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The effect of land tenure security on household labour supply: evidence from Vietnam (2008-2016)

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Abstract. This paper investigates the impact of land tenure security on household labour supply in Vietnam, where the State owns all land and grants usufruct rights to individuals. The 1993 Land Law set usage rights for annual land at 20 years and perennial land at 50 years. In 2013, with usage rights for annual plots approaching expiration, the government passed the 2013 Land Law, extending usage rights for all land to 50 years. Utilizing this unexpected policy shift, we compare households with expiring rights (annual plots) to those with extended rights (perennial plots). Results reveal that increased tenure security reduce household labour supply in agriculture, particularly from women, and spurred greater capital intensity and a reduction in landholdings.

Key Words: tenure security; labour supply; agriculture, Vietnam.

El efecto de la seguridad de la tenencia de la tierra en la oferta de mano de obra de los hogares: evidencia de Vietnam (2008-2016)

Resumen. Este documento investiga el impacto de la seguridad de la tenencia de la tierra en la oferta de mano de obra de los hogares en Vietnam, donde el Estado es propietario de toda la tierra y concede derechos de usufructo a los particulares. La Ley del Suelo de 1993 fijaba los derechos de uso de las tierras anuales en 20 años y los de las tierras perennes en 50 años. En 2013, ante la inminente expiración de los derechos de uso de las parcelas anuales, el gobierno aprobó la Ley del Suelo de 2013, que amplió los derechos de uso de todas las tierras a 50 años. Aprovechando este inesperado cambio de política, se compararon los hogares con derechos que expiran (parcelas anuales) con los que tienen derechos ampliados (parcelas perennes). Los resultados revelaron que el aumento de la seguridad de la tenencia reduce la oferta de mano de obra doméstica en la agricultura, en particular la de las mujeres, y estimula una mayor intensidad de capital y una reducción de la propiedad de la tierra.

Palabras clave: seguridad de la tenencia; oferta de mano de obra; agricultura, Vietnam.

Clasificación JEL: O12; O13; O15.

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1. INTRODUCTION[1]

Clear and well-enforced property rights are essential for agricultural productivity and economic development. Increased tenure security incentivizes long-term investment (Demsetz, 1967; Alchian and Demsetz, 1973; Besley, 1995)[2] and can improve the allocation of production factors like land and labour.[3] As economies grow, households with non-farming advantages often shift to emerging non-agricultural sectors (Duarte and Restuccia, 2010; Gollin *et al.*, 2002; Do and Iyer, 2008).[4] However, in developing countries with weak property rights, high transaction costs and fear of appropriation hinder land trade and discourage investment, leading to inefficient labour and capital allocation and lower productivity. This issue significantly affects economic development and structural transformation.[5]

Why would we expect land property rights to affect households' labour supply? Besley and Ghatak (2010) explain how in a context of weak property rights, labour effort can be used to maintain ownership of your property. We can think of tenure insecurity as a random tax on production, which discourages labour effort. However, if labour effort reduces the risk of expropriation, farmers have an incentive to work on the land –possibly more than the optimal level– to maintain claims over their property.

Empirical evidence has found that tenure security of residential homes can affect household's allocation of labour. In the context of Peru, Field (2007) shows that granting title deeds for urban squatters increased their labour outside their home, and allowed families to substitute child labour for adult labour. She argues that the certification increased tenure security, which eliminated the need to spend human resources to maintain ownership of their home. De Moura *et al.* (2014) obtained similar results in the case of Brazil, where a property certification program increased the hours worked per week

1 The data underlying this article are available in Database Vietnam Data (UNU-WIDER), https://www.wider.unu.edu/database/viet-nam-data

2 See Deininger and Feder (2009) for a review of the literature on land titling and economic development.

3 In China, legalizing land leasing redistributed land to more efficient farmers (Chari *et al.*, 2021). Adamopoulos *et al.* (2015) also find that land institutions reduce productivity by affecting resource allocation among farmers and between sectors.

4 This is something really important to consider in the Vietnamese context since the share of the labour force went from 70% in 1996 to 40% in 2018 (ILOSTAT, 2018).

5 In Ghana, Goldstein and Udry (2008) find that those with stronger land rights invest more in fallowing, boosting productivity.

of adult members in the household. These findings align with the argument that greater tenure security reduces the need for household members to defend their property, freeing up time and energy to engage in productive labour outside the home (Galiani and Schargrodsky, 2010). In both cases, the formalization of property rights alleviated the pressure on families to safeguard their homes, thereby allowing for a more efficient allocation of labor resources (Besley and Ghatak, 2010).

Tenure security for productive assets like agricultural land has distinct implications from residential property. In developing countries, land ownership is often closely tied to usage. A Mexican land reform legally separated land rights from use, issuing household certificates and legalizing intra-community land transfers, which led to a substantial increase in migration as owners no longer feared expropriation when living elsewhere (De Janvry *et al.*, 2015; Valsecchi, 2014). Improved property rights also boost investments and promote land transfers (Besley, 1995; Goldstein and Udry, 2008; Markussen and Tarp, 2014; Do and Iyer, 2008; Kimura *et al.*, 2011; Chen *et al.*, 2021; Chari *et al.*, 2021). In Vietnam, tenure security increased plot-level investments in irrigation and soil conservation (Bellemare *et al.*, 2020) and, after the 1993 land reform, improved labor and land market efficiencies, allowing poorer farmers better access to land as wealthier households shifted to non-agricultural sectors (Deininger and Jin, 2008).

In 1993, the Vietnamese government passed a law where it granted individual usufruct rights to rural households. The duration of these rights was set at 20 years for annual crops, and 50 years for perennial crops. When the rights of annual plots were set to expire, the Vietnamese government passed the 2013 Land Law in which, among other things, extended the usage rights period of annual crops from 20 to 50 years. This unanticipated change in policy improved all landowners' property rights, but it was particularly beneficial for annual crop growers, whose rights were set to expire soon. This paper explores the effect of land tenure security caused by this policy change on farmers' household labour supply. The main hypothesis is that the 2013 Land Law led to a reduction in labour supply as households felt more secure in their land tenure, allowing them to allocate labour more efficiently. Additionally, the complementary hypothesis examines the differences in labour supply impacts by gender and age, considering how these factors influence household dynamics. The underlying mechanism explores the roles of capital and land holdings, assessing how changes in tenure security affect labour allocation decisions across various household members.

Using panel data on over 2 000 rural Vietnamese farming households from 2008 to 2016, we find that the 2013 Land Law, which increased tenure security, led to a reduction in agricultural labor among annual crop growers, particularly female adults. These results are robust across specifications and align with the parallel trends assumption. However, we find no evidence that the law boosted off-farm participation. Two explanations are proposed: first, enhanced land rights may encourage households to adopt a more capital-intensive input structure, reducing labour demand in farming; second, greater tenure security may facilitate land market participation, leading to smaller operational scales and less labour. Findings indicate increased capital intensity and decreased landholdings among annual crop growers post-2013.

The paper contributes to the literature of property rights and labour supply in three ways: first, it uses a difference-in-difference approach to examine the distortions of tenure insecurity in labour allocation, and it sheds light on the intra-household allocation of labour by examining labour supply by age and gender. Second, it explores the possibility of a shift in the structure of input shares by suggesting improvements in tenure security can increase capital intensity in agricultural production. Finally, results can be useful for policy makers as they show farmers devote resources to maintain their usufruct rights. Arguably, removing the need to renew your rights as owner every given time period can have significant benefits for landowners.

The paper is structured as follows: section 2 describes the context of land tenancy in Vietnam. Section 3 presents the empirical strategy. Section 4 describes the data used in the analysis and presents some descriptive statistics. Section 5 discusses the empirical findings and we conclude in section 6.

2. Background: land Reform in Vietnam

In the 1980s the Vietnamese government enacted a series of reforms to transform its agricultural sector from a collective production system to one based on household initiative. As part of these efforts, the Doi Moi reforms of 1988 sought to increase rural household's land tenure security and began a process of privatization and decentralization of output and input markets. However, many restrictions on land usage and transfers remained until the enactment of the 1993 Land Law. This law contemplated the issuance of farm-level Land Use Rights Certificates (LURC), and the duration of those rights was set at 20 years for plots with annual crops and 50 years for plots with perennial crops.

Moreover, the Land Law of 1993 allowed households to transfer, lease, mortgage and bequest the usage rights of their property.[6]

The formalization of private usage rights paved the way for the development of an active land market and the transformation of the rural economy. The land reform of 1993 increased agricultural investment and efficiency, it also granted better access to land for the poor and allowed rural households to pursue opportunities outside of agriculture (Pingali and Xuan, 1992; Smith, 1997; Do and Iyer, 2008; Deininger and Jin, 2008; Khai *et al*., 2013).

The Land Law of 1993 has had two revisions since it was issued. The first was in 2003 to include two names in the LURC where land was jointly owned (for example, in the case of husband and wife) and allowed for certification to be conducted at the plot level, instead of the farm-level as the 1993 law stipulated.[7] The second was in 2013 when, among other things, the usage rights of all land –annual and perennial– was extended to 50 years. Because plots devoted to annual crops were originally given 20 years of usufruct rights, we expect this change in the law to increase tenure security for annual growers while perennial crop growers must be relatively unaffected by the law since they had at least 30 more years of usufruct rights.

Under Vietnamese laws, any agricultural land plot assigned to a household before or in 1993 began its usufruct rights in October 1993, while land acquired later began its rights upon acquisition (Ravallion and Van De Walle, 2004 and 2008). When usufruct rights are transferred (via sales or rentals), their duration is not reset. For instance, a plot acquired in 1993 and sold in 2010 would leave the new owner only three years of rights. Rights can be renewed if there has been no illegal use; however, Article 38 of the 2003 Land Law allows recovery of land used inefficiently or for the wrong purposes, requiring land return upon expired rights without extension.

This paper posits that usufruct right duration effectively characterizes land tenure security, as legal protections apply only within the rights period. Annual crop growers, particularly those with land from 1993 (representing 75% of such growers), faced significant tenure insecurity as expiration

6 The land certification program was one of the most extensive in the world: by the year 2000 more than 11 million certificates had been issued, and in 2004 three quarters of all cultivated land had been titled (Brandt *et al*., 2006).

7 Newman *et al.* (2015) find that including both names in the certificate could be a useful policy to increase women's bargaining power within the household, since there is no trade-off between productivity and including two names in the certificate instead of one.

neared.[8] The 2013 Land Law unexpectedly extended rights for annual crop plots from 20 to 50 years, improving security more for these farmers than for perennial growers, whose rights were still valid. This differential impact is used to analyse the effects of tenure security on household labour supply.

3. Empirical Specification

As discussed in section 2, the 1993 Land Law set the duration of usage rights for annual land at 20 years and perennial land at 50 years. In 2013, when annual land usage rights were set to expire, the Vietnamese government passed the 2013 Land Law which, among other things, extended the usage rights period of annual crops from 20 to 50 years. This unanticipated change in policy improved all landowners' property rights, but it was particularly beneficial for annual crop growers.[9] To investigate the effect of this policy change on household's labour supply, we compare the difference in household's labour decisions for annual crop growers with perennial crop growers.[10] The following linear household fixed-effect specification is estimated:

$$Y_{ht} = \beta_0 + \beta_1 ANNUAL_{ht} + \beta_2 Law13_t + \beta_3 (ANNUAL_{ht} * Law13_t) + \gamma_{rt} + \mu_{ht} + \theta_h + \epsilon_{ht} \quad (1)$$

Where Y_{ht} represents the number of days per capita in own-farm cropping activities of household h at time t, *ANNUAL* is a dummy variable that takes value 1 if household h had annual crops at time t, and 0 otherwise. Law13 is a dummy variable that takes value 1 if year is greater or equal to 2014, γ is a province-year fixed-effect, θ is a household fixed effect, μ is a vector of household characteristics that may vary over time (*e.g.* age of HH head, titles

8 This does not mean that a plot that is still within its usufruct rights time frame cannot be expropriated. However, being inside such time-span provides certain legal assurance against wrong-full land grabbing or reallocation. In a given year, less than 2% of plots are reallocated by commune authorities.

9 75% of households growing annual crops obtained land in 1993 or before. This means that a considerable proportion of annual farmers faced uncertainty regarding the continuation of their usufruct rights as they approached the expiration date of their rights. While more than 80% of households report to have a LURC for their land, without the enactment of the 2013 Land Law such titles did not guarantee continuation as the certificates provide certainty only within the time rights are stipulated.

10 Households with no agricultural production are excluded from the analysis.

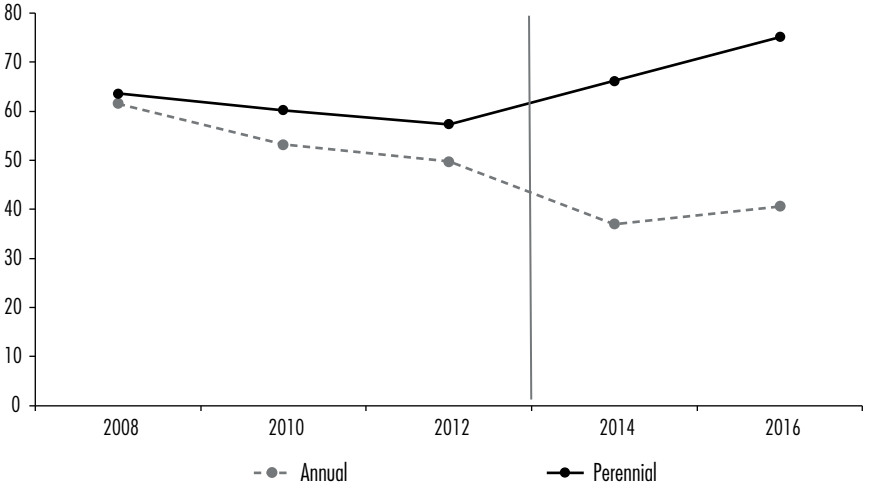
land, etc.) and ϵ is the error term. The household fixed-effects specification allows us to control for unobserved time-invariant characteristics that could be related to labour supply. The province-year fixed effects accounts for any macroeconomic shocks (*e.g.* off-farm labour demand, crop prices, etc.) that affect household's labour allocation. We are mostly interested in coefficient β_3 because it will capture the effect of the Land Law of 2013 on household labour decisions of annual crop growers (our treatment group).[11]

This methodology is particularly well-suited for this analysis as it allows for a robust evaluation of the causal impact of the 2013 Land Law on household labour supply among annual crop growers compared to perennial crop growers. By comparing the changes in labour supply before and after the policy change between these two groups, our model controls for both observed and unobserved factors that could influence labour allocation, thereby isolating the effect of the policy itself. This method assumes that, in the absence of the treatment, the trend in labour supply would have been the same for both groups, allowing for a more accurate estimation of the treatment effect. Additionally, the fixed effects in our specification further strengthen this approach by accounting for any time-invariant characteristics specific to households, such as preferences or production capabilities, and province-year fixed effects mitigate potential confounding factors related to external economic influences, such as changes in labour market conditions or crop prices. Thus, our framework provides a powerful tool for understanding how enhanced tenure security through the 2013 Land Law specifically influenced labour supply decisions in the agricultural sector.

Bellemare *et al.* (2020) use this dataset to analyse the 2013 Land Law's impact on plot-level investment in annual land. Their findings show that, before 2014, investment trends for annual and perennial plots were similar. After the Law's enactment, however, strengthened ownership rights for annual land led to positive impacts on irrigation and soil conservation investments. Following Bellemare *et al.* (2020), we use a Difference-in-Differences approach to mea-

[11] This methodology is also known as Difference-in-Difference (DID) and is based on a comparison of changes over time between two groups: the treatment group (affected by the intervention or policy) and the control group (not directly affected by the policy). The key theoretical assumption is the parallel trends assumption, which states that in the absence of the treatment (the 2013 Land Law), the treatment and control groups would have experienced similar trends in the outcome variable. Formally, the DID estimator is defined as: where are the average outcomes for the treatment group before and after the policy change and are the average outcomes for the control group before and after the policy change. For a detailed description of this technique see Angrist and Pischke (2008) and Bertrand *et al.* (2004).

Figure 1. Household days devoted to own-farm cropping activities



Note: number of days households devoted to own-farm cropping activities divided by household size across time. Households with no cropping activities are excluded from the sample. There are 8 068 annual observations and 867 perennial observations in the sample. The horizontal line depicts the enactment of the 2014 Land Law.

Source: own elaboration.

sure tenure security's effect on labour supply. Our identification strategy thus assumes that household labour supply trends for annual and perennial crop growers would have remained similar without the tenure security improvements for annual plots introduced by the 2013 Land Law.

To verify this in figure 1 we show the number of days per capita devoted to own-farm cropping activities of annual and perennial growers across time. We can see that labour supply to own-farm agriculture is very similar until 2012, before the new land law came into effect. This illustrates that before the change in the law both annual and perennial crop farmer have similar labour decisions before the Land Law of 2013, however these deviates afterwards. We corroborate the parallel trends assumption by estimating equation (1) using only pre-treatment data (*i.e.* before 2014) and using 2012 as the treatment period (see the appendix for more details on robustness checks).

Tenure insecurity may lead households to allocate "excessive" labour to farming to maintain usufruct rights. Improvements in tenure security could reduce this need, freeing up labour for other activities and lowering agricultural

labour input (De Janvry *et al.*, 2015; Do and Iyer, 2008; Li, 2020). However, tenure security can also boost investment and facilitate land transactions (Macours *et al.*, 2010; Bellemare, 2020), potentially increasing returns to farming and encouraging more labor in agriculture. In Peru, Nakasone (2011) found that tenure security increased labor on own farms. Thus, the impact on household labour supply is ultimately empirical and depends on the dominant mechanism.

For the analysis, we exclude households not in agriculture or that grow exclusively on rented land, as ownership rights are the focus. Anticipated rights expiration may cause households to switch crops; however, only 4% of annual plots convert to perennials, making endogeneity concerns minimal. We also address potential bias from rice-growing restrictions, which affect 38% of annual and 9% of perennial crop households. Markussen *et al.* (2011) suggest such households work harder and receive more support; thus, we re-estimate equation (1) for households without restricted plots.

4. Data and Descriptive Statistics

Our data comes from the Vietnam Access to Resources Household Survey (VARHS), covering the period 2008-2016.[12] The VARHS is conducted every two years and is a representative sample of the rural population in Vietnam. We rely on the balanced panel sample which consists of 2 131 rural households that were surveyed in all the five waves collected in the period under analysis. The surveyed households are located in 476 communes across 12 different provinces. The dataset contains precise information on household demographics, economic activities, land use and agricultural production. Crucially for us, the survey reports the time spend in own-farm activities by each member of the household and detailed information on crop choice, input use and cultivated land at the plot-level.

[12] The survey was developed in collaboration between the Development Economics Research Group (DERG), Department of Economics, University of Copenhagen, and the Central Institute of Economic Management (CIEM), the Institute for Labour Studies and Social Affairs (ILSSA), and the Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD), Hanoi, Vietnam. The provinces included 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; and Mekong River Delta: Long An.

Table 1 presents descriptive statistics of households growing annual and perennial crops, before and after the change in the land law. The number of households involved in the production of annual crops is significantly larger than those in perennial crops. Annual crop growers have on average larger households, lower incomes and more land per household member. Before the 2013 Land Law annual and perennial growers were equally likely to have their land titled, however after the change in the law perennial crop growers increased their certified land relatively more than annual farmers.[13]

Table 1. Household characteristics by type of crop before and after 2014 (means)

	Before policy change		*After policy change*	
	Perennial	*Annual*	*Perennial*	*Annual*
Household size (number)	4.27	4.54	4.14	4.31
HH is male (1/0)	0.77	0.80	0.75	0.79
Age of HH (number)	52.19	52.51	55.87	55.54
Education level of HH (number)	2.95	2.73	2.90	2.89
Income (log)	11.47	10.95	11.60	11.18
Landholdings per capita (log)	7.01	6.84	7.08	6.45
LURC (1/0)	0.86	0.86	0.94	0.90
Irrigated land (%)	0.57	0.64	0.69	0.66
Restrictions (1/0)	0.12	0.45	0.05	0.26
Only grows annual crops (1/0)	-	0.63	-	0.75
Only grows perennial crops (1/0)	0.19	-	0.35	-
Observations	470	5 534	397	3 401

Note: considering the pre-reform period to be between 2008 and 2012 and the post-reform period 2014 and 2016.

Source: own elaboration.

[13] Most households would have either all of their land titled or none. Only 12% of the observations report to have some of their plots titled and others untitled. Markussen (2017) says that plots often ceased to be titled if they change owners and the documents were not updated. He also shows that plots that were obtained through forest clearing are seldom certified.

For our identification strategy, it is crucial to consider that households may switch between growing annual and perennial crops. We document households exclusively cultivating either type: over two-thirds of annual crop farmers grow only annual crops, whereas only 21% of perennial crop farmers grow perennials exclusively. After the policy change, more households specialize in one crop type. Additionally, some plots face government restrictions on crop types. Approximately 38% of annual crop households and 9% of perennial crop households have restricted land in our sample, though this proportion declines following the land policy change for both crop types.

In table 2 we explore the differences in household days devoted to agriculture (own-farm).[14] In the first and second row we can see the average number of days per year devoted to cropping activities from all household members for the pre-reform period (years 2008, 2010 and 2012), for annual and perennial farmers. Before the 2013 Land Law, we notice that annual crop growers (households with at least one plot devoted to annual crops) spend more days in farming compared to perennial growers. However, after the policy change, annual crop growers reduced their average number of days in own-farm cropping activities, while perennial crop growers increased it.

Table 2. Household labour supply in own-farm agriculture by type of crop (means)

Agriculture days, own-farm:	*Before policy change*			*After policy change*			*Dif-in-Dif*
	Perennial	*Annual*	*Δ*	*Perennial*	*Annual*	*Δ*	
All members	136.4	165.5	29.1*	171.5	113.8	-57.7*	-86.8
Adult males	69.7	73.5	3.8	93.0	52.4	-40.6*	-44.4
Adult females	61.3	86.3	25.0*	76.0	59.6	-16.4*	-41.4
Children	5.3	5.6	0.3	2.6	1.8	-0.8	-1.04
Observations	470	5 534	-	397	3 401	-	-

Note: total number of days per year. ǂ*Significant at 1%. We consider the pre-reform period to be between 2008 and 2012, and the post-reform period 2014 and 2016.

Source: own elaboration.

[14] Household labour supply is operationalized as the number of days per capita spent in own-farm cropping activities. This is calculated based on survey responses, where each household reports the time spent on different agricultural activities by household members.

Disaggregating labour supply by gender and age reveals notable patterns. In the pre-reform period, the difference in adult male labour days between annual and perennial crop farmers is small and not statistically significant. However, following the 2013 Land Law, male labour days increase significantly for perennial farmers and decrease for annual farmers. Among female household members, annual farmers previously worked 25 more days per year than perennial farmers, but this shifts post-reform, with women in annual-growing households reducing their farm labour while those in perennial-growing households increase it. For child labour, both groups reduce farm days, with the decrease being greater among annual crop growers.

There are two possible explanations for the reduction in own-farm labour supply. On the one hand it suggests that the "guard" effect of improved tenure security out-weights the "productivity" effect. The fact that women and children's labour decreased after the Land Law suggests these households were devoting these labour resources to maintain usufruct right on their land.[15] On the other hand, it could be that the increase in capital investments as found by Bellemare *et al.* (2020) leads to less labour resources being required to maintain productivity. We explore these channels in section 5.

5. Results

The effect of tenure security on household labour supply

Table 3 presents the results from equation (1) where the dependent variable is the number of days per capita devoted to own-farm cropping activities. We also present the results disaggregated by the gender and age of the worker.[16] In the first column, only province-year fixed effects (FE) are included, the second column adds household demographics, and the third column adds relevant land characteristics.[17] As discussed in section 3, we address two potential threats

[15] This is in contrast to Field (2007) who finds evidence from Peru showing that families substitute child labour for adult labour when they obtain title deeds due to the fact that adults have a comparative advantage when protecting their homes.

[16] Household members age 15 and younger are considered in the children's specification.

[17] Household demographic controls are: size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are: the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops. These variables capture the demographic and agricultural characteristics that may impact how households allocate labor to farming activities. Appendix

to our identification strategy: crop-switching and government restrictions on crop choice. Column 4 estimates equation (1) only for households that do not have any restricted land. Column 5 estimates the model using only households that were devoted to annual or perennial crops exclusively during the entire 8-year period. Finally, Column 6 includes non-restricted households that grew exclusively annual or perennial crops for the entire time-span of analysis.

Table 3. The effect of the 2013 Land Law in own-farm labour days per capita

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
All members						
Annual	15.65***	11.03***	8.132***	8.205**	7.970	11.72
	(2.076)	(2.169)	(2.206)	(3.689)	(9.917)	(15.57)
Law2013	8.741**	9.911**	9.110**	21.29***	17.38	15.53
	(3.979)	(4.339)	(4.274)	(6.570)	(11.12)	(13.05)
Annual*Law2013	-12.38***	-7.090***	-7.832***	-7.764*	-25.07***	-26.40***
	(2.678)	(2.699)	(2.709)	(4.278)	(6.500)	(8.442)
Male Adults						
Annual	6.474***	4.422***	2.969**	3.534	3.272	9.167
	(1.428)	(1.268)	(1.271)	(2.200)	(5.445)	(9.853)
Law2013	11.31***	4.896*	4.821*	12.40***	10.63	10.07
	(2.300)	(2.657)	(2.622)	(3.931)	(6.916)	(8.599)
Annual*Law2013	-6.113***	-4.025**	-4.505***	-5.100*	-14.10***	-16.13***
	(1.675)	(1.729)	(1.742)	(2.797)	(4.640)	(6.039)
Female Adults						
Annual	8.592***	6.094***	4.607***	3.843*	5.338	5.992
	(1.162)	(1.458)	(1.450)	(2.334)	(6.627)	(8.735)
Law2013	-2.400	4.642*	3.701	8.007**	6.509	6.398
	(2.370)	(2.473)	(2.440)	(3.859)	(5.187)	(6.819)

Continue

A shows the estimated coefficients for all the controls in our specifications related to household labour supply.

Table 3. The effect of the 2013 Land Law in own-farm labour days per capita (*continuation*)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Annual*Law2013	-5.745***	-2.671	-2.847*	-2.210	-10.62***	-11.04**
	(1.644)	(1.658)	(1.642)	(2.523)	(3.373)	(4.392)
Children						
Annual	0.584***	0.513*	0.557**	0.828	-0.639	-3.437**
	(0.215)	(0.275)	(0.279)	(0.537)	(1.095)	(1.361)
Law2013	-0.172	0.374	0.588**	0.880*	0.234	-0.939
	(0.278)	(0.249)	(0.260)	(0.489)	(0.611)	(0.786)
Annual*Law2013	-0.522**	-0.394	-0.481*	-0.454	-0.347	0.769
	(0.233)	(0.268)	(0.274)	(0.479)	(0.738)	(0.871)
Observations	8 935	8 935	8 904	4 800	2 281	1 224
No. of households	2 018	2 018	2 017	1 763	457	428
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Note: standard errors in parentheses clustered at the household level; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

In columns 1 to 4, the coefficients for the indicators of annual farming (Annual) and the post-2013 Land Law period (Law2013) are statistically significant and positive, indicating that days spent working the land are higher for annual farmers and increase after the Land Law's implementation. However, these coefficients lose significance when we restrict the sample to farmers who did not switch crops. The interaction term between these variables (Annual*Law2013) is our primary focus, as it reflects the differential effect of tenure security for annual crops post-2013. This coefficient is consistently negative and statistically significant across all six specifications, with larger effects in columns 5 and 6, where the sample is limited to non-switching and non-restricted farmers. This indicates that the tenure security improvement from the 2013 Land Law led to a reduction in labour supply

for own-farm cropping activities. The coefficient magnitude ranges from 26.4 to 7.1, suggesting a 20% average reduction in labour supply for annual crop growers, compared to an unconditional mean of 35 cropping days per capita per year.

When analysing results by gender, we find that the labour supply patterns for both men and women align with the aggregate findings. For male adults, the coefficients retain the same sign and significance as the overall results. In the case of female adults, the results mirror those of the aggregate, although the interaction term (Annual*Law2013) is not significant in columns 2 and 4. However, in columns 5 and 6, which focus on non-switching and non-restricted farmers, the effect is both large and significant, indicating that the improvement in tenure security from the policy change led to a decrease in labour supply for both male and female adults.

The results for child labour are less robust as only columns 1 and 3 have significant results on the interaction term. This is not surprising since only 11 percent of farmers in our sample have members 15 years old or younger working on their farm. If the land law increases the value of land, this wealth effect is expected to reduce child labor (Basu and Van, 1998). However, some authors have documented that for low levels of landholdings increasing land assets may lead to increases in child labor (Bhalotra and Heady, 2003; Basu *et al.*, 2010; Oryoie *et al.*, 2017; Muchomba, 2017). Moreover, improvements in women's land rights caused by the 2003 Land Law (this law granted the possibility of including both husband and wife's name in the LURC) may have increased women's bargaining power resulting in reduction of child labour and increased household welfare (Menon *et al.*, 2017; Matz and Narciso, 2021; Wang, 2014; World Bank, 2002).

As discussed above, improvements in land property rights may in turn have a positive effect on off-farm labour supply. We expect that as tenure security is strengthened can release human resources previously engaged in farming with "guarding" purposes. This may allow households to allocate labour supply to off-farm activities. We explore this effect of the 2013 Land Law on annual crop growers by estimating equation (1) where the dependent variable is the number of days per capita in wage employment and off-farm self-employment (*e.g.* trading services).

Table 4 shows the results of this specification. In the case of wage employment, the coefficient on the Land Law indicator is positive and significant in some of the specifications; this suggests that after 2013 farmers in general increased their labour supply in wage employment. However, the interaction term is statistically insignificant in all but one of the specifications (it also has

the opposite sign that we would expect). For off-farm self-employment the results are also not statistically significant. Overall, it seems that the Land Law of 2013 reduced own-farm agricultural labour, but this did not lead to an increase in labour supply outside agriculture suggesting that the labour that was released from farming may have gone other non-income generating activities.

Table 4. The effect of the 2013 Land Law in non-farming days per capita

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Wage employment						
Annual	-2.474	-1.610	-0.707	-1.051	-17.79	-5.920
	(3.289)	(3.169)	(3.043)	(4.262)	(13.17)	(18.06)
Law2013	20.50***	20.68***	12.05**	1.089	19.39	32.63*
	(6.898)	(5.790)	(5.742)	(8.572)	(13.48)	(18.36)
Annual*Law2013	-0.642	-1.994	-1.388	2.490	-19.73**	-18.81
	(4.370)	(3.680)	(3.659)	(4.893)	(8.233)	(11.93)
Off-farm self-employment						
Annual	-9.004***	-0.808	0.231	0.491	16.90**	6.506
	(2.532)	(2.132)	(2.191)	(2.717)	(8.169)	(7.220)
Law2013	-27.46***	-0.0103	-2.127	-1.356	4.603	-3.280
	(4.253)	(3.202)	(3.308)	(4.374)	(5.830)	(12.26)
Annual*Law2013	3.539	-0.0271	0.136	-0.325	-3.075	-0.579
	(2.754)	(2.200)	(2.211)	(2.819)	(5.555)	(6.922)
Observations	8 935	8 935	8 904	4 800	2 281	1 224
No. of households	2 018	2 018	2 017	1 763	457	428
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Note: standard errors in parentheses clustered at the household level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

The effect of tenure security on household's use of capital in agricultural production

The evidence suggests that the 2013 Land Law reduced labour devoted to own-farm cropping, aligning with past findings that weak land rights compel households to invest in guard labour (Besley, 1995; Goldstein and Udry, 2008). With improved tenure security through the law's extension of usufruct rights, we observe a drop in per capita days spent on own-farm activities. However, we do not find an increase in off-farm labour time. Two explanations may account for this. First, as Bellemare *et al.* (2020) noted, enhanced tenure security led to more investment in irrigation and soil conservation, potentially restructuring agricultural inputs toward greater capital intensity and reducing labour demand.

In table 5 we show the results of the estimations using the same specification as in equation (1) but with the level of capital as the dependent variable. Capital assets represent ownership of machinery (*e.g.* tractors, thrillers, etc.) valued at a set of common prices.[18] Expenditure on capital services is the amount in VND spent per square meter in services such as rentals of machinery or cattle for ploughing.[19] The dependent variables are the real value of owned capital assets and the real value of expenditure on capital services (per square meter) divided by the totals days in own-farm agriculture, and the capital expenditure divided by the total number of days in own-farm agriculture.

In the case of ownership of capital assets per worker, the coefficient on the interaction term is positive and significant in columns 5 and 6 (sample restricted to non-restricted and non-switching farmers). When looking at the expenditure on capital services ratio we observe the coefficient is positive and significant in all but the last column. This is suggestive evidence that enhanced tenure security may have created a more capital-intensive process of production, explaining at least in part the reduction in labour.

[18] The VARHS asks household about ownership of agricultural assets and their self-reported value. The survey includes ownership of tractors, grinding machines, rice milling machines, grain harvesting machines, pesticide sprayers, ploughs and carts. The price of each type of equipment is the average of the yearly median price between 2008 and 2016. The use of this common price index removes variations in prices related to regional and time factors, giving us a measure of capital that effectively captures actual differences in physical capital across farms.

[19] Specifically, it includes the monetary expenditure of small non-durable tools (*e.g.* sickles, shovels, etc.), minor repairs and maintenance, rental of agricultural assets or transports, rental of cattle for ploughing.

Table 5. The effect of the 2013 Land Law in capital ownership and expenditure

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Ownership of capital per worker (value)						
Annual	-1.528	-11.75	-9.849	-10.66	1.063	-4.285
	(7.836)	(8.189)	(8.349)	(9.804)	(6.889)	(15.32)
Law2013	-5.631	-114.1	-106.6	-182.9	-13.22	-9.950
	(9.689)	(95.20)	(94.57)	(168.7)	(8.969)	(9.069)
Annual*Law2013	1.839	3.570	2.909	0.211	20.03**	19.46**
	(9.130)	(9.173)	(10.93)	(14.44)	(7.860)	(8.680)
Expenditure on capital services per worker (value)						
Annual	0.0016***	0.0024***	0.0025***	0.0016**	0.0264***	0.0271***
	(0.0005)	(0.0007)	(0.0007)	(0.0007)	(0.0066)	(0.0099)
Law2013	0.0050***	0.0011	0.0018	-0.0007	0.0029	0.0090
	(0.0014)	(0.0046)	(0.0047)	(0.0074)	(0.0066)	(0.0076)
Annual*Law2013	0.0029***	0.0018**	0.0031***	0.00154*	0.0088***	0.0035
	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0025)	(0.0029)
Observations	8 590	8 590	8 562	4 738	2 205	1 214
No. of households	2 005	2 005	2 003	1 749	457	427
Province-Year fe	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Note: standard errors in parentheses clustered at the household level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

Second, property rights lower transaction costs in land markets (Banerjee *et al.*, 2002; Deininger and Jin, 2005; Holden *et al.*, 2011) which allows farmers to readjust their operational scales. If households reduce their agricultural landholdings, they will require fewer labour resources.[20] We explore the effect of tenure security on landholdings in table 6.[21] Results show that in general, annual crop growers possess more land per capita than perennial growers. In all but one of the specifications the coefficient of Law2013 is negative; this reflects the fact that all households in our sample have reduced their landholdings across time. Our main coefficient of interest, the interaction term, is negative and statistically significant in columns 1 to 4. This suggests that annual farmers reduced their landholdings in response to the extension of their usage rights. It should be noted, however, that the coefficients are not statistically significant when we restrict the sample to non-switching crop growers, although the sign remains unchanged.

Overall, while we cannot rule out "guard labour" as one of the reasons for reduced labour supply due to the increase in tenure security, we can say that it is not the only reason. Increased investment in capital is likely to lead to more capital-intensive production and the need for fewer labour resources.[22]

Table 6. The effect of the 2013 Land Law on landholdings per capita (log)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Annual	0.530***	0.227***	0.277***	0.125**	0.220*	0.282
	(0.0852)	(0.0487)	(0.0473)	(0.0502)	(0.118)	(0.195)
Law2013	1.495***	-0.167**	-0.131**	-0.235***	-0.119	-0.00409
	(0.121)	(0.0679)	(0.0649)	(0.0752)	(0.128)	(0.207)
Annual*Law2013	-0.445***	-0.254***	-0.246***	-0.149**	-0.0218	-0.115
	(0.0809)	(0.0519)	(0.0502)	(0.0583)	(0.100)	(0.131)

Continue

[20] In Vietnam land is owned by the State and households possess usufruct rights to the land. When farmers sell or lease land, the time of their usufruct rights does not renew. Hence, households with land close to their expiration date are probably less likely to participate in land markets.

[21] The variable is based on survey responses about the size of all their agricultural plots (regardless of whether they grow any crops on them recently). Our measure is the log transformation of the sum of all the plots owned by the household.

[22] Moreover, the ability to rent out and sell land reduced land holdings and consequently fewer labour resources.

Table 6. The effect of the 2013 Land Law on landholdings per capita (*log*) (*continuation*)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Observations	8 935	8 935	8 904	4 800	2 281	1 224
No. of households	2 005	2 017	2 017	1 763	457	428
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Note: standard errors in parentheses clustered at the household level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

6. Conclusions

Weak enforcement of property rights distorts household labour allocation, forcing farmers to devote excessive resources to maintaining land ownership. This paper shows that Vietnamese farmers facing uncertainty about their usufruct rights experienced such constraints. The Land Law of 2013 increased tenure security for annual crop growers, eliminating the need for labour dedicated to guarding land.

Using detailed panel data from Vietnam, we find that increased tenure security reduced days spent on own-farm cropping activities, particularly for female adults, without increasing off-farm labour time, consistent with reduced guard labour. Two additional channels are explored: First, improved tenure security likely shifted input shares and increased capital intensity among annual crop growers, leading to reduced labour supply. Second, enhanced land rights enabled households to adjust their operational scale and reduced total landholdings, which also contributed to the decline in agricultural labour supply. Overall, this paper highlights the significance of clear, enforceable property rights for efficient labour allocation, demonstrating that farmers with enhanced tenure security reduced both their farming days and landholdings.

Our findings on Vietnam's land tenure security can offer important lessons for Mexico and other Latin American countries, where insecure land rights continue to hamper agricultural productivity. In both regions, tenure insecurity limits investment in land and capital, leading to inefficient labour

allocation. Similar to Vietnam, land reforms that formalize or extend property rights could encourage Mexican and Latin American farmers to invest in more capital-intensive practices, reduce reliance on manual labour, and improve overall productivity. For example, Mexico's ejido system has often led to underinvestment due to unclear property rights. Reforms that enhance tenure security, similar to those in Vietnam, could encourage greater agricultural investment and labour reallocation (De Janvry *et al.*, 2015; Galiani and Schargrodsky, 2010).

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APPENDIX

Robustness checks

To test the parallel trends assumption we conduct a placebo test using only data from before the enactment of the 2013 Land Law (VARHS waves 2008-2012). The placebo treatment effect is a dummy variable taking a value one in 2012. If the reduction in agricultural labour is indeed driven by an improvement of tenure security caused by the 2013 Land Law, then we expect the coefficient on the interaction term in the placebo test to be statistically insignificant. Table A1 shows the results of the placebo test for own-farm cropping days per capita, separated by gender and age. The coefficient of the interaction term is statistically significant in only two of the specifications. However, the more interesting patterns are observed when looking at the test for male and female adults.

In all of the 6 specifications for male farming labour the interaction term is negative and statistically significant. This suggests that male labour in own-farm cropping activities was falling since before the 2013 Land Law. The negative effect observed on male labour may be driven by other drivers that were

not related to the tenure security increase caused by the new law.[23] On the other hand, the interaction term in the specifications for female adult labour supply are statistically insignificant in all but one of the specifications where the coefficient positive. As such, we can rule out non-parallel trends for the case of women's agricultural labour.[24]

Table A2 shows the results for the placebo test for capital and land. In the case of capital ownership only the specification in column 1 has a significant and negative interaction term. In the case of expenditure on capital services none of the coefficients on the interaction terms are statistically significant. This corroborates the evidence presented above regarding capital intensity in agriculture being driven by improved tenure security. Likewise, for the case of landholdings, none of the coefficients on the interaction term are statistically significant. This suggests that the policy change was the main driver of the increase in capital use and the reduction in landholdings of annual crop growers.

Table A1. Placebo test using pre-treatment data for own-farm labour days per capita

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
All members						
Annual	17.53***	8.739***	6.269**	6.456	27.66**	48.55
	(2.389)	(2.771)	(2.854)	(4.888)	(12.16)	(32.57)
Placebo	-2.564	10.72***	12.63***	13.04**	15.01	13.17
	(3.956)	(3.953)	(3.894)	(5.706)	(10.02)	(14.76)
Annual*Placebo	-5.490*	0.0105	-1.486	-8.057*	-9.225	-10.71
	(3.025)	(3.353)	(3.250)	(4.712)	(7.319)	(10.67)

Continue

[23] It is possible that the main explanatory variable of the previous section (Land Law 2013) and the placebo effect are picking other factors related to labour supply which are not caused by the Land Law of 2013 (increased off-farm labour opportunities, for example).

[24] Child labour has a negative and significant effect in columns 1 to 3. Given that the results for child labour are not statistically significant in section 6 we are not as concerned about a violation of the parallel trends assumption of this variable.

Table A1. Placebo test using pre-treatment data for own-farm labour days per capita (*continuation*)

	(1)	(2)	(3)	(4)	(5)	(6)
Male Adults						
Annual	8.143***	4.039***	2.625	4.836*	11.36	34.73
	(1.501)	(1.565)	(1.624)	(2.837)	(6.915)	(23.75)
Placebo	8.042***	10.59***	10.41***	13.26***	13.59**	15.15*
	(2.541)	(2.459)	(2.414)	(3.742)	(6.003)	(8.303)
Annual*Placebo	-4.881**	-3.781*	-3.553*	-8.789***	-11.06**	-13.05**
	(2.007)	(2.189)	(2.133)	(3.296)	(5.200)	(6.040)
Female Adults						
Annual	8.518***	3.974**	2.986	0.607	15.28**	18.55*
	(1.459)	(1.884)	(1.909)	(3.315)	(6.620)	(10.47)
Placebo	-10.72***	-0.828	1.105	-1.098	0.445	-0.798
	(2.477)	(2.561)	(2.521)	(3.595)	(7.156)	(11.57)
Annual*Placebo	0.215	4.844**	3.181	1.559	3.185	3.299
	(1.794)	(2.216)	(2.134)	(2.979)	(5.374)	(9.908)
Children						
Annual	0.866***	0.726*	0.647	1.039	0.966	-4.057**
	(0.298)	(0.415)	(0.436)	(0.856)	(2.353)	(1.577)
Placebo	0.116	0.958**	1.028**	0.963	1.337	0.523
	(0.392)	(0.439)	(0.439)	(0.729)	(0.890)	(1.619)
Annual*Placebo	-0.823**	-1.052**	-1.123**	-0.842	-1.410	-1.190
	(0.368)	(0.470)	(0.464)	(0.739)	(0.948)	(1.654)
Observations	5 534	5 534	5 515	2 561	1 369	565
No. of households	1 989	1 989	1 987	1 387	457	287
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Notes: standard errors in parentheses clustered at the household level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

Table A2. Placebo test in capital and land

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Capital ownership per worker (value)						
Annual	0.869	-19.33	-15.59	-14.51	5.099	-6.034
	(6.767)	(13.76)	(14.08)	(14.68)	(6.516)	(23.72)
Placebo	113.5	66.70	61.78	128.9	-14.95**	-9.637
	(85.69)	(92.70)	(86.23)	(129.5)	(7.162)	(10.90)
Annual*Placebo	-7.158	5.298	4.166	-9.620	10.45	5.852
	(20.38)	(16.73)	(16.59)	(22.61)	(9.004)	(8.416)
Expenditure on capital services per worker (value)						
Annual	4.566***	0.687	-0.638	-1.469	6.435	1.593
	(1.171)	(1.233)	(1.561)	(2.020)	(6.634)	(18.15)
Placebo	34.79***	-2.514	-2.254	7.335	-4.415	-1.698
	(7.737)	(12.58)	(12.26)	(18.27)	(11.39)	(14.83)
Annual*Placebo	8.916***	7.634***	7.323***	7.759**	3.586	3.561
	(2.444)	(2.193)	(2.316)	(3.173)	(3.044)	(3.132)
Observations	5 274	5 274	5 256	2 518	1 309	559
Landholdings per capita (log)						
Annual	0.575***	0.187***	0.188***	0.0645	0.220	0.270
	(0.0930)	(0.0613)	(0.0586)	(0.0656)	(0.187)	(0.359)
Placebo	1.479***	-0.114	-0.0598	-0.0105	0.183	0.0408
	(0.148)	(0.0693)	(0.0638)	(0.0837)	(0.118)	(0.141)
Annual*Placebo	-0.133	0.0522	0.00514	-0.0510	-0.201	-0.0460
	(0.115)	(0.0640)	(0.0591)	(0.0708)	(0.130)	(0.154)

Continue

Table A2. Placebo test in capital and land (*continuation*)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Observations	5 524	5 524	5 513	2 559	1 368	564
	1 988	1 988	1 987	1387	457	287
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	Yes	Yes	Yes	Yes
Household controls	No	No	Yes	Yes	Yes	Yes

Notes: standard errors in parentheses clustered at the household level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Household demographic controls are size, gender of HH, age of HH, education of HH, log of total real income. Household controls related to land characteristics are the proportion of land with LURC, the proportion of land acquired in 1993 or before, the proportion of irrigated land, and the proportion of land devoted to annual crops.

Source: own elaboration.

Coefficients of household characteristics

This appendix describes the relationship between our dependent variables related to household labour supply and several demographic and land characteristics. Table A3 presents the results of the estimated coefficients for the days of all members in own-crop farming activities (per capita). It is interesting to see that household size and farming days are negatively related, this could be because with more members households are able to diversify their activities a little more. Other household characteristics do not seem to be relevant for our dependent variable. In the case of land characteristics, we observe farmers with more irrigated land spend more time in farming. Interestingly, the percentage of land acquired in 1993 is not statistically significant.

Tabla A3. Total days in own-farm cropping activities per capita (controls)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Household size			-3.635***	-3.907***	-4.292***	-5.144***
			(0.346)	(0.509)	(0.779)	(1.099)
HH is female			1.227	3.416	0.681	-2.078
			(1.844)	(3.113)	(3.455)	(5.584)
Age of HH			0.0792	0.125	0.0312	-0.147
			(0.0598)	(0.0891)	(0.0995)	(0.124)
Education of HH			0.129	0.930	-0.353	0.546
			(0.431)	(0.632)	(0.606)	(0.873)
Annual income (log)			-0.222	0.239	0.137	0.897
			(0.550)	(0.852)	(1.009)	(1.611)
Landholdings (log)			8.694***	10.18***	4.265	6.378
			(0.922)	(1.459)	(3.034)	(3.935)
Irrigated land (%)			4.668***	7.174***	5.725**	9.248**
			(1.231)	(1.745)	(2.673)	(3.588)
LURC (%)			3.245***	2.658*	1.104	0.959
			(0.933)	(1.377)	(1.527)	(2.363)
Land acquired in 1993 (%)			-0.110	0.483	0.0895	-0.367
			(1.094)	(1.598)	(2.030)	(3.221)
Annual land (%)			4.733***	0.587	6.373**	4.359
			(1.310)	(1.919)	(3.056)	(5.204)
N	8 935	8 935	8 904	4 800	2 281	1 224

Notes: standard errors in parentheses; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: own elaboration.

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