eabh Papers | No. 20 – 01 | August 2020

Tying Peasants to Their Land: The Rise and Fall of Private Property Rights in Historical Vietnam

Hoang-Anh Ho *

Abstract:

I present a theory to account for the emergence of land rights in a subsistence agricultural economy. An important feature is that, to maximize tax revenue, an authoritarian state must devise land rights to overcome the informational constraint in registering the population for tax collection. It can do so, given the state capacity is sufficiently high, by owning land and assigning cultivation rights (but not sale or transfer rights) to landless peasants to tie them to their land. The theory gives rise to a testable hypothesis, positing that private ownership of land is less prevalent in areas where population density is higher. In the early 19th century, the new Nguyen Dynasty of historical Vietnam carried out a land registry to establish formal land rights in the whole country. Exploiting this land registry, I discover that private ownership of land is less prevalent in areas where population density is higher. Furthermore, primary accounts and related historical studies show that the mechanism at work is in line with the proposed theory. Thus, the theory in question and the associated empirical evidence show that a strong state could reverse the general process in economic history whereby societies moved towards private land rights as population density increased and land became more scarce.

Acknowledgement I am grateful to Martin Dufwenberg, Dick Durevall, Kerstin Enflo, Peter Sandholt Jensen, Nils-Petter Lagerlöf, Andreas Madestam, Peter Martinsson, and Ola Olsson for valuable comments and suggestions, as well as Lina Andersson, David Bilén, Ardeshir Sepehri, Johan Stennek and numerous seminar participants. All remaining errors are mine.

JEL Classification: D02, Q15, N45
Keywords: Land rights; Population density; Historical Vietnam

*University of Economics Ho Chi Minh City, email: anh.ho@ueh.edu.vn

1 Introduction

Why did different regimes of property rights emerge in different countries, and often within the same country? An early theoretical approach focuses on market forces and argues that private property rights efficiently emerge when potential right holders perceive that the benefits to define and enforce such rights exceed the costs (Demsetz 1967; Alchian and Demsetz 1973). In this framework, higher population density makes land more scarce and valuable, and hence gives rise to private land rights (Anderson and Hill 1975).[1] This prediction is consistent with the qualitative observation that land rights evolved towards privatization as population density increased throughout the course of human history (Lewis 1955; Boserup 1965). In his seminal work, North (1981) shows that efficient property rights brought about by market forces were unusual in history, and instead gives the state a central role in explaining the emergence of property rights. In particular, North (1981) argues that, to maximize its own benefit (or tax revenue in particular), the state devises a structure of property rights to gain support from powerful groups of constituents and to reduce the transaction costs of collecting taxes, i.e., monitoring and metering taxable objects. These theoretical approaches, appealing as they are, have so far received few empirical examinations.

In the present paper, I develop a theory of the emergence of property rights to land, following the approach advocated by (North 1981), and provide novel empirical evidence for the role of the state in accounting for the emergence of private land rights. In particular, I study an authoritarian state, whose objective is to maximize tax revenue, broadly defined, in a subsistence agricultural economy. The state collects production tax and various individual duties such as head tax, unpaid labor services, and military conscription. The key feature of the theory is that the state can collect production tax by simply visiting agricultural fields, but it has to know the taxpayer population in order to collect individual duties. The state can overcome this informational constraint in registering the taxpayer population by tying landless peasants to their agricultural fields, i.e., giving them cultivation rights (but not sale or transfer rights) to some land, so that they will

[1] See also North and Thomas (1973), Anderson and Swimmer (1997), Casari (2007), and Alston, Harris, and Mueller (2012) for some other studies following this theoretical approach. Models of the economics of conflict also predict that greater efforts are expended in defending rights over more valuable resources (e.g., Grossman and Kim 1995; Baker 2003).

lose their land if they hide away when the state officials visit to enumerate the taxpayer population. This feature of the theory captures the capacity of historical states to control and register the taxpayer population.[2]

The theory in question generates three main predictions. First, the state prefers to own all land units and assigns only cultivation rights to all peasants to tie them to their land, because doing so enables the state to collect more individual duties from landless peasants. This state ownership system is only feasible when the state capacity is sufficiently high to keep the unit cost of running the state ownership system reasonably small. Second, when there is a new land area and the cost of migration plus land clearing is sufficiently high, the state prefers to grant private ownership of land to create incentives for peasants to migrate and exploit the new land for production, because doing so expands the production tax base. Third, when there are too many landless peasants in the new land, the state has an incentive to confiscate all land and assign only cultivation rights to landless peasants to tie them to their fields and collect more individual duties. State confiscation in the new land is considered to happen a long time after the migration so that peasants still have the incentives to migrate and exploit the new land, even when they anticipate the confiscation in advance. Because the number of landless peasants increases with the level of population density, the state is more likely to confiscate a new land area when its population density increases. Thus, a testable hypothesis posits that, at a point in time, private land ownership is less prevalent in areas where population density is higher.

Examining the theory in question requires rich historical materials of land tenure, which can be found in historical Vietnam. Since the end of the 10^{th} century, early states of historical Vietnam governed the land surrounding the Red River Delta (figure 1). These centralized states collected from their peasants production tax and individual duties such as head tax, unpaid labor services, and military conscription. Because people often hid away when the state officials visited to enumerate the population, state ownership of land was established and only cultivation rights were assigned to landless peasants to tie them

[2] The need to register and control the population was common in historical states. It might explain why the earliest states were characterized by state ownership of both land and people. In later states, where people were free, a typical tool to control their mobility was to tie people to their land by granting them cultivation rights (in exchange for tax payments), but not the rights to sell or contract the land. Thus, the word "real" in "real estate" has its origin in Spanish, literally means "royal" (Oxford English Dictionary). See Powelson (1988) for a world history of land tenure.

to their fields to collect individual duties. From 1069 to 1757, historical Vietnam gradually expanded its territory southward to the Mekong River Delta to form a country as it is today (figure 1). To attract settlers to this new land, the state granted private ownership of land, giving rise to a large proportion of land owned by a majority of peasants, an unprecedented phenomenon in the course of the country history. A century or more after a new region was annexed, the state confiscated private land in the region and assigned only cultivation rights to landless peasants. The motivation was to increase tax revenue, particularly to collect more individual duties.

From 1805 to 1836, right at the beginning of its rule, the Nguyen Dynasty of historical Vietnam carried out a land registry to establish formal land rights in the whole country. Given its details, this land registry provides the necessary data to empirically examine the influence of population density on the prevalence of private land ownership as hypothesized by the theory in question. Most importantly, because the Nguyen Dynasty had to take into account the pre-existing level of population density among other things in its decision to grant private ownership of land, this land registry provides a setting that rules out the reverse influence of private land ownership on population density. Digitizing this huge archive, I find that the percentage of private ownership is lower in areas where population density is higher. The estimated effect is statistically and economically significant, and robust to the inclusion of potential confounding factors as well as a battery of checks.

Also adopting the theoretical approach advocated by North (1981), Mayshar, Moav, and Neeman (2017) study how the transparency of the production process influences the structure of property rights, and use the theory to explain property rights to land in the ancient civilizations of the Near East (Egypt and Mesopotamia). The authors posit that when transparency is sufficiently high, the state can dismiss farmers who exert low effort (an indicator for the lack of private land rights). Nevertheless, when there is sufficient opacity so that the cost of erroneous dismissal outweighs the benefit, the state gives up the option to dismiss, thereby granting farmers de facto title to the land they cultivate. The main differences in the present theory are that state ownership of land emerges as a solution to the problem of overcoming the informational constraint in registering the population for the collection of individual duties, and private ownership is granted to encourage the clearing of new land for production in order to expand the tax base. Moreover, the present theory also generates a hypothesis linking population density to

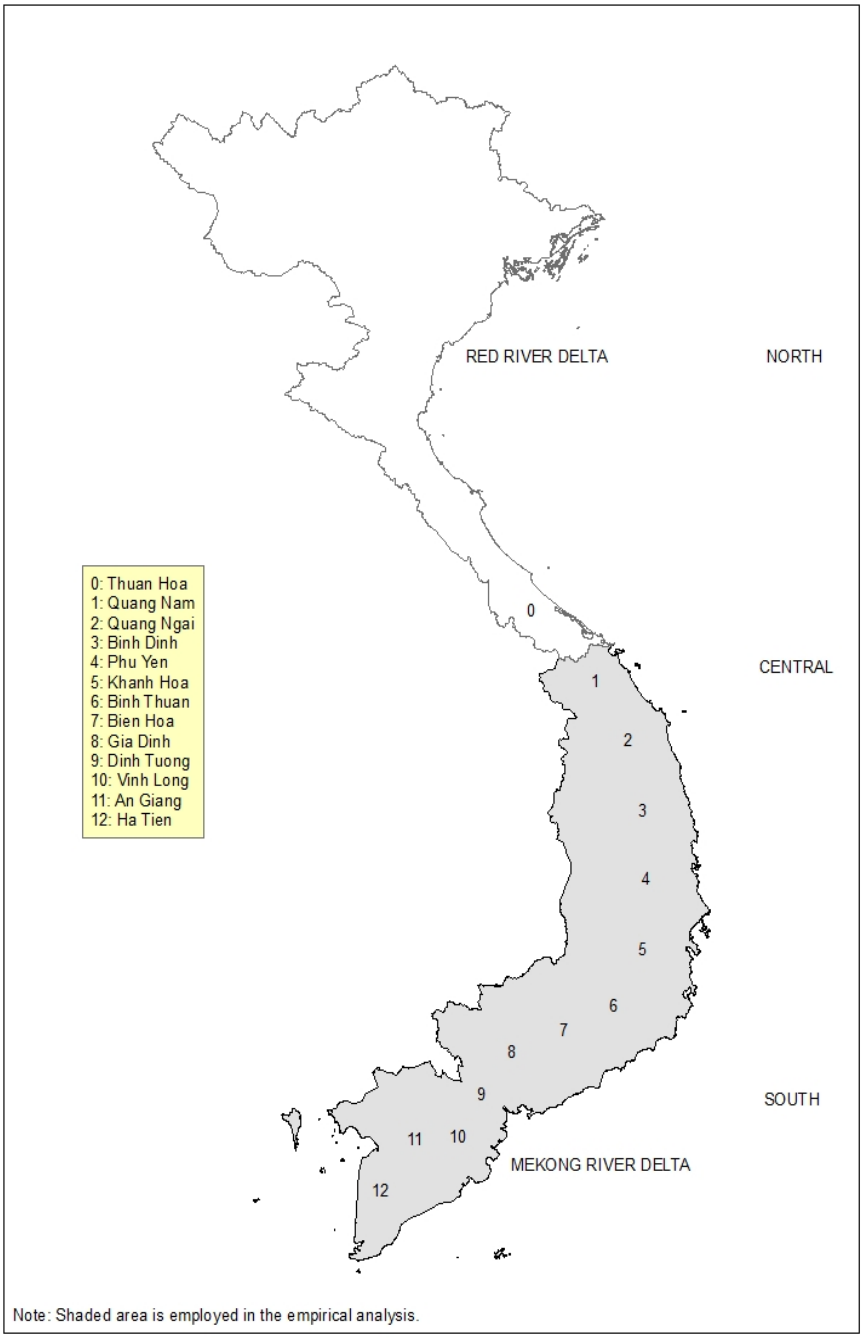

Figure 1. Vietnam in the 19th Century

the prevalence of private land ownership that can be tested empirically.

On the empirical front, there have been only a few studies investigating the emergence of private land rights, presumably because historical data on land ownership are not available. Studying the British industrialization, where Parliament operated a forum to reorganize rights to land and resources into private ownership, Bogart and Richardson (2011) show that Parliament increased the number of acts reorganizing land rights in response to increases in the returns to investments, which in turn were driven by real interest rate and the volume of international trade. Fenske (2013) conducts a descriptive investigation on the determinants of historical land rights, using data from the cross-section of global societies included in the Ethnographic Atlas constructed by Murdock (1967). The author finds that the groups in the sample were more likely to possess any rights over land where land was most scarce and more valuable, and that the theoretical approach put forward by Demsetz (1967) predicts differences across regions better than differences within regions.

In a recent work, Acemoglu and Robinson (2012) argue that extractive institutions compromising private property rights are the biggest obstacles to economic development. The present paper contributes a useful perspective to understand the origins and evolution of these extractive institutions in countries whose states want to control the population and tying people to their land is a typical strategy. In particular, recent research has discovered that secure land tenure encourages migration from rural to urban areas, for example, in the former Russian Empire (Chernina, Dower, and Markevich 2014), China (Mullan, Grosjean, and Kontoleon 2011), and Mexico (de Janvry et al. 2015). These empirical studies often take land tenure as given and argue that these authoritarian states should promote land tenure security in order to bring about a successful structural transformation and rural development. Nevertheless, the key lesson of the present paper suggests a different perspective, i.e., insecure land tenure is devised to tie peasants to the rural areas and the agricultural sector for the benefits of the authoritarian states.[3] As a result, these states will promote land tenure security only when its own interest dictates so, e.g., to generate sufficient labor supply for the development of the revenue-generating manufacturing sector.

The remainder of the present paper is organized as follows. The next section presents

[3] See Fergusson (2013) for a theory that shares this viewpoint.

the theory in detail. Section 3 describes land tenure in historical Vietnam and provides qualitative evidence for the key assumptions and main predictions of the theory. Section 4 describes in detail the land registry of the 19$^{\text{th}}$ century that is used to test the hypothesis linking population density to the prevalence of private land rights. Section 5 presents the baseline empirical results together with a battery of robustness checks. Section 6 closes the paper with some key lessons.

2 Theory

To begin with, the theory assumes an authoritarian state is already present and people are free.[4] The authoritarian state faces a problem of choosing a structure of land rights to maximize tax revenue, broadly defined, while taking into account the actions of the individual peasants. I first discuss the basic structure of the core economy and examine when the state ownership system is an optimal solution to the problem of the state. Next, I study how the state can use private ownership to create incentives for peasants to migrate to a new land area and clear land for production. Finally, I examine what will happen in the new land over time when population density increases.

2.1 The Core Economy

Consider an overlapping-generations economy governed by a Malthusian regime in the style of Galor and Weil (2011), with an exogenously given area of land. In every period, the economy produces a single homogeneous good using land and labor as inputs, in which labor supply is governed by household fertility in the preceding period.

Production

Production occurs over indefinite discrete time according to a constant-returns-to-scale technology in which output at time t in the core economy, $Y_{c,t}$, is:

$$Y_{c,t} = (AX_c)^{\alpha} L_{c,t}^{1-\alpha}, \qquad \alpha \in (0,1), \tag{1}$$

[4] For theories on the origins of the state, see, e.g., Carneiro (1970), Baker, Bulte, and Weisdorf (2010), and Mayshar et al. (2019). For an attempt to model the transition from a stateless hunter-gather society to a slavery society (where state owns both land and people), then to a free-labor society (where state only owns land), see Lagerlof (2009).

where X_c is the area of land, $L_{c,t}$ is labor employed in production at time t, and $A > 0$ represents the technological level. The technological level may capture land quality and agricultural techniques, thereby AX_c captures the productivity-augmented land area used in production. For the purpose of the present paper, the technological level is assumed to be constant over time. It follows that output per worker, $y_{c,t}$, is:

$$y_{c,t} = (AX_c/L_{c,t})^{\alpha}, \tag{2}$$

which shows that the larger the land area, the higher the output per worker.

Taxation

The state collects an exogenously given production tax, $\tau \in (0, 1)$, over each taxable output unit.[5] In addition, the state imposes duties on individuals, such as head tax, unpaid labor services, and military conscription. These duties are also exogenously given, and equivalent to a fixed amount of money, κ, per worker. To collect production tax, the state simply needs to visit the agricultural fields. But to collect individual duties, the state must be able to register the taxpayer population. People who have land to cultivate must show up when the state officials visit to register the taxpayer population, otherwise they will lose their land. In other words, they are tied to their land. Landless peasants, however, can hide away at no cost, making it impossible for the state to register them.

Under a private ownership system, in which the state allows the individuals to freely own as much land as they can, tax revenue at time t in the core economy, $R_{c,t,p}$, is:

$$R_{c,t,p} = \tau Y_{c,t} + \pi\kappa L_{c,t}, \tag{3}$$

where $\pi \in [0, 1]$ is the fraction of land owners in the economy.[6] Because the state simply lets the individuals occupy land, the cost of running the private ownership system is negligible. For simplicity, I set the cost of running the private ownership system to zero. Under a state ownership system in which the state owns all land units and assigns only

[5] Since the purpose is to examine under which conditions private ownership of land is optimal for the state in terms of tax revenue maximization, exogenous tax rate is chosen to simplify the analysis. Treating tax rate as endogenous will not change the conclusions of the theory.

[6] For simplicity, I take the fraction of land owners in the economy as given. Understanding the process that determines the fraction of land owners in a subsistence agricultural economy is of course an important topic for future research.

cultivation rights to all individuals to tie them to their fields, tax revenue at time t in the core economy, $R_{c,t,s}$, is:

$$R_{c,t,s} = \tau Y_{c,t} + \kappa L_{c,t} - CX_c, \tag{4}$$

where C is a fixed administrative cost per one unit of land area required to run the state ownership system, relative to the private ownership system. Compared to the private ownership system, running the state ownership system requires an extra cost of assigning cultivation rights and monitoring the use of land. A lower level of C reflects a stronger state capacity.[7]

The simple tax revenue specified above highlights the importance of having peasants tied to their land. Three implicit assumptions are involved. First, individual duties are assumed to be delivered outside the time of production. This is not only preferred by the state, but also feasible in a subsistence agricultural society where production is only seasonal. Second, to simplify the analysis, all benefits from individual duties are modeled in monetary units as a direct source of tax revenue. Of course, some types of duties may affect tax revenue indirectly through their impacts on output. For example, unpaid labor services used for irrigation and road construction might increase land quality or the technological level, both of which can be captured by a larger constant A.[8] Third, tax revenue is assumed to be unaffected by the structure of land rights. Of course, private ownership might improve the allocative efficiency through the land market and induce more investments in land because of stronger tenure security, leading to a higher constant A. This increase, however, is small if cultivation rights are secured and the allocative inefficiency is low under the state ownership system. Relaxing these assumptions does not change the conclusions of the theory, as long as the efficiency gain in the private ownership system is not too large relative to the efficiency gain in the state ownership system discussed above.

---

[7] Because state capacity is not the focus of the present paper, it is treated as an exogenous variable for simplicity. Johnson and Koyama (2017) provide a comprehensive analysis of the state building process in a range of different countries in Europe and Asia.

[8] Another important benefit of assigning cultivation rights and having landless peasants under control is the reduction in rebellion risk because (i) each peasant has a basic livelihood and (ii) local lords are prevented from accumulating land and building up their own armies.

Labor Supply

In each period t, a generation consisting of $L_{c,t}$ identical individuals joins the workforce. Each individual has a single parent and lives for two periods. In the childhood period, $t-1$, they are supported by their parents. In the parenthood period, t, they inelastically supply their labor, which generates a before-tax income that is equal to the output per worker, $y_{c,t}$. After paying tax, they allocate the after-tax income, $i_{c,t} = (1-\tau)y_{c,t}$, between their own consumption and raising their children.

Each individual obtains utility from his or her consumption and number of children:

$$u_t = (c_t)^{1-\gamma}(n_t)^{\gamma}, \qquad \gamma \in (0,1), \tag{5}$$

where c_t is consumption and n_t is the number of (surviving) children of an individual in generation t. The budget constraint is:

$$c_t + \rho n_t \leq i_{c,t}, \tag{6}$$

where ρ is the cost of raising a child.

Steady-State Equilibrium

With a positive level of the initial population, $L_{c,0} > 0$, there exists a unique and stable steady-state equilibrium in the core economy in which the adult population, $\bar{L}_c$, is:

$$\bar{L}_c = \left[\frac{\gamma(1-\tau)}{\rho}\right]^{1/\alpha} AX_c, \tag{7}$$

and the after-tax income per worker at the steady-state equilibrium, $\bar{i}_c$, is:

$$\bar{i}_c = \frac{\rho}{\gamma}. \tag{8}$$

See appendix A for the derivation.

These results reflect the standard dynamics of a Malthusian economy. At the steady-state equilibrium, after-tax income per worker depends only on the cost of raising a child and the relative importance of the number of children to individual utility. This is because the steady-state level of population adjusts to different values of production tax rate, technological level, and land area.

State Ownership at the Steady-State Equilibrium

To choose between different systems of land ownership in the core economy, the state compares the resulting amounts of tax revenue. Following equations (3) and (4), the difference in tax revenue at time t between the state ownership system, $R_{c,t,s}$, and the private ownership system, $R_{c,t,p}$, is:

$$R_{c,t,s} - R_{c,t,p} = (1-\pi)\kappa L_{c,t} - CX_c, \tag{9}$$

where $(1-\pi)\kappa L_{c,t}$ captures the benefit of the state ownership system compared to the private ownership system, i.e., the state can collect individual duties from the fraction of landless individuals. The larger the adult population, the higher the benefit. To decide whether or not to participate in the system of land ownership chosen by the state, each individual compare the resulting after-tax income with their outside option. For simplicity, assume that each individual requires a subsistence level, θ, in each period to survive, and that there is no better outside option.

PROPOSITION 1. *If $(1-\pi)\kappa(\bar{L}_c/X_c) > C$ and $(\rho/\gamma) > \theta$, then it is optimal in terms of tax revenue maximization for the authoritarian state to institute the state ownership system in the core economy at the steady-state equilibrium.*

PROOF. From equation (9), the state prefers the state ownership system at the steady-state equilibrium if the benefit of collecting individual duties from the fraction of landless individuals, $(1-\pi)\kappa\bar{L}_c$, is larger than the administrative cost of running the state ownership system, CX_c. Divided both sides by X_c gives us $(1-\pi)\kappa(\bar{L}_c/X_c) > C$. Intuitively, this condition is more likely to be satisfied when population density, $\bar{L}_c/X_c$, is higher, given that state capacity is sufficiently high to keep the unit cost of running the state ownership system, C, reasonably small. If state capacity is too low, and hence C is exceedingly high, then it is not beneficial for the state to set up the state ownership system, even if there are many landless peasants in the economy hiding away and not paying individual duties. Under the state ownership system, each individual is granted a quantity of land to cultivate that generates an after-tax income at the steady-state equilibrium equal to ρ/γ. If this level of after-tax income is larger than the subsistence level, θ, the individuals prefer to participate in the state ownership system. Thus, the state ownership system is

optimal at the steady-state equilibrium, and the corresponding tax revenue, $\bar{R}_{c,s}$, is:

$$\bar{R}_{c,s} = \tau \bar{Y}_c + \kappa \bar{L}_c - CX_c. \tag{10}$$

2.2 The New Land

At time t, consider new added land with an exogenously given area of X_n, which may come from previously uncleared land or a newly conquered territory. For simplicity, assume that the core economy is at the steady-state equilibrium at time $t-1$, i.e., it has $\bar{L}_c$ workers, $\bar{i}_c$ after-tax income per worker, and the state ownership system with $\bar{R}_{c,s}$ tax revenue. Also assume that migrating and clearing the new land incur a fixed cost per person, η. Now the problem of the state is to bring this new land into production to broaden the tax base, thereby increasing tax revenue. To do so, the state needs the individuals to migrate and clear the new land.[9] In other words, it has to decide on the structure of land rights in the new land to maximize total tax revenue, subject to the individual decisions to migrate and clear this land. This is a standard sequential game that can be solved by backward induction. In particular, the individual decision to migrate and clear the new land under each ownership system is first examined, and the resulting total tax revenue from the two systems is then compared to find the optimal solution to the problem of the state.

Under the state ownership system, the state owns all land units in the new land in addition to those in the core economy and assigns only cultivation rights to all individuals, resulting in a larger amount of land per worker. Thus, the after-tax income at time t of a worker who migrates to the new land, $i_{n,t}$, is the same as of those who stay in the core economy, $i_{c,t}$. Because the adult population at time t is assumed to be at the steady-state equilibrium level, $\bar{L}_c$, it follows that:

$$i_{n,t} = (1-\tau)\left[\frac{A(X_c + X_n)}{\bar{L}_c}\right]^{\alpha} = \frac{\gamma}{\rho}\left(1 + \frac{X_n}{X_c}\right), \tag{11}$$

where the second equality follows from inserting equation (7). If no individuals migrate and clear the new land, the core economy stays at the steady-state equilibrium in which the after-tax income per worker is $\bar{i}_c$. Individuals thus migrate and clear the new land at time t as long as the after-tax income per worker obtained in the new land, $i_{n,t}$, is higher than what they receive by staying in the core economy, $\bar{i}_c$, plus the fixed cost of migrating

[9] Another important benefit of having people migrating and settling in the new land is to enhance the state's defense against invaders.

and clearing the new land, η, i.e., $i_{n,t} > \eta + \bar{i}_c$. If the fixed cost η is too high, so that $i_{n,t} < \eta + \bar{i}_c$ or:

$$\frac{\gamma}{\rho}\left(1 + \frac{X_n}{X_c}\right) < \eta + \frac{\rho}{\gamma}, \tag{12}$$

then no individuals migrate and clear the new land under the state ownership system, and the state collects production tax and individual duties only in the core economy. In that case, total tax revenue at time t under the state ownership system in the new land, $TR_{t,s}$, is only equal to tax revenue in the core economy, which is assumed to be at the steady-state equilibrium level, $\bar{R}_{c,s}$.

Under the private ownership system, the state grants the rights to own land to all individuals who are willing to migrate and clear the new land. Because individuals can now own as many land units as they wish in the new land, what matters for their decisions is the marginal after-tax income, $m_{n,t} = (1-\tau)\partial Y_{n,t}/\partial L_{n,t}$, instead of the average after-tax income, as in the core economy under the state ownership system. Thus, at time t, a number of individuals, $L_{n,t}$, migrate and clear the new land as long as the marginal after-tax income in the new land, $m_{n,t}$, is higher than the average after-tax income in the core economy, $\bar{i}_c$, plus the fixed cost η, i.e., $m_{n,t} > \eta + \bar{i}_c$. As long as the new land is large, which should be the case in practice, this condition is always satisfied at some specific level of $L_{n,t}$. As individuals migrate, the average after-tax income in the core economy at time t also increases from the steady-state equilibrium level, $\bar{i}_c$, to a new level, $i_{c,t}$, because each staying person is now assigned a larger area of land to cultivate. Migration thus stops when the marginal after-tax income in the new land equals the average after-tax income in the core economy plus the fixed cost η:[10]

$$m_{n,t} = \eta + i_{c,t}. \tag{13}$$

Thus, the larger the new land, the more land owners it can absorb.

When individuals migrate and clear the new land under the private ownership system, the state collects production tax and individual duties in both the core economy and the new land, and only incurs the cost of running the state ownership system in the core economy. Because $L_{n,t}$ individuals who migrate and settle in the new land are all land

[10] In practice, the first peasant comes and cultivates as large a land area as he or she can. Then the second peasant comes and cultivates a smaller land area. Then the third and so on until the leftover land area is small enough to satisfy the condition.

owners, the state is able to collect individual duties from them. The state is also able to collect individual duties from $L_{c,t}$ individuals who stay in the core economy and are tied to their land under the state ownership system. Thus, the state is able to collect individual duties from all the workers available at time t, which is assumed to be at the steady-state equilibrium level, $\bar{L}_c$. Thus, total tax revenue at time t under the private ownership system in the new land, $TR_{t,p}$, is:

$$TR_{t,p} = \tau(Y_{c,t} + Y_{n,t}) + \kappa(L_{n,t} + L_{c,t}) - CX_c = \tau(Y_{c,t} + Y_{n,t}) + \kappa\bar{L}_c - CX_c. \tag{14}$$

PROPOSITION 2. *If η satisfies equation (12), then it is optimal in terms of tax revenue maximization for the authoritarian state to institute the private ownership system in the new land at time t.*

PROOF. See appendix A for the proof.

Recall from above that if the fixed cost η is too high, so that equation (12) is satisfied, no individuals migrate and clear the new land under the state ownership system. Total tax revenue is then only equal to tax revenue in the core economy, which is assumed to be at the steady-state equilibrium level, $TR_{t,s} = \bar{R}_{c,s}$. Thus, the state prefers the private ownership system in the new land at time t if total tax revenue obtained, $TR_{t,p}$ as specified in equation (14), is larger than total tax revenue received under the state ownership system in the new land, $\bar{R}_{c,s}$. Appendix A shows that this is true. Hence, if the fixed cost η is sufficiently high so that no individuals migrate and clear the new land under the state ownership system, then private ownership in the new land is the optimal solution to the problem of tax revenue maximization by the state.

2.3 Evolution in the New Land

What happens in the new land over the long run? When the private ownership system is instituted in the new land at time t and a number of individuals, $L_{n,t}$, migrate and clear the new land, the marginal after-tax income in the new land is larger than the steady-state equilibrium level. Thus, $L_{n,t}$ individuals in the new land can now afford more children, and hence population in the new land will increase to the steady-state equilibrium level. Similarly to the core economy, the population at the steady-state equilibrium ($\bar{L}_n$) in the

new land is:

$$\bar{L}_n = \left[\frac{\gamma(1-\tau)}{\rho}\right]^{1/\alpha} AX_n, \tag{15}$$

and the after-tax income per worker at the steady-state equilibrium, $\bar{i}_n$, is:

$$\bar{i}_n = \frac{\rho}{\gamma}. \tag{16}$$

There are also $(1-\pi)\bar{L}_n$ landless peasants in the new land, where π is the fraction of land owners in the economy. Will the private ownership system be stable under the steady-state equilibrium?

At the steady-state equilibrium under the private ownership system in the new land, the state cannot collect individual duties from $(1-\pi)\bar{L}_n$ landless peasants. Thus, the benefit of switching to a state ownership system is $(1-\pi)\kappa\bar{L}_n$. On the other hand, running a state ownership system in the new land incurs an administrative cost of CX_n. If the gain in tax revenue is smaller than the cost of running the state ownership system, then the private ownership system in the new land is a stable equilibrium. Otherwise, the state has an incentive to establish a state ownership system in the new land, i.e., confiscating all land units and assigning only cultivation rights to landless peasants, thereby tying them to their fields and collecting more individual duties. In other words, the state ownership system emerges in the new land at the steady-state equilibrium if $(1-\pi)\kappa\bar{L}_n > CX_n$, or:

$$(1-\pi)\kappa\frac{\bar{L}_n}{X_n} > C. \tag{17}$$

Thus, the state is more likely to establish a state ownership system in the new land when population density $(\bar{L}_n/X_n)$ is higher, given that state capacity is sufficiently high to keep the unit cost of running the state ownership system, C, reasonably small. As in the core economy, each individual in the new land receives an after-tax income per worker of ρ/γ under the state ownership system at the steady-state equilibrium. Thus, the individuals prefer to participate in the state ownership system if there is no better outside option than the subsistence level θ, and $(\rho/\gamma) > \theta$.

An important issue arises, will the individuals still migrate and settle in the new land at time t if they anticipate that there is a possibility that the state will confiscate the new land at the steady-state equilibrium? The answer is yes in the present setting. This is because: (i) individuals are assumed to be myopic and only care about their own consumption, which is reasonable in a subsistence agricultural economy; (ii) each

individual gains a marginal after-tax income by migrating to the new land that is larger than what obtained by staying in the core economy plus the fixed cost η; and (iii) when a confiscation happens in the new land at the steady-state equilibrium, people in the new land still receive the same average after-tax income as those people who stay in the core economy. Even if the utility function (5) is extended to also include the consumption of the next generation, it is still optimal for the individuals to migrate and settle in the new land at time t. This is because each individual has a higher level of after-tax income at time t, and even when a confiscation happens in the new land at the steady-state equilibrium, their children still receive the same average after-tax income as the children of those people who stay in the core economy. Thus, the whole family is better off.

In summary, the theory discussed above posits that the state prefers to own all land units and assign only cultivation rights to landless peasants to tie them to their fields, thereby collecting more individual duties and maximizing tax revenue, broadly defined. The state grants private land rights to create incentives for migration and land clearing in the new land, but in the long run is likely to confiscate the new land when population density in the new land increases. As a result, there arises a testable hypothesis positing that, at a point in time, private ownership of land is less prevalent in areas where population density is higher. In an empirical context, the exact hypothesis states that the percentage of private land ownership is lower in areas where taxpayer density, i.e., the number of taxpayers per unit of cultivated land, is higher. Before testing this hypothesis using a cross-section of cantons in the nationwide land registry of historical Vietnam in the early 19^{th} century, the next section presents qualitative evidence for the key assumptions and predictions of the theory, drawing from primary accounts as well as related historical studies on land tenure in historical Vietnam.

3 Historical Evidence

3.1 State Ownership in the Early States

After 1000 years of colonization by historical China, the first unified state of historical Vietnam was established in 968 CE and governed the region surrounding the Red River Delta (figure 1) with a centralized government and an agriculture specializing in wet-rice plantation (Taylor 2013). The typical state of historical Vietnam raised its revenue primarily from production tax and individual duties of male adults such as head tax,

unpaid labor services, and military conscription. Therefore, this revenue system depended on an effective strategy to register the land and the population of male adults. Because it was easy for landless peasants to hide away when the state officials visited to enumerate male adults, it was almost impossible to construct a complete registry of the taxpayer population (Tana 1998, p. 161-172).

Studying land tenure in historical Vietnam, the Vietnamese historian Truong Huu Quynh noted that the state only needed to visit agricultural fields to collect production tax, but it had to register and control the number of male adults to collect individual duties such as head tax, unpaid labor services, and military conscription (Truong 2009, p. 249). As a result, the state ownership system of land was established in the early dynasties and was enhanced over time. Under this system, landless peasants were assigned cultivation rights (but not sale or transfer rights), which were revised regularly, normally every six years, to prevent any land being left uncultivated owing to death or migration (Truong 2009, p. 207). Because the same household was normally re-assigned the same land every six years, the incentive to invest in land might not be reduced to a significant extent. By tying the peasants to their fields, the state could register and control the number of male adults to collect individual duties (Truong 2009, p. 213).

3.2 Land Expansion and Private Ownership

To create incentives for peasants to clear new land for production, early states of historical Vietnam already granted private ownership to newly cleared land, normally with zero tax rate (Truong 2009, p. 120-146, 177-228). This fact implies that clearing new land for agricultural production incurred a substantial cost. The benefits of private land ownership in terms of output and tax revenue are not found in available historical sources, suggesting that they might be negligible. In contrast, selling and buying private land often led to the concentration of land in the hands of a small fraction of landlords (Truong 2009, p. 132-134, 237-240), and its negative impacts on output and tax revenue were substantial. First, tax revenue was reduced because it was harder to register and control a large population of landless peasants, pushing the state to impose a production tax on previous tax-free private fields (Truong 2009, p. 390). Second, the dike and irrigation systems were not properly maintained, resulting in harvest losses and famines (Truong 2009, p. 158, 409). And third, landlords sometimes gathered enough dependents to form small armies, posing threats to the incumbent state itself (Truong 2009, p. 161).

From 1069 to 1757, historical Vietnam gradually expanded its territory southward to the Mekong River Delta to form a country as it is today (figure 1).[11] Because the cost of migrating and settling in this annexed region was substantial, private ownership of land had to be granted to create incentives. Le Quy Don, a state official and a leading scholar, in his famous work circa 1776, *Phu Bien Tap Luc*, documented that the state allowed people to occupy land freely (Le 1993, p. 126). Trinh Hoai Duc, another state official and leading scholar, in his famous work circa 1820, *Gia Dinh Thanh Thong Chi*, also explained that, in order to attract settlers, the state was easy, generous, and uncomplicated in bureaucratic matters with those who wanted to open up new agricultural fields, as long as they paid taxes (Trinh 1972, p. 2-17). These policies eventually gave rise to a large proportion of land owned by a majority of peasants, an unprecedented phenomenon in the course of the country history (Nguyen 1999).

3.3 State Confiscation in the New Land

There were three records of state confiscation in the annexed region that can be found in the official chronicles of historical Vietnam, i.e., *Dai Viet Su Ky Toan Thu* and *Dai Nam Thuc Luc*. First, the territory from Thuan Hoa to Binh Dinh (figure 1) was annexed to historical Vietnam after three military conquests in 1069, 1306, and 1471 (*Dai Viet Su Ky Toan Thu*, p. 197, 340, 662). In 1669, the state conducted a land survey in this region, established state ownership, and assigned only cultivation rights to landless peasants (*Dai Nam Thuc Luc*, Volume 1, p. 82). It is recorded that the state continued to grant private ownership to owners of newly cleared land, and the area of new cleared land continued to increase after that. The second record of confiscation was created by the new Nguyen Dynasty right at the beginning of its rule. From 1805 to 1836, the Nguyen Dynasty conducted a land survey in the whole country to establish its ownership over land. The southern part of historical Vietnam (figure 1), which was annexed from 1698 to 1757, was confiscated in 1836.

The third record was in Binh Dinh province in 1839, where the Nguyen Dynasty confiscated about 50% of private land and assigned only cultivation rights to landless

[11] These new territories previously belonged to the Champa Kingdom and the Khmer Empire, which correspond respectively to what is now the central and the southern parts of Vietnam (figure 1). When historical Vietnam annexed these territories, most of the local inhabitants migrated away, while others stayed and submitted themselves to the new ruler.

peasants. With this confiscation, the general impact on tax revenue was reported to be positive because more head taxes were collected while the production tax rate was the same for both private and state fields (*Dai Nam Thuc Luc*, Volume 5, p. 608); see appendix B for more detail. The fact that the number of male adults being taxed increased after private fields were confiscated and cultivation rights were assigned to landless peasants confirms that head taxes, and presumably other individual duties, could only be collected when peasants were tied to their fields. The evolution of the production tax on private fields is also worth noting. From no production tax in earlier dynasties, the Nguyen Dynasty started to collect production tax on private fields, and finally applied the same tax rate to both state and private fields (*Dai Nam Thuc Luc*, Volume 4, p. 1002).

In summary, the historical materials discussed so far have shown that: (i) there were substantial benefits of registering and controlling the population for individual duties, which could only be collected if peasants were tied to their agricultural fields, and these benefits provide an explanation for the state ownership system and the assignment of cultivation rights in the early states of historical Vietnam; (ii) private ownership of land was used to create incentives for people to migrate and clear new land because migration and land clearing involved a substantial cost; (iii) after a long period of time (i.e., a century or more) when the new land was more densely populated, the state had an incentive to confiscate the new land and assign only cultivation rights to landless peasants to tie them to their fields, enabling the state to collect more individual duties. The next section presents an empirical investigation on the relationship between taxpayer density and the prevalence of private ownership of land, using data from the nationwide land registry, conducted by the Nguyen Dynasty in the early 19^{th} century.

4 Data

4.1 The Archive

In the beginning of its rule, the Nguyen Dynasty conducted a land survey in the whole country to establish its ownership over land. To fulfill this ambition, the officials in charge had to go to all provinces in the country to register land ownership for every acre of land. The survey started in 1805 and was completed in 1836, during which time the Nguyen Dynasty instituted state ownership in the whole country at different scales in different places. Therefore, this nationwide land registry generated a variation in the prevalence

of private ownership across places at a point in time, enabling an empirical investigation of the hypothesis in question. More importantly, the Nguyen Dynasty had to take into consideration the pre-existing level of taxpayer density among many other factors in its decision to confiscate land or to grant private ownership. As a result, this land registry rules out the potential reverse influence of private ownership on taxpayer density.

Because of its grand scale, the land registry of the Nguyen Dynasty is a huge archive. The Vietnamese historian Tran Van Giau once described: "If putting each page next to each other, the survey stretches almost 300 km" (Nguyen 1994f, p. 8). The volume of the work, together with the historical Vietnamese characters being used, makes it very costly to exploit this land registry. Fortunately, the Vietnamese historian Nguyen Dinh Dau has spent his academic life since the 1980s translating and summarizing this archive into more than 10000 pages of modern Vietnamese characters. In north to south order, table 1 lists 12 provinces (out of 29 in total) whose results have been published so far.[12] These provinces were annexed to historical Vietnam from 1471 to 1757, and constituted the southern half of 19$^{\text{th}}$ century Vietnam (figure 1). As mentioned earlier, the Nguyen Dynasty also confiscated land in Binh Dinh province another time in 1839. Thus, this province had two land surveys, in 1815 and 1839. In the following empirical analysis, I use the first 12 provinces in table 1 as the baseline sample. For a robustness check, I later add the 1839 land survey of Binh Dinh province.

4.2 Variables

In each studied province, Nguyen Dinh Dau reports the cultivated area for each canton (*tổng*) and breaks down the number into area owned by the state that was used to assign cultivation rights to landless peasants (*công điền công thổ*) and area owned by private individuals (*tư điền tư thổ*). Relying on these numbers, I calculate the percentage of private ownership in the cultivated area. Table 1 reports the number of cantons for each studied province, which was highest in Quang Nam and Vinh Long (44 and 45 cantons) and lowest in Phu Yen and Ha Tien (8 and 11 cantons). In total, the sample contains 251 observations. As can be seen in table 2, the cultivated area per canton was roughly 18 km^2 on average, and the average percentage of private ownership was around 80%.

[12]It took one month for the author of the present paper to read through and code these books into usable data. Unfortunately, it was also the hottest month in Ho Chi Minh City, Vietnam.

Table 1. Provinces Included in the Empirical Analysis

No.	Province	No. of Cantons	Survey Year	Source
1.	Quang Nam	44	1812	Nguyen (2010a)
2.	Quang Ngai	19	1813	Nguyen (2010b)
3.	Binh Dinh	13	1815	Nguyen (1996a)
4.	Phu Yen	8	1816	Nguyen (1997b)
5.	Khanh Hoa	17	1811	Nguyen (1997a)
6.	Binh Thuan	15	1836	Nguyen (1996c)
7.	Bien Hoa	22	1836	Nguyen (1994a)
8.	Gia Dinh	24	1836	Nguyen (1994c)
9.	Dinh Tuong	15	1836	Nguyen (1994b)
10.	Vinh Long	45	1836	Nguyen (1994e)
11.	An Giang	18	1836	Nguyen (1995)
12.	Ha Tien	11	1836	Nguyen (1994d)
13.	Binh Dinh	13	1839	Nguyen (1996b)

The number, however, varies from 0% in 12 cantons of Vinh Long and Ha Tien to 100% in 52 cantons across all provinces except Khanh Hoa, Dinh Tuong, and An Giang (see figure 2 for a full histogram). This variation indicates that the Nguyen Dynasty did not concentrate its confiscation primarily in any specific provinces.

Since there was no population census in historical Vietnam, probably because no one wanted to be taxed, it is impossible to calculate the exact population of taxpayers, i.e., the number of male adults. Historians studying the population of historical Vietnam normally have to rely on the number of villages, which was well recorded, to estimate the total number of taxpayers. Doing so requires critical information about the average number of households per village, assuming that there was one male adult in each household. In a seminal study on the population of historical Vietnam, Tana (1998, p. 161-172) shows that the state normally established a village based on 110 households, and uses this number to estimate the taxpayer population. The present paper follows this strategy to estimate the taxpayer population for each canton. On average, each canton had around 1800 taxpayers, or 700 taxpayers per one km^2 of the cultivated land (table 2). Figure C1 in appendix C plots the percentage of private ownership against ln taxpayer density, which shows a clear negative association.

Besides taxpayer density, the Nguyen Dynasty might have also had to take into account other factors in its decision to confiscate land. To the extent that these factors might also influence taxpayer density, they are potential confounding factors that should be

Table 2. Descriptive Statistics

Variable	Mean	SD	Min	Max	N
Cultivated area (km^2)	17.79	20.43	0.03	127.33	251
Taxpayer population (1000 persons)	1.77	1.67	0.11	14.19	251
Private ownership (%)	84.23	26.86	0	100	251
Taxpayer density (1000 persons per km^2)	0.72	2.82	0.01	37.18	251
Rice-growing land (%)	82.24	23.07	0	100	251
Coastal canton	0.24	0.42	0	1	251
Having national road	0.33	0.47	0	1	251
Uncleared land (%)	16.21	21.71	0	98.88	251

Note: See table 1 for information about data sources.

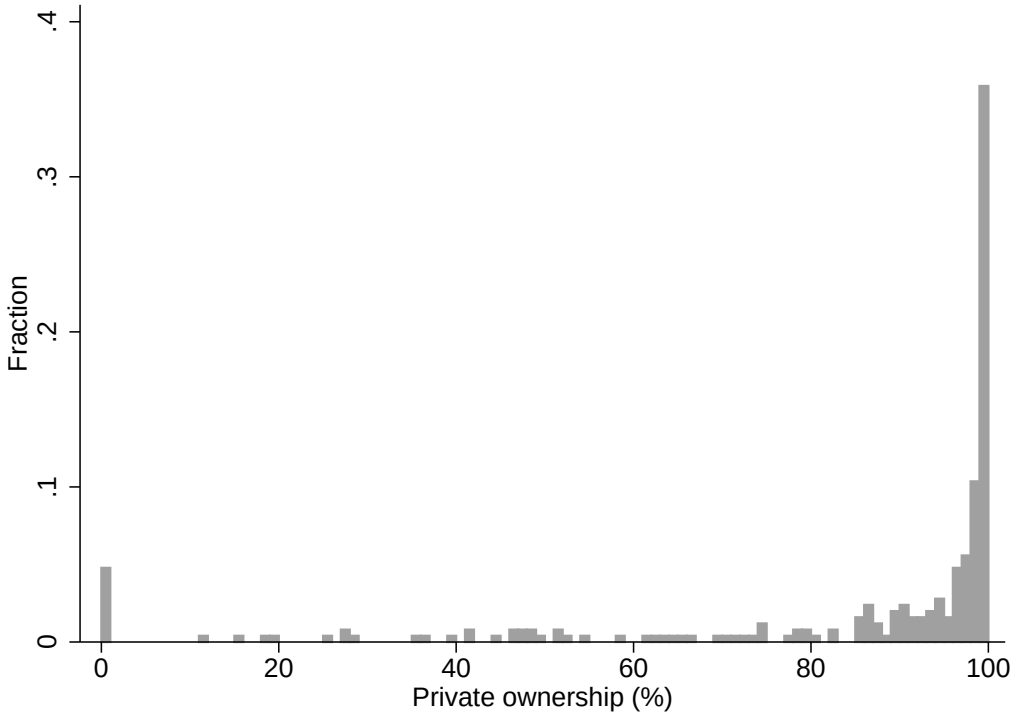

Figure 2. Private Ownership of Land

accounted for in the empirical analysis. First, rice-growing areas might be more likely to be confiscated because rice agriculture was highly transparent, as discussed in Mayshar, Moav, and Neeman (2017). To capture this relationship, I include the percentage of rice-growing land in the cultivated area. Second, private owners in areas with more valuable land might resist state confiscation more strongly. A dummy variable for coastal cantons is employed to capture higher land value, potentially owing to international trade as suggested in Demsetz (1967). Third, cantons that had better state capacity might be more likely to be confiscated because the unit cost of running the state ownership system might be lower, as discussed earlier. A high level of state capacity is captured by a dummy variable indicating whether or not there was a national road passing through the canton. Finally, to preserve incentives for land clearing, the state might be less likely to confiscate land where there was greater potential for land clearing. I use the percentage of uncleared land in the total area to capture the potential for land clearing. On average, rice-growing land constituted around 82% of the cultivated area, the percentage of uncleared land in the total area was around 16%, while 33% of cantons had a national road passing through and 24% of cantons were located along the coast (table 2).[13]

5 Empirical Evidence

5.1 Empirical Model

The empirical strategy revolves around regressing the percentage of private land ownership on the natural logarithm of taxpayer density and potential confounding factors discussed above. The empirical model takes the following form:

$$private_c = \alpha + \beta ln\, density_c + \gamma' \mathbf{X}_c + \epsilon_c, \tag{18}$$

where $private_c$ is the percentage of private land ownership in canton c, $ln\, density_c$ is the natural logarithm of taxpayer density, $\mathbf{X}_c$ is a vector of potential confounding factors discussed above, and ϵ_c is the error term. To establish the baseline results, I use the first 12 provinces in table 1 as the baseline sample. I then add the 1839 land survey of Binh Dinh province for a robustness check. In terms of inference, I use robust standard

[13]Because there is no available map of cantons in the early 19$^{\text{th}}$ century Vietnam, I cannot merge the present data with geo-coded data such as elevation, terrain ruggedness, and land suitability. Nevertheless, the available variables discussed above should capture these factors to some extent.

errors for the baseline results, and later do a robustness check to see if these results also hold with cluster standard errors at the district level.[14] Additional robustness checks are conducted to examine missing data, outliers, and alternative functional forms.

5.2 Baseline Results

To begin with, table 3 reports the results from regressing the percentage of private land ownership on ln taxpayer density and potential confounding factors, using an ordinary least squares estimator. The estimated coefficients of ln taxpayer density are negative and significant, whether or not potential confounding factors are included (columns 1 and 6). In other words, the percentage of private land ownership on average is lower in cantons with higher levels of taxpayer density. In particular, a one percent increase in the taxpayer density is associated with nearly a six percentage points lower in the percentage of private land ownership on average. In addition, the variation in ln taxpayer density alone accounts for 7% of the variation in the percentage of private land ownership, while other explanatory variables together only account for another 1.5%.

How large is the marginal effect of taxpayer density on the percentage of private land ownership? To gain a perspective on this number, take an average canton for example. A one percent increase in the taxpayer density corresponds to an extra 18 taxpayers, and 6 percentage points lower in the percentage of private land ownership corresponds to almost one km^2 of private land. If one-half of these additional taxpayers are landless peasants, then each landless peasant is assigned around 110 m^2 of land to cultivate on average. In the early 19^{th} century Vietnam, a portion of land (*khẩu phần*) used in the land assignment under the state ownership system corresponded to nearly 50 m^2 (Nguyen 2010a, p. 46), and a decree in 1804 prescribed that a typical male adult was assigned 6.5 portions of land, which is roughly 320 m^2 (*Dai Nam Thuc Luc* 2002, p. 599).

The estimated coefficient of the percentage of rice-growing land in the cultivated area is negative and significant whether or not all explanatory variables are included (columns 2 and 6), which indicates that private land ownership on average is less prevalent in cantons

[14]This choice is motivated by the argument of Abadie et al. (2017). In particular, the authors argue that cluster adjustments for standard errors should only be performed when the data were collected by cluster sampling (e.g., first taking a subset of districts, and then drawing a sample of cantons from the sampled districts) or treatment occurs at a higher level of aggregation than the unit of observation. In the present paper, the sample contains all cantons and the treatment is also at the canton level.

Table 3. Baseline Results

	Percentage of Private Ownership in the Cultivated Area						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln taxpayer density	-4.894***					-5.901***	-5.861***
	(1.177)					(1.597)	(1.892)
Rice-growing land (%)		-0.086*				-0.103*	-0.324***
		(0.048)				(0.055)	(0.066)
Coastal canton			-0.481			4.458	7.680***
			(4.045)			(3.961)	(2.911)
Having national road				-7.986**		-4.496	-7.967**
				(3.496)		(3.884)	(3.442)
Uncleared land (%)					-0.083	0.134	0.170
					(0.072)	(0.099)	(0.115)
Constant	75.544***	91.292***	84.344***	86.872***	85.584***	80.455***	101.302***
	(3.182)	(3.789)	(1.934)	(2.100)	(2.149)	(5.057)	(7.610)
Province fixed effects	NO	NO	NO	NO	NO	NO	YES
R^2	0.072	0.005	0.000	0.020	0.005	0.097	0.415
Observations	251	251	251	251	251	251	251

Note: Ordinary least squares estimator, robust standard errors are in parentheses. The sample includes all cantons in the first 12 provinces listed in table 1.
* p<0.1, ** p<0.05, *** p<0.01

where rice production is more widespread. This result is in line with the expectation that rice agriculture was highly transparent and easy to tax, as suggested by Mayshar, Moav, and Neeman (2017). The estimated coefficient of the dummy variable for coastal cantons is not different from zero (column 3). The estimated coefficient of the dummy variable for having a national road passing through is significant when entering the regression model alone (column 4), but is not different from zero when all explanatory variables are added (column 6). Its negative sign indicates that the percentage of private land ownership on average is lower in cantons having a national road passing through, which is line with the theoretical prediction that private land ownership is less prevalent in cantons with a high level of state capacity. Finally, the estimated coefficient of the percentage of uncleared land in the total area is not different from zero (column 5).

There might be some unobserved characteristics at the province level that influence both taxpayer density and the prevalence of private land ownership. For example, the Nguyen Dynasty might have conducted the land registry in the north first because this region was in general more densely populated and the need for confiscation was greater. Thus, the confiscation in some provinces that were surveyed earlier might have generated repercussions for other provinces that were surveyed later. For example, private land owners in provinces that were surveyed later might have been better prepared to resist the state confiscation. As a consequence, the negative relationship between ln taxpayer density and the percentage of private land ownership found above might be confounded by the unobserved preparedness to resist the state confiscation. To investigate the influence of unobserved characteristics at the province level, I also add province dummies to the regression model. Column 7 of table 3 shows that the estimated coefficient of ln taxpayer density remains negative and significant, with a similar marginal effect as its counterpart in the regression model without province dummies (column 6). This result shows that unobserved characteristics at the province level do not confound the relationship between taxpayer density and the prevalence of private land ownership across cantons.

To sum up, the results presented so far have shown that private land ownership is less prevalent in areas where taxpayer density is higher, and that the relationship is robust to the inclusion of potential confounding factors. In the following subsection, I examine further the robustness of these results to many other issues.

5.3 Robustness Checks

Missing Registries

The archive of the land registry in the early 19th Vietnam is far from perfect. Many wars happened in the country since the French colonizers took control in 1887, which burned a small portion of this land registry. Working with the archive, Nguyen Dinh Dau (1994) observes that there must be some parts of this registry missing. In particular, the author identifies the villages whose registries are missing by relying on information about the surrounding landscape of each village. As a result, relying on the available data to measure taxpayer density for each canton does create some errors. Nevertheless, this is not a serious problem as long as the missing registries were destroyed by pure randomness, meaning the measurement errors do not correlate with taxpayer density. This should be the case because there is no evidence showing that the intention of fire and bomb were to destroy some specific parts of this land registry. The current data also confirm this fact. Table C1 in the appendix shows that no canton characteristics significantly predict the percentage of missing villages, and the variation of each variable accounts for nearly zero percent in the variation of the percentage of missing villages.

Nevertheless, the problem of random measurement errors in the explanatory variable is well-known to cause a downward bias in the magnitude of its estimated coefficient toward zero (Hausman 2001). To examine the influence of measurement errors in taxpayer density, I restrict the empirical analysis to cantons that have no missing registries. Table 4 reports that the estimated coefficient of ln taxpayer density remains negative and significant (columns 1 to 3). Moreover, the marginal effect increases substantially in magnitude compared to its counterpart in the full sample reported in table 3, which is in line with the expectation that taxpayer density is measured with errors. In the full specification (column 3 of table 4), a one percent increase in the taxpayer density is associated with a nine percentage points lower in the percentage of private land ownership on average. Following the above interpretation, each additional landless peasants in an average canton is assigned around 200 m^2 to cultivate on average. Compared to the baseline result discussed earlier, this number is closer to the 320 m^2 of land assigned to a typical male adult to cultivate under the state ownership system in the early 19th Vietnam.

Table 4. Missing Registries and Southern Provinces

	Percentage of Private Ownership in the Cultivated Area					
	Missing Registries			Southern Provinces		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln taxpayer density	-6.858***	-7.436***	-9.229***	-6.904***	-10.382***	-14.670***
	(1.721)	(2.177)	(3.476)	(1.628)	(2.144)	(2.604)
Control variables	NO	YES	YES	NO	YES	YES
Province fixed effects	NO	NO	YES	NO	NO	YES
R^2	0.148	0.201	0.505	0.149	0.252	0.486
Observations	117	117	117	135	135	135

Note: Ordinary least squares estimator, robust standard errors are in parentheses. The sample includes all cantons in the first 12 provinces listed in table 1. Columns 1 to 3 only include cantons that have no missing registries. Columns 4 to 6 only include cantons in the six southernmost provinces. Control variables include the percentage of rice-growing land in the cultivated area, being a coastal canton, having a national road passing through, the percentage of uncleared land in the total area, and a constant.

* p<0.1, ** p<0.05, *** p<0.01

Southern Provinces

The next robustness check examines the influence of state ownership of land in the past, which is an unobserved confounding factor. Instead of setting up land ownership from scratch, it might have been the case that the Nguyen Dynasty simply re-established the state ownership created by previous dynasties. Thus, cantons with higher percentages of state land ownership in the past had lower percentages of private land ownership under the Nguyen Dynasty. If the prevalence of state land ownership in the past promoted the level of taxpayer density under the Nguyen Dynasty, then the coefficients of ln taxpayer density are overestimated. The land in the six southernmost provinces was annexed to historical Vietnam from 1698 to 1757, and the people were allowed to freely occupy the land ever since that time (Trinh 1972). Because the Nguyen was the first dynasty to officially survey and register this land in 1836, the influence of state ownership of land in the past should not be a concern within this sub-sample.

Table 4 reports the results of restricting the empirical analysis to the six southernmost provinces. The estimated coefficient of ln taxpayer density remains negative and significant (columns 4 to 6). Moreover, the marginal effect increases to a great extent compared to its counterpart in the full sample reported in table 3. In the full specification (column 6 of table 4), a one percent increase in the taxpayer density is associated with nearly a 15 percentage points lower in the percentage of private land ownership on average. Following the above interpretation, each additional landless peasants in an average canton is assigned around 440 m^2 to cultivate on average. An explanation is that, given the same level of taxpayer density, there might be more landless peasants in these provinces than in the rest of the sample, inducing the state to confiscate a larger fraction of private land to assign to these landless peasants. This explanation is consistent with the fact that land owners in the six southernmost provinces possessed much larger areas of land compared to their counterparts in the more northern provinces (Nguyen 1994f).

Binh Dinh 1839

As mentioned earlier, the Nguyen Dynasty confiscated about 50% of private fields in Binh Dinh province in 1839. Thus, land in Binh Dinh province was surveyed twice in 1815 and 1839, but the empirical analysis so far has only used the 1815 land survey. The historical evidence presented in appendix B shows that the confiscation in Binh Dinh in 1839 was

driven by tax revenue maximization. In particular, the aim was to collect more head taxes by confiscating land and then assigning only cultivation rights to landless peasants to tie them to their land. The data also confirm the hypothesis in question. In particular, taxpayer density (1000 persons per km^2) in Binh Dinh province increased from 0.23 in 1815 to 0.27 in 1839, and the percentage of private land ownership decreased from 95% to 47%. In other words, a one percent increase in the taxpayer density is associated with nearly a three percentage points lower in the percentage of private land ownership.[15]

Following the theory presented earlier, cantons with higher levels of taxpayer density would have higher fractions of land confiscated, and hence would have lower percentages of private ownership. If this was the case in the 1839 confiscation in Binh Dinh province, then adding the 1839 land survey to the empirical analysis as a separate province (the 13^{th} province in table 1) would not change the estimated impact of taxpayer density on the prevalence of private ownership to any significant extent. To see if this the case, I replicate the above regression models using the new sample that includes the 1839 land survey in Binh Dinh province. Table 5 shows that the estimated coefficient of ln taxpayer density remains negative and significant in all specifications. In each specification, the marginal effect is almost similar to its counterpart in the earlier results where the 1839 land survey of Binh Dinh province is not added.

Outliers

Figure 2 shows that there is a large number of observations with 100% private land ownership, which may drive the whole results. Dropping these outliers from the sample, table C2 in the appendix shows that the estimated coefficient of ln taxpayer density remains negative and significant (columns 1 to 3), and the marginal effect is even larger compared to its counterpart in the full sample reported in table 3.

[15]Theoretically, a fixed-effects model can be used with the panel dataset containing cantons in Binh Dinh province in two survey years (1815 and 1839). In practice, two problems arise. First, cantons changed names between the two survey years, and the available information is not enough to match them. Second, there were only 13 cantons in Binh Dinh province, meaning only two observations per estimated parameter in the full regression model.

Table 5. Adding Binh Dinh 1839

	Percentage of Private Ownership in the Cultivated Area					
	Baseline Results			Missing Registries		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln taxpayer density	-5.142***	-6.129***	-5.893***	-7.043***	-7.531***	-9.249***
	(1.186)	(1.573)	(1.882)	(1.724)	(2.167)	(3.465)
Control variables	NO	YES	YES	NO	YES	YES
Province fixed effects	NO	NO	YES	NO	NO	YES
Survey-year fixed effects	NO	NO	YES	NO	NO	YES
R^2	0.073	0.116	0.468	0.149	0.215	0.533
Observations	265	265	265	123	123	123

Note: Ordinary least squares estimator, robust standard errors are in parentheses. The sample includes all cantons in the 13 provinces listed in table 1 (Binh Dinh province was surveyed twice in 1815 and 1839). Columns 4 to 6 only include cantons that have no missing registries. Control variables include the percentage of rice-growing land in the cultivated area, being a coastal canton, having a national road passing through, the percentage of uncleared land in the total area, and a constant.
* p<0.1, ** p<0.05, *** p<0.01

Clustered Standard Errors

The empirical analysis so far has used robust standard errors. To address the concern that the error components are correlated within districts, I use standard errors clustered at the district level. There are 47 districts in the sample, which constitutes a number of clusters that is not too large for a precise estimation of clustered standard errors. Nevertheless, it is still good enough for a robustness check. Table C2 in the appendix (columns 4 to 6) shows that although the estimated standard errors increase substantially with clustering compared to their counterparts in the case of robust standard errors presented in table 3, the estimated coefficient of ln taxpayer density remains significant at conventional levels (the p-value is 0.056 in the full specification in column 6).

Fractional Responses

Because the percentage of private land ownership is essentially a fractional response (i.e, bounded by 0 and 1), a linear regression model might not be the right specification (Papke and Wooldridge 1996). To examine this issue, I employ fractional response models with both logit and probit estimators. Table C3 in the appendix presents the average marginal effects calculated from the estimated coefficients. The average marginal effects of ln taxpayer density are negative, significant, and slightly smaller in magnitude compared to their counterparts obtained from the linear regression model reported in table 3.

6 Conclusion

In the present paper, I have proposed a theory to explain the emergence of land property rights in a subsistence agricultural economy. The basic setting involves an authoritarian state, devising a structure of land rights to maximize tax revenue, broadly defined. The key feature is that, to collect individual duties (such as head tax, unpaid labor services, and military conscription), the state has to tie landless peasants to their agricultural fields, i.e., giving them cultivation rights (but not sale or transfer rights) to some land, so that they will lose their land if they hide when the state officials visit to enumerate the taxpayer population. This strategy is optimal only if the state capacity is sufficiently high. The theory generates a testable hypothesis that, at a point in time, private ownership of land is less prevalent in areas where population density is higher. I find empirical evidence for this hypothesis, using the nationwide land registry of historical Vietnam in the early

19^{th} century and a historical setting that rules out the potential reverse influence of private ownership of land on population density. Moreover, primary accounts and related historical studies show that the mechanism at work is in line with the theory in question. Thus, the case of historical Vietnam shows that a strong state, with the objective of maximizing its own benefit, could reverse the general process in economic history whereby societies moved towards private land rights as population density increased (Lewis 1955; Boserup 1965).

To sum up, the theory in question and the associated evidence corroborate the general view that the state has a central role in explaining the emergence of different regimes of property rights, as advocated by North (1981). The key lesson to take away is that insecure land rights (rights to cultivate but not sale or transfer), which were often found in historical societies, were devised by authoritarian states to tie the peasants to their agricultural land, for the benefits of the states, and more secure land rights only arise when the interests of the states dictate so. This lesson is useful for understanding the origins and evolution of land rights in authoritarian countries that are trying to draw labors from agricultural to manufacturing sectors to speed up industrialization and generate more tax revenue for the states.

References

Abadie, Alberto, et al. 2017. "When Should You Adjust Standard Errors for Clustering". *NBER Working Paper* No. 24003.

Acemoglu, Daron, and James A. Robinson. 2012. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Random House.

Alchian, Armen A., and Harold Demsetz. 1973. "The Property Right Paradigm". *Journal of Economic History* 33 (1): 16 –27.

Alston, Lee J., Edwyna Harris, and Bernardo Mueller. 2012. "The Development of Property Rights on Frontiers: Endowments, Norms, and Politics". *Journal of Economic History* 72 (3): 741 –770.

Anderson, C.Leigh, and Eugene Swimmer. 1997. "Some Empirical Evidence on Property Rights of First Peoples". *Journal of Economic Behavior & Organization* 33 (1): 1 –22.

Anderson, Terry L., and P. J. Hill. 1975. "The Evolution of Property Rights: A Study of the American West". *Journal of Law and Economics* 18 (1): 163–179.

Baker, Matthew, Erwin Bulte, and Jacob Weisdorf. 2010. "The Origins of Governments: From Anarchy to Hierarchy". *Journal of Institutional Economics* 6 (2): 215–242.

Baker, Matthew J. 2003. "An Equilibrium Conflict Model of Land Tenure in Hunter-Gatherer Societies". *Journal of Political Economy* 111 (1): 124–173.

Bogart, Dan, and Gary Richardson. 2011. "Property Rights and Parliament in Industrializing Britain". *Journal of Law and Economics* 54 (2): 241–274.

Boserup, Ester. 1965. *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. London: George Allen and Unwin.

Carneiro, Robert L. 1970. "A Theory of the Origin of the State". *Science* 169 (3947): 733–738.

Casari, Marco. 2007. "Emergence of Endogenous Legal Institutions: Property Rights and Community Governance in the Italian Alps". *Journal of Economic History* 67 (1): 191 –226.

Chernina, Eugenia, Paul Castaneda Dower, and Andrei Markevich. 2014. "Property Rights, Land Liquidity, and Internal Migration". *Journal of Development Economics* 110:191–215.

Nguyen, Ngoc Tinh, trans. *Dai Nam Thuc Luc*. 2002. Vol. 1. Ha Noi: Giao Duc.

Nguyen, The Dat, et al., trans. *Dai Nam Thuc Luc*. 2007b. Vol. 4. Ha Noi: Giao Duc.

Do, Mong Khuong, et al., trans. *Dai Nam Thuc Luc*. 2007a. Vol. 5. Ha Noi: Giao Duc.

Cao, Huy Giu, trans. *Dai Viet Su Ky Toan Thu.* 2012. Ha Noi: Thoi Dai.

de Janvry, Alain, et al. 2015. "Delinking Land Rights from Land Use: Certification and Migration in Mexico". *American Economic Review* 105 (10): 3125–3149.

Demsetz, Harold. 1967. "Toward a Theory of Property Rights". *American Economic Review Papers and Proceedings* 57 (2): 347–359.

Fenske, James. 2013. "Does Land Abundance Explain African Institutions?" *Economic Journal* 123 (573): 1363–1390. ISSN: 1468-0297.

Fergusson, Leopoldo. 2013. "The Political Economy of Rural Property Rights and the Persistence of the Dual Economy". *Journal of Development Economics* 103:167 –181.

Galor, Oded, and David N. Weil. 2011. "Dynamics and Stagnation in the Malthusian Epoch". *American Economic Review* 101 (5): 2003–2041.

Grossman, Herschel I., and Minseong Kim. 1995. "Swords or Plowshares? A Theory of the Security of Claims to Property". *Journal of Political Economy* 103 (6): 1275–1288.

Hausman, Jerry. 2001. "Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left". *Journal of Economic Perspectives* 15 (4): 57–67.

Johnson, Noel D., and Mark Koyama. 2017. "States and Economic Growth: Capacity and Constraints". *Explorations in Economic History* 64:1 –20.

Lagerlof, Nils-Petter. 2009. "Slavery and Other Property Rights". *Review of Economic Studies* 76 (1): 319–342.

Le, Quy Don. 1993. "Phu Bien Tap Luc". In *Southern Vietnam Under the Nguyen: Documents on the Economic History of Cochinchina (Dang Trong), 1602-1777*, ed. by Li Tana and Anthony Reid, trans. by Li Tana. Singapore: Institute of Southeast Asian Studies.

Lewis, W. Arthur. 1955. *The Theory of Economic Growth.* London: George Allen and Unwin.

Mayshar, Joram, Omer Moav, and Zvika Neeman. 2017. "Geography, Transparency, and Institutions". *American Political Science Review* 111 (3): 622–636.

Mayshar, Joram, et al. 2019. "The Origin of the State: Land Productivity or Appropriability?" *Working Paper, University of Warwick.*

Mullan, Katrina, Pauline Grosjean, and Andreas Kontoleon. 2011. "Land Tenure Arrangements and Rural-Urban Migration in China". *World Development* 39 (1): 123–133.

Murdock, George P. 1967. *Ethnographic Atlas.* Pittsburgh: University of Pittsburgh Press.

Nguyen, Dinh Dau. 1999. *Che Do Cong Dien Cong Tho trong Lich Su Khan Hoang Mien Nam*. Ho Chi Minh City: Tre.

— . 1995. *Nghien Cuu Dia Ba Trieu Nguyen: An Giang*. Ho Chi Minh City: Ho Chi Minh City.

— . 1994a. *Nghien Cuu Dia Ba Trieu Nguyen: Bien Hoa*. Ho Chi Minh City: Ho Chi Minh City.

— . 1996b. *Nghien Cuu Dia Ba Trieu Nguyen: Binh Dinh*. Vol. III. Ho Chi Minh City: Ho Chi Minh City.

— . 1996a. *Nghien Cuu Dia Ba Trieu Nguyen: Binh Dinh*. Vol. I and II. Ho Chi Minh City: Ho Chi Minh City.

— . 1996c. *Nghien Cuu Dia Ba Trieu Nguyen: Binh Thuan*. Ho Chi Minh City: Ho Chi Minh City.

— . 2010a. *Nghien Cuu Dia Ba Trieu Nguyen: Dinh Quang Nam*. Vol. I and II. Ho Chi Minh City: National University, Ho Chi Minh City.

— . 1994b. *Nghien Cuu Dia Ba Trieu Nguyen: Dinh Tuong*. Ho Chi Minh City: Ho Chi Minh City.

— . 1994c. *Nghien Cuu Dia Ba Trieu Nguyen: Gia Dinh*. Ho Chi Minh City: Ho Chi Minh City.

— . 1994d. *Nghien Cuu Dia Ba Trieu Nguyen: Ha Tien*. Ho Chi Minh City: Ho Chi Minh City.

— . 1997a. *Nghien Cuu Dia Ba Trieu Nguyen: Khanh Hoa*. Ho Chi Minh City: Ho Chi Minh City.

— . 1997b. *Nghien Cuu Dia Ba Trieu Nguyen: Phu Yen*. Ho Chi Minh City: Ho Chi Minh City.

— . 2010b. *Nghien Cuu Dia Ba Trieu Nguyen: Quang Ngai*. Ho Chi Minh City: National University, Ho Chi Minh City.

— . 1994e. *Nghien Cuu Dia Ba Trieu Nguyen: Vinh Long*. Ho Chi Minh City: Ho Chi Minh City.

— . 1994f. *Tong Ket Nghien Cuu Dia Ba Nam Ky Luc Tinh*. Ho Chi Minh City: Ho Chi Minh City.

North, Douglass C. 1981. *Structure and Change in Economic History*. New York: Norton.

North, Douglass C., and Robert Paul Thomas. 1973. *The Rise of the Western World: A New Economic History*. Cambridge: Cambridge University Press.

Papke, Leslie E., and Jeffrey M. Wooldridge. 1996. "Econometric Methods for Fractional Response Variables with An Application to 401(k) Plan Participation Rates". *Journal of Applied Econometrics* 11 (6): 619–632.

Powelson, John P. 1988. *The Story of Land: A World History of Land Tenure and Agrarian Reform*. Cambridge: Lincoln Institute of Land Policy.

Tana, Li. 1998. *Nguyen Cochinchina: Southern Vietnam in the Seventeenth and Eighteenth Centuries*. Ithaca: Cornell University Press.

Taylor, Keith W. 2013. *A History of the Vietnamese*. Cambridge: Cambridge University Press.

Trinh, Hoai Duc. 1972. *Gia Dinh Thanh Thong Chi*. Trans. by Tao Nguyen. Sai Gon: Nha Van Hoa.

Truong, Huu Quynh. 2009. *Che Do Ruong Dat va Mot So Van De Lich Su Viet Nam*. Ha Noi: The Gioi.

Appendix A. Derivation and Proofs

EQUILIBRIUM. This derivation shows that the core economy described in the main text has a unique and stable steady-state equilibrium.

The solution to the individual problem is obtained by maximizing the utility function in equation (5) subject to the budget constraint in equation (6). In particular, individuals of generation t in the core economy devote a fraction $(1-\gamma)$ of their after-tax income, $i_{c,t}$, to consumption and a fraction γ to child rearing:

$$c_t = (1-\gamma) i_{c,t}; \tag{A.1}$$

$$n_t = \frac{\gamma i_{c,t}}{\rho}. \tag{A.2}$$

The evolution of the adult population is determined by its initial size, $L_{c,0} > 0$, and the number of (surviving) children per adult, n_t. In particular, the adult population size in period $t+1$ in the core economy is given by:

$$L_{c,t+1} = n_t L_{c,t} \tag{A.3}$$

Combining (A.2) and (A.3) yields:

$$\begin{aligned} L_{c,t+1} &= \frac{\gamma}{\rho} i_{c,t} L_{c,t} \\ &= \frac{\gamma}{\rho}(1-\tau) y_{c,t} L_{c,t} \\ &= \frac{\gamma}{\rho}(1-\tau) \left(\frac{A X_c}{L_{c,t}} \right)^{\alpha} L_{c,t} \\ &= \frac{\gamma}{\rho}(1-\tau) \left(A X_c \right)^{\alpha} \left(L_{c,t} \right)^{(1-\alpha)} \\ &= \Phi(L_{c,t}; A). \end{aligned}$$

It follows that:

$$\Phi'(L_{c,t}) = \frac{\gamma}{\rho}(1-\tau)(1-\alpha) \left(A X_c \right)^{\alpha} \left(L_{c,t} \right)^{(-\alpha)} > 0; \tag{A.4}$$

$$\Phi''(L_{c,t}) = (-\alpha)\frac{\gamma}{\rho}(1-\tau)(1-\alpha) \left(A X_c \right)^{\alpha} \left(L_{c,t} \right)^{(-\alpha-1)} < 0; \tag{A.5}$$

$$\Phi(0; A) = 0; \tag{A.6}$$

$$\lim_{L_{c,t} \to 0} \Phi'(L_{c,t}) = \infty; \tag{A.7}$$

$$\lim_{L_{c,t}\to\infty} \Phi'(L_{c,t}) = 0. \tag{A.8}$$

Hence, for a given level of technology A and an initial adult population $L_{c,0} > 0$, there exists a stable and unique steady-state level of the adult population in the core economy, $\bar{L}_c$, which is given by:[16]

$$\begin{aligned} \bar{L}_c &= \frac{\gamma}{\rho}(1-\tau)\left(AX_c\right)^{\alpha}\left(\bar{L}_c\right)^{(1-\alpha)} \\ \Leftrightarrow \bar{L}_c &= \left[\frac{\gamma(1-\tau)}{\rho}\right]^{1/\alpha} AX_c. \end{aligned} \tag{A.9}$$

The evolution of output per worker is determined by its initial level, $y_{c,0} > 0$, and the number of (surviving) children per adult, n_t. In particular, the output per worker in period $t+1$ in the core economy is given by:

$$\begin{aligned} y_{c,t+1} &= \left(\frac{AX_c}{L_{c,t+1}}\right)^{\alpha} \\ &= \left(\frac{AX_c}{n_t L_{c,t}}\right)^{\alpha} \\ &= \frac{y_{c,t}}{n_t^{\alpha}}, \end{aligned} \tag{A.10}$$

where the second equality follows from (A.3).

Combining (A.2) and (A.10) yields:

$$\begin{aligned} y_{c,t+1} &= \frac{y_{c,t}}{\left(\frac{\gamma}{\rho} i_{c,t}\right)^{\alpha}} \\ &= \frac{y_{c,t}}{\left(\frac{\gamma}{\rho}(1-\tau) y_{c,t}\right)^{\alpha}} \\ &= y_{c,t}^{1-\alpha}\left(\frac{\rho}{\gamma(1-\tau)}\right)^{\alpha} \\ &= \Psi(y_{c,t}; A). \end{aligned}$$

Similar to the case of adult population derived above, it can be shown that $\Psi'(y_{c,t}) > 0$, $\Psi''(y_{c,t}) < 0$, $\Psi(0) = 0$, $\lim_{y_{c,t}\to 0} \Psi'(y_{c,t}) = \infty$ and $\lim_{y_{c,t}\to\infty} \Psi'(y_{c,t}) = 0$. Hence, for a given technology A and an initial income per adult $y_{c,0} > 0$, there exists a stable and unique

[16] The trivial steady state, $\bar{L}_c = 0$, is unstable. So, for a given $L_{c,0} > 0$, this equilibrium will not be an absorbing state for the population dynamics.

steady-state level of income per adult in the core economy, $\bar{y}_c$, which is given by:[17]

$$\begin{aligned} \bar{y}_c &= \bar{y}_c^{1-\alpha} \left(\frac{\rho}{\gamma(1-\tau)} \right)^{\alpha} \\ \Leftrightarrow \bar{y}_c &= \frac{\rho}{\gamma(1-\tau)}. \end{aligned} \tag{A.11}$$

It follows that the steady-state level of after-tax income per adult in the core economy, $\bar{i}_c$, is:

$$\bar{i}_c = \frac{\rho}{\gamma}. \tag{A.12}$$

PROPOSITION 2. This proof shows that as long as the fixed cost of migrating and clearing the new land is so high that no individuals do so under the state ownership system, then the private ownership system in the new land is the optimal solution to the problem of tax revenue maximization of the state.

It has been shown in the main text that if the fixed cost η is too high, so that equation (12) is satisfied, then no individuals migrate and clear the new land under the state ownership system, and hence tax revenue obtained from the new land is zero. Total tax revenue at time t under the state ownership system in the new land, $TR_{t,s}$, is then only equal to tax revenue in the core economy, which is assumed to be at the steady-state equilibrium level, $\bar{R}_{c,s}$. What left to be shown is that total tax revenue at time t obtained under the private ownership system in the new land, $TR_{t,p}$, is greater than total tax revenue receives under the state ownership system, $TR_{t,s} = \bar{R}_{c,s}$.

Under the private ownership system in the new land, a number of individuals $L_{n,t}$ migrate and clear the new land. First note that, as individuals move out of the core economy at time t, each person staying in the core economy is now assigned a larger area of land, and hence the average after-tax income in the core economy increases from the steady-state equilibrium level, $\bar{i}_c$, to a new level, $i_{c,t}$, which means:

$$i_{c,t} > \bar{i}_c. \tag{A.13}$$

[17]The trivial steady state, $\bar{y}_c = 0$, is unstable. So, for a given $y_{c,0} > 0$, this equilibrium will not be an absorbing state for the income per adult dynamics.

The migration to the new land stops when the marginal after-tax income in the new land, $m_{n,t}$, equals the average after-tax income in the core economy, $i_{c,t}$, plus the fixed cost η, which means:

$$\begin{aligned} m_{n,t} &= i_{c,t} + \eta \\ \Leftrightarrow (1-\tau)(1-\alpha)(AX_n)^{\alpha} L_{n,t}^{-\alpha} &= i_{c,t} + \eta \\ \Leftrightarrow (1-\tau)(1-\alpha) y_{n,t} &= i_{c,t} + \eta \\ \Leftrightarrow (1-\alpha) i_{n,t} &= i_{c,t} + \eta \end{aligned} \tag{A.14}$$

Second, under the private ownership system in the new land at time t, the number of workers who migrate and clear the new land, $L_{n,t}$, plus the number of workers who stay in the core economy, $L_{c,t}$, must equal the total number of workers at time $t-1$, which by assumption is at the steady-state equilibrium level $\bar{L}_c$.

At time t, total tax revenue under the private ownership system in the new land, $TR_{t,p}$, is larger than total tax revenue under the state ownership system in the new land, $TR_{t,s} = \bar{R}_{c,s}$ if and only if:

$$\begin{aligned} & \tau(Y_{c,t} + Y_{n,t}) + \kappa(L_{n,t} + L_{c,t}) - CX_c > \tau\bar{Y}_c + \kappa\bar{L}_c - CX_c \\ \Leftrightarrow\ & \tau(Y_{c,t} + Y_{n,t}) + \kappa\bar{L}_c > \tau\bar{Y}_c + \kappa\bar{L}_c \\ \Leftrightarrow\ & Y_{c,t} + Y_{n,t} > \bar{Y}_c \\ \Leftrightarrow\ & y_{c,t}L_{c,t} + y_{n,t}L_{n,t} > \bar{y}_c\bar{L}_c \\ \Leftrightarrow\ & (1-\tau)y_{c,t}L_{c,t} + (1-\tau)y_{n,t}L_{n,t} > (1-\tau)\bar{y}_c\bar{L}_c \\ \Leftrightarrow\ & i_{c,t}(\bar{L}_c - L_{n,t}) + i_{n,t}L_{n,t} - \bar{i}_c\bar{L}_c > 0 \\ \Leftrightarrow\ & (i_{c,t} - \bar{i}_c)\bar{L}_c + (i_{n,t} - i_{c,t})L_{n,t} > 0. \end{aligned} \tag{A.15}$$

From equation (A.13), it is clear that $i_{c,t} - \bar{i}_c > 0$. Equation (A.14) says that $(1-\alpha)i_{n,t} - i_{c,t} = \eta > 0$, which means that $i_{n,t} - i_{c,t} > \eta > 0$ since $\alpha \in (0,1)$. Hence, as long as (A.13) and (A.14) are true, (A.15) is also true. Q.E.D.

Appendix B. The Land Confiscation in Binh Dinh in 1839

In 1839 in Binh Dinh province, the Nguyen Dynasty confiscated about 50% of all private land and assigned only cultivation rights to landless peasants. Below, I translate and examine an extract from the report to the king prepared by the mandarin in charge (*Dai Nam Thuc Luc*, Volume 5, p. 608), which demonstrates that (i) tax revenue maximization by the state was the primary motivation of this land confiscation and assignment, and (ii) its impact on total tax revenue was positive, in particular more head taxes could be collected by assigning only cultivation rights to landless peasants.

The King asked:

> "Regarding the land confiscation and assignment in Binh Dinh, what is the change in total tax revenue this year compared to last year?"

This question clearly demonstrates that tax revenue is the foremost concern of the king in this act of land confiscation and assignment.

The mandarin reported:

> "That province, in the old registry [1815], the area of state fields is around 6000 to 7000 acres, while the area of private fields is more than 90000 acres. Now half of the area of private fields is confiscated, the area of state fields thus increases to around 40000 acres. In general, tax revenue from land decreases, but revenue from head taxes increases. Since the beginning, in provinces in the southern half, tax rates on state fields and private fields were equal, while the tax rate on mandarin fields was higher. Recently, mandarin fields have been changed to state fields, hence although the area of state fields increases, tax revenue decreases. Before the land confiscation and assignment, revenue raised from head taxes on peasants with assigned state fields was higher than revenue raised from head taxes on those without assigned state fields. Now that more state fields are assigned so that more peasants have land, revenue raised from head taxes increases."

Mandarin fields (*quan điền*) are agricultural fields assigned to state officials and soldiers as a form of salary. The Nguyen Dynasty later on abolished this system and paid salaries directly in money. Therefore, mandarin fields did not exist in provinces that were surveyed in 1836.[18] Because the tax rate on mandarin fields was higher than that on state fields,

[18]For provinces that were surveyed earlier, I do not include mandarin fields in the empirical analysis

changing mandarin fields into state fields decreased the tax revenue from land in total. Without this change, tax revenue from land should have been the same after the land confiscation and assignment, because tax rates on state fields and private fields were the same. The above report from the mandarin in charge demonstrates clearly that, by assigning state fields to landless peasants, the state could collect more head taxes.

The king, with his foremost concern about the impact of the land confiscation and assignment on tax revenue, as shown above, now surprisingly turned:

> "The land confiscation and assignment is purposed to share the benefits to all peasants, so whether total tax revenue increases or decreases is not worth paying a calculation."

If this statement of the king is to be taken as evidence that the primary function of the state ownership system in historical Vietnam was to bring about economic equality, then an answer must be provided to the question why the king did not ask in the first place if the land confiscation and assignment were successful in providing every landless peasant a basic livelihood.

---

because their primary purpose was not to tie the peasants to their fields.

Appendix C. Additional Figures and Tables

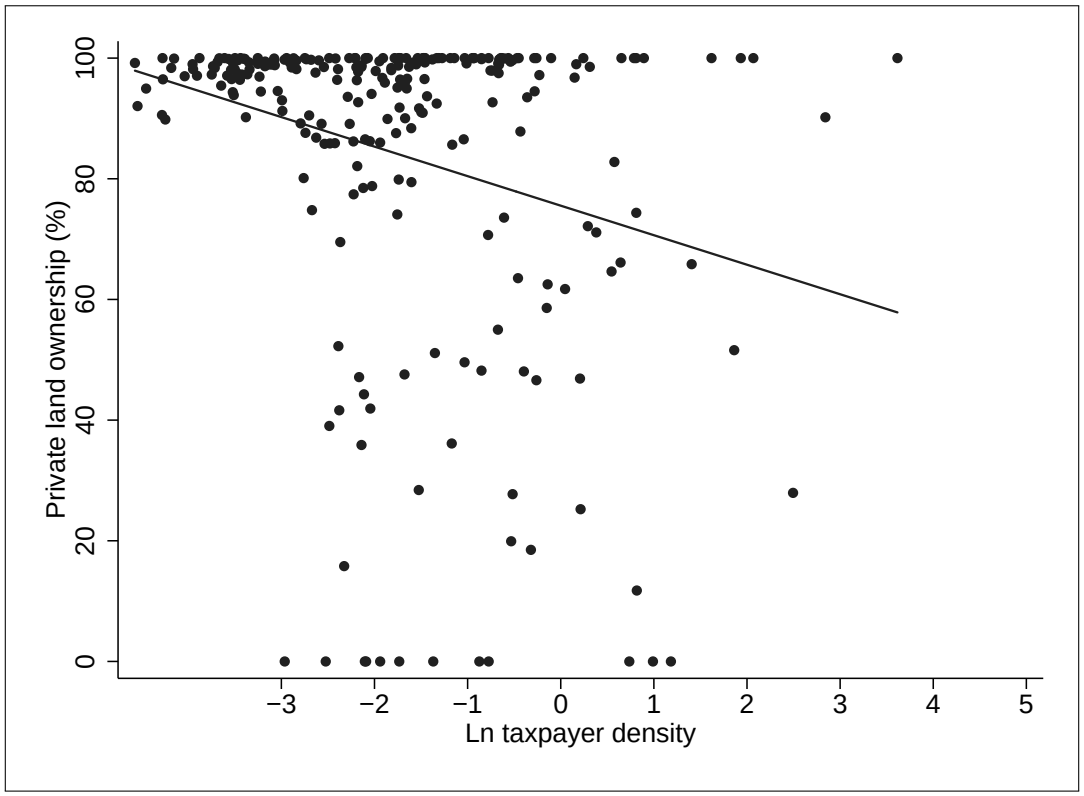

Figure C1. Taxpayer Density and Private Ownership

Note: Each dot represents one canton, and the number of observations is 251. The line depicts the predicted values of percentage of private ownership obtained from regressing the percentage of private ownership on ln taxpayer density, and the estimated coefficient is -4.894 with a p-value of 0.000.

Table C1. Canton Characteristics and Missing registries

	Percentage of Missing Villages				
	(1)	(2)	(3)	(4)	(5)
Ln taxpayer density	-0.347				
	(0.316)				
Rice-growing land (%)		0.005			
		(0.026)			
Coastal canton			0.625		
			(1.156)		
Having national road				0.224	
				(0.997)	
Uncleared land (%)					0.007
					(0.021)
Constant	5.544***	5.715**	6.014***	6.086***	6.040***
	(0.727)	(2.259)	(0.569)	(0.636)	(0.640)
R^2	0.004	0.000	0.001	0.000	0.000
Observations	251	251	251	251	251

Note: Ordinary least squares estimator, robust standard errors are in parentheses. The sample includes all cantons in the first 12 provinces listed in table 1.
* p<0.1, ** p<0.05, *** p<0.01

Table C2. Outliers and Cluster Standard Errors

	Percentage of Private Ownership in the Cultivated Area					
	Outliers			Cluster Standard Errors		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln taxpayer density	-8.423***	-8.801***	-10.517***	-4.894**	-5.901**	-5.861*
	(1.324)	(1.877)	(2.218)	(1.906)	(2.817)	(2.986)
Control variables	NO	YES	YES	NO	YES	YES
Province fixed effects	NO	NO	YES	NO	NO	YES
R^2	0.170	0.181	0.484	0.072	0.097	0.415
Observations	199	199	199	251	251	251

Note: Ordinary least squares estimator, robust standard errors (columns 1 to 3) and standard errors clustered at the district level (columns 4 to 6) are in parentheses. The sample includes all cantons in the first 12 provinces listed in table 1. Columns 1 to 3 drops 52 cantons with 100% private land ownership. Control variables include the percentage of rice-growing land in the cultivated area, being a coastal canton, having a national road passing through, the percentage of uncleared land in the total area, and a constant.
* p<0.1, ** p<0.05, *** p<0.01

Table C3. Fractional Response Models

	Fraction of Private Ownership in the Cultivated Area					
	Logit			Probit		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln taxpayer density	-0.044***	-0.054***	-0.050***	-0.046***	-0.056***	-0.049***
	(0.010)	(0.013)	(0.013)	(0.010)	(0.013)	(0.014)
Control variables	NO	YES	YES	NO	YES	YES
Province fixed effects	NO	NO	YES	NO	NO	YES
Observations	251	251	251	251	251	251

Note: Average marginal effects, robust standard errors are in parentheses. The sample includes all cantons in the first 12 provinces listed in table 1. Control variables include the percentage of rice-growing land in the cultivated area, being a coastal canton, having a national road passing through, the percentage of uncleared land in the total area, and a constant.
* p<0.1, ** p<0.05, *** p<0.01

The ***eabh* Working Papers Series** (***eabh* Papers**), launched in 2014, gives scholars in banking, financial, business, and economic history and related fields the opportunity to distribute their research-in-progress. Making these findings available to a wider audience, even at an early stage, supports authors' search for qualified feedback, makes their work visible to international audiences, and increases their research's impact. These are important steps towards publication in a top-ranking scientific journal.

eabh offers

- 'Light-touch editing': ensuring that basic scholarly standards are met. Papers may be sent to outside experts for advice.
- Language editing (papers must be submitted in English): ensuring that a basic English language level is met.
- Copyediting in line with the RePEc standards.
- Promotion through our international network and listing of papers in relevant on-line databases.

Submission

Submissions should go to Ms Carmen Hofmann (c.hofmann@bankinghistory.org)

Series Co-Editors

Andrea Papadia, Bonn University

Chenzi Xu, Stanford University

Further information

Submission guidelines and a full list of *eabh Papers* are available from the *eabh* website (http://bankinghistory.org/publications/eabh-papers/)