several questions: what is the impact of formal land rights? Is security of tenure the most important feature of land titles, or is it the ability to transform land into working capital that matters? Is it enough to have government legislation in the land market alone?

In order to assess the impact of the 1993 land law, we use household-level data from two waves

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<sup>1</sup>Source: Economist Intelligence Unit (2003)

<sup>2</sup>To view this program in comparative perspective, 8.7 million land titles have been distributed in Thailand since the early 1980s and 1.87 million in Indonesia between 1996 and 2000.

of the Vietnam Living Standards Measurement Study Survey, which took place in 1992-93 and 1997-98 respectively. Since individual-level information on possession of land titles is not available in these surveys, we collected province-level information on the issuance of land certificates. The large variation across provinces in the progress of the reform enables us to construct a difference-in-differences estimate of the impact of the land law.<sup>3</sup> We argue that between-province heterogeneity is probably due to bureaucratic performance rather than other factors which might also influence the outcomes we are interested in. We compare the change in outcomes for households between the two time periods, across provinces at different stages of the land titling process. We find that households in provinces which have made significant progress in land titling increase the proportion of cultivated area devoted to multi-year crops. Our results provide little support to the view that such increased investment is financed by credit since we find no significant increase in household borrowing. Analysis of land market transactions is hampered by severe under-reporting; we do find that the overall volume of transactions increases after the reform, but the increase is not significantly different in provinces which are at an advanced stage of the titling process.

Our results are complementary with other studies of agrarian transition in Vietnam such as Benjamin and Brandt (2004) and Ravallion and Van de Walle (2003). However, the use of measures of land reform progress across provinces enables us to distinguish the incremental impact of the 1993 land law from the overall effect of economic growth during this period. To our knowledge, this is the only study which specifically addresses this identification issue.

The paper is structured as follows: section 2 describe the process of reform and land policies in Vietnam and section 3 proposes a theoretical model to discuss the possible impacts of the land law. Section 4 describe our data and empirical strategy and section 5 describes the variation in the implementation of the land reform across provinces Our main results are discussed in section 6 and an investigation of the potential mechanisms at work is undertaken in section 7. Section 8 concludes.

## 2 Land Rights in Vietnam

The history of Vietnam in the second half of the twentieth century is punctuated by three key dates: 1954 marked the independence of the country from the French and its division into two parts, North and South; in 1975, the so-called “Vietnam war” ended with the reunification of North and South Vietnam, and 1986 corresponds to the implementation of sweeping economic reforms (the “doi moi” policy) and a move towards a market-oriented economy, which continues to the present day.<sup>4</sup>

### 2.1 The Institutional Framework until 1988

Before the Geneva Accord of 1954, Vietnam was under French control. During the colonial period, most farmland in Vietnam was owned either by French plantation owners or by large Vietnamese landlords: 52 percent of the land was owned by only 3 percent of the indigenous population and more than 60 percent of farmers across the country were landless in the mid-1940s.

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<sup>3</sup>See maps at the end of the paper.

<sup>4</sup>The material in this section is largely based on Boothroyd and Pham (2000), Pingali and Vo-Tong (1992), and Wiegiersma (1988)

After independence in the North, a major land reform was carried out. As a reward for their war efforts, land and ownership rights were distributed to farmers and a rapid increase in agricultural output and productivity followed. However, the policy was reversed and land began to be collectivized in the late 1950s, as Communist ideology gained strength. As a result, 86 percent of all peasant households and 68 percent of total farmland, were brought into cooperatives by 1960. Despite significant declines in output, the collectivization process continued so that 90 percent of all peasant households in the North were working in cooperatives by the mid-1960s. An illuminating stylized fact illustrates the impact of such an incentive system: while individual rural households were privately allocated 5 percent of farmland, they derived 60 to 70 percent of their earnings from this small plot.

Land institutions in the South during that same period were driven by political conflicts. At times where the government sought support from the local elites, pro-landowner policies were adopted. When the war against North Vietnam began, the government tried to gain popular support by adopting the Land-to-the-Tiller law in 1970. Tillers of the soil were to enjoy all the benefits of their work, and this would be accomplished by providing ownership rights to cultivators and putting a retention limit on landlords as low as 20 hectares. However, the law found opposition from landlords and the lack of independence of the bureaucracy made enforcement uneven throughout South Vietnam.

In 1975, when the war ended and the country was reunified, land collectivization started in the South but was implemented with little success: as late as 1986, only 5.9 percent of farmers in the Mekong Delta and 20 percent in the Southeastern region were part of cooperatives, while this figure amounted to 85 percent in the Central Lowlands region (Pingali and Vo-Tong, 1992). Under the collective system, all households were paid a share of output according to their recorded labor hours on the communal land. In 1981, the first changes were made to these arrangements: workers were now allowed to keep all of the surplus they produced over a contracted output. However, this policy was later modified and quotas were constantly renegotiated, resulting in a decline of public confidence. Agricultural yields were extremely low in this period and even as late as 1985, Vietnam was a net importer of rice.

Faced with a worsening economic crisis, the government announced the program of “Doi Moi”, or Renovation, in 1986 and began a gradual movement towards a market economy. As part of a major structural adjustment program, production and consumption subsidies were eliminated from the State budget, government spending was reduced to 6 percent of Gross Domestic Product (GDP), the government work force was reduced by 15 percent, 500 000 soldiers were demobilized, interest rates on loans to State-owned firms were raised and central bank credit was no longer used to finance the budget deficit. The economy started opening up to trade, and the central bank undertook a massive devaluation of the currency to the prevailing black market rate bringing inflation rates from 400 percent in 1986-87 down to 10 percent in 1993. Financial markets were partly deregulated, foreign banks are now allowed to operate in Vietnam and a stock exchange was opened in 2000. In the agricultural sector, Resolution 10 of 1988 granted land-use rights to individual households, while the land law of 1993 made these rights pledgeable and tradable. These two changes are described in detail in following sections.

These reforms have had a dramatic impact on the economy. Government revenue and spending began increasing after 1991. Agricultural production increased rapidly after 1988, and Vietnam is

currently a major exporter of rice, as well as cash crops like coffee, pepper and cashew.<sup>5</sup> Exports accounted for 79 percent of GDP by 1995, and the economy has experienced a growth rate of above 8 percent in the 1990's. Agriculture now accounts for only 25 percent of GDP, down from 40 percent in 1989. The benefits from growth have been fairly widespread: poverty rates are estimated to have declined from 75 percent in 1984 to 55 percent in 1993.<sup>6</sup>

## 2.2 The 1988 Land Law - Resolution 10

A reform undertaken in 1981 allowed households to keep any surplus above a quota level. Such reform was a failure partly because the government did not manage to commit not to raise quotas, always extracting more surplus from farmers. The lack of commitment from the authorities eventually destroyed individual incentives. Then came Resolution 10 of the 1988 land law, aimed at recovering credibility by further liberalizing the agricultural sector in Vietnam. The reform consisted of transferring control and cash-flow rights from the cooperative to the individual household. Land was allocated to households with a fifteen-year security of tenure, output markets were privatized and investment decisions were decentralized and left to households. Private property was virtually instituted. However, as land-use rights were given to families without the possibility to trade such rights, a proper land market did not develop despite some informal transactions.

Land allocation to individual households was conducted by the commune authorities, and encountered some difficulties across the country. In the North and in some regions of the South, land was distributed on a fairness basis, taking into account soil and socio-demographic characteristics of the region. Comparing the realized land allocation process with a simulated market-based outcome, Ravallion and van de Walle (2001) conclude that the realized process generated lower inequality and made the poorest better off. However, the process sometimes relies on arbitrary considerations, leading to favoritism and disputes. For instance, Hayami (1993) reports that "a farmer (...) in Hai Hung Province complained that he received too small a land allocation because his eldest son was in military service and his other children were so young that they received only one-third of an adult's allocation at a time. Thus, he expects that his unfavorable allocation will be corrected at the end of the ten-year tenure period" (p. 13). The situation in the South was complicated by the fact that Resolution 10 stipulated that farmers should be assigned the land they owned prior to 1975 and this generated disagreement between farmers and former landlords, although a 1989 ordinance gave rights to farmers. The allocation was thus not immune to controversy and disputes were still being settled in July 2001, as land allocation was being brought to completion in rural areas.

To many Vietnamese, Resolution 10 is perceived as the major land reform undertaken since 1975 and some scholars attributed Vietnam's agricultural output growth to such liberalization (see e.g. Pingali and Vo-Tong, 1992). There is no denying that newly assigned property rights must have unleashed farmers' incentives to invest and put effort, but much remained to be done to achieve further economic efficiency. The 1993 land law is an additional step towards this end.

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<sup>5</sup>As a matter of illustration, the Vietnam Trade Office in the United States of America (<http://www.vietnamustrade.org/agriculture.htm>), reports that Vietnam was, by 2002, the World third largest exporter of rice, second exporter of coffee (after Brazil), second exporter of pepper (first exporter of black pepper), second exporter of cashew...

<sup>6</sup>See Dollar and Litvack (1998)

### 2.3 The 1993 Land Law and the Issuance of Land Use Certificates

The main focus of this paper is the 1993 land law. The spirit of the law is in continuation of the reforms undertaken by the government since 1988. Despite the allocation of land and its corresponding use rights, no transaction could yet be made officially. The 1993 land law made up for this deficiency. It granted five rights to the household: the right to transfer, exchange, inherit, rent and mortgage.<sup>7</sup> The implementation of the land law consisted of provision of Land-Use Certificates (LUCs). As the actual procedure has some interest for our empirical strategy, it is worth going into some details.

The issuance of LUCs is done as follows: individuals have first to apply for a Land Use Certificate (alternatively known as Land Tenure Certificate or Red Book) through the commune-level People's Committee. The district Bureau of Land Administration then does the groundwork, which includes making a list of all land users, training the staff, purchasing materials, checking and updating the documents related to land such as cadastral maps, land survey records etc. In the meantime, a Land Registration Committee is set up, which includes members from the District Bureau of Land Administration, as well as officials from the commune-level, district-level and sometimes province-level People's Committees. This process takes about four or five weeks. Application forms for land registration are then given out to all the land-users in the commune, who are asked to list all the plots of land owned or allocated to them. This form has finally to be signed, not only by the land user himself, but also by all neighboring households in order to certify the absence of dispute regarding claims on the land.

The Land Registration Committee scrutinizes all these forms and then decides whether a given land user is eligible or not. Land users are classified as ineligible if (i) they obtain the land through an illegal land transfer i.e. without registering the transaction, without paying transfer taxes, or without a legal contract, (ii) they inherit the land from parents without a formal inheritance letter, so that old documents are still in the parents' names, (iii) they have no legal documents to prove their claim to the land, (iv) they are illegally occupying unallocated land, (v) they have not paid all their land taxes in the past, or (vi) there are disputes regarding their ownership or the boundaries of the land they claim. Within 10 days of sending these application forms, a public meeting is held where information regarding eligibility is made public. At this time, the land administration also tries to resolve these disputes. The list of land users who are eligible for receiving the LUC is then sent to the district-level People's Committee. Unresolved disputes are referred to a special working group within the Department of Land Administration. After approval at the district-level, work begins on making the actual LUC for the land-user. This stage is estimated to take about 1500-2000 man days per commune in urban areas, and this figure is unlikely to be much different in rural areas. Note that in 1998, there is an average of 160 communes per province, and 1300 households per commune.

Similarly to previous land reforms, the 1993 land law was unevenly implemented throughout the country. Because province-level differences in the level of registration, i.e. the percentage of households registered, is the keystone of our empirical strategy, we investigate the sources of such heterogeneity. According to Vo (1997), district Bureaus of Land Administration have on average

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<sup>7</sup>There were further modifications to the land law in 1998 and in July 2001. The 1998 revisions granted further rights by making it possible to sub-lease land and they moreover allowed Vietnamese entrepreneurs to use such rights as contribution in a joint venture with a foreign company. The 2001 additions simplified procedures in urban areas.

five members and most communes have only one land officer, which makes registration a lengthy process. Haque and Montesi (1996) also report the major reasons for this slow progress to be “a lack of adequate finances, a lack of trained cadres, a lack of interest and enthusiasm on the part of officials, a lack of proper direction and supervision and disputes among the cadres”, which is consistent with the information given to us by the General Department of Land Administration (henceforth GDLA).<sup>8</sup> As we mentioned earlier, a phenomenon which is likely to slow down the process is the number of disputes that can emerge in villages. The way allocation was made, the existence of pre-existing property rights, the personality of the head of the village are as many determinants that can cause one region to achieve faster registration than another one. An additional reason for delay may also be due to the fees related to registration and the backlog of taxes that some households may be required to pay to become eligible. However fees are not very high, below VND 20 000 (less than USD 1.50) in most areas. Besides, in an effort to increase land registration rates, the government has even made it free for people residing in remote and mountainous areas, and the payment of overdue taxes was no longer a prerequisite for the issuance of LUCs.

Some aspects of this large land titling program give rise to concern regarding the long-term sustainability of this reform. The guidelines for implementation of the five rights was formulated and approved by GDLA in late 1998. In the meantime, substantial volumes of transactions had not been reported to the commune authorities, raising the concern that commune-level land registries would be outdated in a few years’ time (ADB Report, 1998). The certificates are issued at the household level rather than a plot level, which can cause problems in updating the land use certificate in the event of a land transaction. Further, several of the 15 year leases granted during the initial decollectivization of 1988 will be coming up for renewal soon. Procedures regarding LUC issuance or re-issuance in such cases have not been clarified.

### 3 Potential Impact of Improved Land Rights: a Simple Model of Transition

What is likely to be the impact of the land law and more specifically the issuance of LUCs? Rights to transfer, exchange, lease, inherit, and mortgage LUCs are expected to affect the equilibrium allocation of resources through different channels.

- *Tradable Land-Use Certificates:* The rights to transfer, exchange, lease, and then sublease LUCs create a formal market for land. Land transactions are now possible at a larger scale. Whether the market for land thus created achieves a better allocation of land than a centralized system does and hence induces land transactions at all is an open question.
- *Secure Land-Use Certificates:* The longer lease term and the right to inherit (and thus bequeath) that came with LUCs might decrease the likelihood that an individual and her offspring will be expropriated by the State. However, with Resolution 10, tenure was given for 10 years. In that respect, the 1993 Land Law is an incremental improvement of ownership security vis-à-vis Resolution 10, as it extends the lease term and constitutes an additional signal that the government is willing to move towards a private ownership system. Thus,

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<sup>8</sup>GDLA is now part of the Ministry of Natural Resources and Environment (MONRE).

we expect the land law of 1993 to increase farmers’ actual and perceived security of tenure. How much the land law of 1993 constitutes an incremental increase also depends on commune authorities’ ability and willingness to commit to tacitly secure individual landholdings before 1993, and especially since 1988.

- *Pledgeable Land-Use Certificates*: In a world with imperfect credit markets, property rights are, as stated by De Soto (2000), a way to transform illiquid assets into money. Such feature will affect the credit market if banks have the ability to seize collateral at low cost and sell land afterwards. A well-functioning land market is therefore a prerequisite. Furthermore, the incremental impact will also depend on the relative inability of the commune to put in places implicit or explicit contracts aimed at providing incentives to reimburse loans.<sup>9</sup>

### 3.1 The Basic Setting

We next present a simple model to account for these channels in a general framework. Let’s consider a small open economy populated with farmers. Farmers are endowed with one unit of labor that they allocate across agricultural and non-agricultural technologies. They do not have capital to start with. To simplify, non-agricultural technologies will be called off-farm activities, while we will consider rice cultivation and perennial crops cultivation as agricultural activities.

- To address the first potential channel, i.e. *land transactions*, we want to make land allocation relevant. Thus, we assume that the agricultural production is concave in land area. The concavity assumption is not crucial; the only important feature is the existence of a strictly optimal land distribution.
- To capture the *land tenure security* mechanism, we make some assumptions on technologies. Individuals cannot be expropriated of their investments on non-agricultural technologies or investments in rice. However, output on perennial crops are subject to some expropriation risk.
- Finally, the *credit channel* will be addressed in the model by assuming that only land ownership is pledgeable. Demand for credit will be generated by the requirement that the price for acquiring land need to be paid upfront, and that investment in perennial crops require a start-up cost.

Considering a large number of farmers indexed by  $i \in \{1, \dots, N\}$ , and a land area of measure 1. A land allocation is a *partition* of the overall surface. We henceforth restrict attention to a model in which only land area matters.<sup>10</sup> We thus denote a land allocation as a land area profile  $\mu$ , i.e. each individual  $i$  is allocated a plot of area  $\mu_i$ , so that  $\sum_{i=1}^N \mu_i = 1$ .  $(\mu_i)_{i \in \{1, \dots, N\}}$  denotes the land allocation schedule at the end of time  $T = 0$ , while the initial distribution of land is exogenous and denoted  $(\mu_i^0)_{i \in \{1, \dots, N\}}$ . The economy is structured as follows:

- $T = 0$  : Agents are endowed with an initial amount of land. Financial contracts between farmers and lenders are signed. Land exchange arrangements and investments take place.

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<sup>9</sup>Indeed there is anecdotal evidence collecting during field work that in some places, commune authorities would not reallocate land to households who defaulted on a loan.

<sup>10</sup>We want to abstract from land fragmentation issues that are nevertheless important in the case of Vietnam. However, we believe the results under such assumption not to be qualitatively different from a more general case.

- $T = 1$  : Returns on non-farm activity and rice cultivation are realized. Loans are reimbursed or defaulted.
- $T = 2$  : Land expropriation potentially occurs. Output on perennial crops is realized and consumption takes place.

### 3.1.1 Technology

Each individual is endowed with one unit of labor (and no capital) that can be split between the three available technologies: non-farm activity, rice cultivation and perennial crop cultivation. The production functions are specified as follows: for any individual  $i \in \{1, \dots, N\}$ , and plot of size  $\mu$ ,

$$\begin{aligned}
 (1) \quad & \text{nonfarm}(l) = f(l) \\
 (2) \quad & \text{rice}(l, \mu) = g(l, \mu) \\
 (3) \quad & \text{perennial}(l, k, \mu) = h(l, \mu) * 1 \{k \geq \kappa\}
 \end{aligned}$$

where  $f(\cdot)$ ,  $g(\cdot)$ ,  $h(\cdot)$  are increasing concave functions and  $l$  is the amount of labor invested by  $i$ . Furthermore,  $\lim_0 f'(\cdot) = \infty$ , and for any  $l, \mu > 0$ ,  $\lim_{\mu \rightarrow 0} \frac{\partial g}{\partial \mu}(l, \mu) = \infty$ ,  $\lim_{l \rightarrow 0} \frac{\partial g}{\partial l}(l, \mu) = \infty$ . However, we assume that  $\lim_{\mu \rightarrow 0} \frac{\partial g}{\partial \mu}(0, \mu) = \lim_{l \rightarrow 0} \frac{\partial g}{\partial l}(l, 0) = 0$ . Specification (3) reflects that investment in perennial crops requires a minimum amount of capital  $\kappa$ .

Henceforth, investment choices  $\{n_i, r_i, p_i\}$  represent the amounts of time devoted to non-farm activities, rice cultivation and perennial crop cultivation respectively. Recall that  $n_i + r_i + p_i \leq 1$ . Furthermore  $\rho_i$  denotes the share of land area devoted to perennial crop cultivation, while the remaining  $1 - \rho_i$  is used to grow rice. Thus, the areas under perennial and rice are  $\rho_i \mu_i$  and  $(1 - \rho_i) \mu_i$  respectively. For any defined variables  $x_i$ , we subsequently denote  $x \equiv (x_i)_{i \in \{1, \dots, N\}}$ .

### 3.1.2 The Land Law

The focal point of this model is the land allocation process. We interpret the land law of 1993 as the transition between a centrally planned allocation of land to a market-based allocation of land, both statically and dynamically. Then, the impact of the land law will depend on how the market performs relatively to a central decision maker. To summarize how we model transition, we make the following assumptions:

*Assumption A1:* The land law of 1993 shifts the economy from a two-decision-maker problem (the commune decides land allocation while farmers decide investment levels) to a one-decision-maker problem (farmers decide both land allocation and investment levels).

*Assumption A2:* The land law of 1993 is unanticipated by agents.

Admittedly, the institutional framework in Vietnam is not as clearcut as suggested above. For example, land transactions are partially controlled after 1993 in an attempt to prevent “excess” landlessness. Furthermore, land transactions were anecdotally reported to informally take place

even before 1993. More importantly, as we saw earlier, resolution 10 of 1988 gave ownership of land to households for a period up to fifteen years. Strictly speaking, the land law of 1993 is interpreted to give an additional signal that the terms of resolution 10 are not to be renegotiated, while extending the lease term, and formalizes an informal land market which existed previously.

### 3.1.3 Post-1993 Individual Ownership of Land

In the post-1993 economy, a market for land exists and individual buy or sell land, pledge land as collateral. Individuals can sell ownership rights, keep them over the next period, or pledge them as collateral in a loan contract. Thus, individuals take land prices and interest rates as given and then choose land ownership, loan contracts, savings/reimbursement decisions, and occupations to maximize utility.

**a) Land and Credit Markets** At the beginning of each time period, there is a spot market for land, and the price of a marginal plot of land will be noted  $\eta$ . If necessary and possible, agents will need to borrow in order to buy land. To this purpose, there exists an atomistic credit market characterized by free entry, with risk-free interest rate normalized to 1. Contracts written between lenders and borrowers are fully enforceable.

For each individual  $i$ , a financial contract consists of the following: (i) an amount borrowed  $B_i$  at time  $T = 0$ , (ii) an amount  $D_i$  due at the end of time  $T = 1$ , (iii) and an expropriation clause  $\pi_i(\delta_i)$ , where  $\delta_i$  is a dummy variable equal to 1 in case of default and 0 otherwise. We naturally assume that contracts are restricted to cases in which  $\pi_i(1) \geq \pi_i(0)$ . Default occurs when the amount  $d_i$  reimbursed by individual  $i$  at the end of time  $T = 1$ , is lower than the amount due  $D_i$ :  $\delta_i = 1 \{d_i < D_i\}$ . By abuse of notation,  $\delta_i$  will henceforth denote the probability of default as well, while  $d_i$  will refer to both the repayment strategy and the expected repayment. We then have  $\pi_i(\delta_i) \equiv \delta_i * \pi_i(1) + (1 - \delta_i) * \pi_i(0)$ .

As mentioned previously, land only is expropriated and  $1 - \pi_i(\delta_i)$  is the expected share of the plot that remains to individual  $i$  at the beginning of time  $T = 2$ . Thus, individual  $i$  enjoys a share  $1 - \pi_i(\delta_i)$  of the output of perennials, while the remaining  $\pi_i(\delta_i)$  is seized by creditors.

**b) Preferences** Agents are assumed to be risk-neutral, hence maximizing expected final wealth levels. We take commodity prices and wages as exogenously set to 1. A general equilibrium analysis would however not change substantially the qualitative predictions delivered by a partial equilibrium framework. Farmers take the price of land  $\eta$  as given, sign financial contracts with potential creditors, buy and sell land, and undertake their investments and repayment decisions accordingly. They just optimize the following program:

$$U_i^{post}(\mu_i^0, \eta) = \max_{\substack{\mu_i, \rho_i, \{B_i, D_i, \pi_i(\cdot)\}, \\ d_i, k_i, \{n_i, r_i, p_i\}}} f(n_i) + g[r_i, (1 - \rho_i) \mu_i] + [1 - \pi_i(\delta_i)] [h(p_i, k_i, \rho_i \mu_i) 1(k_i \geq \kappa)] - \eta(\mu_i - \mu_i^0) - k_i + (B_i - d_i)$$

subject to:

- labor constraints:

$$(4) \quad n_i + r_i + p_i \leq 1$$

- cash constraints:

$$(5) \quad \begin{aligned} \eta (\mu_i - \mu_i^0) + k_i &\leq B_i \\ d_i &\leq f(n_i) + g[r_i, (1 - \rho_i) \mu_i] \end{aligned}$$

- credit market break-even conditions:

$$(6) \quad D_i = B_i - \pi_i(0) [h(p_i, k_i, \rho_i \mu_i) 1(k_i \geq \kappa)]$$

$$(7) \quad d_i = B_i - \pi_i(\delta_i) [h(p_i, k_i, \rho_i \mu_i) 1(k_i \geq \kappa)]$$

In the post-1993 economy, farmers maximize expected output by borrowing to buy and sell land, and pay for potential start-up costs that need to be undertaken (inequalities (5)) and then by allocating one unit of labor across occupations (inequality (4)). Free-entry on the credit market implies that default is defined when repayments do not match the initial loan net of pledged output (equation (6)), while (7) guarantees that lenders make zero profit in equilibrium.

The aggregate welfare of the post-1993 economy, can then be written:

$$W^{post}(\mu^0, \eta) = \sum_{i=1}^N U_i^{post}(\mu_i^0, \eta).$$

### 3.1.4 Pre-1993 Community Ownership of Land

In the community land ownership regime, individuals do not have control over the land distribution  $(\mu_i)_{i \in \{1, \dots, N\}}$ . Thus, the institutional environment will differ from the previous case in some important aspects.

**a) Land and Credit Markets** There is no land market, as a central planner arbitrarily allocates land, hence chooses  $(\mu_i)_{i \in \{1, \dots, N\}}$  but also  $[\pi_i(\delta)]_{i \in \{1, \dots, N\}}$ . We assume that once land is expropriated, the proceeds are redistributed in a lump-sum manner to all farmers in the village.

Credit markets are identical to the post-1993 economy, at the exception that individuals cannot pledge land as collateral for a loan. Indeed the allocation of land is determined at the community level. A financial contract is the pair  $\{B_i, D_i\}$ . However a central planner can always make expropriation contingent on default history.

**b) Preferences** Similarly to the post-1993 case, agents are risk-neutral and maximize lifetime earnings, taking land distribution and expropriation profiles as given:

$$U_i^{pre} [\mu, \pi (\cdot)] = \max_{\substack{\rho_i, \{B_i, D_i\}, \\ d_i, k_i, \{n_i, r_i, p_i\}}} f(n_i) + g[r_i, (1 - \rho_i) \mu_i] + [1 - \pi_i(\delta_i)] [h(p_i, k_i, \rho_i \mu_i) \mathbf{1}(k_i \geq \kappa)] - k_i + (B_i - d_i)$$

subject to:

- labor constraints:

$$(8) \quad n_i + r_i + p_i \leq 1$$

- cash constraints:

$$(9) \quad \begin{aligned} k_i &\leq B_i \\ d_i &\leq f(n_i) + g[r_i, (1 - \rho_i) \mu_i] \end{aligned}$$

- credit market break-even conditions:

$$(10) \quad D_i = B_i - \pi_i(0) [h(p_i, k_i, \rho_i \mu_i) \mathbf{1}(k_i \geq \kappa)]$$

$$(11) \quad d_i = B_i - \pi_i(\delta_i) [h(p_i, k_i, \rho_i \mu_i) \mathbf{1}(k_i \geq \kappa)]$$

The major difference between the post-1993 and pre-1993 economies is the allocation of land and the expropriation scheme that are taken as given before 1993, while post-1993, agents choose land allocation and take land prices as given.

At the beginning of period 0, the central planner chooses a land allocation and announces an expropriation schedule to maximize the following criterion:

$$W^{pre} = \max_{\mu, \pi(\cdot)} \sum_{i=1}^N U_i^{pre} [\mu_i, \pi_i(\cdot)] + \Phi[\mu, \pi(\cdot)]$$

subject to

$$\sum_{i=1}^N \mu_i \leq 1.$$

The difference in the aggregate between the individual and community land ownership regimes is captured in the function  $\Phi[\cdot]$ . This difference of objectives between the community and individuals can be driven by the following reasons:<sup>11</sup>

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<sup>11</sup>We will see later on that the market-based land allocation mechanism maximizes aggregate utility as defined previously. However, specifications of the economy and assumptions of perfect functioning of land and credit markets under the market-based land allocation scheme are arbitrary. We do not intend to make any welfare comparison between the two allocation regimes that we investigate. The market outcome is set to be an arbitrary benchmark, and  $\Phi(\cdot)$  is the reduced-form function that incorporates all possible features that might induce the community-based land allocation system to deliver an outcome different from the market outcome. The empirical sections will test some hypothesis about the characteristics of the function  $\Phi(\cdot)$ . The paper is indeed investigating transition but does not address any normative issue.

- *externalities*: land ownership has some spillovers. For example, a large population of landless can be a source of social tensions. As social unrest is a public bad, market outcomes are unlikely to internalize such phenomenon. In such case,  $\Phi[\cdot]$  may capture the willingness of the central planner not to expropriate a poor farmer in case of default on a loan, or allocate productive land to a poor farmer despite his lower productivity, etc. On the other hand, if there are regulations against land sales post 1993, these will also be captured by  $\Phi[\cdot]$ .
- *political economy*: the decision process within a community (not explicitly modeled here) can be the source of capture that distorts the final reduced-form objective function that such community pursues. The function  $\Phi[\cdot]$  can then also incorporate political features that distinguish a market allocation from a central decision: allocation of land to some well-connected individuals despite their lower productivity. Similarly,  $\Phi[\cdot]$  can capture political economy tensions resulting on expropriation of some farmers for redistributive purposes.
- *information and transaction costs*: implicitly assumed in the model, the land market functions perfectly. Farmers' productivity is common knowledge. Thus, in this case,  $\Phi[\cdot]$  stands for the comparative *disadvantage* of the community (vis-à-vis the market) to gather information about productivity that prices are assumed to reflect frictionlessly. In  $\Phi[\cdot]$  is also incorporated the feature that the 1993 land law comes after Resolution 10 in 1988. Similarly, when land is pledged as collateral in a financial contract, land seizing is assumed to be costless in the individual-ownership system, while it might not. Here again,  $\Phi[\cdot]$  reflects the relative ability of the community-based system to enforce contracts.

## 3.2 Equilibrium outcomes

We will solve for the equilibrium of the economies in the two scenarios, adopting a subgame perfection equilibrium concept.

### 3.2.1 Investment Decisionsm

For a given land distribution  $\mu$  and expropriation schedule  $\pi(\cdot)$ , the first-order conditions for an interior solution for an investment in only two technologies (non-farm activities and rice cultivation) are given by  $k_{\mu_i}^{(2)} = 0$ ,  $\rho_{\mu_i}^{(2)} = 0$ ,

$$(12) \quad f' \left( n_{\mu_i}^{(2)} \right) = \frac{\partial}{\partial l} g \left( r_{\mu_i}^{(2)}, \mu_i \right)$$

subject to

$$n_{\mu_i}^{(2)} + r_{\mu_i}^{(2)} = 1,$$

while investment in the three technologies implies for individual  $i$  that  $k_i^{(3)}(\mu_i) = \kappa$ , and the following allocations of labor and land hold:

$$(13) \quad f' \left( n_{\mu_i, \pi_i(\delta_i)}^{(3)} \right) = \frac{\partial}{\partial l} g \left[ r_{\mu_i, \pi_i(\delta_i)}^{(3)}, \left( 1 - \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} \right) \mu_i \right] = [1 - \pi_i(\delta_i)] * \frac{\partial}{\partial l} h \left( p_{\mu_i, \pi_i(\delta_i)}^{(3)}, \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} \mu_i \right)$$

$$(14) \quad \frac{\partial}{\partial \mu} g \left[ r_{\mu_i, \pi_i(\delta_i)}^{(3)}, \left( 1 - \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} \right) \mu_i \right] = [1 - \pi_i(\delta_i)] * \frac{\partial}{\partial \mu} h \left( p_{\mu_i, \pi_i(\delta_i)}^{(3)}, \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} \mu_i \right)$$

subject to

$$\begin{aligned} n_{\mu_i, \pi_i(\delta_i)}^{(3)} + r_{\mu_i, \pi_i(\delta_i)}^{(3)} + p_{\mu_i, \pi_i(\delta_i)}^{(3)} &= 1, \\ \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} &\in [0, 1] \end{aligned}$$

These equalities are standard interior solutions as farmers equalize the marginal productivity of labor across occupations, and marginal productivity of land across crops. Superscripts <sup>(2)</sup> and <sup>(3)</sup> respectively indicate situations in which only non-farm activities and rice cultivation are adopted or the three types of crop are potentially adopted. Finally the choice whether to invest in perennial crops is dictated by a condition on optimal output levels:

$$(15) \quad f\left(n_{\mu_i}^{(2)}\right) + g\left(r_{\mu_i}^{(2)}, \mu_i\right) \leq f\left(n_{\mu_i, \pi_i(\delta_i)}^{(3)}\right) + g\left[r_{\mu_i, \pi_i(\delta_i)}^{(3)}, \left(1 - \rho_{\mu_i, \pi_i(\delta_i)}^{(3)}\right) \mu_i\right] \\ + [1 - \pi_i(\delta_i)] h\left(p_{\mu_i, \pi_i(\delta_i)}^{(3)}, \rho_{\mu_i, \pi_i(\delta_i)}^{(3)} \mu_i\right) - \kappa$$

Note that if (15) holds, we refer to a three-occupation portfolio, although rice cultivation might not be undertaken at all ( $r_{\mu_i, \pi_i(\delta_i)}^{(3)} = 0$  and  $\rho_{\mu_i, \pi_i(\delta_i)}^{(3)} = 1$ ). To avoid unnecessary distinctions, a reference to three-occupation portfolio choice will henceforth take into account cases in which rice cultivation is not considered by households.

**Proposition 1** *Let's consider a farmer  $i$  with land area  $\mu_i$  and expropriation risk  $\pi_i(\delta_i)$ . Defining the two triplets  $\left\{n_{\mu_i}^{(2)}, r_{\mu_i}^{(2)}, p_{\mu_i}^{(2)}\right\}$  and  $\left\{n_{\mu_i, \pi_i(\delta_i)}^{(3)}, r_{\mu_i, \pi_i(\delta_i)}^{(3)}, p_{\mu_i, \pi_i(\delta_i)}^{(3)}\right\}$  the labor allocation decisions solutions to (12) and (13) respectively, a farmer  $i$  best-responses are given by:*

$$\left\{n_{\mu_i, \pi_i(\delta_i)}, r_{\mu_i, \pi_i(\delta_i)}, p_{\mu_i, \pi_i(\delta_i)}\right\} = \begin{cases} \left\{n_{\mu_i, \pi_i(\delta_i)}^{(3)}, r_{\mu_i, \pi_i(\delta_i)}^{(3)}, p_{\mu_i, \pi_i(\delta_i)}^{(3)}\right\} & \text{if (15) holds} \\ \left\{n_{\mu_i}^{(2)}, r_{\mu_i}^{(2)}, 0, 0\right\} & \text{otherwise} \end{cases}$$

and

$$\left\{k_{\mu_i, \pi_i(\delta_i)}, \rho_{\mu_i, \pi_i(\delta_i)}\right\} = \begin{cases} \left\{\kappa, \rho_{\mu_i, \pi_i(\delta_i)}^{(3)}\right\} & \text{if (15) holds} \\ \left\{0, 0\right\} & \text{otherwise} \end{cases}$$

Henceforth and in order to simplify notations, a reference to perennial crop production for a given agent  $i$  implicitly assumes that  $k_i = \kappa$ .

### 3.2.2 Loan Default Decisions

Default decisions crucially depends on contingent expropriation threats: we can thus state the following result.

**Proposition 2** *For a given land allocation  $\mu$ , expropriation schedule  $\pi(\cdot)$ , and financial contract profile  $\{B, D\}$ , farmer  $i$  best-response is given by:*

$$(16) \quad \begin{cases} \delta_i[\mu_i, \pi_i(\cdot)] = 0 & \text{if } D_i < [\pi_i(1) - \pi_i(0)] h \left\{p_{\mu_i, \pi_i(0)}, \rho_{\mu_i, \pi_i(0)} \mu_i\right\} \\ \delta_i[\mu_i, \pi_i(\cdot)] = 1 & \text{if } D_i > [\pi_i(1) - \pi_i(0)] h \left\{p_{\mu_i, \pi_i(1)}, \rho_{\mu_i, \pi_i(1)} \mu_i\right\} \\ \delta_i[\mu_i, \pi_i(\cdot)] \in [0, 1] & \text{if } D_i = [\pi_i(1) - \pi_i(0)] h \left\{p_{\mu_i, \pi_i(\delta_i)}, \rho_{\mu_i, \pi_i(\delta_i)} \mu_i\right\} \end{cases}$$

Furthermore

$$\text{Supp} \{d_i [\mu_i, \pi_i (\cdot)]\} \subset \{0, D_i\}.$$

Conditions (16) are the equilibrium incentive-compatibility requirements for reimbursement to take place in period  $T = 1$ . They emphasize that default decisions and the associated expropriation risk need to be consistent with the investment decisions undertaken, vice-and-versa.

### 3.2.3 Land Allocation and Financial Contracting

Let's consider the arbitrary initial land allocation  $\mu^0$ . Assumption A1 is crucial to the determination of the equilibrium outcomes pre and post 1993. We will use superscripts "pre" and "post" to refer to equilibrium values of the pre-1993 and post-1993 economies respectively.

**a) Post-1993 Equilibrium Outcomes** In the Post-1993 economy, agents take borrowing, purchase, sales investment decisions simultaneously. Before going further, we make some technical assumptions to restrict attention to relevant cases:

*Technical Assumption TA1:* Incentive compatibility assumption: there exists  $\beta^{post} \in (0, 1)$

$$(17) \quad \kappa + \frac{1}{N} \frac{\partial}{\partial \mu} \left[ g \left( r_{1/N,0}^{(3)}, \frac{1 - \rho_{1/N,0}^{(3)}}{N} \right) + h \left( p_{1/N,0}^{(3)}, \frac{\rho_{1/N,0}^{(3)}}{N} \right) \right] = (1 - \beta^{post}) * h \left( p_{1/N,0}^{(3)}, \frac{\rho_{1/N,0}^{(3)}}{N} \right).$$

*Technical Assumption TA2:* Individual rationality assumption:

$$(18) \quad f \left( n_{1/N}^{(2)} \right) + g \left( r_{1/N}^{(2)}, \frac{1}{N} \right) < f \left( n_{1/N,0}^{(3)} \right) + g \left( \left[ r_{1/N,0}^{(3)}, \frac{1 - \rho_{1/N,0}^{(3)}}{N} \right] \right) + h \left( p_{1/N,0}^{(3)}, \frac{\rho_{1/N,0}^{(3)}}{N} \right) - \kappa,$$

We can state the following proposition:

**Proposition 3** *The post-1993 land allocation schedule  $\mu^{post}$  is characterized by:  $\forall i \in \{1, \dots, N\}$ ,*

$$\mu_i^{post} = \frac{1}{N}$$

*and land is split according to*

$$\rho_i^{post} = \rho_{1/N,0}^{(3)},$$

*so that the price of the marginal plot of land is given by*

$$\eta^{post} = \frac{\partial}{\partial \mu} \left[ g \left( r_{1/N,0}^{(3)}, \frac{1 - \rho_{1/N,0}^{(3)}}{N} \right) + h \left( p_{1/N,0}^{(3)}, \frac{\rho_{1/N,0}^{(3)}}{N} \right) \right]$$

The intuition behind such result is fairly straightforward. Farmers are identical with access to the same technologies. The concavity condition with respect to land area implies that any heterogenous land allocation creates an incentive to sell and buy land in order to realize productivity gains. The price of land is then the marginal productivity of land at the optimal allocation choice. The following proposition characterizes the credit market:

**Proposition 4** *Under Technical Assumptions TA1 and TA2, the post-1993 economy is characterized by:  $\forall i \in \{1, \dots, N\}$*

$$(19) \quad \pi_i^{post}(0) = 0,$$

and

$$(20) \quad \pi_i^{post}(1) > \beta^{post},$$

so that

$$(21) \quad \delta_i^{post} = 0.$$

As lenders break-even in equilibrium, farmers internalize the whole net present value of their investments. Then, under (18), any ex-post expropriation due to default induces ex-ante inefficiencies in the form of under-investment in perennials.<sup>12</sup> Thus the optimal contract necessarily verifies (19), while (20) ensures that the incentives to reimburse the loan at time  $T = 1$  are powerful enough.

**Corollary 5** *Under Technical Assumptions TA1 and TA2, borrowing and investment decisions verify:*

$$(22) \quad B_i^{post} = \kappa + \eta^{post} \left( \frac{1}{N} - \mu_i^0 \right),$$

$$(23) \quad D_i^{post} = B_i^{post},$$

and holds:

$$(24) \quad \left\{ n_i^{post}, r_i^{post}, p_i^{post}, \rho_i^{post}, k_i^{post} \right\} = \left\{ n_{1/N,0}^{(3)}, r_{1/N,0}^{(3)}, p_{1/N,0}^{(3)}, \rho_{1/N,0}^{(3)}, \kappa \right\}.$$

Under the assumption that agents borrow only when necessary, (22) indicates that agents borrow to cover the initial start-up cost  $\kappa$ , and any land purchase when relevant. As default does not occur in equilibrium, (23) holds under the normalization of interest rates to 1. Finally, (24) reflects the optimal labor allocation decisions across occupations, given that expropriation does not occur and land area is equal to  $\frac{1}{N}$  for each individual.

As shown in the results above, under Technical Assumptions TA1 and TA2, the decentralized equilibrium where agents are the only decision-makers and choose  $[\mu, \pi(\cdot)]$ , achieves the highest level of aggregate output. Indeed, as credit constraints are not binding, production functions are

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<sup>12</sup>Note that expropriation in case of default is a necessary condition for lenders to break-even.

concave so that the first welfare theorem applies. We can thus rewrite the optimization program faced by the post-1993 economy by aggregating individual objectives as follows:

$$(25) \quad W^{post} \equiv W^{post}(\mu^0, \eta^{post}) = \max_{\mu, \pi(\cdot)} \sum_{i=1}^N f(n_i) + g[r_i, (1 - \rho_i) \mu_i] + [h(p_i, k_i, \rho_i \mu_i) \mathbb{1}(k_i \geq \kappa)] - k_i$$

subject to

- land restrictions:

$$\sum_{i=1}^N \mu_i \leq 1$$

- individuals' reaction functions:  $\forall i \in \{1, \dots, N\}$ ,

$$\{n_i, r_i, p_i, k_i, \rho_i, d_i, B_i, D_i\} \in \arg \max_{\substack{\{n, r, p, k\} \\ \{\rho, d, B, D\}}} f(n) + g[r, (1 - \rho) \mu_i] + [1 - \pi_i(\delta)] [h(p, k, \rho \mu_i) \mathbb{1}(k \geq \kappa)] - d$$

subject to

- labor constraints

$$n + r + p \leq 1$$

- cash constraints

$$\begin{aligned} B &= \eta(\mu_i - \mu_i^0) + k \\ d &\leq f(n) + g[r, (1 - \rho) \mu_i] \end{aligned}$$

- credit market break-even conditions

$$\begin{aligned} D &= B - \pi_i(0) [h(p, k, \rho \mu_i) \mathbb{1}(k \geq \kappa)] \\ d &= B - \pi_i(\delta) [h(p, k, \rho \mu_i) \mathbb{1}(k \geq \kappa)] \end{aligned}$$

**b) Pre-1993 Equilibrium Outcomes** Given that expropriated output is assumed to be redistributed to farmers in a lump-sum fashion, the community-level decision program can be rewritten as:

$$(26) \quad W^{pre} = \max_{\mu, \pi(\cdot)} \sum_{i=1}^N f(n_i) + g[r_i, (1 - \rho_i) \mu_i] + [h(p_i, k_i, \rho_i \mu_i) \mathbb{1}(k_i \geq \kappa)] - k_i + \Phi[\mu, \pi(\cdot)]$$

subject to

- land restrictions:

$$\sum_{i=1}^N \mu_i \leq 1$$

- individuals' reaction functions:  $\forall i \in \{1, \dots, N\}$ ,

$$\{n_i, r_i, p_i, k_i, \rho_i, d_i, B_i, D_i\} \in \arg \max_{\substack{\{n, r, p, k\} \\ \{\rho, d, B, D\}}} f(n) + g[r, (1 - \rho) \mu_i] + [1 - \pi_i(\delta)] [h(p, k, \rho \mu_i) \mathbb{1}(k \geq \kappa)] - d$$

subject to

– labor restrictions

$$n + r + p \leq 1$$

– cash constraints

$$B = k$$

$$d \leq f(n) + g[r, (1 - \rho)\mu_i]$$

– credit market break-even conditions

$$D = B - \pi_i(0) [h(p, k, \rho\mu_i) \mathbf{1}(k \geq \kappa)]$$

$$d = B - \pi_i(\delta) [h(p, k, \rho\mu_i) \mathbf{1}(k \geq \kappa)]$$

The difference between programs (25) and (26) is the existence of the component  $\Phi[\cdot]$ . It is also true that in the post-1993 economy, the cash constraint might be tighter for some individuals as they need to borrow more in order to purchase land. Note however that if  $\Phi[\cdot] = 0$ , then the pre-1993 and post-1993 economies deliver the exact same aggregate output, and are characterized by the same allocation of land. Indeed, the cash constraint is not binding under Technical Assumptions TA1 and TA2.

We assume that  $\Phi[\cdot]$  such that there exists a solution  $[\mu^{pre}, \pi^{pre}(\cdot)]$  to optimization program (26). To start with, we analyze the particular case, in which  $\mu^{pre}$  is such that  $\forall i \in \{1, \dots, N\}$ ,  $\mu_i^{pre} = \frac{1}{N}$ . Considering equations (13) and (15), we denote  $\beta^*$  the value of  $1 - \pi_i(\delta_i)$  such that inequality (15) is binding in the case  $\mu_i = \frac{1}{N}$ . Then we have

$$(27) \quad f\left(n_{1/N}^{(2)}\right) + g\left(r_{1/N}^{(2)}, \frac{1}{N}\right) = f\left(n_{1/N, 1-\beta^*}^{(3)}\right) + g\left(r_{1/N, 1-\beta^*}^{(3)}, \left(1 - \rho_{1/N, 1-\beta^*}\right) \frac{1}{N}\right)$$

$$+ \beta^* * h\left(p_{1/N, 1-\beta^*}^{(3)}, \rho_{1/N, 1-\beta^*} \frac{1}{N}\right) - \kappa.$$

We then look at Figure 1. The horizontal axis measures tenure security  $1 - \pi_i(0)$ , while the vertical axis is the contingent eviction threat  $\pi_i(1) - \pi_i(0)$ . The 45 degree line corresponds to expropriation threats such that  $\pi_i(1) = 1$ , while the horizontal axis plots contracts where eviction is not contingent on default:  $\pi_i(1) = \pi_i(0)$ . By assumption, the space of feasible schedules is included in the lower triangle. Vertical line (AA') is defined by  $1 - \pi_i(0) = \beta^*$ . For arrangements with a greater security of tenure than  $\beta^*$  (i.e. on the right of (AA')), and ignoring credit considerations, farmers have the incentives to invest in perennials. Curve (BB') is determined by (16) :

$$(28) \quad \kappa = [\pi_i(1) - \pi_i(0)] * h\left\{p_{1/N, \pi_i(0)}^{(3)}, \rho_{1/N, \pi_i(0)}^{(3)} \frac{1}{N}\right\}.$$

Any arrangements below the (BB) line will not induce borrowers to reimburse their loans, ex-ante inducing the credit market to break down. As (27) also implies that  $\beta^* * h\left(p_{1/N, 1-\beta^*}^{(3)}, \frac{1}{2N}\right) - \kappa > 0$ , (AA') and (BB') divide the lower triangle in figure 1 into four regions respectively labeled (I) (NE region), (II) (NW region), (III) (SE region) and (IV) (SW region) respectively. Arrangements in region (I) both provide incentives to farmers to invest in perennials and are such that reimbursement of loans is incentive-compatible. Thus pre-1993 economies characterized by expropriation schedules in region (I) have farmers invest in the three occupations (or at least in perennials), with an increase in investment in perennials (either or both in terms of labor input and land area devoted) as tenure security improves. For the three other regions, investment in perennials does not take place either

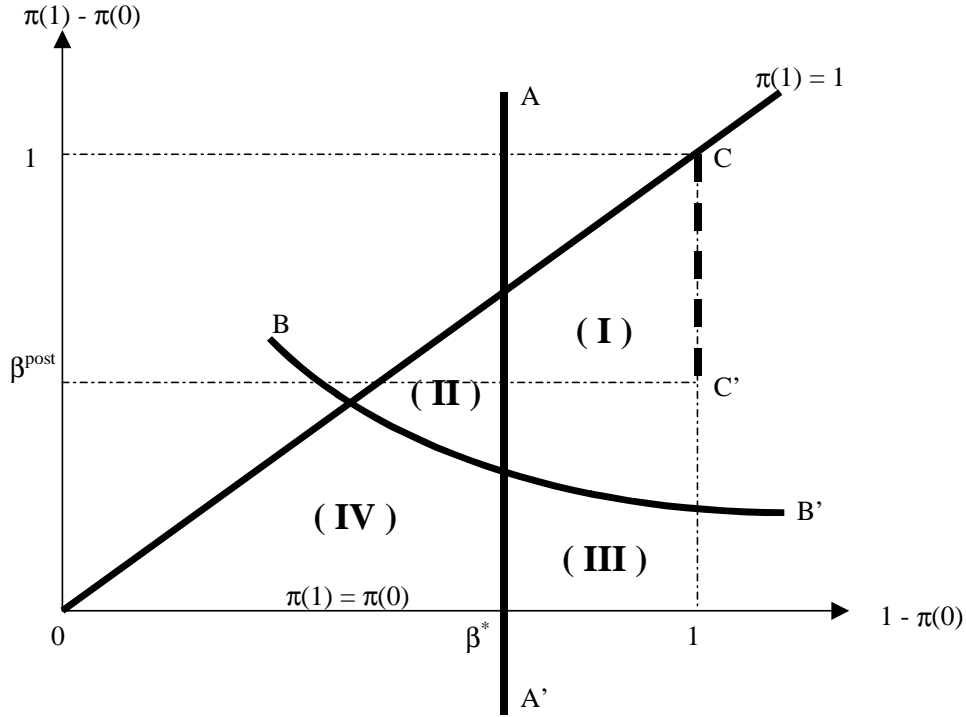


Figure 1: Security of tenure and Contingent eviction threat

due to a lack of incentives (region (II)), the absence of a credit market (region (III)), or both (region (IV)).

The analysis above assumes an equal distribution of land. Applying the envelope theorem to both (27) and (28) shows that an increase in land endowment for a given individual  $i$  will shift the curve (AA') westward, while (BB') moves down. The intuition behind this example is fairly simple: an additional plot of land increases agricultural output from perennials, increasing the ex-ante incentives to invest; by the same token, for the same amount of land pledged, more output is actually mortgaged, reducing the scope for default. However, an increase in land area for one implies a decrease for at least another. The concavity assumption then implies that in net, aggregate investment in perennials decreases with the inequality of land distribution. This also corresponds to a decrease in aggregate output.

### 3.3 A Look at the Transition

To determine the changes in outcomes during transition, we will consider all possible scenarios of the pre-1993 economy  $[\mu, \pi(\cdot)]$ . The post-1993 economy is characterized by an expropriation schedule which lies on the segment  $[C, C']$  in Figure 1 (results (19) and (20)).<sup>13</sup> This section investigates the

<sup>13</sup>Denoting by  $\Lambda(\mu)$  the set of possible post-1993 equilibrium expropriation schedules, then it is easy to show that  $[C, C'] = \bigcap_{\mu \in [0,1]^{\{1, \dots, N\}}} \Lambda(\mu)$ . In other words,  $[C, C']$  is the locus of expropriation schedules that are sustainable in equilibrium irrespectively of the initial distribution of land.

predictions that the model delivers when the pre-1993 economy moves from a given point in Figure 1 to a point on  $[C, C']$ .

An explicit specification of the production functions will be useful to describe the expected evolution of relevant variables during transition. We will therefore adopt the following specifications:

$$(29) \quad \begin{cases} f(l) = l \\ g(l, \mu) = l^\alpha \mu^{1-\alpha} \\ h(l, \mu) = l^\sigma \mu^{1-\sigma} \end{cases}$$

Technical assumptions TA1 and TA2 become under such specification:

$$(30) \quad N\kappa < \sigma^{\frac{1}{1-\sigma}}$$

and

$$(31) \quad (1 - \alpha) \alpha^{\frac{\alpha}{1-\alpha}} < (1 - \sigma) \sigma^{\frac{\sigma}{1-\sigma}} - \kappa N$$

respectively.

Solving the equilibrium under such specification gives the following set of results. When no investment in perennials is undertaken (equation (12)),

$$(32) \quad \begin{cases} r_{\mu_i}^{(2)} = \min \left\{ \alpha^{\frac{1}{1-\alpha}} \mu_i ; 1 \right\} \\ n_{\mu_i}^{(2)} = \max \left\{ 1 - \alpha^{\frac{1}{1-\alpha}} \mu_i ; 0 \right\} \end{cases} .$$

On the other hand, when investment in perennials is undertaken (equation (13)), investment levels are given by

$$(33) \quad \begin{cases} p_{\mu_i}^{(3)} = \min \left\{ \{[1 - \pi_i(\delta_i)] \sigma\}^{\frac{1}{1-\sigma}} \mu_i ; 1 \right\} \\ r_{\mu_i}^{(3)} = 0 \\ n_{\mu_i}^{(2)} = \max \left\{ 1 - \{[1 - \pi_i(\delta_i)] \sigma\}^{\frac{1}{1-\sigma}} \mu_i ; 0 \right\} \end{cases}$$

so that

$$\rho_{\mu_i}^{(3)} = 1.$$

Indeed, the constant-returns-to-scale assumption implies that when individuals have access to both rice and perennial crops, only one of the two crops will be adopted. The necessary conditions for investment in perennials to take place are the intersection of the first-order condition for land area (border solution for (14)) and (15), which pins down to

$$(34) \quad (1 - \alpha) \alpha^{\frac{\alpha}{1-\alpha}} \leq [1 - \pi_i(\delta_i)] (1 - \sigma) \{[1 - \pi_i(\delta_i)] \sigma\}^{\frac{\sigma}{1-\sigma}} - \frac{\kappa}{\mu_i}.$$

### 3.3.1 Crop and Labor Diversification

Transition outcomes on the intensive and extensive margins differ substantially. On the intensive margin (region (I) in figure 1), equilibrium investment levels are given by (33). Thus, a decrease in the expropriation risk  $\pi_i(\delta_i)$  translates into higher levels of investment in perennials, and therefore

households substitute away from non-farm activities. Furthermore, a more equal distribution of land will have no aggregate effect on aggregate investment levels. However this result is essentially driven by the Cobb-Douglas specification, which makes investment levels linear functions of land area.

More interesting transition phenomena occur on the extensive margin. When the pre-1993 economy lies in regions (II), (III) or (IV), investment in perennials does not take place. Thus, in the post-1993 economy, these individuals now adopt perennial crop cultivation. The constant return to scale assumption made in (29) - in addition to the assumed absence of general equilibrium effects on commodity prices - implies that the transition is characterized by a complete switch from rice cultivation to perennial crop cultivation. The effect on labor decisions is however ambiguous. While no labor is devoted to rice cultivation, the impact of the reform on non-farm activities is obtained by comparing (32) and (33). Changes in levels of labor devoted to non-farm activities depend on the change of land area cultivated and the relative productivity of labor of the two agricultural technologies, i.e.  $\alpha$  and  $\sigma$  respectively. In addition to (30) and (31), we also assume that perennial crop cultivation is labor saving, i.e.

$$(35) \quad \sigma < \alpha.$$

Indeed, we can realistically assume that, at least in the short and medium run, perennial crop cultivation is relatively less intensive than rice cultivation is. This implies that the overall effect depends on the extent of land redistribution which took place. To see this, let's compare non-farm labor levels before and after 1993 for interior solutions:

$$\begin{aligned} \Delta_i &= \left(1 - \sigma^{\frac{1}{1-\sigma}} \mu_i^{post}\right) - \left(1 - \alpha^{\frac{1}{1-\alpha}} \mu_i^{pre}\right) \\ &= \alpha^{\frac{1}{1-\alpha}} \left(\mu_i^{pre} - \mu_i^{post}\right) - \left(\sigma^{\frac{1}{1-\sigma}} - \alpha^{\frac{1}{1-\alpha}}\right) \mu_i^{post}, \end{aligned}$$

so that the sign of  $\Delta_i$  is given by

$$(36) \quad \text{sgn}(\Delta_i) = \text{sgn}\left(\frac{\mu_i^{pre}}{\mu_i^{post}} - \frac{\sigma^{\frac{1}{1-\sigma}}}{\alpha^{\frac{1}{1-\alpha}}}\right).$$

Assumption (35) implies that switching to perennial crop cultivation saves labor that is then devoted to non-farm activities. However, if land area cultivated by individual  $i$  increases, i.e.  $\frac{\mu_i^{pre}}{\mu_i^{post}} < 1$ , then the marginal productivity of agricultural labor increases, so that households have an incentive to devote more time to agricultural activities. Which of the two effects dominates depends on the extent of land redistribution as shown in (36).

### 3.3.2 Productivity, Income and Consumption

The long-term effect of the land law on productivity and income is unambiguous. A decrease in the expropriation rate, better access to credit and a better allocation of land provides incentives to individual agents to maximize output, hence increasing total factor productivity. The increase in productivity then translates into an increase in permanent income, inducing higher consumption levels.

Pushing the analysis further, we have identified three mechanisms at work: the incentive channel (the decrease in the expropriation rate), the credit channel (the ability to make expropriation contingent on loan reimbursement) and the land distribution channel (the ability to reallocate land). There are yet reasons to believe that these three channels, and the credit channel particularly, did not function immediately after 1993. Relaxing the assumption of a perfect post-1993 credit market implies qualitative changes to the predictions described above. Indeed an anticipated lower expropriation risk and the ability to trade land raises the demand for finance. However, a lack of supply induces households to rely on retained earnings in order to finance potential land transfers and start-up costs.

Thus, in the short run, conflicting effects might determine the overall impact of the 1993 land law. An increase in permanent income and a short-term credit constraint associated with investment opportunities deliver ambiguous results in terms of consumption. Furthermore, the lag between investment and output for perennial crops also makes predictions in terms of income and productivity uncertain.

## 4 Data and Empirical Strategy

### 4.1 Data

Our major source of data is the two rounds of the Vietnam Living Standards Measurement Study Survey (VLSS), conducted by the General Statistical Office (GSO) of the Government of Vietnam and funded by the United Nations Development Program (UNDP) and the World Bank under the Living Standards Measurement Study (LSMS). The first round of the survey was conducted in 1992-93 (henceforth VLSS-93) and the second round was conducted in 1997-98 (henceforth VLSS-98). We take the former as our pre-reform baseline data and the latter as our post-reform outcomes. The surveys used multi-stage stratified sampling techniques to select 4800 households in the first round. 4285 of these households were re-interviewed in 1998, and replacement households were chosen to bring the sample size to 6000.<sup>14</sup> The surveys followed established LSMS practices and are considered high-quality data. They contain detailed information on household size and composition, educational attainment, health, employment, fertility, migration, household expenditures, agricultural activities, non-farm economic activities and borrowing and lending activities. Table 1 presents some basic characteristics of the rural households in the surveys, broken down into whether they were re-interviewed (“panel”) households or replacement households. We note the large increase in real household expenditure between 1993 and 1998, consistent with the high growth rates enjoyed by the Vietnamese economy in this period.

Province-level data on progress of LUC issuance (number of households and communes with LUC), as well as the number of land department officials in each province, come from the records of the GDLA in Hanoi. We also have data on province-level population, agricultural yields, urbanization etc. from the annual Statistical Yearbooks published by the General Statistical Office (GSO). We also use some information on infrastructure facilities in rural areas from the 1994 Agricultural and Rural Census conducted by the Ministry of Agriculture and Rural Development (MARD).

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<sup>14</sup>The attrition rate is higher for smaller, urban, more educated and richer households. The overall attrition is around 7% in rural areas.

## 4.2 Empirical Strategy

Ideally we would like to compare portfolio choices and productivity across two households that differ only in the quality of land rights possessed by them. In our setting, we take the possession of a land-use certificate as an indicator of having good land rights. However we do not have household level data on land registration, since the VLSS does not ask this question. We therefore use the province-level proportion of households with LUC as a measure of the probability that a given household would have a LUC. We will thus be using the differences in the level of LUC issuance across provinces to identify the impact of the Land Law. We will also use an alternative measure (“speed of registration”) which captures how quickly the province issues LUC to at least 50% of the households, which takes into account the whole process of LUC issuance over time.

We estimate the impact of the land reform using a differences-in-differences strategy, by comparing the difference between 1993 and 1998 (before and after reform) for the high-issuance provinces as compared to the low-issuance provinces. The regression equation we use is:

$$(37) \quad y_{ijt} = \beta_0 + \beta_1 T_t + \beta_2 R_j + \beta_3 (T_t \times R_j) + X_{it} \gamma + \epsilon_{it}$$

where  $y_{ijt}$  represents the outcome of household  $i$  of province  $j$  at time  $t$  (1993 or 1998),  $T_t$  represents the time dummy (equal to 0 for 1993, and 1 for 1998),  $R_j$  is the measure of land reform implementation in province  $j$  (proportion of households with LUC in 1998 or number of years since LUC issuance crossed 50 percent threshold (speed measure)) and  $X_{it}$  are other household characteristics. The coefficient  $\beta_1$  represents the change between 1993 and 1998 for a province which had zero LUC issuance, while  $\beta_2$  represents the difference between high-issuance and low-issuance provinces in 1993 (pre-existing difference). Our coefficient of interest is  $\beta_3$ , which tells us how much the high-issuance provinces have increased investment, compared to the low-issuance provinces over the period 1993-1998. We will be controlling for household characteristics like age, gender and education of the household head, total household size, ethnicity and total area cultivated. All our regressions are for households in rural areas only, since our land reform figures are for rural sector. Since our main explanatory variable, the LUC issuance measure, is measured at the province level, we will also cluster all our standard errors at the province level.<sup>15</sup>

## 4.3 Endogeneity

Referring to the theory developed in the previous section, the identifying assumption made throughout the paper is that the vector  $R$ , measuring the land reform implementation in the country is not correlated with pre-existing conditions, namely  $\{\pi_0, \pi_1, \mu\}$ .

Our strategy is thus likely to give biased results if the province-level registration levels are correlated with other unobserved variables, that also affect our dependent variables. This could be due to both “supply” and “demand” factors for land registration. For instance, more productive farmers may be registering their land earlier (demand side effect), or a higher registration level might be indicative of a more efficient local bureaucracy, which might have a direct effect on any outcomes we examine, irrespective of the impact of the Land Law itself.

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<sup>15</sup>Bertrand et. al. (2002) suggest clustering as one way to obtain correct standard errors in a difference-in-differences framework.

The next section examines whether the progress of LUC issuance across provinces is systematically related to any province-level characteristics.

## 5 Implementation of the 1993 Land Law

The identification strategy in this paper relies on the observation that the land law was not implemented homogeneously throughout the country. Table 2 documents the progress of LUC issuance in Vietnam. About 24 percent of households had been issued land-use certificates at the end of 1994; by the end of 2000, this proportion had increased to 90 percent, consistent with the target of issuing certificates to more than 11 million rural households by the end of 2001. Table 2 also shows considerable variation across provinces in the speed of implementing this process. For instance, An Giang province had issued LUCs to 91 percent of households in 1994, at which time Lai Chau and Lang Son had made negligible progress. Similarly the proportion of households with LUCs varied from 12 percent to 100 percent in 1998. Another way of seeing this is the variation in the years it took for a province to increase the level of LUC issuance to 25 percent, 50 percent and 75 percent of the households (Table 2, Panel B). 21 provinces crossed the 25 percent threshold in 1994, while 4 provinces attained this in 1998 or later. 16 provinces had issued LUCs to 50 percent or more of households by 1995, while 13 provinces took till 2000 to attain this level. As of 2000, five provinces had yet to attain the 75 percent level of LUC issuance.

We also obtained (from GDLA) data on land department manpower at the province level in different years. Consistent with the lack of manpower cited by the GDLA, we find that most provinces had less than two land officials per commune in these years. Most provinces also had less than two land officials per 1000 agricultural households in the province. As we would expect, the number of land officials per commune (or per 1000 agricultural households) is somewhat positively correlated with measures of the speed of LUC issuance (Table 2, Panel C). However, these correlations are not very large and none of them are statistically significant.

The finding of a positive but low correlation between manpower measures and LUC issuance also shows up in the regressions reported in Table 3. Our two major measures of the prevalence of land rights due to the reform are the proportion of households with LUC in 1998, and the “speed of registration” measure which we compute as 2001 minus the year in which LUC issuance reached 50 percent of households.<sup>16</sup> While the first measure captures the status of issuance at a point of time, the second measure is based on the whole process of land titling over all the years. These two measures are highly correlated ( $\rho = 0.83$ ). Table 3 further shows that land registration is not strongly correlated with any other province characteristics such as population density, urbanization, proportion of communes having a market, mean level of education or per capita household expenditure.<sup>17</sup> The results are qualitatively similar when we use land officials per 1000 agricultural households instead of land officials per commune; when we include paddy yields as an additional explanatory variable; and when we use proportion of households with LUC

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<sup>16</sup>We choose 1998 because our household survey data are from this year; see section 4.

<sup>17</sup>Variables used in these regressions have been obtained from Statistical Yearbooks published by the General Statistical Office. Mean age, education, household size and per capita expenditure are from the 1993 Living Standards Survey. The significant coefficient for proportion of communes having a highway is driven by one outlier (old Minh Hai province). The significant coefficient for proportion under perennial crops is also due to one outlier (old Song Be province).

in years other than 1998 as a measure of the progress of land reform. We also tried specifications including weather variables (rainfall and sunshine hours recorded in 1993), as well as a dummy for whether the province was already reporting coffee production in 1996: these variables do not have much explanatory power for our dependent variable; in particular, the coefficient on the coffee dummy is negative and insignificant. We also note that there is no significant difference in the implementation of the reform in the North and the South, despite the North's longer history of collectivization.<sup>18</sup> This can also be seen in the maps in Figure 1, where each province is categorized as low, middle-low, middle-high or high depending on the quartile it belongs to, quartiles being obtained from the distribution of registration levels across provinces.

The other major factor cited by the GDLA to explain widely varying levels of LUC issuance is the number of disputes. We are unable to obtain any quantitative information on this; however, there have been incidents of peasant unrest in Vietnam during the 1990s.<sup>19</sup> While Table 3 still leaves open the question of why the progress of land reform is so different across different provinces, it serves as a preliminary, though certainly not conclusive, check on the exogeneity of our main explanatory variable. For the time being therefore, we take the registration levels in a province to be exogenously determined in our regression analysis.

## 6 Results on the Impact of the 1993 Land Law

In this section, we will test the predictions delivered by the model presented and analyzed previously. We will first look at the impact of the 1993 land law on crop and labor decisions of rural households.

### 6.1 Investment Decisions

As suggested by the theory, the 1993 land law potentially affects farmers investment decisions. Adopting specification (37), we look at two outcomes of interest: crop and labor choices.

#### 6.1.1 Crop choice

As discussed earlier, the additional land rights conferred by the 1993 law might induce households to undertake more long-term investments on their land. One way of measuring this is by looking at the allocation of land between annual crops and multi-year industrial or fruit crops, which typically require large investments up-front and yield returns only after a few years.

To make the interpretation of the empirical methodology easier, we first consider the results reported in Table 4, panel A. Provinces have been divided into two categories, depending whether the level of LUC issuance was above or below the sample median, equal to 80%. Then the numbers reported in panel A are the average percentage of total cultivated land devoted to perennial industrial and fruit crops. Thus, the differences in the bottom row are the time differences for each of the

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<sup>18</sup>In 1994, provinces in the North had on average 24 percent of households registered, while provinces in the South had a registration level of 23 percent. The corresponding figures for 1998 were 74 percent and 69 percent.

<sup>19</sup>It is interesting that Thai Binh province, which witnessed large scale unrest in 1997 (related partly to corruption by land officials) has the lowest level of LUC issuance in 2000.

two categories of provinces, while the differences reported on the right column shows for each year the difference of outcomes between low and high registration provinces. Finally, the bottom-right cell computes the difference-in-differences outcome: a household in a highly registered province in 1998, on average increases between 1992-93 and 1997-98 the share of cultivated land area devoted to perennial industrial and fruit crops by 5.6% more than the same household in a low-registration province.

Panel B of Table 4 presents a continuous version of Panel B. The coefficient in front of the interaction term is the continuous version of the difference-in-differences computed in Panel A. Consistently with the results of Panel A, Panel B shows that the land reform led to a large and statistically significant increase in the proportion of total cultivated area devoted to multi-year crops: a household in a province where everybody had a LUC would increase this proportion by 7.5 percentage points over the period 1993-98, compared to a household in a province where nobody was issued LUC. This means that if the proportion of households registered goes up by one standard deviation, the proportional area devoted to long-term crops will increase by 0.09 standard deviations. This increase comes at the expense of annual crops, which show a decrease of 6.5 percentage points in their share of total cultivated area (regressions not shown). We control for household characteristics like age, education, gender, household size and ethnicity while obtaining these estimates.<sup>20</sup> The coefficients are robust to the addition of region fixed effects (column (3)), to adding the household controls interacted with the time dummy, and to adding household income in 1993 or province-level mean per-capita income as additional regressors (last two specifications not shown in the table). Further, the coefficients are similar, though a little smaller, when we restrict our sample to only the “panel” households, who are interviewed in both 1993 and 1998, and use household fixed effects to control for any time-invariant household characteristics (column (4)).

We get very similar results when we use our speed of LUC issuance measure instead of the level of issuance in 1998 as the main explanatory variable (columns (5)-(8)). These results indicate that if a province were to reach the 50 percent issuance level one year earlier, households in that province would on average increase the proportional area devoted to long-term crops by 1.3 percentage points (0.06 standard deviations).<sup>21</sup>

We might be concerned that our results are driven by other government policies regarding the promotion of long-term crops such as coffee. We should note that table 3 shows that the area under long-term crops in 1993 is negatively related to the land reform progress; provinces which were growing coffee in 1996 also have slightly lower levels of LUC issuance than other provinces. Any bias in the estimates is thus likely to be downward, rather than in the upward direction.

We can conduct a similar analysis of the area devoted to long-term crops, using province-level aggregate data from the Statistical Yearbooks of various years. However, the results of the household level surveys are not replicated in these data. In both a difference-in-differences specification (replicating the regression for the survey data) and a specification with province and time fixed effects, we get a negative (though statistically insignificant) coefficient on the measures of LUC

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<sup>20</sup>We should note that in the household surveys, some respondents answer questions about long-term crops by mentioning the number of trees they have, rather than the area devoted to them. Our results are robust to several ways of converting trees to areas.

<sup>21</sup>We get similar results if we break up the sample into early and late issuers (based on 1994 issuance) and use the first measure: coefficients are much larger and strongly significant for early issuers and smaller for late issuers.

issuance (regressions not shown). However, this is subject to the caveat that we are not quite sure how the data for the Statistical Yearbooks is collected; the province-level aggregate figures are somewhat different from the figures obtained by aggregating the household survey data.

### 6.1.2 Labor Choice

The model also predicts that under assumption (35), a more widespread adoption of perennial crops induces an increase in labor devoted to non-farm activities. This result is mitigated or even offset when land reallocation is associated with large efficiency gains (see equation (36)). Table 5 panels A and B show the reduced-form results related to non-farm activities. We indeed estimate equation (37) in which the left-hand side variable is  $(\Delta_i)$  as defined in (36). The 1993 land law is found to have had a significant impact on the number of weeks worked in non-farm activities per working member in the household. Indeed, the results in table 5, Panel A show that a household in a province with registration status in 1998 above the 80% median will increase the number of weeks worked off the farm by 1.5 for each working member, compared to the same household in a below-median province. Similarly, in table 5 and panel B, columns (1)-(3), suggest that receiving a LUC increases between 1992-93 and 1997-98 by three the number of weeks worked off the farm.<sup>22</sup> The result is robust when we restrict attention to panel households and introduce fixed-effects.

Using alternative specifications to check the robustness of the findings, we take another measure of land law implementation. Similarly to the case of crop choices, we take the speed of registration as proxy for exposure to the land law. We find that getting the LUC one year earlier, increases the diversification of labor out of the farm up to one week per year (column (5)). Such estimate is lower than under the previous specification. Another robustness check consists of taking the number of hours worked in the past week per working member as dependent variable (column (6)). The coefficient we obtain is consistent with the coefficient found in the initial specification under the assumption that households work 52 weeks per year and 8 hours per day.

### 6.1.3 Specialization or Diversification?

In the two previous paragraphs, we have shown results on crop and labor choices that are consistent with the theory developed above. One important alternative story would consist of considering that some households got rid of their land and hence devoted more time to non-farm activities, and other households just devoted larger areas to perennial crop cultivation.

In an attempt to discriminate between these two alternative stories of diversification and specialization, table 6 shows the results of a multinomial logistic regression specified as follows: restricting attention to “panel households”, we computed the change in crop and labor choices between the dates 1992-93 and 1997-98. Depending whether these differences are positive (denoted 1) or non-positive (denoted 0), households are divided into four categories (00, 01, 10, and 11 respectively). The results showed in table 6 are thus the multinomial logistic coefficients obtained by regressing

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<sup>22</sup>The average number of working members in the household was 4.37 in 1992-93 and 4.46 in 1997-98. Furthermore, the average number of weeks worked per year and per working member in non-farm activities amounted to 7.6 in 1992-93 versus 8.7 in 1997-98. This corresponds to an average of 1.01 hour per week in 1992-93 versus 1.15 in 1997-98.

this four category variable on a vector of covariates of interest. The base category (denoted 00) is in this case the category of households that decreased crop and labor diversification over the period 1992-1998.<sup>23</sup>

Table 6 reports the relative risk ratios that indicate how much more likely we are to observe a given category rather than the base category. In particular, an increase of the registration rate from 0 to 1 makes it 3.169 times more likely for a given household to be of category 11, than of category 00. The transition towards the two other categories (namely 01 and 10) is marginally or not significant, suggesting that crop and labor diversifications take place within rather than between households. What exact mechanism is underlying such transformation will be investigated further in a later section of the paper. We now turn to productivity, income and expenditure results.

## 6.2 Productivity, Income and Expenditure

As we discussed in the theoretical section, the 1993 land law is supposed to generate productivity gains in the long run, increasing households' permanent income and hence expenditure. However the short time lag between the implementation of the law and the 1997-98 survey makes such impact difficult to detect. Table 7 shows results obtained from the estimation of (37), in which the left-hand side variables of interest are rice yield, a measure of farm income and real household expenditure respectively. For these three outcomes, there is no significant effect of the 1993 land law. While the absence of any result for rice yields is consistent with the absence of expropriation threat of rice output as assumed in our theoretical model, the failure to detect any effect on income or expenditure would deserve more attention. Indeed, returns on investment in perennials are unlikely to be realized by the time of the second round of the survey, and consumption might not have increased in the presence of persisting credit constraints. Admittedly, measurement errors could also generate an attenuation bias. Further investigation would be necessary in order to provide a deeper analysis of these issues.

## 7 What are the Mechanisms at Work?

We have found so far evidence of crop and labor diversification: farmers tend to devote more land area to the cultivation of perennial crops, and at the same time, allocate relatively more of their labor time to non-farm activities. As suggested in the theoretical analysis, we now try to investigate which channels lead to such transformation of the rural economy. We will therefore alternatively look at credit and land markets.

### 7.1 Credit Markets

In this section, we check whether the land law has had an impact on credit markets. Recall that having a pledgeable land use certificate was expected to increase a household's access to credit, especially from formal sources like banks and credit cooperative. Table 8, however, shows that the issuance of LUCs leads to households being less likely to have an outstanding loan. Approximately

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<sup>23</sup>The medians of such differences are close to zero.

half of all households have outstanding loans (51% in 1993 and 54% in 1998): the probability of having a loan goes down by 11 percentage points when a province implements the land reform fully. Households in highly-registered provinces also have lower amounts borrowed (as a fraction of total household expenditure). These results hold overall (statistically significant with a tobit specification) and within the sample of borrowers only (statistically insignificant). Further, we see that there is no change in the fraction of loans from formal sources (panel C).

Note nevertheless the significant increase of credit access for the whole country over the period. We simply do not find evidence supporting the hypothesis that credit expansion was driven by the 1993 land law.

## 7.2 Land Markets

We would also like to investigate whether the land law facilitated land transfers, thereby making the land market more efficient. Unfortunately, evidence on land market transactions is hard to come by because of substantial underreporting by respondents. This is mainly because of the high tax imposed on land transactions. Nevertheless, there seems to be an increase in land market transactions between 1993 and 1998: the proportion of households who report receiving land increases ten-fold from 2.5 percent in 1993 to 25 percent in 1998, a similar ten-fold increase is seen for households reporting sales of land (from 1 percent to 10 percent). This could however simply reflect less under-reporting after the law was passed. The increase does not seem to be very different across high issuance vs. low issuance provinces (see Table 9). The participation of households in the land rental market also increases between 1993 and 1998, but again, is not systematically related to the progress of land certificate issuance.<sup>24</sup>

A preliminary analysis of land distribution suggests that there has not been much change over time (see Table 10). In particular, there is not much evidence that formalizing land rights creates increasing landlessness (because people are now able to sell land in times of need). The proportion of landless households decreases from 11.4% to about 7%. High-issuance provinces have slightly lower levels of landlessness in 1993 itself, but the changes are similar across high-issuance and low-issuance provinces. Further, province-level Gini coefficients of land ownership also decline over time.<sup>25</sup> The decrease is mainly for provinces in the South (from 0.58 to 0.50) which started at much higher levels of inequality than the North, where the Gini remains constant at around 0.37. There is no difference in the change in Gini by province registration levels.

## 7.3 A Test Between Theories?

The two previous set of results do not provide evidence of an increased activity in either credit or land markets. However, in order to get additional information on the mechanisms at work, tables 11 and 12 provide results of regression (37), when the outcomes of interest are crop and

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<sup>24</sup>The data on renting are not fully comparable across the two surveys: the 1993 survey asks separately about land rented in and land sharecropped, while the 1998 survey does not ask about sharecropping. Figures reported in the table include sharecropping in 1993.

<sup>25</sup>This might indicate that the increase in land transactions mentioned earlier may be primarily driven by an increase in reporting, rather than an increase in the actual volume of transactions.

labor diversification respectively, and the sample is divided into different dimensions. We look at whether the law had any differential impact across income groups (columns (2) and (3)), across land holding classes (columns (4) and (5)), or depending on whether credit is easily accessible (columns (6) to (9)). Finally, we also split the data according to province-level gini coefficients of land distribution (columns (10) and (11)).<sup>26</sup>

The results shown in tables 11 and 12 suggest a similar pattern for both crop and labor diversification, which is consistent with the set of results of section 6. Columns (2) to (5) results suggest that the 1993 land law had a larger impact on poorer households. Such finding should be taken with caution given that the point estimates do not differ much and the marginal significance of the estimate for poorer households can well be driven by a larger number of observations. This caveat being considered, we also find that crop and labor diversification is taken place where access to credit is potentially easier (see columns (6) and (7) and especially columns (8) and (9)). If one believes that better access to credit benefits lower income groups relatively more, then the set of results shown in columns (2) to (9) seem to be consistent with some effect of the land law through the credit channel. However, such results are merely suggestive and more conclusive evidence would require further investigation.

As far as land market activity is concerned, columns (10) and (11) do not allow us to draw clearcut conclusions on a land transaction channel affecting labor and crop choices. Admittedly provincial gini coefficients are an approximate and noisy measure of the scope and extent of land transaction.

Thus, this preliminary analysis of the mechanics underlying the transformation of the Vietnam rural economy, shows little support for a strong contribution of credit and land markets.

## 8 Conclusion

We study a land reform which makes land rights secure, pledgeable and tradable and show that it has a statistically significant impact on the decisions of households to undertake long-term agricultural investments and at the same time devote labor to non-farm activities.

We then attempt to test several theories that can be at the origin of such transformation of Vietnam's rural economy. We therefore find no evidence that land titles increase access to credit on the part of poor households; neither are they significant determinants of land market activity. We have some suggestive evidence that the credit channel may have played a role, but a deeper analysis of this channel is required before stronger statement could be made. On the land market, while other authors have found that a large redistribution a land towards efficiency has taken place in the period 1992-1998 (see Ravallion and Van de Walle, 2001), we have no evidence that the 1993 land law was the trigger of such transformation. However, we cannot rule out the possibility that the reform might lead to significant changes in the functioning of the land and credit markets over time, as households learn about the legal environment and credit and legal institutions develop in order to enforce the dispositions of the law.

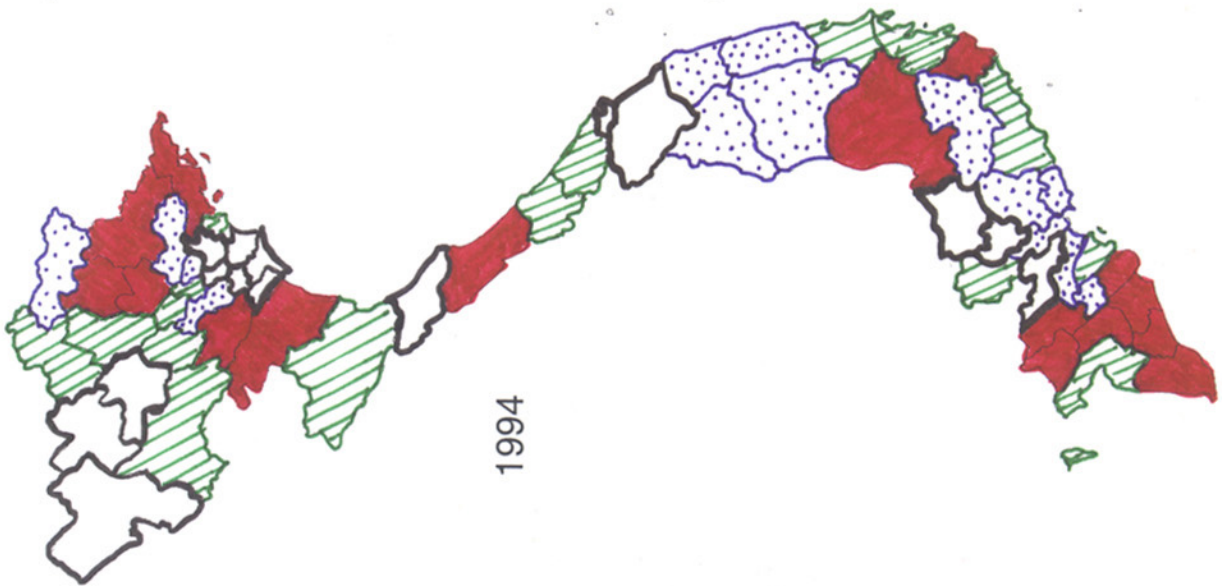
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<sup>26</sup>The coefficients obtained from such strategy are actually triple difference coefficients. We chose this approach for expositional simplicity.

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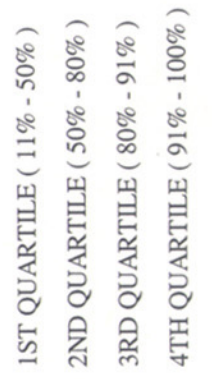
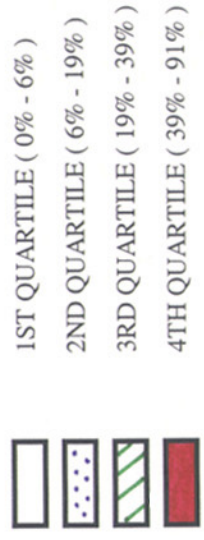


1994



1998

Geographical Distribution of Registration Levels (1994 - 1998)



**Table 1: Characteristics of survey households**

Sample: Rural households

	1993 survey	1998 survey	
		Panel hhs	Replacement hhs
# households	3840	3375	894
Age of household head	44.85 (14.79)	47.47 (13.81)	45.63 (14.07)
Household size	4.97 (2.12)	4.79 (1.90)	4.84 (1.85)
Sex of household head (1=Male)	0.77 (0.42)	0.77 (0.42)	0.84 (0.37)
Ethnicity (1=Kinh)	0.86 (0.35)	0.84 (0.36)	0.82 (0.38)
Literate household head (1=literate)	0.88 (0.33)	0.88 (0.33)	0.86 (0.34)
Years of education of household head	5.96 (4.07)	6.48 (3.90)	6.03 (3.85)
Real household expenditure ('000 dong)	5541.00 (3856.02)	10189.95 (6426.11)	11487.02 (7278.54)
Farming as main occupation	0.83 (0.38)	0.78 (0.42)	0.76 (0.43)

Source: Vietnam Living Standards Measurement Study Surveys 1993 and 1998  
All means weighted by sampling weights.

**TABLE 2: MEASURES OF LAND RIGHTS**

Panel A	Proportion of households registered				Panel B				
	Mean	North	South	Min	Max	Year	# provinces with registration more than	75%	
1994	0.237	0.246	0.227	0.001	0.914	1994	21	8	4
1995	0.367	0.345	0.391	0.040	0.960	1995	33	16	6
1996	0.435	0.404	0.469	0.074	0.952	1996	44	25	14
1997	0.632	0.597	0.667	0.111	1.000	1997	57	43	28
1998	0.713	0.687	0.740	0.119	1.000	1998	60	48	38
2000	0.902	0.893	0.911	0.533	1.000	2000	61	61	56

**Panel C** Correlation among registration measures and manpower measures

% hh registered 1998	1.000							
% hhs registered 1996	0.644		1.000					
% hhs registered 1994	0.376		0.595	1.000				
Years since reg> 25%	0.492		0.691	0.697	1.000			
Years since reg> 50%	0.828		0.799	0.648	0.619	1.000		
Officials/commune 1994	0.102		-0.033	-0.050	-0.016	0.072	1.000	
Officials/commune 1998	0.113		0.250	-0.087	0.136	0.111	0.062	1.000
Officials/1000 hhs 1994	0.081		-0.118	0.077	-0.016	0.070	0.465	1.000
Officials/1000 hhs 1998	-0.007		-0.051	0.110	0.076	0.015	-0.018	0.702

Notes: Figures computed by authors from data provided by General Department of Land Administration, Hanoi.

Proportion of households registered in Panel A refers to the number of households who possess a Land Use Certificate as a fraction of the total number of households. For 1996, 1998 and 2000, GDLA provided the total number of households. For the remaining years, total number of households is estimated by authors based on total number of agricultural households.

The entries in Panel B are the number of provinces in which the proportion of households registered crosses the specified threshold (25%, 50%, 75%). E.g. 21 provinces crossed the 25% threshold in 1994, 12 provinces crossed it in 1995 etc.

"Years since reg> 25%" is 2001 minus the year in which LUC issuance in the province exceeded 25%.

"Officials/commune" is the number of land department officials in the province divided by the total number of communes in the province.

"Officials/1000 hhs" is the number of land department officials in the province divided by the total number of agricultural households.

**TABLE 3: WHAT DETERMINES IMPLEMENTATION OF LAND REFORM ?**

Sample: Provinces

	% HHs registered 1998				Speed of registration			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land officials/commune (1994)		0.063 (0.072)	0.069 (0.065)	0.055 (0.052)		0.803 (0.720)	0.618 (0.517)	0.523 (0.524)
Population density 1993	-0.012 (0.015)	-0.012 (0.015)			-0.097 (0.115)	-0.089 (0.114)		
Total area of province ('000 sq km)	-0.128 (0.123)	-0.099 (0.132)			-0.135 (0.920)	0.333 (1.046)		
Proportion urban 1993	0.343 (0.310)	0.230 (0.318)			-0.147 (2.587)	-0.854 (2.537)		
Proportion under perennial crops 19	-0.137 (0.191)	-0.170 (0.210)			-2.133 (3.039)	-2.732 (3.168)		
Dummy for North	-0.030 (0.071)	-0.012 (0.071)	0.033 (0.074)	0.113 (0.120)	-0.723 (0.646)	-0.665 (0.661)	0.092 (0.589)	0.527 (0.997)
Prop. Communes having market			0.142 (0.207)				1.539 (1.650)	
Prop. Communes having highway			-0.184 (0.159)				-2.861 (2.051)	
Prop. Communes having clinic			0.400 (0.368)				0.320 (2.844)	
Mean age of HH head (1993)				0.022** (0.009)				0.088 (0.086)
Mean HH size (1993)				0.049 (0.060)				0.914 (0.561)
Mean years of education (1993)				0.019 (0.026)				0.157 (0.262)
Log per capita expenditure (1993)				0.204 (0.166)				1.672 (1.398)
Observations	59	57	57	54	57	55	55	54
R-squared	0.06	0.07	0.11	0.18	0.05	0.06	0.09	0.14

Notes: Robust standard errors in parantheses. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

"%HHs registered" is the proportion of rural households in the province who have a Land Use Certificate.

"Speed of registration" is computed as 2001 minus the year when 50% of households in the province obtain LUC.

Regressions exclude Hanoi and Ho Chi Minh City, which are outliers in terms of population density and urbanization rates.

Regressions (5) and (6) exclude old Song Be province, which is an outlier.

Regression (7) excludes old Minh Hai province, which is an outlier.

**Table 4: Impact of LUC issuance on crop choice**

**PANEL A: Discrete Regression**  
 Mean (s.d.) proportion of total cultivated area devoted to perennial industrial crops and fruit crops (by LUC issuance levels and years)

	% hhs with LUC		Difference
	<80%	>80%	
1993 Survey	0.1017	0.0870	-0.0147 (0.0347)
1998 Survey	0.0959	0.1372	0.0413 (0.0382)
Difference	-0.0058 (0.0149)	0.0502 (0.0132)***	<b>0.0560</b> <b>(0.0199)***</b>

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
 All regressions weighted by sampling weights  
 Median LUC issuance: 80%

**PANEL B:** Continuous Regression

Dependent variable = Proportion of total cultivated area devoted to perennial industrial crops and fruit crops  
 Mean (s.d.) of dep. var. in 1993 = 0.0938 (0.2049) in 1993; 0.1185 (0.2566) in 1998

	No controls				Robustness checks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land rights*Year=1998	0.080*** (0.025)	0.075*** (0.024)	0.075*** (0.025)	0.053* (0.031)	0.013** (0.005)	0.148* (0.088)	0.041** (0.021)	0.034** (0.015)
Year=1998	-0.033 (0.020)	-0.033* (0.017)	-0.033* (0.017)	-0.014 (0.020)	-0.029* (0.017)	0.025 (0.068)	-0.025* (0.013)	-0.008 (0.008)
Land rights	0.038 (0.047)	-0.012 (0.037)	-0.011 (0.027)		-0.010* (0.006)	-0.087 (0.094)	-0.003 (0.023)	-0.008 (0.010)
Age of household head		0.001*** (0.000)	0.002*** (0.000)		0.002*** (0.000)	0.004*** (0.001)	0.001*** (0.000)	0.001*** (0.000)
Male household head		-0.019* (0.011)	-0.020** (0.010)		-0.021** (0.010)	-0.010 (0.015)	-0.017** (0.007)	-0.003 (0.005)
Years of education of head		0.008*** (0.002)	0.008*** (0.002)		0.008*** (0.002)	0.014*** (0.002)	0.005*** (0.001)	0.003*** (0.001)
Household size		-0.001 (0.002)	-0.002 (0.002)		-0.003 (0.002)	0.011*** (0.004)	-0.002 (0.002)	-0.000 (0.001)
Majority ethnic group dummy		-0.006 (0.030)	0.003 (0.030)		0.003 (0.029)	-0.039 (0.058)	-0.005 (0.031)	0.008 (0.008)
Dummy for north		-0.195*** (0.039)						
Total area cultivated (*10 <sup>-5</sup> )		-0.148* (0.088)	-0.208** (0.090)		-0.214** (0.095)	0.127 (0.104)	-0.056 (0.070)	-0.151*** (0.046)
Region fixed effects	no	no	yes	no	yes	yes	yes	no
Household fixed effects	no	no	no	yes	no	no	no	yes
No. of observations	7469	7469	7469	6012	7469	7469	7469	7469
No. of provinces	59	59	59	59	59	59	59	59
R-squared	0.01	0.15	0.22	0.80	0.22	0.07	0.22	0.06

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
 All regressions weighted by sampling weights

Regression (5) uses an alternative measure of land rights: the speed of registration measure which is 2001 minus the year in which LUC issuance crosses 50%.  
 Discrete measure equals 1 if the household reports cultivating any perennial crops and/or fruit trees, and zero otherwise.

% perennial is the proportion of total cultivated area devoted to perennial industrial crops  
 # fruit trees is the number of fruit trees reported by the household.

**Table 5: Impact of LUC issuance on nonfarm activities**

**PANEL A: Discrete Regression**

Mean (s.d.) of number of weeks worked in nonfarm activities (per working member) in the last 12 months (by LUC issuance levels and years)

	% hhs with LUC		Difference
	<80%	>80%	
1993 Survey	8.016	7.227	-0.789 (1.17)
1998 Survey	8.346	9.043	0.697 (1.21)
Difference	0.330 (0.586)	1.816 (0.328)***	<b>1.486</b> <b>(0.666)***</b>

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All regressions weighted by sampling weights

Median LUC issuance: 80%

**PANEL B:** Continuous Regression

Sample: Rural households

Dependent variable = Number of weeks worked in nonfarm activities (per working member) in the last 12 months

	No controls			Robustness checks		
	(1)	(2)	(3)	(4)	(5)	(6)
Land rights*Year=1998	3.614*** (1.227)	3.088** (1.174)	2.948** (1.159)	3.358** (1.312)	0.328** (0.159)	0.408** (0.202)
Year=1998	-1.518 (0.984)	-1.193 (0.918)	-1.089 (0.911)	-0.854 (1.150)	-0.284 (0.745)	-0.168 (0.137)
Land rights	-1.638 (2.342)	-3.043 (2.231)	-3.428 (2.352)		-0.431 (0.344)	-0.410 (0.319)
Age of household head		-0.032** (0.012)	-0.034*** (0.013)		-0.035** (0.013)	-0.005*** (0.002)
Male household head		1.827*** (0.504)	1.845*** (0.496)		1.857*** (0.491)	0.183*** (0.065)
Years of education of head		0.393*** (0.068)	0.396*** (0.068)		0.396*** (0.066)	0.043*** (0.009)
Household size		-0.341*** (0.096)	-0.345*** (0.091)		-0.345*** (0.092)	-0.022* (0.013)
Majority ethnic group dummy		3.990*** (0.911)	3.421*** (1.284)		3.366*** (1.254)	0.580*** (0.173)
Dummy for north		-3.003*** (1.068)				
Region fixed effects	no	no	yes	no	yes	yes
Household fixed effects	no	no	no	yes	no	no
No. of observations	8109	8109	8109	6848	8109	8109
No. of provinces	59	59	59	59	59	59
R-squared	0.00	0.07	0.07	0.76	0.07	0.06

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All regressions weighted by sampling weights

Regression (5) uses an alternative measure of land rights: speed of registration which is 2001 minus the year in which LUC issuance crosses 50%.

Hours measure is the number of hours worked in non-farm activities in the previous 7 days per working member.

**Table 6: Multinomial Logistic Regression: crop and labor diversification**

Sample: Panel households

Dependent variable: categorical variable with values in {00, 01, 10, 11}

Category 00 is base category

	category 01	category 10	category 11
Land Rights	0.6599 (0.3581)*	0.5591 (0.4709)	1.1534 (0.4807)***

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Note:

Multinomial logistic coefficients - Standard errors (in parenthesis) are clustered at province level

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

Categories are determined as follows:

For each panel household, difference variables are constructed for crop diversification (proportion of total cultivated area devoted to perennial industrial crops and fruit crops) and labor diversification (number of weeks worked in nonfarm activities per working member in the last 12 months)

category 00: difference for crop and labor diversification non-positive

category 01: difference for crop non-positive and positive for labor

category 10: difference for crop positive, and non-positive for labor

category 11: difference for crop and labor positive

**Table 7: Impact of LUC issuance on productivity, income and expenditure**

Sample: Rural households		Log rice yields		Value of agr. output / cultivated area		Real household expenditure	
Dependent variable		kg/sq m		1998 dong/ sq m cultivated		1998 dong/ (000)	
Units							
Mean (s.d.) in 1993		3.35 (0.505)		0.7985 (2.342)		5414.04 (3480.40)	
Mean (s.d.) in 1998		3.56 (0.411)		1.659 (6.728)		10293.81 (5885.25)	
Registration rate 1998*Year=1998		-0.032 (0.121)	-0.002 (0.109)	0.691 (0.470)	0.723 (0.470)	495.222 (625.744)	490.478 (599.934)
Year=1998		0.231** (0.100)	0.218** (0.088)	0.323 (0.227)	0.302 (0.233)	4,486.901*** (490.666)	4,511.802*** (473.702)
Registration 1998		0.150 (0.093)	0.267*** (0.086)	0.221 (0.203)	0.338 (0.223)	37.810 (323.907)	336.781 (322.540)
age		0.001 (0.001)	0.000 (0.001)	0.014* (0.007)	0.015** (0.007)	44.159*** (3.732)	45.158*** (3.688)
Gender of HH.head		-0.021 (0.014)	-0.012 (0.014)	-0.277 (0.195)	-0.287 (0.198)	-130.423 (143.366)	-149.058 (141.896)
Years of education of HH head		0.019*** (0.003)	0.013*** (0.003)	0.029* (0.018)	0.033** (0.017)	296.885*** (18.773)	301.997*** (18.165)
Household size		-0.008** (0.003)	0.003 (0.003)	-0.054* (0.028)	-0.058** (0.028)	1,027.795*** (35.365)	1,020.578*** (35.893)
Ethnicity (Kinh=1)		0.314*** (0.046)	0.278*** (0.042)	0.501*** (0.122)	0.598*** (0.157)	1,825.293*** (217.538)	1,853.284*** (258.754)
Dummy for north				-0.097 (0.193)	0.520* (0.273)	-2,366.574*** (200.814)	-2,064.018*** (690.004)
Region fixed effects		no	yes	no	yes	no	yes
Observations		6547	6547	7466	7466	7501	7501
R-squared		0.16	0.24	0.01	0.02	0.44	0.46

Standard errors in parentheses, corrected for village-year clustering. All regressions weighted by sampling weights.

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

**Table 8: Impact of LUC issuance on credit market activity**

<b>PANEL A: Dependent variable = 1 if household has outstanding loans</b>												
	No controls		Region FE		Panel hhs		Alternative land rights		Distance to source		Alternative credit	
	(1)	(3)	(4)	(5)	<=5km	>5km	yes	no	yes	no	yes	no
Land rights * Year=1998	-0.111 (0.071)	-0.107 (0.073)	-0.087 (0.093)	-0.013 (0.009)	0.047 (0.092)	-0.241* (0.135)	0.009 (0.157)					-0.102 (0.102)
Land rights	0.035 (0.070)	-0.002 (0.061)	-	0.018 (0.009)*	-	-	-	-	-	-	-	-
Year=1998	0.110 (0.054)**	0.125 (0.055)**	0.091 (0.071)	0.106 (0.041)**	0.003 (0.067)	0.198* (0.104)	-0.016 (0.138)					0.114 (0.074)
household characteristics	no	yes	no	yes	no	no	no	no	no	no	no	no
household fixed effects	no	no	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
Observations	8108	8108	6686	8108	2930	3688	1618	5000	1618	5000	1618	5000
R-squared	0.00	0.06	0.24	0.05	0.63	0.61	0.63	0.61	0.63	0.61	0.63	0.61

<b>PANEL B: Dependent variable = Amount borrowed/total expenditure</b>												
	No controls		HH chars. +region FE		Panel hhs		Alternative land rights		Distance to source		Alternative credit	
	(1)	(3)	(4)	(5)	<=5km	>5km	yes	no	yes	no	yes	no
Land rights * time	-0.080 (0.073)	-0.091 (0.071)	-0.116 (0.137)	-0.006 (0.010)	-0.156 (0.162)	-0.053 (0.143)	-0.240 (0.237)					-0.098 (0.151)
Land rights	0.010 (0.042)	-0.012 (0.034)	-	-0.002 (0.005)	-	-	0.293 (0.186)					0.111 (0.113)
Year=1998	0.208 (0.061)***	0.211 (0.059)***	0.145 (0.107)	0.060 (0.047)	0.216** (0.110)	0.064 (0.110)						
household controls	no	yes	--	yes	--	--	--	--	--	--	--	--
region fixed effects	no	yes	--	yes	--	--	--	--	--	--	--	--
household fixed effects	no	no	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4315	4315	3570	4315	1579	1980	971	2588	971	2588	971	2588
R-squared	0.02	0.03	0.76	0.03	0.73	0.79	0.71	0.78	0.71	0.78	0.71	0.78

**PANEL C:** Dependent variable = Proportion of borrowing from formal sources

Independent variable:	No controls		HH chars. +region FE		Panel hhs		Alternative land rights		Distance to source		Alternative credit	
							<=5km	>5km	yes	no	yes	no
Land rights * time	0.061 (0.089)	0.063 (0.090)	0.075 (0.193)	0.011 (0.015)	0.071 (0.261)	0.058 (0.257)	0.358 (0.478)	-0.023 (0.155)				
Land rights	0.225*** (0.065)	0.210*** (0.066)		-0.017 (0.010)								
Year=1998	-0.054 (0.073)	-0.124** (0.057)	0.181 (0.138)	0.210*** (0.063)	0.130 (0.191)	0.239 (0.193)						
household controls	no	yes	--	yes	--	--	--	--	--	--	--	--
region fixed effects	no	yes	--	yes	--	--	--	--	--	--	--	--
household fixed effects	no	no	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4315	4315	3570	4315	1579	1980	971	2588				
R-squared	0.09	0.11	0.75	0.11	0.74	0.76	0.72	0.76				

Standard errors in parantheses, clustered at province level.

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

Household controls include age, gender, education, ethnic origin of household head, household size

"Distance to source" is the average distance to all credit institutions in the commune, measured from the People's Committee of the commune.

"Alternative credit" refers to the presence of a credit institution in the commune which is not a government bank.

**Table 9: Impact of LUC issuance on land market activity**

<b>PANEL A:</b> Dependent variable =1 if household reports acquiring land in last one year														
	No controls		HH chars		Region FE		Panel hhs		Alternative land rights		Distance to source		Alternative credit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Land rights * Year=1998	0.003 (0.096)	0.004 (0.095)	0.019 (0.097)	-0.023 (0.142)	0.001 (0.012)	0.0964 (0.1416)	-0.1710 (0.2002)	0.3970** (0.1540)	-0.1410 (0.1561)					
Land rights	0.002 (0.012)	0.028 (0.022)	0.008 (0.042)		0.001 (0.006)									
Year=1998	0.221*** (0.067)	0.229*** (0.066)	0.209*** (0.070)	0.227** (0.099)	0.219*** (0.053)	0.1468 (0.0962)	0.3371** (0.1459)	-0.1061 (0.0985)	0.3154** (0.1097)					
household characteristics	no	yes	yes	--	yes	--	--	--	--					
region FE	no	no	yes	--	yes	--	--	--	--					
household FE	no	no	no	yes	no	yes	yes	yes	yes					
Observations	8108	8108	8108	6848	8108	3031	3694	1649	5076					
R-squared	0.10	0.13	0.15	0.57	0.15	0.57	0.57	0.58	0.57					

<b>PANEL B:</b> Dependent variable =1 if household reports selling land in last one year														
	No controls		HH chars		Region FE		Panel hhs		Alternative land rights		Distance to source		Alternative credit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Land rights * Year=1998	-0.086 (0.055)	-0.085 (0.055)	-0.079 (0.057)	-0.093 (0.077)	-0.011 (0.008)	-0.0775 (0.0831)	-0.1482 (0.1229)	0.0701 (0.0732)	-0.1668* (0.0949)					
Land rights	0.011* (0.006)	0.010 (0.009)	-0.002 (0.013)		0.001 (0.002)									
Year=1998	0.156*** (0.045)	0.155*** (0.045)	0.149*** (0.047)	0.167*** (0.064)	0.136*** (0.038)	0.1680** (0.0655)	0.2053** (0.1029)	0.0562 (0.0578)	0.2185 (0.0772)					
household characteristics	no	yes	yes	--	yes	--	--	--	--					
region FE	no	no	yes	--	yes	--	--	--	--					
household FE	no	no	no	yes	no	yes	yes	yes	yes					
Observations	8108	8108	8108	6848	8108	3031	3694	1649	5076					
R-squared	0.04	0.04	0.05	0.53	0.05	0.52	0.54	0.51	0.54					

Standard errors in parantheses, clustered at province level.  
 \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 10: 2x2 tables: Impact of LUC issuance on provincial distribution of land**

Sample: Province-level measures

**Panel A:** Province gini coefficient

	Low 98	High98	Difference
1993	0.4730	0.4762	0.0033 (0.0467)
1998	0.4439	0.4371	-0.0069 (0.0383)
Difference	-0.0290 (0.0425)	-0.0391 (0.0424)	<b>-0.0102</b> <b>(0.0603)</b>

**Panel B:** Proportion of landless in province

	Low 98	High98	Difference
1993	0.1191	0.1159	-0.0032 (0.0403)
1998	0.0706	0.0695	-0.0011 (0.0277)
Difference	-0.0485 (0.0350)	-0.0464 (0.0337)	<b>0.0021</b> <b>(0.0486)</b>

Note: standard errors in parenthesis. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

The column Low98 is the set of provinces with a Level of Registration in 1998 is below the median, or 80% registration level.

The column High98 is the set of provinces with a Level of Registration in 1998 is above the median, or 80% registration level.

Gini coefficients are computed by the authors from household-level data on land holdings.

**Table 11: Impact of LUC issuance on crop choice in different subcategories**

Sample: Panel households

Dependent variable = Proportion of total cultivated area devoted to perennial industrial crops and fruit crops

	Base spec		1993 income quintile		1993 land holding		distance to credit institutions		Alternative credit		Provincial Land Gini	
	(1)	(2)	<=3	>3	<7000sq.m	>7000sq.m	<=5km	>5km	yes	no	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(11)
Land rights*Year=1998	0.053* (0.031)	0.051* (0.029)	0.052 (0.049)	0.047* (0.029)	0.060 (0.042)	0.060* (0.032)	0.046 (0.055)	0.110* (0.058)	0.034 (0.035)	0.030 (0.026)	0.117 (0.074)	
Year=1998	-0.014 (0.020)	-0.019 (0.017)	-0.003 (0.036)	-0.007 (0.016)	-0.022 (0.027)	-0.010 (0.020)	-0.015 (0.035)	-0.047 (0.044)	-0.004 (0.021)	-0.012 (0.019)	-0.036 (0.049)	
Household fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of observations	6012	3620	2392	3030	2962	2700	3252	1384	4568	3482	2530	
R-squared	0.80	0.77	0.83	0.81	0.80	0.81	0.79	0.75	0.82	0.78	0.80	

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All cells reflect results of regressions of the proportion of total cultivated area devoted to perennial crops and fruits on land rights.

"Land rights" refers to the proportion of households in the province who have obtained Land Use Certificates.

Length of tenure based on answers to the question "In which year did your household begin farming this plot?"

"Distance of credit institutions" is the average distance to all credit institutions in the commune, measured from the People's Committee of the commune.

"Alternative credit" refers to the presence of a credit institution in the commune which is not a government bank.

1993 income quintiles are based on household expenditure. Lower quintile imply poorer households.

Provincial Land Gini is computed by the authors from survey data. A province is "low" when gini coefficient is below median, or .46, and "high" otherwise

**Table 12: Impact of LUC issuance on nonfarm activities in different subcategories**

Sample: Panel households

Dependent variable = Number of weeks worked in nonfarm activities in last 12 months, per working member

	Base spec (1)	1993 income quintile <=3 (2)	>3 (3)	1993 land holding <7000sq.m (4)	>7000sq.m (5)	distance of credit institutions <=5km (6)	>5km (7)	Alternative credit yes (8)	no (9)	Provincial Gini Low (10)	High (11)
Land rights*Year=1998	3.358** (1.312)	2.821* (1.646)	3.678 (3.943)	4.018** (2.025)	2.329 (1.579)	3.022* (1.623)	3.701* (2.043)	3.585** (1.706)	2.879 (4.765)	3.146** (1.516)	3.755 (2.557)
Year=1998	-0.854 (1.150)	-0.324 (1.376)	-1.411 (3.119)	-1.364 (1.754)	-0.006 (1.252)	-0.425 (1.271)	-1.233 (1.830)	-0.884 (1.454)	-0.809 (4.091)	-1.019 (1.417)	-0.736 (2.005)
Household fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of observations	6848	4549	2299	3313	3049	3031	3694	5076	1649	3692	3156
R-squared	0.76	0.80	0.86	0.73	0.71	0.77	0.75	0.76	0.76	0.74	0.78

Standard errors in parentheses, corrected for province-level clustering. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All cells reflect results of regressions of the proportion of total cultivated area devoted to perennial crops and fruits on land rights.

"Land rights" refers to the proportion of households in the province who have obtained Land Use Certificates.

Length of tenure based on answers to the question "In which year did your household begin farming this plot?"

"Distance of credit institutions" is the average distance to all credit institutions in the commune, measured from the People's Committee of the commune.

"Alternative credit" refers to the presence of a credit institution in the commune which is not a government bank.

1993 income quintiles are based on household expenditure. Lower quintile imply poorer households.

Provincial Land Gini is computed by the authors from survey data. A province is "low" when gini coefficient is below median, or .46, and "high" otherwise