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The Forgotten Property Rights:
Restrictions on Land Use in Vietnam

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Abstract: Studies of land property rights usually focus on tenure security and transfer rights. Rights to determine how to use the land are regularly ignored. However, in transition economies such as Vietnam and China, user rights are often limited. Relying on a unique Vietnamese panel data set at both household and *plot* level, we show that crop choice restrictions are widespread and prevent crop diversification. Restrictions do not decrease household income, but restricted households work harder, and there are indications that they are supplied with higher quality inputs. Our findings are consistent with the view that the Vietnamese government has managed to intervene effectively in agricultural (rice) production to promote output and food security. At the same time, it is now time to carefully consider the potential benefits of a more diversified crop pattern.

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1. Introduction

Twenty two years after the introduction of the Doi Moi reform process, market institutions have established themselves firmly in rural areas in Vietnam. Households sell their production output to private buyers, trade land and sell labor on the private market. Nevertheless, the state (including national, provincial, district, and commune authorities) retains a hugely important role in economic life in comparison with most non-transition economies, and even with many transition economies, for example in Eastern Europe. The state intervenes actively in the land market, places priority on rice as a crop farmers must grow, supplies many inputs in agricultural production, strongly dominates formal markets for financial services, and to a large extent controls a large number of local organizational activities. More specifically, authorities intervene heavily in farmers' choice of crops, and while the land law gives households the right to sell, rent, exchange, mortgage, and bequeath their land, many farmers do not have the right to decide what to use their plots for. In our sample, around 50 percent of plots have restricted crop choice. Market reforms are very far from "complete", and understanding the sustained success of Vietnam in promoting growth and poverty reduction is not as straightforward as often assumed.

A range of insightful studies have analyzed the effects of the Vietnamese move towards privatization of agricultural land management (Do and Iyer 2008, Deininger and Jin 2008, Ravallion and van de Walle 2004, 2005, 2006). Yet, these studies have focused on tenure security and transfer rights with no attention to the importance of user rights. Econometric analysis of the effects of crop choice restrictions faces difficult identification challenges. The most important crop choice restriction in Vietnam is to compel farmers to grow. This is done to achieve production quotas so as to secure food supplies and meet export targets. It follows that authorities have strong incentives to impose restrictions on the most productive land and most productive households. This means that crop choice restrictions are likely to be correlated with unobserved land and household characteristics, which are, in turn, correlated with crop choice and land productivity. To deal convincingly with these problems, we use panel data at both household and plot level. We know of only one other study which uses a plot level panel to study land rights. Goldstein and Udry (2008) analyze the relationship between political power, tenure security and investment in seven villages/hamlets in the Akwapim region of Ghana. In contrast with their work we include plot fixed effects in our regressions.

Our results suggest that restrictions are binding in an economic sense. If they were lifted, many farmers would shift to other crops. A simple argument from microeconomic theory suggests that binding crop choice restrictions should decrease either household income, leisure or both. We test these hypotheses and find that restrictions do indeed have a significant effect on household labor supply, but no effect on income from cultivation. We also find some evidence that restricted households are supplied by the authorities with higher quality inputs than other households. Another result is that land titles have significant effects on crop choice, agricultural income and household labor supply in line with existing literature.

Section 2 reviews the literature on different types of land rights, while Section 3 discusses the history and nature of restrictions on crop choice in Vietnam. In Section 4 a simple microeconomic model of the effect of crop choice restrictions is formulated, and Section 5 data and descriptive statistics. Sections 6 and 7 investigate the effects of restrictions on crop choice and labor supply, while Section 8 brings out the impact on agricultural income. Section 9 concludes.

2. Literature review[1]

The right to choose which crops to grow is an important aspect of farmer property rights to land. However, analytical studies on the effects of land rights have focused on tenure security and transfer rights, such as the right to sell, rent, mortgage, and bequeath land, rather than rights concerning use (e.g. Feder and Onchan 1987, Place and Hazell 1993, Besley 1995, Hayes et. al. 1997, Braselle et. al. 2002, Goldstein and Udry 2008). One reason for this focus is that use rights are often implied by transfer rights. For example, Braselle et al. (2004) study a region in Burkina Faso and report that 91.2 percent of farmers surveyed have a permanent right to choose what to grow on their plots, while only about 25 percent have the right to rent or give away the plot. Sales are never allowed, and it is virtually never the case that a farmer has the right to transfer a plot, but not the right to choose what to grow.

In contrast, in Vietnam and other transition economies the situation is very different. Brandt et al. (2002) report that in 25 percent of the villages they surveyed in rural China, villagers cannot freely determine what to grow. In addition, 80 to 90 percent of all plots are held as "responsibility land", which implies that households are obliged to deliver set quotas of grain or other specified crops to the commune. Hence, farmers are forced to grow these crops on at least some of their land. In our sample, around 74 percent of plots owned and operated by households are

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[1] For general surveys of the literature on land rights and other policies related to land, see Feder and Nishio (1999), Deininger and Feder (2001), Deininger (2003) and Pande and Udry (2005).

held with a title, a so-called Land Use Certificate (LUC).[2] LUCs grant 20 year tenure security for annual crops land (50 years for perennial crops land) and a wide range of transfer rights, but *not* the right to determine use.

Most studies of land rights in Vietnam analyze the effects of land use certificates, and focus on tenure security and transfer rights rather than use rights. Deininger and Jin (2008) study the effects of the land market. They find that LUCs facilitate participation in land rental and sales markets, and that these markets in turn work to transfer land from large to small farms, and from less to more skilled farmers. Ravallion and van de Walle (2006) find that land market transactions have worked to decrease inefficiencies brought about by the administrative allocation of agricultural land following de-collectivization in the late 1980s and early 1990s. They do not directly study the effects of land rights, but to the extent that land market activities are facilitated by formal transfer rights, their study implies a positive effect of such rights. Do and Iyer (2008) combine province level data on the progress of land titling with household level data from the 1993 and 1998 Vietnam Household Living Standards Surveys (VHLSS) to study the effects of LUCs. They conclude that rights have a statistically significant, but economically moderate effect on investment in perennial crops, and on hours of work in non-agriculture.

The descriptive report by Brandt et al. (2005), based on the 2004 VHLSS, contains statistics on the prevalence of LUCs and presents descriptive regressions on land prices. They show that a LUC is associated with a price increase of approximately 23 percent. No statistics are reported on restricted crop choice, since data on restrictions are not collected in the VHLSS. An early study by Pingali and Xuan (1992) investigated the effect of the change from collective farming to "contract farming" implemented in 1981. In the new system farmers were individually responsible for delivering a quota of rice or other crops to the commune, and were entitled to keep any surplus above the quota for own consumption or sale. Hence, the policy change improved farmers' property rights to the harvested crop and this increased productivity.

Finally, the present paper is to our knowledge, the first analysis of the effects of restrictions on crop choice in Vietnam. In fact, we are not aware of any studies focusing on this issue in transition economies.

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[2] Somewhat ironically for a document that assigns private property rights in a communist country, LUCs are also known as "red books".

3. History and nature of state intervention in land use management[3]

Many policy areas in Vietnam have been characterized by a gradual process of liberalization since the beginning of the Doi Moi reform program in 1986. Policies on agricultural land use are in some respects an exception. The important Resolution no. 10 in 1988 and the 1993 Land Law nominally granted farmers the right to decide what to grow. As the land law was implemented, however, it was hotly debated whether farmers in rice growing areas should be allowed to shift to other crops; and the 1998 and 2001 revisions to the land law clarify that changes in land use purpose are only allowed "within the existing physical planning framework adopted by central and local governments" (Vasavakul 2006, p. 226). The formal justification for state intervention is now found in the 2003 Land Law (for example article 11, §1 and article 36). Restrictions are administered by commune authorities, according to the commune land use plan. The plan is produced by commune authorities, subject to approval at district level. Formally, households can apply for a change in land use purpose at the district level but in practice it is very difficult for farmers to change or remove restrictions on their plots.[4] At each administrative level, land use plans must be consistent with plans at higher levels (from the commune to the district, the province and national plan). Hence, flexibility in relation to land use is limited.

Table 1 presents administrative, national level data on the extent of land use restrictions in different regions of Vietnam.

Table 1 Land restricted for rice production, regional and national level (2006)
(percent of all land for crop agriculture)

North East and North West	17.9
Red river delta	74.9
North Central Coast	40.0
South Central Coast	23.4
Central Highlands	4.9
South East	9.6
Mekong river delta	68.3
Vietnam	35.3

Source: data compiled by the Ministry of Natural Resources and Environment (MONRE) based on the detailed 2006 National Land Use Plan.

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[3] For in-depth descriptions of land policies in Vietnam, see Kerkvliet (2006) and Marsh, MacAuley and Hung (2006).

[4] This is based on extensive of a qualitative nature (including in-depth discussion with officials at national level in CIEM, ILSSA, IPSARD and MONRE, and observations made during repeated field trips by the authors over the past seven years.

The table shows that farmers are obliged to grow rice on 35 percent of the total land area used for crop agriculture. Restrictions are concentrated in the two deltas of the Mekong and Red River. Since land in the deltas is considerably more productive land than in the uplands and population densities are much higher, the importance of restrictions in terms of the number of farmers affected is much higher than 35 percent. As demonstrated in Table 2 in Section 5, the obligation to grow rice is the overwhelmingly dominant type of restriction, but other restrictions apply as well.

Why does the state impose restrictions on land use? In a sense, it is not surprising that the government of Vietnam makes use of centralized planning. Still, we may ask why an administration which has liberalized in many other fields has chosen to maintain restrictions on land use. Originally, the overriding concern was food security. In the early 1980s, Vietnam experienced severe food shortages, and these events continued to affect agricultural policies after the initiation of the Doi Moi reforms in 1986. Food security remains a major motive behind restrictions, but export targets are playing an increasing role. For example, the Ministry of Planning and Investment's Five Year Socioeconomic Development Plan (SDP) (p. 64) states that Vietnam should export 3 to 4 million tons of food crop products per year over the period 2006-2010. One method for reaching this goal is to restrict farmers to growing rice, the most important food export.

The fact that one of the reasons for imposing restrictions is to meet certain production targets means that the government (national and local) has an incentive to impose restrictions on the highest quality land, and the most effective producers, in order to maximize the probability that targets are met. Other reasons for restricting land use mentioned by Vietnamese officials include "the fact that local violations [of land use restrictions] may environmentally damage the areas developed for rice growing; that in some areas farmers are not equipped to grow anything other than rice; and that the state has already invested heavily in irrigating rice land" (Vasavakul 2006, p. 227).

Finally, anecdotal evidence exists on disputes over land use between farmers and authorities. In the south, conflicts have occurred because farmers were prevented from converting rice fields into shrimp raising farms. In the Red River delta, conflicts are reported to have taken place because farmers were not allowed to grow fruit trees instead of rice (Vasavakul 2006, p. 227).

4. Theory

We now go on to sketch a simple microeconomic model to illustrate how restrictions on crop choice may affect household behavior. Consider a farm household who maximizes the following utility function:

$$U = C + X \tag{1}$$

where *C* is consumption, and *X* leisure. Assume that the household commands time resources normalized to 1 and operates an agricultural land area of size $\bar{Q}$. The household grows two different crops, denoted 1 and 2. The prices received by the household for the crops are denoted p_1 and p_2, respectively. The income of the household is given by:

$$I = p_1 f_1(L_1, Q_1) + p_2 f_2(L_2, Q_2) \tag{2}$$

where f_1 and f_2 are the production function for crop 1 and crop 2, respectively. Assume that both production functions exhibit decreasing returns to scale. Also, assume that consumption simply equals income. The household then maximizes:

$$U = p_1 f_1(L_1, Q_1) + p_2 f_2(L_2, \bar{Q} - Q_1) + 1 - L_1 - L_2 \tag{3}$$

Denote the solution to this problem by (L_1^*, L_2^*, Q_1^*), and assume that the government imposes the restriction that the household must grow crop 1 on an area equal to at least Q_1^r. If Q_1^r is higher than the desired area for crop 1, Q_1^*, we say that the restriction is binding. The effect of imposing a binding restriction can be illustrated in a diagram such as Figure 1. The figure shows income as a function of leisure (or equivalently, of labor supply). The schedule *PP* is the income function in the case without restrictions, and the schedule PP_r is the income function after a binding restriction has been imposed. *U* and U_r are simple, linear indifference curves.

Figure 1 The effect of a crop choice restriction on leisure and income

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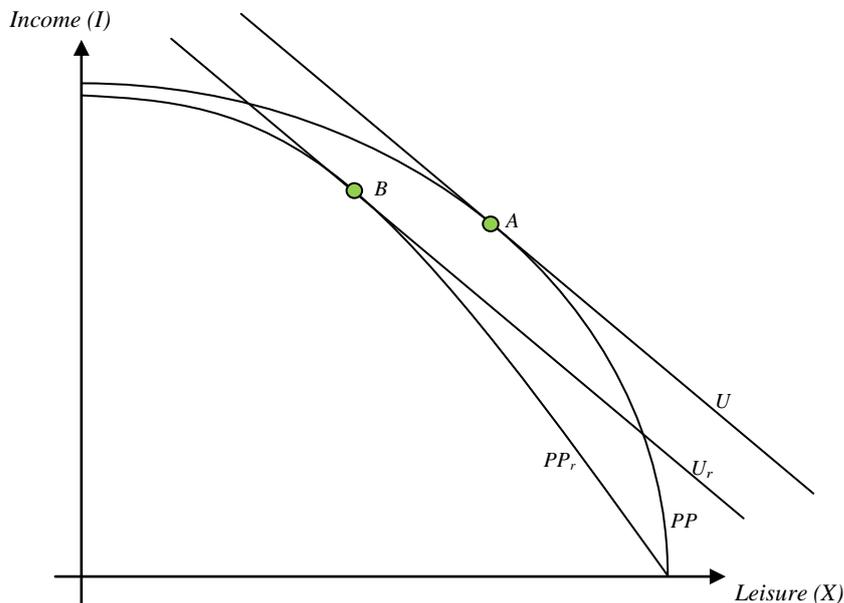
The optimal solution for the household is point *A* before the restriction is imposed, and point *B* after. The restriction in this case increases both labor supply and income. For other parameter values, income might drop as a result of restrictions. The only outcome which is entirely ruled out is a simultaneous increase in both leisure and income. This argument motivates our analysis of the impact of crop choice restrictions on income and labor supply in Sections 7 and 8.

5. Data and descriptive statistics

We make use of a unique household and plot level panel data set collected in the Vietnam Access to Resources Household Survey (VARHS). The surveys were implemented in 12 provinces in Vietnam between July and September 2006 and July and September 2008. It re-interviewed households sampled for the income and expenditure modules of the 2002 and 2004 VHLSS in the 12 provinces.[5] Provinces were selected to facilitate the use of the survey as an evaluation tool for Danida supported programs in Vietnam. Seven of the 12 provinces are covered by the Danida business sector support program (BSPS), and five provinces are covered by the agricultural and rural development (ARD) program. The provinces supported by the agricultural support program are located in the North West and Central Highlands, so these relatively poor and sparsely populated regions are over-sampled. Our sample is statistically representative at the provincial but not at the national level.

The 2006 round of the VARHS survey covered 2,324 households in 466 communes. Out of these households, 2,271 were identified and re-surveyed in 2008 (implying an attrition rate of seven percent). We analyze the 2,049 of these households, who operate a farm, grow crops, and have data on key variables. The household survey collected detailed plot-level information on property rights (including restrictions on use), land use, irrigation, mode and time of acquisition, and other plot characteristics. It also provides detailed information at the household level on agricultural inputs, outputs and investment in addition to general information about individuals and households.

While household level panel data has become relatively common, it is unusual that economic surveys collect panel data at the *plot* level. In the 2006 round of the survey, enumerators sketched a "map of plots" for each household. It indicates the approximate location of each household plots in relation to the family home, and also includes information on the size of the plot,

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[5] See CIEM et al. (2007, 2009) for further background information and details. The sampled provinces are, by region: Red River Delta: Ha Tay. North East: Lao Cai, Phu Tho. North West: Lai Chau, Dien Bien. North Central Coast: Nghe Anh. South Central Coast: Quang Nam, Khanh Hoa. Central Highlands: Dak Lak, Dak Nong, Lam Dong. Mekong River Delta: Long An.

the distance from the family home, and the code assigned to the plot, according to the coding system detailed in the questionnaire and enumerators' manual. Appendix 1 shows one of the maps collected. These maps were stored, and copies were taken back to households in 2008 and used to identify plots. A total of 12,511 plots were included in the 2006 survey for the households who were re-interviewed in 2008, and 9,432 of these plots were identified again in 2008. Households stated that they parted with a total of 861 plots, and if plots had been split up, or merged with other plots, they were regarded as "new" plots. Some 1,865 plots were classified to have changed in these two ways. An additional 353 plots (three percent of the original sample) were not re-surveyed for a variety of reasons.

Table 2 presents descriptive statistics for the plots and households analyzed. The first line shows restrictions on crop choice are common, and a drop occurred between 2006 and 2008.

Table 2 Descriptive statistics
(means, unless otherwise specified)

Variable	2006	2008	Observations (total)
*Plot level^*			
Crop choice restricted	0.52	0.45*	16,520
Must grow rice	0.48	0.41*	16,520
Has red book (title)	0.74	0.73	16,698
Planted with rice	0.65	0.62	15,879
Irrigated	0.68	0.68	16,698
Rented	0.05	0.05	16,698
Household level			
Household size	4.7	4.6	4,029
Age of household head	50.1	51.5*	4,028
Female household head	0.19	0.20*	4,029
Income from crop agriculture, '000 VND (2006 RRD prices, median)^^	3,900	5,819*	3,894
Operated ag. area, sqm. (median)	3,500	3,309	4,030
Labor supply per working hh member, days in last 12 months	175	177	4,009
Labor input in crop agriculture per working hh member, days in last 12 months	57	61*	4,009

^Only plots where crops are grown are included.
^^Income is adjusted for regional differences in price levels, and for region specific inflation. The base is prices in rural areas of the Red River Delta in 2006 (the 2006 baseline is calculated from Vietnam Household Living Standards Survey (VHLSS) 2006, and region-specific inflation from July 2006 to July 2008 is calculated on the basis of data provided by the General Statistics Office (GSO). The income- and farm size variables are quite strongly skewed to the right, so medians are more informative than means. * denotes that the difference between 2006 and 2008 is significant at the 5 percent level.

This stems partly from the general trend towards increased influence of market forces, and partly from the fact that high rice prices in 2008 rendered restrictions less necessary in some areas, in the sense that the high prices meant that rice became a more attractive crop. Next, the table documents that by far the most common restriction is that farmers must grow rice. The table also shows that most plots are titled and that the share of plots titled remained stable between 2006 and 2008. The share of plots planted with rice has decreased slightly, while the share irrigated and the share which is rented is the same in the two survey years.

At the household level, household size and the share of household heads, which are female are unchanged, while household heads, not surprisingly, are older in 2006 than in 2008. Real income from crop agriculture increased very substantially. This is mostly a reflection of the very large increases in world market prices of crops over the period. Farm sizes decrease moderately over the period, reflecting continuous subdivision of farms, as parents hand over land to their children. Household labor supply increased marginally, especially in crop agriculture, in line with increased monetary returns.

6. Crop choice

In our econometric analysis, we first investigate whether restrictions do in fact impose binding constraints on farmers. Would they grow something else if they were not subject to restrictions? Most restrictions compel farmers to grow rice, but obviously many would plant rice even in the absence of restrictions. Natural conditions in most areas of Vietnam are very well suited to rice cultivation. If restrictions are binding in an economic sense, there should be a significant, partial correlation between restriction status and the decision to grow rice, even when household and plot characteristics are controlled for.

We proceed assuming that the determination of crop choice can be described by the following model:

$$C_{pht} = \alpha + \beta R_{pht} + x_{pht}' \gamma + u_h + v_{ph} + e_{pht}, \tag{4}$$

where C_{pht} is crop choice on plot p in household h in year t. The variable takes the value one if the plot is planted with rice in at least one season in year t, and zero otherwise. R_{pht} is a dummy indicating whether there is a restriction on the plot specifying that rice must be grown; x_{pht} is a vector of potentially time-varying variables that may affect crop choice; u_h is an unobserved,

household specific effect and v_{ph} is an unobserved, *plot*-specific effect; and e_{pht} is an idiosyncratic, time varying error term. Conditional on the unobserved, fixed effects, e_{pht} is assumed to be uncorrelated with the explanatory variables, and α, β and γ are parameters to be estimated.

In this model, the introduction of household fixed effects in a regression would remove the bias stemming from u_h, but not the bias from v_{ph}. It is eminently plausible that unobserved plot characteristics, such as the quality and nature of the soil, play a significant role for the choice of crop. At the same time, these characteristics are correlated with the imposition of restrictions. Authorities have, as already alluded, a significant incentive to choose restrictions in such a way as to maximize rice production. Introducing fixed effects at the plot level removes the bias from unobserved plot characteristics which are fixed over time. Since this is likely to be more or less true for variables such as the type and quality of soil, the possibility to include plot fixed effects due to the nature of our data is a significant benefit.

Results are shown in Table 3, and the first column shows a strong, and highly statistically significant, partial correlation between restrictions and crop choice. The probability of growing rice is predicted to increase by 14 percentage points when a restriction is imposed. Column two shows that this effect is only slightly lower (12 percentage points) when controls for potentially time-varying plot characteristics are included.

Table 3 Crop choice regressions with plot FE, 2006-2008

Must grow rice	0.144	0.123
	(18.89)***	(16.56)***
Red book		0.041
		(3.79)***
Irrigated		0.212
		(24.55)***
Year = 2008		0.015
		(3.71)***
Constant	0.572	0.395
	(144.05)***	(37.08)***
Fixed effects	Plot	Plot
No. Plots	7,284	7,283

Note: Dependent variable is "plot planted with rice in at least one season" and absolute value of t statistics in parentheses.

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

Unsurprisingly, the availability of irrigation has a strong positive effect on the probability of growing rice. This variable might be endogenous in the sense that the decision to

invest in irrigation may follow the decision to grow rice, rather than the other way around. Note, however, that investment in irrigation facilities is in Vietnam generally undertaken by local authorities, rather than by households. We therefore believe it is reasonable to assume that the availability of irrigation is exogenous.

The probability of growing rice increases when the household receives a title for a plot. This may appear to be at variance with Do and Iyer (2008) who found that land titles increase investment in perennial crops. Yet, the apparent contradiction disappears when it is recalled that initiating rice production also entails investment costs.[6] Controlling for plot characteristics, households are more likely to grow rice in 2008 than in 2006. Again, this no doubt reflects the strong increase in the price of rice over the period.

In sum, changes in restriction status are very strongly correlated with changes in crop choice, even when observed and unobserved plot characteristics are controlled for. This is a clear indication that formal restrictions do in fact affect household behavior. Another piece of evidence pointing in this direction is provided in Table 4. In VARHS 2008, respondents were asked for each plot they had planted, why they had chosen the crop they grew in the most recent season.

Table 4 Stated reasons for crop choice, 2008 (percent)

Reason	All plots	Plots with restricted crop choice
Obliged by commune authorities	37.3	80.4
High productivity/high efficiency	40.5	12.0
Plot not suitable for other crops	16.7	6.5
Other	5.5	1.2

N=7,672

The results show that for 37 percent of *all* plots, farmers state that the main reason for growing the crop they grow is that they are "obliged by authorities". Some 41 percent say that the crop has high productivity or high efficiency, and 17 percent say that the plot is not suitable for other crops. On plots where an objective, formal crop choice restriction is present (column two), respondents on 80 percent of the plots say that the obligation toward the authorities is the most important reason for their choice of crop. While this does not imply that farmers would shift to another crop if restrictions were lifted in 80 percent of the cases, the fact that a large share of

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[6] Land titles, and transfer rights in general, are typically regarded as endogenous in the literature (e.g. Besley 1995, Braselle et. al. 2004, Markussen 2008). However, since a main source of endogeneity is unobserved household and land characteristics (such as entrepreneurship and soil quality), it is plausible that land titles are exogenous in the plot fixed effects model, where these factors are controlled, in contrast with the cross-section models typically estimated (including an earlier draft of this paper based on the 2006 data only).

respondents answer that the obligation is the most important reason for their crop choice strengthens the finding that restrictions affect behavior.

7. Household labor supply

The simple microeconomic argument illustrated in Figure 1 suggests that if crop choice restrictions are binding, they are likely to have an effect on household income and labor supply. We therefore turn to an investigation hereof. Since labor input and income from crop agriculture are not available at the plot level, these analyses are conducted at the household level.

We first consider labor supply. Table 5 presents the results of estimating household fixed effects regressions for household labor supply per working household member. The first two columns explain labor input in crop agriculture and the last two total household labor supply (in logs). The measure of crop choice restrictions used is the share of agricultural land subject to a restriction. A year dummy is included in all regressions. In columns two and four, a number of other control variables are also included. First, the share of land with a red book is introduced. If land titles increase investment, they may also affect labor supply, depending on whether these investments are labor-saving or labor-using (see Do and Iyer 2008). The size of operated agricultural area ("farm size") is also included, since land and labor are complementary inputs in agricultural production. Finally, total household size in logs is included, and all models account for household fixed effects. These play an important role by helping remove the effect of unobserved household preferences for leisure. Local authorities in Vietnam may be able to observe at least some of these preferences, and since they have an incentive to impose restrictions on the most hard-working households, this strengthens our analysis.

Results show a significant, positive effect of restrictions on labor supply, both for crop agriculture and for all activities. Such an effect appears plausible. Rice cultivation requires higher labor inputs per hectare than most other crops. For example, in 2008 households who grew only rice put in a total of 717 days of labor per hectare per year in crop agriculture, whereas households growing no rice supplied 494 days per hectare per year. As we have seen, restrictions increase the probability of growing rice.

It is somewhat surprising that the effect on labor input in agriculture is not significantly stronger than on total labor supply. One would expect the effect of restrictions to work mainly through crop agriculture. One possible explanation is that attenuation bias is stronger for labor input in crop agriculture than for total labor supply. First, total labor supply is likely to be measured with less error than labor supply in any particular sector (since errors for different sectors

to some extent cancel out in the aggregate). Second, labor input in agriculture is particularly difficult to measure, inter alia because the number of hours worked per day often varies strongly over the year.

Table 5 Restrictions and labor supply, household fixed effects

	Dependent variable			
	Hh labor supply in crop agriculture per working household member, log		Total hh labor supply per working household member, log	
Share of land with restrictions	0.100	0.119	0.106	0.112
	(2.25)**	(2.73)***	(3.42)***	(3.60)***
Share of land with red book		-0.074		0.103
		-1.39		(2.71)***
Farm size in sqm, log		0.247		0.075
		(7.15)***		(3.11)***
HH size, log		-0.516		-0.003
		(6.33)***		-0.05
year_2008	0.068	0.065	-0.006	0
	(3.29)***	(3.18)***	-0.45	-0.02
Constant	3.709	2.465	5.006	4.314
	(150.38)***	(8.11)***	(295.69)***	(20.43)***
Household fixed effects	Yes	Yes	Yes	Yes
Observations	3907	3906	4004	4003
Number of household	2103	2103	2138	2138

Note: Absolute value of t statistics in parentheses

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

The results also show that the share of land held with a title has an insignificant, negative effect on labor input in crop agriculture, but a positive effect on total labor supply. This is consistent with the results reported in Do and Iyer (2008), who found that land titles in Vietnam increase labor input in non-farm activities. Increases in total household size are estimated to decrease labor input per worker in crop agriculture. This indicates that total household labor input in agriculture does not increase proportionally with household size. As the household size increases, members share the workload in agriculture, and each works less. On the other hand, household size has no effect on total labor supply per worker. Controlling for other factors, households tend to work harder in crop agriculture in 2008 than in 2006. Since year does not have an effect on total

labor supply, this indicates that households have shifted labor resources from other sectors into crop agriculture, consistent with higher crop prices.

In sum, crop choice restrictions increase labor input per worker, both in crop agriculture and on aggregate. This is consistent with the observation that rice cultivation requires relatively high labor inputs.

8. Income from crop agriculture

We now turn to the econometric analysis of restrictions and household income from crop agriculture. Table 6 presents regressions for income from crop agriculture, in logs. Income is defined as the value of output minus the value of all purchased, variable inputs, and all inputs are assumed to be purchased, except for "self-provided fertilizers". The measure of restrictions used is, again, the share of operated area with restrictions. All specifications include a household fixed effect and a year-dummy. Column two includes land and household characteristics that may plausibly vary over time. These are the share of land with a title, farm size, household labor input in crop agriculture, the share of irrigated land, and the share of rented land. In addition, column three introduces land characteristics which are, by and large, time-invariant at the plot level. Since the household might acquire or part with land, however, these characteristics may in principle change at the household level, and these changes may be correlated with restrictions and with income. We include the share of land with slight, medium, and steep slope (leaving out the share with a flat slope as the residual category), and have an additional measure of land quality. This is the share of land that falls in each of four tax brackets.[7]

Results show that restrictions have a statistically insignificant, positive effect on income from crop agriculture. Hence, restrictions do not seem to make households poorer, although, as illustrated in Figure 1, the increased labor efforts they induce might still mean that restrictions

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[7] Following the 1993 Land Law, most plots in Vietnam were, as described by Le (undated), classified for tax purposes. For annual crops land, six categories were defined. For perennial crops land there were five categories. Classification depended on five objective plot characteristics, soil quality, location (i.e. distance from residence), terrain (e.g. slope), climate, and irrigation conditions. Higher taxes were due for land in a better category (category one is best). Based on the tax-classification information, we created a unified measure of land quality applying to both annual and perennial crops land. The classification schemes for annual- and perennial land are unified based on the tax rates for each category of land. Hence, in each of the four land quality "classes" we define, approximately the same amount of tax was due for all plots. The four classes on the land quality variable relate to the tax classification scheme in the following way:
Class 1: Category 1 of annual land and category 1 and 2 of perennial land. Tax rates: 550-650 kg rice/ha/year
Class 2: Category 2 and 3 of annual land and category 3 of perennial land. Tax rates: 370-460 kg rice/ha/year
Class 3: Category 4 and 5 of annual land and category 4 of perennial land. Tax rates: 180-280 kg rice/ha/year
Class 4: Category 6 of annual land and category 5 of perennial land. Tax rates: 50-80 kg rice/ha/year.
Since the tax-related land-classifications have not been updated since the 1990s, as a result of the land tax being abandoned in 2003, the variable is in our analysis fixed at the plot level from 2006 to 2008.

reduce welfare. Another interesting result from the table is the finding that land titles have a significant, positive effect on income. As already alluded to, land rights are often viewed as endogenous. However, since a major, potential source of endogeneity is unobserved household- and land characteristics, this is much less of a concern in household fixed effects models than in cross-section analyses. The positive effect contrasts with the results in Do and Iyer (2008), who do not find a positive effect of land titles on income or restrictions.

Table 6 Restrictions and income, household fixed effects

Share of land with restrictions	0.022	0.052	0.061
	-(0.47)	-(1.16)	-(1.37)
Share of land with red book		0.097	0.103
		(1.68)*	(1.77)*
Farmsize in sqm, log		0.48	0.475
		(12.44)***	(12.14)***
Household labor input in crop production, log		0.179	0.182
		(7.04)***	(7.13)***
Share of land irrigated		0.032	0.019
		-0.55	-0.32
Share of land rented in		0.102	0.114
		-0.75	-0.84
Year = 2008	0.347	0.348	0.327
	(15.74)***	(16.67)***	(13.90)***
Share of land with slight slope			-0.056
			-1.04
Share of land with medium slope			-0.025
			-0.32
Share of land with steep slope			-0.019
			-0.14
Share of land class 2			-0.001
			-0.02
Share of land class 3			-0.115
			-1.45
Share of land class 4			-0.03
			-0.27
Share of land with unknown category/class			0.079
			-1.18
Age of head			-0.002
			-0.41
Female hh head			0.018
			-0.16
Constant	8.29	3.341	3.473
	(314.00)***	(10.09)***	(8.72)***
Household fixed effects	Yes	Yes	Yes
Observations	3768	3768	3765
Number of household	2049	2049	2049

Note: The d*ependent variable is* Income from crop production, log, and absolute value of t statistics in parentheses

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

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It might be unexpected that land titles have a positive effect on income already in the same period as they are acquired. After all, the channel of causation most usually assumed to transmit an effect from property rights to income operates through increased investment. Investments take time to complete, and will often only yield a return after some time. However, at least one plausible explanation for a same-period effect exists in the case of Vietnam. The state-sponsored Vietnam Bank for Agricultural and Rural Development (VBARD), which plays a large role in rural credit provision, provides loans *only* to households who can offer titled land as collateral. Borrowing from VBARD is common, and loans are often used to buy *current* inputs in crop production, such as seeds, saplings or fertilizers (field observations). Hence, a same-period effect of land titles on income is likely to be transmitted through the credit channel.

As we would expect from Table 2, there is a large, positive year-effect. Income from crop agriculture is more than 30 percent higher in 2008 than in 2006. Farm size and labor input have the expected signs and are highly significant. The share of land irrigated does not have a significant effect on income. This might indicate that Vietnamese irrigation systems are ineffective, but it is more likely a result of the fact that this variable does not vary much over time.

Estimated coefficients on the slope and land class variables are all insignificantly different from zero. We take this as an indication that the household fixed effects do a good job of controlling for land characteristics.

The fact that the restrictions variable remains positive even after controls for labor input have been introduced (in columns 2 and 3) is not what one would have expected from Figure 1. It implies that *for a given level of labor supply*, restrictions should lead to a decrease in income. One might argue that since the estimated coefficients on restrictions are not significantly different from zero, the theoretical prediction and our findings are reconcilable; but the fact the coefficient is positive does suggest that it is relevant to ponder further about the full story behind the data.

There are at least two different explanations for the absent, negative effect of restrictions on income. First, restrictions may be beneficial if they solve coordination problems. For example, the yield of rice might be lower if the crop grows in the shadow of tree crops. The use of rice fields for shrimp production might lead to salinization of the soil, making it unsuitable for crop production. Cross-pollination between different varieties of crops could also present collective action problems. If restrictions do solve such problems, it implies that they have positive externalities. If they do, a household should in theory experience a positive effect of restrictions on *other* farms in their neighborhood.

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We tested this hypothesis by calculating the average share of land with restrictions among all sampled households in a commune and including this variable in regression 3 in the model in Table 6. This did not change the sign on the variable measuring the household own restrictions. Instead, the commune-average variable entered with the wrong sign (negative), although insignificantly different from zero.

Second, restrictions tend to come with certain benefits from the authorities, such as increased access to extension services, irrigation water or price subsidies. We therefore investigate the importance of such effects. Since some key variables used in these analyses (in particular, fertilizer prices and plot level information about the use of high-quality rice seed) were only measured in 2006, we rely here on the sample from that year only.

Consider prices first. The vast majority of households sell their output to private traders, so it is implausible that households with restrictions are given subsidies on their output prices. How about input prices?

Table 7 presents results of regression models explaining the unit price paid by each household for chemical fertilizers, which is an important, purchased input.[8] The regressions include commune fixed effects.

Table 7. Restrictions and the price of chemical fertilizers

	OLS	OLS
Share of land with restrictions	-0.042	0.004
	(1.52)	(0.16)
Amount of fertilizer purchased, log		-0.104
		(11.28)***
Constant	1.275	1.83
	(82.35)***	(35.67)***
Fixed effects	Commune	Commune
Observations	1,647	1,647
R-squared	0.55	0.59

Note: the dependent variable is the unit price of chemical fertilizers, log. Observations with reported prices of fertilizer less than 1,000 VND pr kg are deemed unrealistic and were set as missing.
* significant at 10%; ** significant at 5%; *** significant at 1%

The first column in Table 7 shows that, controlling for commune characteristics, restrictions are indeed associated with a lower unit price of fertilizer. However, once the amount of fertilizer purchased is controlled for (in column 2) this effect disappears. It seems that households simply get

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[8] 651 households did not report fertilizer prices. 21 households were excluded because they reported prices below 1000 VND per kg., which was deemed unrealistically low. The results do not change substantially if they are included.

a quantity discount (prices drop by 10 percent when the purchased amount doubles), and that households under restrictions use more fertilizer than others. Hence, the results do not support the hypothesis that restricted households are subsidized.

Table 8 shows the effect of restrictions on access to extension services and irrigation in OLS regressions with commune fixed effects. The share of land with restricted crop choice is not positively related to the probability of using extension services. In contrast, restricted farms are much more likely to have access to irrigation. In particular, they are more likely to use public or cooperative irrigation infrastructure. This might be the result of either (i) a higher tendency for irrigated plots to be put under restrictions, or (ii) a higher willingness on part of the authorities to supply irrigation water to restricted plots. Note, however, that access to irrigation is already controlled for in the income regressions.

Table 8 Restriction and use extension services and irrigation

	Dependent variable		
	Hh used extension services in last 12 months=1	Share of land irrigated	Hh dependent on public or cooperative irrigation=1
Share of land with restrictions	-0.03	0.171	0.187
	(0.86)	(8.46)***	(8.12)***
Constant	0.425	0.59	0.552
	(23.05)***	(55.37)***	(45.63)***
Fixed effects	Commune	Commune	Commune
Observations	2081	2081	2081
R-squared	0.38	0.65	0.72

Note: All models are estimated with OLS.

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

Finally, an important determinant of rice yields is the type of seeds used. In particular, the introduction of "hybrid" seeds is a key important factor behind the improvement of rice yields experienced in Vietnam over recent decades. Substantial investments and government effort have gone into promoting breeding, multiplication and extension of good quality seed of high yielding varieties.

Table 9 shows the effects of restrictions on the probability that a plot is sown with hybrid seeds in at least one season in the last 12 months, using OLS regressions at the plot level with household fixed effects. The regressions only include plots sown with rice in at least some

seasons. The measure of restrictions used is an indicator for the restriction that the plot must be sown with rice in at least some seasons. Results show that restricted plots are more likely to be sown with hybrid seeds than other plots. This indicates that better seeds are supplied to restricted plots than to other plots, either because authorities favor these plots or because restricted plots are more likely to be endowed with characteristics necessary for successful use of hybrid seeds, such as irrigation.

Table 9 Restrictions, hybrid seeds and the number of cropping seasons

Must grow rice in at least some seasons	0.077	0.076
	(5.15)***	(5.18)***
Number of rice harvests in last 12 months		0.085
		(9.15)***
Constant	0.297	0.144
	(45.58)***	(8.07)***
Fixed effects	Household	Household
Observations	6,205	6,205
R-squared	0.92	0.92

Note: The dependent variable is whether the household used hybrid seeds in at least one season in the last 12 months All models are estimated with OLS. Only plots planted with rice in at least some seasons are included.

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

In sum, the evidence indicates that restricted households do not obtain better prices of fertilizer or better access to extension services. However, restricted plots are more likely to be irrigated and to be sown with hybrid seeds than on plots. Hence, we do find indications that restricted plots are supplied with better inputs than other plots in line with officially declared government policy.

9. Conclusion

Vietnam is an intriguing case of economic development. Wide-ranging market oriented reforms have been coupled with robust economic growth and poverty reduction over the past two decades. At the same time, the state has retained a strong and interventionist stance in many aspects of economic and social life and organization. Vietnam defies simplistic categorization, and much remains to be learnt about the causes of success. This paper has demonstrated that restrictions on crop choice are common and widespread in Vietnamese agriculture in spite of recent reforms. We have also shown that restrictions impose real constraints on the behavior of farmers. When they are

lifted, a significant share of farmers changes their choice of crop. Restrictions have also had a significant effect on household labor supply, but no effect on income from cultivation was found. There is some evidence as to why standard predictions fails to emerge as restricted households are supplied (compensated) by the authorities with higher quality inputs than other households in accordance with officially declared policy. Another result – in line with previous literature – is that land titles have significant effects on crop choice, agricultural income and household labor supply.

Our results confirm that land use restrictions should not be ignored in analyses of land policies in Vietnam and other transition economies, most notably China, where restrictions on crop choice are common. In these economies, the tendency in the literature to focus on transfer rights instead of use rights should be re-considered. From a methodological perspective we have demonstrated the advantages of using panel data at both household and plot level in studies of land property rights.

Turning to policy implications, the Vietnamese government would appear to have managed to combine market reforms with strong and effective intervention in agricultural production for food security and export promotion purposes. Thus our results do not provide a basis for recommending dismantling of state intervention in Vietnamese agriculture. They do, however, suggest that it may be time to consider carefully the potential benefits of a more diversified crop pattern and whether the present system of land use planning remains the most efficient Vietnam could have. At a point in time where the country produces a large surplus of rice and transport infrastructure is becoming increasingly developed, concerns about food security are maybe less of a challenge than in the past. Restrictions that compel farmers to growing rice do tie up significant labor resources in low-value added agriculture. As Vietnam continues to develop at a rapid pace, human resources may well be put to better use in the production of higher-value added agricultural crops and work in non-farm activities.

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Appendix: Example of plot map

SƠ ĐỒ CÁC MẢNH ĐẤT