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Tenurial security and agricultural investment: Evidence from Vietnam☆

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ABSTRACT

In Vietnam, all lands belong to the state, which assigns usufruct rights to those lands to individuals and households. In 1993, the state gave 20-year usufruct rights to growers of annual crops, and 50-year usufruct rights to growers of perennial crops. In 2013, as the usufruct rights of growers of annual crops were about to expire, the Vietnamese government passed a law—the Land Law of 2013—that extended the usufruct rights of *all* landowners by 50 years. We exploit this largely unanticipated shock to study the effect of tenurial security on agricultural investment. Using a difference-in-differences design, we find that the Land Law of 2013 is associated with a higher likelihood of investment by growers of annual crops in irrigation technology or soil and water conservation, but not other types of investment. Our results are robust to controlling for endogenous switching from annual to perennial crops, and our data support the parallel trends assumption.

1. Introduction

In Vietnam, all plots of land belong to the state, and the state assigns individuals and households usufruct rights on those plots for a pre-defined period.[1] Thus, the 1993 Vietnamese Land Law gave 20-year usufruct rights to those growing annual crops on their plots,[2] but 50-year usufruct rights to agricultural households growing perennial crops on theirs. Two decades later, when the usufruct rights of those households growing annual crops were about to expire, the government of Vietnam passed the 2013 Land Law, which extended the usufruct rights of both the growers of annual crops and of the growers of perennial crops on their plots. This unexpected change in the law was a boon to all landowners, but particularly to growers of annual crops relative to growers of perennial crops.

Economic theory suggests that on the eve of the Land Law of 2013, the incentives of annual crop growers to invest in their plots were considerably weaker than the incentives of perennial crop growers to invest in theirs given the relationship specificity of investments in land (Joskow, 1987). Put simply, before the passage of the 2013 Land Law, a grower of annual crops and a grower of perennial crops making the exact same investment in their respective plots were going to face drastically different returns on their investments, *ceteris paribus*, with the annual crop grower capturing effectively none of those returns and the perennial crop grower capturing most if not all of them over the remaining 30 years of her usufruct period.

In this paper, we look at whether this is the case, and whether we see differential investment behaviors of annual versus perennial crop growers as a consequence of the Land Law of 2013 in Vietnam. To do so, we use a newly available longitudinal data set on Vietnamese households, and we examine the impacts of the 2013 Land Law on landowner decisions to invest in maintaining and improving their plots of land. We exploit the facts that (i) the Land Law's passage was largely unanticipated, and (ii) the Land Law affected land tenure security differentially for growers of annual versus perennial crops in a difference-in-differences setup.

There is substantial literature looking at the relationship between

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[1] Merriam-Webster defines usufruct as "the legal right of using and enjoying the fruits or profits of something belonging to another" (Merriam-Webster, 2018). In the Vietnamese context, usufruct is more concretely defined as having the right to cultivate, sell, lease, and rent a plot, or use it as collateral.

[2] In the interest of brevity, and in a slight abuse of language, we refer for the remainder of this paper to plots on which agricultural households have usufruct rights as "their" plots, and to operators of plots under usufruct as "landowners."

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property rights and investment when it comes to land in rural areas of developing countries. On the one hand, Besley (1995), Bandiera (2007), Holden et al. (2009) and Goldstein et al. (2018) find that better-defined property rights translate into more investment in land. On the other hand, Brasselle et al. (2002) find no such relationship.[3] More generally, a systematic review of the literature on the effects of land rights in developing countries by Lawry et al. (2017) concludes that greater tenurial security translates much more clearly into more investment in Asia and Latin America than it does in Africa.

The contribution of this paper is twofold. First, we provide novel evidence that increased tenurial security through the extension of usufruct rights leads to greater land investments using a unique natural experiment in Vietnam. Moreover, we use high-quality plot-level longitudinal data that allow controlling for unobserved heterogeneity at the plot level to generate new evidence of the causal impacts of land rights on agricultural investment. Combined with the nationally representative nature of our data, this means that our results potentially have greater internal as well as external validity than earlier findings in the literature.

The remainder of this paper is organized as follows. In Section 2, we provide some background on the Vietnamese Land Law of 2013. Section 3 discusses the data and presents some descriptive statistics. In Section 4, we discuss the empirical framework we use to study the effect of the Land Law of 2013 on agricultural investment, discussing in turn our estimation and identification strategies. Section 5 presents and discusses our estimation results. We conclude in Section 6 by discussing the research and policy implications of our findings.

2. Background

Land ownership and land use have always been heavily regulated in Vietnam, especially in agriculture. All lands are legally owned by the state, who assigns them to individuals and households, along with usufruct rights, for a predefined period. Beyond this period, lands are subject to reallocation by the state. This institutional characteristic is arguably influenced by the land collectivization process that took place during the Vietnam War, and which brought farmlands into cooperatives so that multiple households could work on them together.

Since the end of the Vietnam War in 1975, the country has moved gradually toward land liberalization and privatization (Deininger and Jin, 2003; Do and Iyer, 2008; Markussen et al., 2011). The 1988 Land Law marked the first major milestone in this process as the law transferred land control and usufruct rights from farming cooperatives to households. The same law also established the duration of land use rights varying from 10 to 15 years (Do and Iyer, 2008).

The 1993 Land Law strengthened land rights substantially by allowing for the legal trading (i.e., selling, leasing, and renting) of plots and by issuing land titles, known as Land Use Certificates (LUCs) or Red Books, which allowed landowners to pledge their lands as collateral for loans. More importantly for our purposes, the Land Law of 1993 also set the duration of usufruct rights for annual crop plots at 20 years and for perennial crop plots at 50 years. After 1993, there were further modifications to simplify the process of obtaining a LUC in 2003. In late 2013, the government passed the 2013 Land Law, which extended the duration of usufruct for all agricultural lands—annual *and* perennial crop plots—by 50 years. This law went into effect in July 2014.

Under these laws, the duration of usufruct rights on a plot of land is defined as the period during which the usufruct of individuals and households with respect to that land is legally recognized. The 1993 Land Law established that for any plot assigned before or on October 15, 1993, that date would be the starting date for their land use duration. For any plot assigned after this date, the usufruct duration would start on the date at which the government assigned that land to its "owner." In other words, the start date does not change when the land is sold from one "owner" to another. Because the length of usufruct duration varies by land use (i.e., annual or perennial crop cultivation), landowners have to register with the government how they plan to use the plot (i.e., to grow annual crops, to grow perennial crops, to construct residential buildings, and so on). In most cases when landowners want to switch use, they can request that the government update the duration of their usufruct rights, but the starting date would not change. As mentioned before, the 1993 Land Law set usufruct duration at 20 years for landowners growing annual crops and at 50 years for landowners growing perennial crops.

What was supposed to happen when the usufruct period ended? The 1993 Land Law stated that the government would then reassign the lands to the same owners provided they had not used the lands in any illegal way. The 2003 Land Law, however, added that (i) landowners would be responsible for returning the plot if the government wanted to take it back or the usufruct duration ended, and (ii) the government would recover a plot in case the duration of usufruct ended without any extension. This means that without the 2013 Land Law that extended the duration of usufruct rights, landowners whose usufruct period was ending faced uncertainty over what would happen to their plots regardless of whether they held a LUC for those plots or not.

Based on these laws, we argue that usufruct duration effectively characterizes land tenure security because land rights are protected by the law against wrongful land-grabbing only within the usufruct period.[4] Beyond that period, one's status on one's plot becomes legally murky as that plot could legally be recovered by the government.[5] That is, landowners with a shorter usufruct duration will feel less secure than landowners with a relatively longer duration.

Hence it becomes clear that the 2013 Land Law substantially improves the tenurial security of landowners who grow annual crops, since their original usufruct period was only 20 years. This is especially true for those whose lands were assigned to them before or during 1993 as their usufruct period was ending in 2013. In contrast, because the original usufruct period of landowners who grow perennial crop was 50 years, these households still had at least 30 more years before their usufruct period ended. Therefore, we argue that the effect of the 2013 Land Law on tenurial security among these landowners should be relatively much smaller than for landowners growing annual crops. That difference in the tenurial security effects of the Land Law of 2013 allows using a difference-in-differences approach as our empirical strategy.

It is important to note that the way that the 2013 Land Law affects tenurial security of landowners is substantially different from the 1993 Land Law that previous studies have examined (Do and Iyer, 2008). Specifically, the 1993 Land Law focused on strengthening land rights by requiring provinces to physically issue LUCs to landowners. This generated substantial differences in how fast the 1993 Law was implemented across provinces (Do and Iyer, 2008), which is likely due to unobserved provincial differences (e.g., red tape, geographic characteristics). In contrast, the 2013 Land Law virtually extends the duration of the land use rights for all landowners without any physical implementation. Furthermore, the 2013 Land Law was featured on several state-owned media such as Tuoi Tre News and Thanh Nien News.[6] This implies delay in implementation is much less likely for the 2013 Land Law compared to the 1993 Land Law.

[3] Likewise, Bellemare (2013) finds no statistically significant relationship between the presence of a land title on a plot and the same plot's rice productivity in Madagascar.

[4] This protection does not guarantee that a landowner's plot will not be taken away wrongfully, but it provides the landowner with a legal basis to reclaim her plot.

[5] In the data, 1 to 2 percent of plots were expropriated by the state in any given year.

[6] See for instance House approves revised Land Law (2013), Eight laws, including revised Land Law, announced (2013) on Tuoi Tre News, and Vietnam house wraps up session, passes amended land law (2013) on Thanh Nien News.

3. Data and summary statistics

To examine the effects of the 2013 Land Law on agricultural investment, we use the Vietnam Access to Resources Household Survey (VARHS), a biennial panel of rural households from across 12 provinces in Vietnam. The data set follows over 2,000 households between the years 2008–2016 and contains household-level information about household demographics and agricultural activities as well as plot-specific information about investments and production decisions. Interviews are typically held in July. Importantly, as the questions on agricultural activities are framed retrospectively for the previous two years, we treat the 2016 wave as the sole post-reform period, since the 2014 wave covers both the periods before and after the implementation of the Land Law of 2013.

The longitudinal sample of VARHS consists of 2,343 households for the period 2008–2016. The panel constructed from this sample is unbalanced, with 2,131 households appearing in all five waves. On average, the households have household heads that are aged 52 in the first survey wave, approximately 79% of whom are male and 45% have at least a long-term vocational degree. Respondents were asked about awareness of the Vietnam Land Law of 2013 in the 2014 and 2016 survey waves. We find that between these two years, the share of respondents who have heard about the law rose from 30.57% to 38.58%. Moreover, the proportion answering correctly (i.e., 50 years) to the question about the duration of land use rights increased from 35.15% to 44.25%.

An advantage of our data set is that the type of crop being grown (i.e., annual or perennial) as well as land-related investment decision are both observed at the plot level. To measure plot-level investments, we rely on a series of indicator variables measuring whether the household has made specific investments in a given plot over the last two years. We distinguish among four specific types of investments:

1. Investment in irrigation technology or soil and water conservation improvements,
2. Investments in permanent or semi-permanent infrastructure (e.g., a fence, an animal shed),
3. Investment in trees or bushes, and
4. Investments in aquaculture (i.e., ponds).

Considering those four different types of investment as our outcome variables does two things. First, we allow for investments that are crop type-specific. For instance, households growing annual crops are likely to invest in irrigation technology or soil and water conservation improvement. Second, our inclusion of investments in aquaculture allows conducting a placebo test, since we would expect investments in aquaculture on a given plot not to be affected by the Land Law of 2013.

In Table 1, we present the plot-level descriptive statistics for perennial and annual crop plots, both before and after the Land Law of 2013 went into effect in late 2014. The number of plots dedicated to growing perennial crops is relatively small compared to the number of plots dedicated to growing annual crops. For the purposes of identification, it is important to note that households can switch between perennial and annual crops. Hence, we document crop-switching plots, i.e., plots whose owners switch between the two types of crop at some point during 2008–2016. Crop-switching is relatively more prevalent among perennial crop plots than among annual crop plots: 31 to 36 percent of perennial crop plots have been used to grow annual crop at some point during 2008–2016 while only 3 to 4 percent of annual crop plots have been used to grow perennial crop at some point during the

Table 1
Plot-level descriptive statistics of the VAHRS sample.
Source: Authors' compilations based on the VARHS data for 2008–2016

	Before		After	
	Perennial (N = 2606)	Annual (N = 32993)	Perennial (N = 817)	Annual (N = 7110)
Area plot (m^2)	6695.50	1268.69	6647.97	1382.06
	(8917.82)	(3567.36)	(11551.15)	(3642.09)
Plot value (1000 VND/m^2)	37.96	42.27	39.38	75.35
	(352.99)	(195.52)	(90.97)	(240.03)
Distance from home to plot (m)	3491.32	1087.90	2881.82	1036.93
	(27436.00)	(5915.61)	(14667.72)	(1431.17)
Can construct permanent structures (1/0)	0.52	0.09	0.26	0.06
	(0.50)	(0.29)	(0.44)	(0.24)
Plot has crop restriction (1/0)	0.08	0.53	0.04	0.40
	(0.27)	(0.50)	(0.21)	(0.49)
Crop switching (1/0)	0.31	0.04	0.36	0.03
	(0.46)	(0.19)	(0.48)	(0.17)
Investment type (1/0)				
Irrigation	0.17	0.59	0.13	0.54
	(0.38)	(0.49)	(0.33)	(0.50)
Infrastructure	0.02	0.01	0.02	0.01
	(0.13)	(0.09)	(0.12)	(0.07)
Tree planting	0.46	0.01	0.50	0.01
	(0.50)	(0.10)	(0.50)	(0.09)
Aquaculture	0.01	0.00	0.02	0.01
	(0.09)	(0.06)	(0.12)	(0.10)
Type of ownership (1/0)				
Owned	0.91	0.82	0.94	0.76
	(0.28)	(0.39)	(0.24)	(0.43)
Borrowed	0.06	0.08	0.04	0.07
	(0.23)	(0.27)	(0.19)	(0.26)
Rented out	0.03	0.11	0.02	0.17
	(0.17)	(0.31)	(0.15)	(0.38)
Plot has red book (1/0)	0.67	0.75	0.71	0.72
	(0.47)	(0.43)	(0.45)	(0.45)

Table 2
VARHS and Analytical sample size comparison.
Source: Authors' compilations based on the VARHS data for 2008–2016

Unit	Sample	2008	2010	2012	2014	2016
Household	VARHS	2278	2244	2758	2721	2669
	Analytical	1860	1775	2034	1963	1869
Plot	VARHS	9321	8679	9339	8260	7927
	Analytical	7853	7168	7624	6650	6161

same period. Crop-switching behavior presents a potential threat to our identification strategy because landowners can switch crops when anticipating that their usufruct rights will expire. This issue is explored in more detail in the next section.

It is also important to note that some plots face a government restrictions on crop choice, which means farmers can only grow a specific crop on these plots. In our sample, roughly 30 percent of perennial crop plots and 3 percent of annual crop plots face such restrictions. Markussen et al. (2011) specifically studied these plots using the VARHS data and found that farmers facing this restriction tend to receive favors from the government in terms of higher quality inputs such as hybrid seeds. Markussen et al. also found that such farmers tend to work harder. Because of these differences, we suspect that landowners of plots with crop restriction may behave differently in response to the 2013 Land Law than landowners of plots without such restrictions do, and we account for these restrictions in our analysis.

Another important observation is that while most plots are owned, roughly 10 percent of plots are either borrowed or rented out. For owner-operated plots, landowners are directly subject to the usufruct duration and are thus affected by the Land Law. For plots that are borrowed or rented out, it is unclear whether farmers who borrow or rent out face similar tenurial security as owner-operators.

Given the foregoing, we apply two restrictions to the VARHS sample to obtain our estimation sample. First, we only consider agricultural plots, namely plots that are used to grow annual or perennial crops. Our empirical strategy relies on the fact that the Land Law of 2013 affects tenurial security for these plots differently, which in turn affects their landowners' investment decisions. Landowners of plots with non-agricultural purposes (e.g., gardening or fish-farming) may behave differently from those of agricultural plots or face different usufruct duration constraints, and we thus exclude them from our analysis. Second, we only consider owner-operated plots. Combining these restrictions, we first define our households of interest as those who own at least one agricultural plot in any year the data were collected. We use plot-specific information for these households to construct our estimation sample, and the unit of analysis is a given plot in a given year. Table 2 provides a comparison in sample size between the VARHS sample and our estimation sample by year at both the household and plot levels.

In Table 3, we calculate and compare the differences in investment decisions for annual and perennial crop plots for the pre- and post-2014 periods. We first observe that landowners are likely to invest in irrigation for both plot types in any given period; that is, irrigation investment is not specific to the type of crop being grown on a given plot. In contrast, we observe that tree-planting investment are more prevalent on plots that are dedicated to growing perennial crops; specifically, investment in trees takes place on 47 to 51 percent of perennial crop plots compared to only 1 to 2 percent of annual crop plots. Lastly, we note that infrastructure and aquaculture investments are rare for both crop types.

These exploratory observations suggest that we are more likely to observe the effect of the Land Law of 2013 on investment in irrigation investment relative to the other three types because the Land Law only increases tenurial security for annual crop plots. We show this by taking the difference in the two "difference" columns and presenting the result in the last column. This simple calculation suggests that the effect of the Land Law of 2013 on investment in irrigation is larger than the effect on the other three types of investment. In the next section, we explain our identification strategy we rely on to formally quantify the effects of the Land Law of 2013 on investment.

4. Empirical framework

As explained in Section 2, we expect the 2013 Land Law to affect tenurial security differently on annual crop plots than it does on perennial crop plots. Specifically, given that the usufruct duration for landowners growing annual crops is considerably shorter, we argue that the Land Law increases tenurial security more for those who own annual crop plots than for those who own perennial crop plots, because the latter did not face the immediate threat of asset loss. Therefore, we compare the difference in investment outcomes between the two types of plots before and after the passage of the Land Law of 2013. To account for unobserved heterogeneity across plots, we control for plot fixed effects, and we also control for province-year fixed effects to account for unobserved macroeconomic shocks which could have affected investment decisions.

We estimate the following difference-in-differences specification in Eqn 1:

$$y_{ijpt} = \beta_0 + \beta_1 a_{ijpt} + \beta_2 (a_{ijpt} \times T_t) + \beta_3 h_{ijpt} + \gamma_{pt} + \sigma_i + \epsilon_{ijpt} \quad (1)$$

where y_{ijpt} is equal to one if a specific type of investment is made on plot i owned and operated by household j in province p in year t, a_{ijpt} is a variable equal to one if plot i owned and operated by household j in province p in year t is used to grow annual crops and equal to zero otherwise, T is a variable equal to one after the passage of the Land Law of 2013 and equal to zero otherwise, h denotes the size of the plot, γ is a province-year fixed effect, σ is a plot fixed effect, and ϵ is an error term whose mean is zero.

Table 3
Differences in investment decisions for annual and perennial crop plots for pre- and post-2014.
Source: Authors' compilations based on the VARHS data for 2008–2016

	Before			After			Difference
	Perennial	Annual	Difference	Perennial	Annual	Difference	in differences
Irrigation	0.17	0.51	−0.34	0.10	0.60	−0.50	0.15
	(0.37)	(0.50)	(0.01)	(0.30)	(0.49)	(0.03)	(0.04)
Infrastructure	0.02	0.01	0.01	0.01	0.00	0.01	−0.00
	(0.13)	(0.10)	(0.00)	(0.12)	(0.05)	(0.01)	(0.01)
Tree planting	0.47	0.02	0.45	0.51	0.01	0.50	−0.04
	(0.50)	(0.13)	(0.01)	(0.50)	(0.11)	(0.02)	(0.02)
Aquaculture	0.01	0.01	0.00	0.01	0.01	0.00	0.00
	(0.09)	(0.07)	(0.00)	(0.10)	(0.09)	(0.01)	(0.01)
Observations	2204	13025		740	3355		

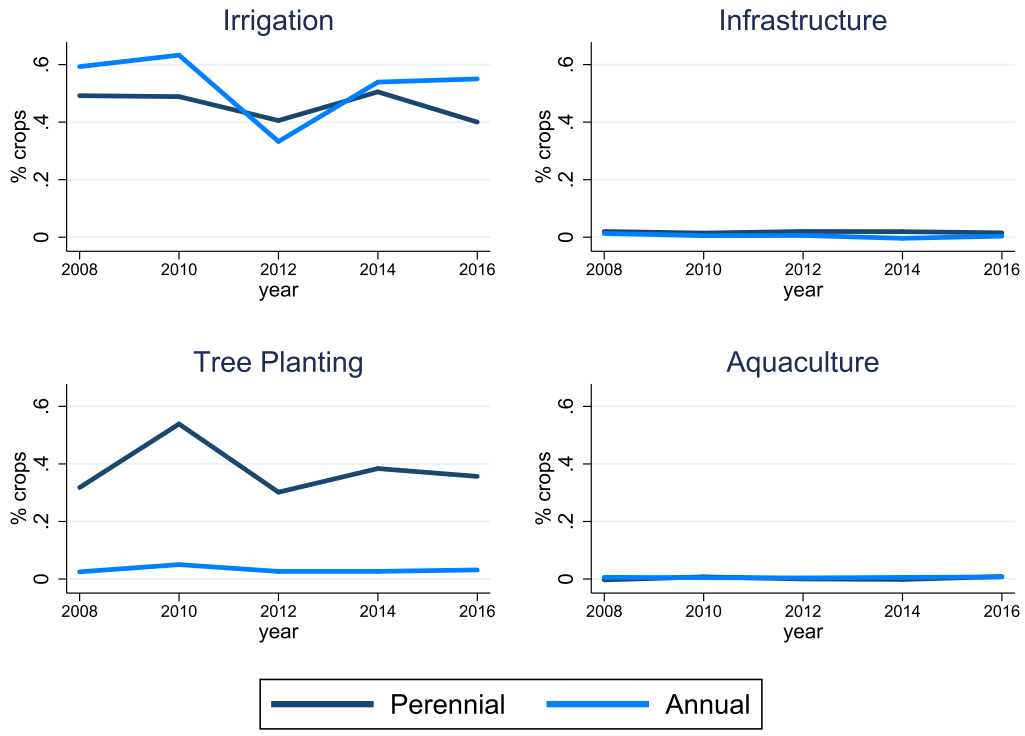

Fig. 1. Investment trends by type of crop
Source: Authors' compilations based on the VARHS data for 2008–2016. The graphs show the predicted value of each type of investment controlling for plot fixed effects and year fixed effects.

Table 4
Placebo test using the pre-treatment period – owned, non-restricted plots.

Outcomes	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Irrigation	−0.002	−0.032	0.009	0.077	0.080	0.082	0.082
	(0.039)	(0.040)	(0.052)	(0.053)	(0.056)	(0.056)	(0.056)
	[7295]	[7295]	[7295]	[7295]	[6692]	[6692]	[6692]
Infrastructure	−0.004	−0.004	−0.007	−0.005	−0.008	−0.008	−0.009
	(0.008)	(0.008)	(0.011)	(0.015)	(0.017)	(0.017)	(0.017)
	[7295]	[7295]	[7295]	[7295]	[6692]	[6692]	[6692]
Tree-planting	−0.098***	−0.068*	−0.032	−0.089	−0.110*	−0.104*	−0.103*
	(0.038)	(0.039)	(0.048)	(0.056)	(0.059)	(0.059)	(0.059)
	[5144]	[5144]	[5144]	[5144]	[4730]	[4730]	[4730]
Aquaculture	−0.002	−0.003	−0.007	−0.013	−0.017*	−0.017*	−0.017*
	(0.005)	(0.005)	(0.005)	(0.011)	(0.010)	(0.010)	(0.010)
	[7284]	[7284]	[7284]	[7284]	[6681]	[6681]	[6681]
Year FE	No	Yes	Yes	No	No	No	No
Plot FE	No	No	Yes	Yes	Yes	Yes	Yes
Province-year FE	No	No	No	Yes	Yes	Yes	Yes
Irrigation Fee Waiver	No	No	No	No	Yes	Yes	Yes
New irrigation project	No	No	No	No	Yes	Yes	Yes
New agriculture project	No	No	No	No	No	No	Yes

Note: Clustered standard errors in parentheses. Number of observations in brackets. Each cell corresponds to an individual OLS regression in which the outcome variable is specified in every row. Placebo sample includes observations from 2008–2012. Seven specifications are analyzed. In Model 1, we regress the corresponding outcome to a dummy of whether the plot is annual or perennial, a time dummy that takes the value of 1 in year 2010, and the interaction of the latter two dummies. Model 2 includes year fixed effects. Model 3 adds plot fixed effects. Model 4 adds province-year fixed effects. Model 5 adds a control for whether commune applied for Irrigation Fee Waiver. Model 6 adds a control for whether commune had any irrigation-related project in past 2 years. Model 7 adds a control for whether commune had any agriculture-related project in past 2 months. All specifications control for plot area. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

We estimate Eq. (1) by ordinary least squares. Given that we are adopting a difference-in-differences design, our coefficient of interest is β_2, which captures the effect of investment of the passage of the Land Law of 2013 (i.e., its adoption in late 2014) for annual crop plots. Following Bertrand et al. (2004), standard errors are clustered throughout at the household level.

We consider several threats to our identifications. First, we note that households can switch from growing annual to perennial crops, and vice versa. If this switching decision is endogenous, a_{ijpt} is endogenous. Fortunately, the number of plots for which the landowner switched crops is small, possibly because switching crop requires that notifying local authorities, and so there might be significant transaction costs to switching. We thus suspect that the potential endogeneity problem posed by crop switching is minimal. Still, to address this issue, we re-

Table 5
Effects on Land Law on investment for owned, non-restricted plots.

Outcomes	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Irrigation	0.155***	0.177***	0.299***	0.161**	0.168**	0.168**	0.168**
	(0.044)	(0.043)	(0.061)	(0.081)	(0.084)	(0.084)	(0.084)
	[8273]	[8273]	[8273]	[8273]	[7641]	[7641]	[7641]
Infrastructure	−0.004	−0.004	0.003	0.006	0.007	0.007	0.007
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
	[8273]	[8273]	[8273]	[8273]	[7641]	[7641]	[7641]
Tree-planting	−0.040	−0.071*	−0.037	−0.107	−0.103	−0.105	−0.105
	(0.041)	(0.041)	(0.068)	(0.077)	(0.080)	(0.079)	(0.079)
	[6122]	[6122]	[6122]	[6122]	[5679]	[5679]	[5679]
Aquaculture	0.001	0.001	−0.000	0.007	0.007	0.007	0.007
	(0.007)	(0.007)	(0.010)	(0.012)	(0.013)	(0.013)	(0.013)
	[8262]	[8262]	[8262]	[8262]	[7630]	[7630]	[7630]
Year FE	No	Yes	Yes	No	No	No	No
Plot FE	No	No	Yes	Yes	Yes	Yes	Yes
Province-year FE	No	No	No	Yes	Yes	Yes	Yes
Irrigation Fee Waiver	No	No	No	No	Yes	Yes	Yes
New irrigation project	No	No	No	No	Yes	Yes	Yes
New agriculture project	No	No	No	No	No	No	Yes

Note: Clustered standard errors in parentheses. Number of observations in brackets. Each cell corresponds to an individual OLS regression in which the outcome variable is specified in every row. Seven specifications are analyzed. In Model 1, we regress the corresponding outcome to a dummy of whether the plot is annual or perennial, a time dummy that takes the value of 1 in year 2016, and the interaction of the latter two dummies. Model 2 includes year fixed effects. Model 3 adds plot fixed effects. Model 4 adds province-year fixed effects. Model 5 adds a control for whether commune applied for Irrigation Fee Waiver. Model 6 adds a control for whether commune had any irrigation-related project in past 2 years. Model 7 adds a control for whether commune had any agriculture-related project in past 2 months. All specifications control for plot area. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

estimate Eq. (1) using the sub-sample of non-switching plots.

We rely on a difference-in-differences design, and so the most important assumption of our identifications strategy is that the investments of households growing annual crops would have followed the same trend as the investments of households growing perennial crops in the absence of the tenurial insecurity brought on by the different usufruct durations before the passage of the Land Law of 2013.

To ensure that this is the case, we plot in Fig. 1 the probability of investment for each type of investment for the period 2008–2016, conditional on plot and year fixed effects. Fig. 1 suggests that investments for irrigation and tree planting follow similar trends before the passage of the Land Law of 2013. For infrastructure and aquaculture, the levels of such investment for both crops are extremely small, and the differences between the two crops before and after 2014 are also unnoticeable. To test the parallel trends assumption holds, we estimate our model using pre-treatment data only, using 2010 as the treatment period, that is, with $T_t = I(t \geqslant 2010)$. This allows looking at whether there is any differential effect in the investment variables between households growing annual and perennial crops during the pre-treatment period. If the parallel trends assumption holds, we expect β_2 to be statistically insignificant in this specification.

We present the results of this parallel trends test in Table 4. The results suggest that there is no significant difference in all investment types between annual and perennial crop plots during the pre-treatment period, except for tree planting. Specifically, the point estimates for the irrigation or soil and water conservation investment,infrastructure, and aquaculture investment are generally small and statistically insignificant across all specifications.

In contrast, the point estimates for tree-planting investment are statistically significant across all specifications, suggesting that the difference in this investment between the two crops diverged before the policy took place. On one hand, these results allow us to rule out the possibility that the parallel trends assumption is violated for investment in irrigation, infrastructure, and aquaculture. On the other hand, any effect on tree-planting investment might be driven by the pre-treatment diverging trends.

Another threat to this identification strategy is that there are other policies or programs that coincided with the 2013 Land Law and also had differential effects on the investment incentive of the farmers of annual and perennial crop, for which our province-year fixed effects may or may not fully address.[7] In particular, the Vietnamese government has a policy to exempt an irrigation fee for various targets such as farmers in disadvantaged areas, known as the Irrigation Fee Waiver; if this policy affected how farmers of one crop invested in irrigation differently than farmers of another crop, it would bias our estimations. To address this concern, we first note that this policy was implemented in 2007 which was before the studied period. Furthermore, the implementation of this policy varies at the commune level as communes have to apply to be exempted. Therefore, We take advantage of the VARHS questionnaire for commune's leaders to construct and include a control variable for whether the commune applied for the exemption since last year in the model.

Other development programs also could have taken place that might have affected the results. For instance, if the government or international organizations such as the World Bank or the Asian Development Bank provided financial support to improve irrigation infrastructure in the province, households may have weaker incentive to invest. To capture how this might have affected our results, we account for the existence (and the extent) of agriculture and irrigation development programs started in past two years in the commune in the model.

5. Results and discussion

Table 5 presents estimation results when we estimate the effects of the 2013 Land Law on investment decisions at the plot level using various specifications. Each cell shows the estimation coefficient of interest in a regression in which the dependent variable corresponds to the investment type in the column on the far left, while each of the subsequent columns represent a different specification. Specifically, in column 1, we estimate a standard difference-in-differences specification with a dummy variable for plots growing an annual crop, a dummy variable for the post-treatment period, an interaction term for the two

[7] We thank the anonymous reviewers for pointing this out, allowing us to strengthen our findings.

Table 6
Effects on Land Law on investment for owned, non-restricted, non-switching plots.

Outcomes	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Irrigation	0.159***	0.187***	0.324***	0.271**	0.260**	0.260**	0.259**
	(0.045)	(0.045)	(0.058)	(0.107)	(0.109)	(0.109)	(0.108)
	[7400]	[7400]	[7400]	[7400]	[6831]	[6831]	[6831]
Infrastructure	−0.000	−0.000	0.002	−0.004	−0.003	−0.003	−0.003
	(0.007)	(0.007)	(0.008)	(0.004)	(0.004)	(0.004)	(0.005)
	[7400]	[7400]	[7400]	[7400]	[6831]	[6831]	[6831]
Tree-planting	−0.002	−0.033	0.011	−0.099	−0.102	−0.105	−0.105
	(0.050)	(0.050)	(0.084)	(0.090)	(0.093)	(0.092)	(0.092)
	[5389]	[5389]	[5389]	[5389]	[4991]	[4991]	[4991]
Aquaculture	0.004	0.004	−0.007	−0.006	−0.006	−0.006	−0.006
	(0.009)	(0.009)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
	[7390]	[7390]	[7390]	[7390]	[6821]	[6821]	[6821]
Year FE	No	Yes	Yes	No	No	No	No
Plot FE	No	No	Yes	Yes	Yes	Yes	Yes
Province-year FE	No	No	No	Yes	Yes	Yes	Yes
Irrigation Fee Waiver	No	No	No	No	Yes	Yes	Yes
New irrigation project	No	No	No	No	Yes	Yes	Yes
New agriculture project	No	No	No	No	No	No	Yes

Note: Clustered standard errors in parentheses. Number of observations in brackets. Each cell corresponds to an individual OLS regression in which the outcome variable is specified in every row. Seven specifications are analyzed. In Model 1, we regress the corresponding outcome to a dummy of whether the plot is annual or perennial, a time dummy that takes the value of 1 in year 2016, and the interaction of the latter two dummies. Model 2 includes year fixed effects. Model 3 adds plot fixed effects. Model 4 adds province-year fixed effects. Model 5 adds a control for whether commune applied for Irrigation Fee Waiver. Model 6 adds a control for whether commune had any irrigation-related project in past 2 years. Model 7 adds a control for whether commune had any agriculture-related project in past 2 months. All specifications control for plot area. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

variables, and plot size. In column 2, we include year fixed effects instead of only the post-treatment dummy. In column 3, we also control for plot fixed effects—the inclusion of which is made possible by the fact that some landowners switch from annual to perennial crops or vice versa—in addition to year fixed effects. In column 4, instead of controlling for year fixed effects, we control for province-year fixed effects by including dummy variables for each province-year pair.

To address the concern about other policies or development programs that may confound the results, we consider three additional controls at the commune-level. Specifically, in column 5, we include an additional control for whether commune has applied for Irrigation Fee Exemption. In column 6, we also control for whether the commune has any development project that is irrigation-related in past 2 years. In column 7, we further control for whether the commune has any development project that is agriculture-related in past 2 years.

Our results suggest that the Land Law of 2013 has had a positive, statistically significant impact on investment in irrigation technology or soil and water conservation improvements, an effect that is robust across all specifications. Specifically, we find that owner-operators of annual crops plots are 15 to 30 percent points more like to invest in

Table 7
Long-differenced model of the effects on investment for owned, non-restricted plots.

Outcomes	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Irrigation	0.154***	0.154***	0.490***	0.490***	0.418**	0.431**	0.431**
	(0.053)	(0.053)	(0.113)	(0.172)	(0.182)	(0.185)	(0.182)
	[3590]	[3590]	[3590]	[3590]	[3305]	[3305]	[3305]
Infrastructure	−0.007	−0.007	−0.020**	−0.004	−0.007	−0.007	−0.007
	(0.010)	(0.010)	(0.009)	(0.004)	(0.006)	(0.006)	(0.007)
	[3590]	[3590]	[3590]	[3590]	[3305]	[3305]	[3305]
Tree-planting	−0.113**	−0.113**	0.027	−0.075	−0.132	−0.135	−0.135
	(0.049)	(0.049)	(0.113)	(0.141)	(0.147)	(0.148)	(0.149)
	[3590]	[3590]	[3590]	[3590]	[3305]	[3305]	[3305]
Aquaculture	−0.001	−0.001	−0.022	−0.063	−0.075	−0.073	−0.073
	(0.008)	(0.008)	(0.018)	(0.045)	(0.048)	(0.047)	(0.047)
	[3590]	[3590]	[3590]	[3590]	[3305]	[3305]	[3305]
Year FE	No	Yes	Yes	No	No	No	No
Plot FE	No	No	Yes	Yes	Yes	Yes	Yes
Province-year FE	No	No	No	Yes	Yes	Yes	Yes
Irrigation Fee Waiver	No	No	No	No	Yes	Yes	Yes
New irrigation project	No	No	No	No	Yes	Yes	Yes
New agriculture project	No	No	No	No	No	No	Yes

Note: Estimates from the VARHS 2008 and 2016 waves only. Clustered standard errors in parentheses. Number of observations in brackets. Each cell corresponds to an individual OLS regression in which the outcome variable is specified in every row. Seven specifications are analyzed. In Model 1, we regress the corresponding outcome to a dummy of whether the plot is annual or perennial, a time dummy that takes the value of 1 in year 2016, and the interaction of the latter two dummies. Model 2 includes year fixed effects. Model 3 adds plot fixed effects. Model 4 adds province-year fixed effects. Model 5 adds a control for whether commune applied for Irrigation Fee Waiver. Model 6 adds a control for whether commune had any irrigation-related project in past 2 years. Model 7 adds a control for whether commune had any agriculture-related project in past 2 months. All specifications control for plot area. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

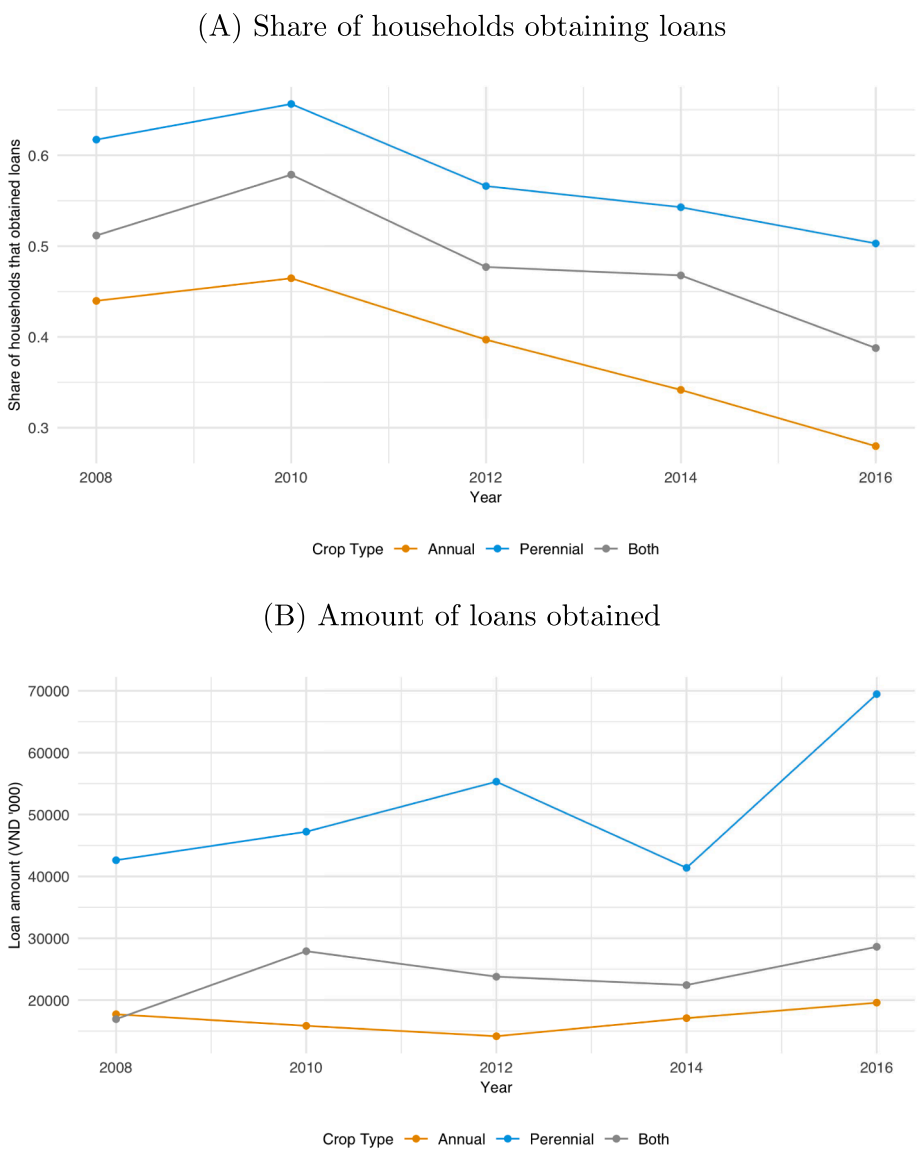

Fig. B1. Loans obtained by crop and year
Source: Authors' compilations based on the VARHS data for 2008–2016.

irrigation technology or soil and water conservation as a consequence of the 2013 Land Law. The point estimate is 16.8 percentage point in the most conservative specification estimation. In contrast, we find no statistically significant impact of the Land Law of 2013 on investments in infrastructure, trees, or aquaculture. Given that there is no reason for aquaculture to be affected by what happens to annual crop plots, the fact that we find no statistically significant effect for investment in aquaculture serves as a useful placebo test.[8]

We assess the extent to which endogenous crop switching might have contaminated our main findings by re-estimating our model using the subset of plots on which landowners do not switch crop during the period we study and present the result in Table 6. The results in Table 6 are qualitatively similar to those in Table 5. Focusing on the statistically significant coefficients, this exercise suggests that endogenous crop switching is a minor issue, given that the estimated coefficients in Table 5 are only slightly smaller in magnitude than those in Table 6.

Lastly, we also estimate a long-differenced model which considers only the first and last years of the study period to address concerns that our results are only driven by a dip in investments during the years immediately preceding the end of usufruct rights in 2013, the period of greatest uncertainty regarding land tenure. Results from these are presented in Table 7. Similar to the main findings, we find a statistically significant rise in the likelihood of investing in irrigation technology or soil and water conservation. Our preferred specification in the last column of Table 7, which includes controls for plot and province-year fixed effects, the estimated impact of the law is estimated to be 0.431, compared to 0.168 and 0.259 in Tables 5 and 6, respectively. We take this as evidence that tenurial insecurity may cast a shadow on land investments that stretches over a longer time horizon.

6. Summary and concluding remarks

The 2013 Vietnamese Land Law renewed the usufruct rights of

[8] A potential concern, as raised by an anonymous reviewer, is that investment in irrigation technology or soil and water conservation is crop-specific, and changes in tenurial security might not have affected such investment in perennial crop plots. We check the robustness of our results by looking at changes in investment on a sub-sample of annual crop plots before and after the 2013 Land Law. We find that conditional on plot fixed effects and a large set of time-varying controls, our findings are qualitatively similar. See Appendix for results.

individuals and households growing annual crops on the plots they use to do so, thereby giving those individuals and households greater security of tenure. Given what economic theory posits about the effects of greater tenurial security on investment, we look at whether the 2013 Land Law had any effect on the investment behaviors of rural households in Vietnam. Using data from the Vietnam Access to Resources Household Survey for the period 2008–2016, we use a difference-in-differences design to disentangle the potential causal impact of the Land Law of 2013 on investment from the correlation between the two.

Our results indicate that the Land Law of 2013 has had a positive, statistically significant effect on investments in irrigation technology or soil and water conservation, and our most conservative estimate of that effect suggest that the renewal of usufruct rights increased that the likelihood of that type of investment by 16.8 percentage points on the average annual crop plot. Our results are robust to accounting for endogenous crop switching, and our data support the parallel trends assumption necessary for our difference-in-differences design to generate a causal estimate. The results are also qualitatively unchanged when we look at long-differenced models of investment behavior.

An alternative explanation for our main findings is that landowners of annual crop plots might have obtained more loans through their LUCs after 2014 (or more landowners of annual crop might have obtained loans), leading to greater investment. We examine borrowing behaviors among farmers of different crops in Fig. B1. First, we find that farmers are less likely to obtain loans after 2014 for both annual and perennial crop growers. Second, we find that the average loan amount of farmers growing perennial crop actually *increased* in 2016 following a drop in 2014, while that of farmers growing annual crop was growing steady over time. These pieces of evidence suggest that the 2013 Land Law did not affect borrowing behaviors differentially across crop types. This conclusion is consistent with Do and Iyer (2008) who find that the 1993 Land Law also did not affect loan amounts or shares of farmers making loans.

This study sheds new light on the importance of land tenure security, and imply that gains from policies promoting such may be large. Nevertheless the sources of tenure uncertainty are varied, and the setting in which examine their effects may be unique from those found in other countries. In order to draw sound policy recommendations for other countries, one would have to be willing to assume that the nature of uncertainty surrounding land tenure in these contexts are similar to those in Vietnam where land rights are held by the state and where practices surrounding land appropriation and conversion are well-defined. Despite the unique setting of this study, the experience of Vietnam farmers may hold valuable lessons for land tenure policy and the role of usufruct rights in determining land investment.

Appendix A

An additional robustness check suggested by an anonymous reviewer is to estimate the following model on the subsample of annual crop plots:

$$Y_{ijpt} = \beta_0 + \beta_1 T_t + \beta_2 h_{ijpt} + \gamma \mathbf{X_{ijpt}} + \sigma_i + \epsilon_{ijpt}$$

where T_t is time dummy taking value of 1 in year 2016, h_{ijpt} is plot size, and $\mathbf{X_{ijpt}}$ is a vector of time-varying controls for household wealth and income. We consider several measures of income and income shocks that might have influenced household's decision to invest in annual crop plots. First, we estimate the fixed effect model with no $\mathbf{X_{ijpt}}$ control as baseline. Second, we control for real household income either in log or in quintile. Third, we control for log income and log monetary values of durable assets in household. Fourth, we add dummy variables for whether household experienced any natural shock, pest shock, and economic shock as controls. The results are presented in Table A1. The point estimates for investment in irrigation varies between 0.192 and 0.204 and statistically significant across all specifications. The point estimates for other investment outcomes are very close to zero and statistically insignificant. These results strengthen our conclusion that households growing annual crops respond to the increase in tenuarial security of their land by increasing investment in irrigation.

Table A1
Changes in investment on annual crop plots after the 2013 Land Law.

Outcomes	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Irrigation	0.192***	0.202***	0.196***	0.204***	0.205***	0.201***	0.203***
	(0.049)	(0.053)	(0.048)	(0.055)	(0.055)	(0.055)	(0.055)
	[6675]	[6565]	[6675]	[6316]	[6316]	[6316]	[6316]
Infrastructure	−0.006*	−0.005	−0.006*	−0.004	−0.004	−0.004	−0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
	[6675]	[6565]	[6675]	[6316]	[6316]	[6316]	[6316]
Tree-planting	−0.001	−0.001	−0.003	−0.000	−0.000	−0.000	−0.002
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
	[4649]	[4570]	[4649]	[4363]	[4363]	[4363]	[4363]
Aquaculture	0.001	0.003	0.001	0.003	0.003	0.003	0.003
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
	[6665]	[6555]	[6665]	[6306]	[6306]	[6306]	[6306]
HH income (log)	No	Yes	Yes	No	No	No	No
HH income (quintile)	No	No	Yes	No	Yes	Yes	Yes
HH value of durable assets (log)	No	No	No	Yes	No	No	No
HH experienced natural shock	No	No	No	No	Yes	Yes	Yes
HH experienced pest shock	No	No	No	No	Yes	Yes	Yes
HH experienced economic shock	No	No	No	No	No	No	Yes

Note: Clustered standard errors in parentheses. Number of observations in brackets. Each cell corresponds to an individual OLS regression in which the outcome variable is specified in every row. Seven specifications with plot fixed effects are analyzed. In Model 1, we regress the corresponding outcome to a time dummy that takes the value of 1 in year 2016. Model 2 adds real household income in log. Model 3 replaces log household income with household income quintiles. Model 4 adds a control for total values of durable assets of household. Model 5 adds a control for whether household had any natural shock. Model 6 adds an indicator for whether household experienced any pest shock. Model 7 adds indicator for whether household experienced any economic shock. All specifications control for plot area. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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