LAND AND PEASANTS IN LATE IMPERIAL CHINA:
AN ECONOMIC ANALYSIS

by

He Yang
A Dissertation
Submitted to the
Graduate Faculty
of
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in Partial Fulfillment of
The Requirements for the Degree
of
Doctor of Philosophy
Economics

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Land and Peasants in Late Imperial China: An Economic Analysis

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

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DEDICATION

This is dedicated to Professor Yoram Barzel who gave birth to my intellectual life.
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LAND AND PEASANTS IN LATE IMPERIAL CHINA: AN ECONOMIC ANALYSIS

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George Mason University, 2013

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The dissertation is organized around a common theme, the institutions of serfdom in late Imperial China. The dissertation consists of three chapters that investigate the following questions: 1) How did the structure of land tax determine landownership? 2) How did land tenure evolve in response to external changes in agricultural technology? 3) How did the competition for corvée labor between local governments and private landlords shape serfdom? The first two chapters examine serfdom from the new institutional economics perspective, studying contractual arrangements between the landlords and the serfs within a manor. The third chapter studies serfdom from the public choice perspective, discussing the fiscal interaction between local governments and private landlords.
The dissertation is organized around a common theme, the institutions of serfdom in late Imperial China. The first two chapters of the dissertation examine serfdom from the new institutional economics perspective, studying contractual arrangements between the landlords and the serfs within a manor. The third chapter studies serfdom from the public choice perspective, discussing the fiscal interaction between local governments and private landlords.

The first chapter discusses a voluntary contractual arrangement between landlords and dependent tenants under dual landownership in late Feudal China. Under dual landownership, landlords became subsoil owners and tenants became topsoil owners. Dual landownership emerged when serfdom was declining. During this period, peasants were no longer bound to land and had partial ownership (topsoil right) of land. However, they still had obligations to provide monetized corve (ground rent) to their landlord.

I hypothesize that dual landownership acted as a tax shelter for heavily taxed peasant households who colluded with lightly taxed gentry households to maximize the value of land. In the later phase of feudalism, the social status of peasants enhanced after serfdom had declined. But inequalities between peasants and landed elites still existed. Inequality was reflected in tax rate differentials faced by different social classes. Gentry households faced lower tax rates than peasant households. Peasant households had better farming skills. Thus gentry households had a “comparative advantage” in tax reductions and the peasants households had a “comparative advantage” in day-to-day farm management. To best utilize their “comparative advantage” and maximize the value of land, the peasants and
the gentry entered into a perpetual lease which assigned the former the full responsibility of farm management and assigned the latter the full responsibility of tax payment. The perpetual lease defined the peasants as topsoil owners and the gentry as subsoil owners.

The second chapter is essentially about how technological advances gradually weakened serfdom. During the Ming and Qing Dynasties, fixed-rent tenancy gradually replaced sharecropping as the dominant form of land tenancy in China. One of the consequences of the institutional change was weakened ties between serfs and landlords. Under sharecropping arrangement, serfs were more closely supervised and directed by landlords. Under fixed-rent contracts, serfs had more discretion in agricultural productivities and the role of landlords in agriculture faded.

I argue that the shift in land tenancy was generated by the technological movement from annual cropping to multiple cropping. The more intensive technology created greater responsibility for serfs. To test the hypothesis I exploit a dataset constructed from the rent collection archives of Confucius's Lineage in the Qing Dynasty. I find that double cropped plots were 30% more likely to use fixed-rent contracts compared with annually cropped plots. The findings are consistent with the factor market imperfections theory. Double cropping placed greater demands on managerial abilities of tenants. In the absence of a factor market for managerial ability, fixed-rent contract provided tenants with a greater incentive to supply managerial inputs than share contract.

The third chapter proposes a political economy theory on serfdom from the perspective of public finance. Viewing serfdom as the unofficial sector of a feudal society, our model characterizes the fiscal competition for corve labor and tax revenue between local governments (the official sector) and private landlords (the unofficial sector). Rational peasants could choose optimally to be independent peasants in the official sector or serfs in the unofficial sector. The model predicts that a larger fraction of peasants would enter the unofficial sector when the government-imposed was heavy and local public goods provision in the official sector was inadequate. We further study the fiscal interaction between the central authority and the unofficial sector. Our model suggests that for the ruler to allow serfdom to exist, the rent that private landlords could effectively exact under serfdom must be greater than the direct tax revenue that the ruler gives up by allowing peasants to voluntarily enter the unofficial sector.
We provide case studies from the Qing Dynasty as qualitative evidence. In the first case study, we discuss the tanding rumu tax reform that merged corvée quota into land tax launched in mid-Qing Dynasty. We argue that one consequence of the abolition of corvée was the decline of serfdom and increasing mobility of free peasants. As our model predicts, after the state abolished peasants’ corvée obligations in the official sector, serfs who had to provide corvée to private landlords would switch into the official sector. Thus serfdom was abolished. In the second case study, we discuss serfdom under the native chieftain system. Although serfdom was officially abolished in most of China by the mid-Qing Dynasty, it remained the dominant institution under the native chieftain system in ethnic communities and frontier areas. We argue that serfdom was more enduring in these areas because native chieftains were more efficient in supplying protection and justice than local governments to indigenous peasants, due to cultural barrier and religious diversity.

In conclusion, the methodology of the whole dissertation is an economic analysis based on rational choice models. Economics, I believe, is a powerful tool to study Chinese history. The conventional methods of research used by Chinese historians focused on the role of elites while largely ignored the role of commoners. How did commoners behave in history? What was the role of average people in Chinese history. My dissertation tries to reconstruct Chinese history from the perspective of average Chinese peasants.
DUAL LANDOWNERSHIP AS TAX SHELTER: 
HOW DID THE CHINESE SOLVE RICARDO’S PROBLEM?

“Rent often belongs to those who, after many years of toil, have realised their gains, and expended their fortunes in the purchase of land or houses; and it certainly would be an infringement of that principle which should ever be held sacred, the security of property, to subject it to unequal taxation.”

– David Ricardo

2.1 Introduction

Rules of tenure define how property rights to land are to be allocated. The basic economic efficiency criterion for land-use allocation is land value maximization. In an agrarian society, the value of agricultural land is determined by two factors, agricultural productivity and land tax. On the one hand, those with the best farming skills are able to generate the highest output, but may face high land tax rates. On the other hand, those who have political power often enjoy tax privilege, but may not have good farming skills. Therefore, how should property rights be efficiently allocated under the conflicting conditions? This is a problem David Ricardo was concerned with.¹

This paper provides a solution to Ricardo’s problem that had been used in China from

¹In *On the Principle of Political Economy and Taxation*, David Ricardo wrote: “And if it be considered, that land, regarded as a fit subject for exclusive taxation, would not only be reduced in price, to compensate for the risk of that taxation, but in proportion to the indefinite nature and uncertain value of the risk, would become a fit subject for speculations, partaking more of the nature of gambling, than of sober trade, it will appear probable, that the hands into which land would in that case be most apt to fall, would be the hands of those, who possess more of the qualities of the gambler, than of the qualities of the sober-minded proprietor, who is likely to employ his land to the greatest advantage.”
the late Ming Dynasty till the Communist land reform. The solution is dual landownership\textsuperscript{2}. Under dual landownership, land was divided into subsoil (\textit{tian di}) and topsoil (\textit{tian mian}). Subsoil properties and topsoil properties were separately sold or collateralized in the land market. Subsoil properties tended to be owned by lightly-taxed gentry households who took the responsibility of paying the land tax\textsuperscript{3}. Topsoil properties tended to be owned by heavily-taxed commoner (peasant) households who managed day-to-day farming. While subsoil owners held the official land titles, they did not interfere with agricultural production, but rather collected a ground rent from topsoil owners.

Economic historians use the concept of the agricultural ladder to describe the hierarchy of a land tenure system from wage laborers at the lowest rung, to sharecroppers and tenants on intermediate rungs, and to sole owners at the top rung (Alston and Ferrie 2008). The Chinese dual owner system stands between fixed-rent tenancy and sole ownership. Although the collection of a fixed ground rent makes dual ownership appear as an ordinary fixed-rent tenancy, dual ownership differs from fixed-rent tenancy on several major aspects: First, topsoil owner was not subject to eviction threat as long as the ground rent was paid. Second, once the ground rent was set between the topsoil owner and the subsoil owner, it could never be increased. Third, subsoil owners were not responsible for land improvement.

Interestingly, the Chinese way to solve Ricardo’s problem was an application of the Ricardoian principle of comparative advantage. In the Qing Dynasty, households were divided into gentry households and commoner (peasant) households. Gentry households enjoyed tax privileges, but did not have good farming skills. While gentry households had a comparative advantage in tax reductions, peasant households had a comparative advantage in farm management. To maximize the value of land, the peasants and the gentry entered into a perpetual lease which assigned the former the full responsibility of farm management and assigned the latter the full responsibility of tax payment. The perpetual lease defined the peasants as topsoil owners and the gentry as subsoil owners.

I hypothesize that dual ownership acted as a tax shelter for heavily taxed peasant households who colluded with lightly taxed gentry households to maximize the value of land\textsuperscript{4}.

\textsuperscript{2}Some scholars use the concept “One field Two Masters” System. Some call it secondary landlordism system.

\textsuperscript{3}The concept of gentry refers for a social class called shenshi or shenjin, meaning variously degree-holders, literati, scholar-bureaucrats or officials.

\textsuperscript{4}It should be noted that tax shelter was not only sought by commoners, but also by lower-ranked gentry
To explain the mechanism of the hypothesis, I construct a simple model and discuss the conditions that give rise to dual ownership. The separation of topsoil and subsoil arises if the peasant becomes the sole residual claimant of agricultural production and the gentry becomes the sole residual claimant of tax payment. The model has an important implication: The dual owner system exhibits separation of ownership and control. The operation of topsoil is completely independent from the ownership structure of subsoil. Under the dual ownership system, topsoil owners are responsible for land improvement and agricultural investment. According to the Fisher Separation Theorem, regardless of the ownership structure of subsoil, topsoil owners can make optimal investment decisions. Thus, the dual owner system did not impede agricultural investment.

To test the tax shelter hypothesis, I exploit a dataset constructed from the land transaction and rent collection archives of Confucius’s Lineage in the Qing Dynasty. I find that as the gentry’s comparative advantage in tax reductions declined after the standing rumu tax reform in mid Qing, peasants tended to consolidate landownership and become sole owners. Moreover, dual ownership was more likely to arise on double cropped plots than annually cropped plots due to peasants’ greater comparative advantage in managing double cropping systems.

The implication of the hypothesis contributes to an ongoing debate on whether the dual owner system was one of those complex property norms that caused the relative decline of Chinese agriculture in the preindustrial period\(^5\). Comparing the Chinese customary property norms with the Anglo-American private property system, some scholars claim that the Chinese customary tenure systems were inefficient. Brenner and Isett (2002) claim that in the Yangzi delta absentee landlords extracted high levels of surpluses from the agricultural sector but had little incentive to invest in production due to the dual owner system. Macauley (2009) argues that dual ownership provided security for tenants, but made land transactions and tax collection difficult. Objecting to this line of argument, Pomeranz

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\(^{5}\)There is a large literature along this line. For instance, some posit that the custom of partitioning on inheritance resulted in small fragmented holdings that impeded economy of scale. Huang (1985) considers the lack of managerial farming an important cause of agricultural stagnation based on the fact that most landlords were rental landlords rather than managerial landlords. Some think that the problem of Chinese property system is the restrictions on the transaction of land. Some argue that the custom of “conditional sales” (dian) that guaranteed the seller an interminable right of redemption at zero interest was the cause of inefficiency (Zhang 2011, Ellickson 2012).
(2010) responds that the Chinese property systems seem to have facilitated transfers of usage rights to those who were positioned to make the best use of the land.

More broadly, this paper is related to the literature on the role of customary tenure system and indigenous property norms in economic development. A conventional theme of this literature is that complex customary systems of land tenure, including multiple ownership and lack of official titles, are obstacles to land transactions and agricultural investment (De Soto 1989, Besley 1995, Yoo and Steckel 2010). These studies usually take the customary tenure systems as exogenously given. Following Conning and Robinson (2007), my paper shows that customary property rights can be the endogenous outcome of collective choices under certain political constraints and institutional constraints, thus may not be inefficient per se.

The paper is organized as follows: Section 2 provides the historical background of dual ownership. Section 3 summarize the literature on dual ownership. Section 4 constructs a simple model to explain the mechanism of dual ownership. Section 5 provides an empirical test of the model. Section 6 concludes.

2.2 Historical Background

2.2.1 The Dual Owner System

The separation of topsoil and subsoil had been one of the central features of the Chinese land market from the late 16th century to the early 20th century (Pomeranz 2010, Yang 1988). The dual owner system spread over China and was especially popular in the advanced areas, including much of the Yangzi delta. Due to a lack of statistics in the early periods, only limited regional estimation about the distribution of dual ownership could be obtained. In a study based on the land registration book (yu lin ce) from the Kang Xi period (1661-1722), Zhang (1988) estimated that 95% of the lands in Anhui Province had separate subsoil rights and topsoil rights. Dual landownership persisted in the Republican period and was eventually ended by the Communist Land Reform. Besides mainland China, dual ownership was also popular in the pre-British New Territories of Hong Kong and pre-colonial Taiwan. Figure 1 shows the estimated proportion of land under dual ownership in each province in
the 1930’s according to the National Land Survey\textsuperscript{6}.

Figure 1 about here.

An important feature of the dual owner system is a high level of absentee proprietorship. According to the estimation of a scholar in the 18th century, 40\% - 50\% of the landlords (subsoil owners) in the Yangzi delta lived in the cities; 30\% - 40\% lived in towns, and only 10\% - 20\% lived in villages (Bernhardt 1992). The high degree of absentee landlordism generated several problems. First, as topsoil owners lived close to their properties and subsoil owners lived in towns and cities, the shipment of in-kind rent from rural areas to urban areas involved large transportation costs. No matter who had to pay the shipment costs, this arrangement seemed to be costly\textsuperscript{7}. Second, because subsoil owners lived far away from their properties, topsoil owners could take advantage of information asymmetry and under-report harvest. Their purpose was to obtain \textit{ex-post} rent reduction by renegotiating with subsoil owners. Rent renegotiations and rent disputes were costly\textsuperscript{8}.

\subsection*{2.2.2 Tax Inequality}

In the Qing Dynasty, effective land tax rates were determined by two factors, the social status of the taxpayer and the transaction costs of tax collection. The higher the social status of a taxpayer, the lower the effective tax rate he faced\textsuperscript{9}. The higher the transaction costs of tax collection, the higher the effective tax rate.

Different social classes faced different effective land tax rates. Gentry households were closely connected with official hierarchy and enjoyed preferential effective tax rates\textsuperscript{10}. Land tax was comprised of two parts, the grain tax and the \textit{di-ding} quota (labor services). Gentry households had lower rates than commoner households in both the grain tax and the di-

\textsuperscript{6}The figure was likely to have underestimated the proportion of dual ownership, especially in the Southern provinces. The estimation excluded leases that did not stipulate contract duration. However, in South China, many perpetual leases didn’t specify contract duration. These contracts were in fact dual ownership contracts.

\textsuperscript{7}If the contract stipulated that the topsoil owner was responsible for shipping the rent, why didn’t the topsoil owner contract with someone living closer to the property? If the subsoil owner was responsible for collecting the rent from rural areas to the cities, why didn’t he move closer to his own properties and manage the land by himself?

\textsuperscript{8}In extreme cases, rent disputes might develop into rent-resistance movements.

\textsuperscript{9}After 1750, the amount of tax a landowner paid was determined by the product of a fixed land tax quota and effective tax rate. Amount of land tax = Land tax quota \times effective tax rate (Wang 1973).

\textsuperscript{10}The gap between the rates of gentry households and commoner households varied widely among districts.
ding quota\textsuperscript{11}. For instance, in the mid 19th century, commoner households in the Suzhou area paid the grain tax three to four times higher than the gentry households. In northern Jiangsu, some gentry households were exempted from grain tax payment, but the commoners paid 6,000-7,000 cash per shi. Table 1 demonstrates the inequality of the \textit{di-ding} quota between gentry households and commoner households in several counties from different provinces in the 1900’s:

Table 1 about here.

Besides the social status of taxpayers, variations in the transaction costs of tax collection also generated inequality of effective rates between urban areas and rural areas. The backward conditions in transportation made the costs of tax collection differ between urban areas and rural areas. In the Qing dynasty, local governments were located in urban areas. To enforce tax payment in the countryside, local governments set up rural tax collection stations to ship the grain tax to the cities. The additional enforcement costs and shipping costs in the countryside were borne by the taxpayers living in those areas. Therefore, rural areas had higher tax rates than urban areas.

Table 2 about here.

2.3 Literature

2.3.1 Theories about the Origin of Dual Ownership

Chinese historians have proposed various theories to explain the historical origins of dual landownership, ranging from the initial partition of property rights over uncultivated lands, financial stress, to rent default prevention(Yang 1998).

The first theory emphasizes the initial partition of property rights over uncultivated lands. A supportive evidence is the prevalence of dual ownership in newly cultivated areas\textsuperscript{12}. The rationale of the hypothesis is that landownership was initially divided between

\textsuperscript{11}Reported land area and land grades can be manipulated, and were often affected by the social status of taxpayers. It was not uncommon for powerful gentry landowners and large lineages to bribe tax officers to under-report the size and grade of their lands. The underpaid tax quota due to tax fraud was transferred to smaller landowners and made the inequity in collection rates even greater.

\textsuperscript{12}See Tao Wu, New Form of Dual Ownership and Land Tenure Relations in Qing Jiangnan, for a discussion on the increasing distribution of dual ownership after the Taiping Rebellion. Another well cited evidence
landowners and tenants in the process of cultivation. Instead of cultivating the land by themselves, landowners rented out the land to tenants. Conditional on land improvement, topsoil right was ceded to tenants as compensation for their labor input and fixed investment\(^\text{13}\). Two issues arise from this analysis: First, why didn’t the cultivators claim the land by themselves since there was no regulation that prohibited them from being landowners\(^\text{14}\)? Second, subsoil owners could not increase rent unless they purchased the topsoil right from the topsoil owners. Why didn’t subsoil owners have the incentive to purchase topsoil right and gain from the increased yields after soil was improved?

The financial stress theory argues that peasants who initially had sole ownership of land sold subsoil right to gentry under financial stress. As a result, owner-cultivators “deteriorated” into topsoil owners. Supportive evidence is found in land mortgage contracts: Subsoil right was sold by peasants who initially had sole ownership of land. However, this theory does not explain why peasants sold subsoil right but kept topsoil right, not vice versa.

The rent default prevention theory claims that to prevent rent default problems landlords required tenants to pay security deposit. The security deposit arrangement evolved into the purchase of topsoil. As the amount of security deposit rose, tenants acquired more control of land. Eventually, tenants became topsoil owners when the amount of security deposit equaled the price of topsoil. This theory, however, cannot explain why tenants didn’t climb further up the tenancy ladder and became the sole owner of land.

The above three theories discuss the initial assignment of property right by analyzing three approaches to separate topsoil and subsoil: The first assumes that the gentry and the peasant divided the ownership of an initially uncultivated parcel. The second assumes that the peasant initially had sole ownership and ceded the subsoil right to the gentry. The third assumes that the gentry initially had sole ownership and ceded the topsoil right to the peasant. According to the Coase Theorem, regardless of the initial assignment of property right, the resource should end up with the party who can use it most efficiently, if there are no impediments to bargaining. Therefore, the problem with these theories is that they fail

\(^{13}\) In many tenancy contracts found in Taiwan, tenants were required to have their own farming tools and draft cattle to be qualified as cultivators.

\(^{14}\) A Taiwanese historian Wu Congmin noticed that “It seems that the only thing the subsoil owners needed was the land title... It wasn’t difficult to obtain the land title. Why didn’t the topsoil owners apply for the title by themselves?”
to explain why the separation of topsoil and subsoil prevailed as an efficient arrangement between the peasant and the gentry.

To put it differently, the problem with these theories is the same with some of the hypotheses in the literature on British open fields— they do not explain why the institution persisted for hundreds of years. As McCloskey (1980) points out: “…studying the origin of open fields or of anything else is antiquarianism unless it is accompanied by evidence connecting the origin with persistence.” Thus, what needs to be explained is the persistence of dual landownership despite the transaction cost of rent collection, i.e. the cost of shipping grain rent from rural areas to cities and the cost of rent disputes.

### 2.3.2 The Credit Constraint Theory

Before elaborating on the tax shelter hypothesis, there is still one more alternative hypothesis that needs to be addressed— the credit constraint hypothesis. Topsoil owners did not climb up the agricultural ladder to acquire sole ownership because of the credit constraint. The rationale is that subsoil owners can be viewed as investors who provided finance to agricultural production. Gentry households had a comparative advantage in accessing the credit market as opposed to peasant households. Therefore, gentry households became investors (subsoil owners) and peasant households became farm managers (topsoil owners). The hypothesis seems plausible, as it is well known that credits in preindustrial China were prohibitively expensive\(^\text{15}\). Rather than the previous hypotheses that emphasize the origin of dual ownership, this one deals with the persistence issue. However, several problems with this hypothesis should be pointed out.

First, why did dual landownership emerge in late Imperial China rather than earlier times? And why was dual landownership more popular in advanced areas rather than backward areas? Presumably credits were more expensive in earlier times and in more backward areas. Secondly, it is not always true that subsoil owners were wealthier and had better access to credit market than topsoil owners. In fact, it was a common practice that wealthy merchants who had lower political status and faced relatively high land tax rates, sold or “donated” large quantities of their land to privileged gentry families for tax evasion.

\(^\text{15}\)Credit costs were on the order of 10% per month or 100% per year—in effect ten to twenty times higher than in Europe (Rosenthal and Wong 2011).
purpose. These merchant landowners had no problem in accessing credit market. Rather, they chose to remain topsoil owners to avoid the tax burden. Finally, the mortgage loan market of topsoil and subsoil functioned well in advanced areas. All sorts of mortgage loan contracts in land financing have been found in recent years. These evidence weakens the credit constraint hypothesis.

2.4 Theory

2.4.1 The Tax Shelter Hypothesis

I hypothesize that dual landownership persisted because it acted as a tax shelter for heavily taxed peasant households who colluded with lightly taxed gentry households to maximize the value of land\textsuperscript{16}. The rationale of the hypothesis follows Barzel (1997) on divided ownership: The value of agricultural land is determined by agricultural productivity and land tax payment. While peasant households had a comparative advantage in agricultural production, gentry households had a comparative advantage in tax reductions. To maximize the value of land, the peasants and the gentry entered into a perpetual lease which assigned the former the full responsibility of farm management and assigned the latter the full responsibility of tax payment. Because of the non-traded farming skills\textsuperscript{17} of the peasant and the non-traded social status of the gentry\textsuperscript{18}, the dual owner system best utilizes the peasant’s comparative advantage in farm management and the gentry’s comparative advantage in tax reductions. Thus the dual owner system enabled the peasant class and the gentry class to jointly maximize the land value under unequal taxation. The hypothesis explains not only why subsoil owners tended to be gentry households, but also why subsoil owners tended to be urban dwellers. As section 2.2 points out, there were tax rate differentials between cities and villages due to the transaction costs of tax collection in the countryside.

The dual owner system has a substitute institutional arrangement that also took advan-

\textsuperscript{16}To form a tax shelter by establishing a coalition between a heavily taxed party and a lightly taxed party has a long history in China. According to \textit{Song Hui Yao Ji Gao}, in the Tang Dynasty, heavily taxed landowners colluded with the lightly taxed noble families by entering a rental contract, to avoid the tax burden. This suggests that dual ownership may have even existed in the Song Dynasty.

\textsuperscript{17}Eswaran and Kotwal (1986) emphasize that the selection of tenancy of contract depends on market imperfections, such as non-traded farming skills.

\textsuperscript{18}Some may argue that purchase of offices provided a channel for commoners to become gentry. But it should be noted that the costs of purchasing offices were often beyond the means of a peasant.
tage of tax rate differentials—tax brokerage (bao lan). Tax brokerage was an underground arrangement between a gentry broker and commoner taxpayers. On the one hand, the gentry broker paid land taxes on behalf of the commoners or other less privileged proprietors in exchange for a brokerage fee. On the other hand, the gentry broker bargained with local government officials to obtain a lower tax rate. This practice, executed at the expense of the tax revenues of local governments, was largely illegal (Bernhardt 1992). Banned by the government, the arrangement of tax brokerage involved higher risk than the dual owner system. Due to the risk of transaction, the duration of a tax brokerage contract should be shorter than that of a dual ownership contract. This is true because dual ownership is in fact a perpetual lease.

The dual owner system is analogous to today’s corporate tax shelter in a number of ways: First, just as a corporate tax shelter lacks any significant economic substance in production, a subsoil owner performed no substantial role in day-to-day farm management. Second, just as a corporate tax shelter is designed to be replicated multiple times for use by different participants, a subsoil owner contracted with multiple topsoil owners for tax shelter practices. Third, just as a corporate tax shelter relies on the use of tax-exempted parties to deflect tax liability from the taxable party, dual ownership relied on the tax privilege of gentry to deflect tax liability from commoners.

### 2.4.2 A Model

This section presents a simple model to describe the mechanism of the tax shelter. Consider a mutual agreement over the operation of a parcel between a peasant and a gentry who seek to jointly maximize the value of the parcel. We assume that the value of the parcel is determined by agricultural productivity and land tax. The gentry and the peasant both supply effort to manage the parcel and to lower the tax payment. The set-up of the model largely follows the double-sided moral hazard model in Bhattacharyya and Lafontaine (1995), but adds tax payment as an additional dimension.

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19 Even though the government knew that dual ownership also generated losses of tax revenue, dual ownership was legal most of the time. The tolerance towards dual ownership was probably due to the difficulty to distinguish perpetual lease from ordinary fixed-rent tenancy.

20 The reason for using a static model rather than a dynamic model is to focus on the mechanism of tax inequality. A dynamic model would place a lot of emphasis on eviction threat and renewal of contract, which is not the focus of this paper. Since this is not a dynamic model, we cannot distinguish permanent tenancy from ordinary fixed-rent tenancy.
Agricultural output is given by \( F(e, l) \). The first argument is the managerial input (effort) of the peasant, while the second argument is the managerial input (effort) of the gentry. Regular Inada conditions hold that \( F(0, l) = F(e, 0) = 0 \), \( F'_e > 0 \), \( F'_l > 0 \), \( F''_e < 0 \) and \( F''_l < 0 \). The effective tax burden is measured by \( T_0 - T(r, \tau) \), where \( T_0 \) is a default lump sum tax, and \( r \) is the effort of peasant in reducing tax, and \( \tau \) is the effort of gentry in reducing tax. We could think about the effort as under-report of land area and grade, petition to local governments for tax reduction, or participation in a protest against tax burden. Similarly, we assume \( T'_r > 0 \), \( T'_\tau > 0 \), and \( T''_r < 0 \), \( T''_\tau < 0 \).

The gentry and the peasant agree on a rent distribution scheme \( \{R, \alpha\} \), where \( R \geq 0 \) is a fixed amount paid by the peasant to the gentry, and \( \alpha \) is the share of rent allocated to the gentry. They share the tax burden by distribution scheme \( \beta \). The peasant will pay a tax equal to \( T_0 - \beta T(r, \tau) \).

For managerial input \( e \) and \( r \), the peasant suffers a disutility \( c(e) \) and \( s(r) \). \( c'(e) > 0 \), \( s'(r) > 0 \) and \( c''(e) > 0 \), \( s''(r) > 0 \). Analogously, the gentry suffers from disutility \( C(l) \) and \( S(\tau) \) for managerial efforts he puts in. For simplicity, we assume all inputs can be infinitely supplied.

We can write the gentry’s problem as:

\[
\max_{l, \tau, \alpha, \beta} R - T_0 + \alpha F(e, l) + \beta T(r, \tau) - C(l) - S(\tau) \\
\text{s.t.} \ (1 - \alpha)F(e, l) - R + (1 - \beta)T(r, \tau) - c(e) - s(r) \geq u_0, \\
\quad (1 - \alpha)F'_e - c'(e) = 0, \\
\quad (1 - \beta)T'_r - s'(r) = 0.
\]

Without loss of generality, we assign the initial land title to the gentry. The gentry’s problem in the above program involves his or her input \( \{l, \tau\} \) and a distribution scheme \( \{\alpha, \beta\} \). The gentry maximizes his or her share of from the land yielding net of the tax quota he or she is responsible for. The equation \( (1 - \alpha)F(e, l) - R + (1 - \beta)T(r, \tau) - c(e) - s(r) \geq u_0 \) describes the participation constrain of the peasant (IR). The other two equations with respect to \( e \) and \( r \) characterize the peasant’s best response to the distribution scheme \( \{\alpha, \beta\} \) (IC). Following Bhattacharyya and Lafontaine (1995), we obtain the following optimal distribution scheme:

\footnote{We do not impose any constraint on the value \( T(\infty, \infty) \). When the inputs are large, \( T_0 - T(r, \tau) \) can be negative. In this case, government subsidize a region hit by famine.}
\[ \alpha^* = \frac{(F'_e)^2[(1-\alpha^*)F''_e - c''(e)]]}{(F'_e)^2[\alpha^* F'_e - c''(e)] + (F'_e)^2[(1-\alpha^*)F''_e - c''(e)]}; \]

\[ \beta^* = \frac{(T'_r)^2[(1-\beta^*)T''_r - s''(r)]}{(T'_r)^2[\beta^* T'_r - S''(\tau)] + (T'_r)^2[(1-\beta^*)T''_r - s''(r)]}. \]

To establish the result straightforwardly, we assume that both agricultural production and tax reduction follow the Cobb-Douglas technology, i.e.

\[ F(e,l) = e^\theta l^{1-\theta} \] (0 < \theta < 1),

and

\[ T(r,\tau) = r^\sigma \tau^{1-\sigma} \] (0 < \sigma < 1). Here \( \theta \) is the output elasticity of the peasant and \( 1 - \theta \) is the output elasticity of the gentry. Similarly, \( \sigma \) is the tax reduction elasticity of the peasant, and \( 1 - \sigma \) is the tax reduction elasticity of the gentry. Moreover, the disutility functions are convex,

\[ c(e) = \frac{m_1 e^2}{2}, \quad C(l) = \frac{m_2 l^2}{2}, \quad s(r) = \frac{n_1 r^2}{2}, \quad \text{and} \quad S(\tau) = \frac{n_2 \tau^2}{2}. \]

Then the share allocated to the gentry in equilibrium is:

\[ \alpha^* = \frac{1}{1 + \sqrt{\frac{\theta(1+\theta)}{(1-\theta)(2-\theta)}}} \] \hspace{1cm} (2.1)

\[ \beta^* = \frac{1}{1 + \sqrt{\frac{\sigma(1+\sigma)}{(1-\sigma)(2-\sigma)}}} \] \hspace{1cm} (2.2)

1. When \( \alpha \to 0 \) and \( \beta \to 1 \), land would be completely divided into topsoil and subsoil. That is, the peasant becomes the sole residual claimant of agricultural production and the gentry becomes the sole residual claimant of tax payment. This occurs when \( \theta \to 1 \) and \( \sigma \to 1 \): the peasant has a comparative advantage in increasing productivity and the gentry has a comparative advantage in reducing tax burden.

2. When \( \alpha \to 1 \) and \( \beta \to 1 \), the gentry owns the right to both topsoil and subsoil. This happens when the gentry has a significant advantage in both farm management and tax exemption: \( \theta \to 0 \) and \( \sigma \to 1 \).

3. When \( \alpha \to 0 \) and \( \beta \to 0 \), the peasant has sole ownership of the parcel. This happens when the peasant has significant comparative advantage in farm management and tax exemption.

4. Finally, when \( 0 < \alpha < 1 \) and \( 0 < \beta < 1 \), the optimal scheme features the traditional sharecropping: each of the two parties obtains a share of the agricultural output and pays a share of the tax\(^{22}\).

Now I turn to the comparative static. I analyze the impact of the following on the ownership structure: (a) the effect of variations in the relative elasticity of the peasant’s managerial effort. (b) the effect of variations in the relative elasticity of the peasant’s tax

\(^{22}\)The case that \( \alpha \to 1 \) and \( \beta \to 0 \) is unlikely, as it would imply that the gentry specializes in cultivation and the peasant specializes in paying the tax.
reduction effort. I then move on to discuss an important implication of the model - the separation of ownership and control.

**Proposition 1.** *Ceteris paribus, landownership should be increasingly divided into topsoil and subsoil as the relative elasticity of peasant’s managerial effort increases.*

This is a straightforward implication of equations (1) and (2): As $\alpha$ converges to 0 and $\beta$ converges to 1, the ownership of land would be increasingly divided into topsoil and subsoil. This happens when the relative elasticity of the peasant’s managerial effort $\theta$ is close to 1. The implication is that the ownership of land is more likely to be divided, if the peasant’s managerial effort has a greater impact on the value of the land.

This prediction is supported by two facts. The first is that dual ownership was more often observed on paddy fields than cotton fields, because the irrigation and daily maintenance of paddy fields required the peasant to supply more intensive managerial effort (Bernhardt 1992). The second fact is that landownership was more likely to be divided under multiple cropping system, because multiple cropping systems required greater managerial effort than annual cropping systems. Section 5 provides a test about this.

**Proposition 2.** *Ceteris paribus, landownership should be increasingly divided into topsoil and subsoil as the relative elasticity of peasant’s tax reduction effort decreases.*

Similarly, when the tax reduction elasticity of the gentry $(1 - \sigma)$ is close to 1, the peasant would put little effort in dealing with the land tax. The peasant and the gentry then specialize in the business they each have comparative advantage in.

This prediction is supported by the evidence that dual ownership was observed on “polder land” (cao tian) but not on “sandy land” (sha tian) in the regions adjacent to rivers or lakes. Polder land, enclosed by a high and thick hard-packed mud wall, was fully cultivated and subject to taxation. Sandy land was newly claimed land on emerging floodplain that was not yet subject to taxation. Compared with polders, the relative importance of peasants’ tax evasion effort in operating sandy land is greater, because peasants could more easily hide information about the size of sandy lands due to the uncertainty of floods. Therefore, dual landownership was more likely to be found on polder land.

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23 A land survey in the county of Changsha, Suzhou and Wuxi found that dual ownership widely existed on polder lands but not on sandy fields (He 1977, Page 33042).
Proposition 3. *The division of subsoil and topsoil exhibits separation of ownership and control.*

When the division of labor occurred as described above, subsoil owners did not interfere with agricultural production even though they held the official land titles. It was the topsoil owners who operated production and made investment. Dual ownership exhibits separation of ownership and control. According to the Fisher Separation Theorem, topsoil owners should be able to make investment decisions that maximize the present value of agricultural production, independent of subsoil owners’ preferences. This implication is supported by two facts, subdivision of subsoil and consolidation of topsoil.

Subsoil properties were often subdivided and jointly owned by multiple subsoil owners. Bernhardt (1992) finds that a subsoil owner’s “subsoil portfolio” consisted of many “shares” of subsoil properties dispersed over a broad area\(^{24}\). The dilution of subsoil ownership could increase rent collection cost and generate collective action problems among subsoil owners. However, the benefit of joint ownership is to align the interests of subsoil owners in dealing with rent disputes, a problem getting increasingly rampant in late Qing Dynasty. To deal with rent-resistance problems, the allied subsoil owners jointly hired bailiffs or later organized “rent bursaries” to collect rent.

Despite the complex subsoil ownership structure, topsoil owners had incentives to consolidate adjacent topsoil properties to achieve economy of scale. Evidence is found in topsoil contracts: In the Ming and the Qing Dynasties, all parcels were assigned with unique registration numbers by the local tax offices. Adjacent parcels had consecutive registration numbers. Based on the registration numbers specified in the topsoil contracts, I find that adjacent topsoil properties were often purchased together. In support of my finding, Chao (2006) notices that in Jiangsu Province, peasants purchased fragmented topsoil properties from different absentee landowners to consolidate the topsoil properties\(^{25}\). For instance, 10 topsoil owners in Changzhou County were managing topsoil properties leased by 48 absentee landowners in the year of 1676.

Sometimes topsoil owners sublet their properties instead of cultivating the land by them-

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\(^{24}\)For instance, a family surnamed Qu owned land scattered over 60 percent of Pinghu Country. And between 1772 and 1886, a landlord family of Yuanhe County purchased 490 small separate plots (totally 990) located in forty different polders. (Page 17).

\(^{25}\)Note that the name of the topsoil contract is *pi tian yue*, which means whole sale land contract. The name could mean that several top soil properties were being sold together.
selves. This type of topsoil owner was called secondary landlord. Secondary landlords charged a fixed topsoil rent from the subtenants. They were managers of farms who looked for subtenants, intervened with agricultural production, evicted shirking cultivators and made agricultural investments. Consequently, secondary landlords lived close to their properties to supervise production. The sublease between secondary landlords and subtenants usually had short durations. In this scenario, the Fisher Separation Theorem still holds, since secondary landlords’ management decisions were independent of subsoil owners’ preferences. Which social classes were likely to become secondary landlords? Wealthier commoner households who had better access to credit market than poor peasant households but faced higher tax rates than gentry households were likely to become secondary landlords. The presence of secondary landlords suggests that the operation of farm was further divided into agricultural production, finance of capital and tax payment. If wealthier commoners’ comparative advantage in providing finances was not large enough, there would not have been a separate class of secondary landlords arising from topsoil owners.

2.5 An Empirical Test: Dual Landownership on Confucius’s Manors

This section uses data constructed from the archives of Confucius’s Lineage in Shandong to test the first two propositions of the model: 1) As the gentry’s comparative advantage in tax reductions declined after the tax reform in mid Qing, commoners started to consolidate ownership and became sole owners. 2) Dual ownership was more likely to arise on double cropped plots than annually cropped plots due to peasants’ greater comparative advantage in managing double cropping systems.

Confucius’s Lineage was one of the most prestigious feudal landlord in Chinese history. In the Qing Dynasty, the lineage possessed the largest private rural estate (min tian) in China. They were also controlling large amount of public land (guan tian). There were two types of manors operated by the lineage, private manors and public manors. Private

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26see Tan (1993), Sandy Land in the Pearl delta of the Qing Dynasty.
27Their properties were located in four provinces (Shandong, Henan, Zhili and Jiangsu).
28In 1705, there were 5,014 tenants working on the public land in the city of Qufu. In 1760, the number of tenants increased to 10,243. The Shandong Provincial Government, official Info base of Shandong Province. See http://www.infobase.gov.cn/bin/mse.exe?seachword=&K=a&A=71&run=12 (accessed on 05/15/2012)
manors were taxed at rate lower than the prevalent rate faced by commoners. Public manors were tax-exempted.

Both sole ownership and dual ownership existed on private manors and public manors. Dual ownership takes the form of perpetual fixed-rent tenancy contract. Three features help us identify a dual ownership contract: 1) The tenants paid a large sum of “security deposit” that was equivalent to the price of topsoil. 2) The tenants paid a ground rent that was said to be fixed for “a thousand years”; 3) The tenants could sublet and transfer their holdings without the permission of the lineage; 4) The tenants could decide cropping systems and crop mix. The lineage’s sole ownership takes the form of share tenancy. Under share contract, the lineage provided seeds, draft animals, and farming tools. The lineage aided with production and took half of the output at harvest. If the tenants shirk, the lineage can evict the tenant. The tenants could not transfer their holdings without the lineage’s permission. Thus, sharecropping characterizes the lineage’s sole ownership of land.

2.5.1 The Impact of Tax Reforms on Dual Ownership

The tanding rumu tax reform in the middle of the Qing Dynasty significantly reduced the tax rate differential between the gentry and the commoners. The tax reform abolished informal taxes and surcharges, lowered peasants’ tax burden and reduced tax evasions of wealthy gentry households. The reform was initiated by the Yongzheng Emperor in 1723, but did not finish until 1883 in some regions, due to local resistance. In the districts of Confucius’s Manors, the tanding rumu tax reform was launched in 1742 under the reign of Emperor Qianlong (1711-1799). The reform lowered the tax burden of commoners and reduced the tax privilege of Confucius’s decedents. The low tax rates lasted through the end of Qianlong Period.

The model predicts that as the gentry’s comparative advantage in tax reduction fell after the tax reform, the topsoil owners had an incentive to consolidate ownership and become

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29 The land tax rates faced by commoners in Shandong Province during the late 19th century were as follows: In Heze County, the di-ding tax was 0.026 tale per mu and rice 0.38 sheng per mu. In Donghe County, 0.029 tale per mu and 0.71 sheng per mu. In Yutai, 0.024 tale per mu, and rice 0.13 shen per mu. The private manors had a lower di-ding tax. The manors enjoyed a tax reduction at 9 li per mu. See Lai Huimin, Imperial Power and Nobilities in the Qing Dynasty, page 125)

30 This paper does not investigate the details of the tanding rumu tax reform. For a description of the reform, see Kent Deng, Fact or Fiction? Re-examination of Chinese Premodern Population Statistics http://eprints.lse.ac.uk/22353/1/wp76.pdf
the sole owners of land. That is because, if the land tax collected by the state fell below the
ground rent collected by the lineage, the topsoil owners would have an incentive to terminate
the perpetual lease with the lineage and switch to pay land tax to the state.

Just as the model predicts, Confucius’s Lineage started to dispose of the subsoil properties to less privileged households immediately after the tax reform. The disposal of subsoil properties lasted through the end of the Qianlong period due to the persisting low tax policy. Since private manors were subject to taxation and public manors were tax-exempted, the lineage’s comparative advantage in tax reduction of private land declined faster than of public land. Subsoil properties from private manors should be sold. Table 3 lists the information on subsoil transactions recorded in the archives of land transactions of the lineage.

Table 3 about here.

Under the reign of Emperor Jiaqing (1796-1820), a series of tax evasion and appropriation scandals in Shandong Province were disclosed in 1806-1809\textsuperscript{31}. Corruption and budget deficit in Shandong was so serious that the emperor investigated into the tax collection systems of Shandong and required the local governments to balance the budget. Consequently, the local governments reassessed tax base and increased land taxes across the province. Large quantities of unregistered land were discovered and incorporated in the tax base. The reform reduced peasants’ comparative advantage in tax evasion by increasing the monitoring intensity of tax collection.

As the model predicts, landownership should be increasingly divided into topsoil and subsoil as the peasants’ comparative advantage in tax evasion decreases. The land transaction documents in Confucius’s Lineage recorded such a trend: Immediately following the tax reform, commoners and lower-ranked gentry landowners ”donated” the previously unregistered land to Confucius’s Lineage to avoid the increasing tax burden in exchange for the tax shelter benefits.\textsuperscript{32}Some of the land documents specified that the increasing tax burden was the reason for donating land. This practice divided ownership into topsoil and subsoil and let the lineage become the subsoil owner.

Table 4 about here.

\textsuperscript{31}See Zhu (2001), Studies on Budget Deficit in the Jiaqing Period.
\textsuperscript{32}Presumably some of the lower-ranked gentry landowners were secondary landlords who had better access to credit market than poorer peasants.
2.5.2 The Impact of Double Cropping on Dual Ownership

Wheat-soybean double cropping began to spread in northern China during the late Ming through the early Qing period. Wheat-soybean double cropping refers to planting soybeans directly into wheat stubble after harvesting winter wheat. Double cropping requires intensive input of labor. According to the Handbook of Agriculture and Mulberry (Nong Sang Jing) written in 1705, tenants on double cropped fields need to work almost 10 months annually.

The technical know-how and managerial skills associated with wheat-soybean double cropping were more complex than annual cropping. Successful operation of the double cropping system requires peasants’ timely decisions and careful day-to-day farm management. Tenants’ proper selection of winter wheat varieties was the first step. An ideal wheat variety in a double cropping system matures early enough to permit timely establishment of soybeans, and consistently produces high yields of high-quality grain. Second, every effort must be made to get the wheat harvest and the soybeans seeded as early as possible. Soybean planting date is crucial in determining the productivity of the system. Third, the straw remaining after wheat harvest needs to be rearranged. While excessive amounts of straw can interfere with the soybean planting, some wheat stubble should be left to provide mulch cover for the soybean crop. Fourth, the proper selection of soybean varieties is crucial too. Early-maturing varieties do not yield as well as later-maturing varieties, but late-maturing varieties might not avoid the first killing freeze.

Since the relative elasticity of peasants’ managerial effort was higher under double cropping, double cropped land should be more likely to be divided into topsoil and subsoil than annually cropped land.

2.5.3 Data and Descriptive Statistics

To test the predictions, I construct a plot-level dataset from the rent collection records of eleven public manors operated by Confucius’s Lineage. Rent collection records contain information on ownership of the plot, size of plot, type of grain, amount of ground rent,

\(^{33}\)See Li Lingfu (1995) for a discussion about the history of the invention of wheat-soybean double cropping. \(^{34}\)Chao (1986) points out that “the Chinese methods of fertilization and multi-cropping are so labor consuming that they yield a considerably lower average output per man-hour than other, simpler methods of fertilization and annual cropping.”
The statistics of cropping systems on Confucius’s manors are summarized in Table 6. Except the last one, the other columns are all annual cropping systems. Table 7 summarizes the main variables.

2.5.4 The Choice of Dual Ownership

In this section, I outline a probit model to estimate the effects of cropping systems on landownership. The problem is described by the latent variable model:

$$ \text{Dualownership}_i^* = X'_i \beta_0 + \text{Doublecropping}_i \beta_1 + TaxReduction_i \beta_2 + \epsilon_i \quad (2.3) $$

$Dualownership_i^*$ is the propensity of dividing ownership into topsoil and subsoil. $Doublecropping$ is a dummy variable indicating the choice of double cropping system. $TaxReduction$ is a dummy variable indicating the period of low land tax under the reign of Emperor Qianlong. $X'_i$ is a vector of control variables, including size of a plot, natural disasters, and kinship variable $Kong$. $\epsilon_i$ is a normally distributed random error with zero mean and unit variance.

Results from the probit model are presented in Table 8:

Table 8 about here.

The regression results show that tax reduction has a significantly negative effect and double cropping has a significantly positive effect on the probability of having dual ownership on a plot. The tax reduction effect means that under the Qianlong Reign, when

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35 Since the landlords only maintained the records they were concerned about, the information on tenants was limited. I do not observe the wealth, labor input, and other household characteristics of tenants. Thus, I do not know if the topsoil owner was a secondary landlord or a topsoil cultivator.

36 I am not able to track the plots over time, since rent collection records were based on units of tenants rather than plots. Therefore, time-series data is not available.

37 I lag shock by one period since shocks in $t-1$ would affect contractual choice in $t$. 

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land tax burden of commoners was low, landownership was less likely to be divided. The double cropping effect means that when land was operated under double cropping systems, landownership was more likely to be divided. This is consistent with the prediction that as peasants’ comparative advantage in tax reductions/farm management increases/decreases, landownership tend to be more consolidated/divided. The variable size has a significantly negative effect on the probability of having dual ownership, probably because smaller plots were more likely to be divided into topsoil and subsoil due to tenants’ credit constraints. Kinship relation and natural disasters don’t have significant effect on landownership.

2.5.5 Omitted Variable Bias

In this section I consider the possibility that the adoption of wheat-soybean double cropping is endogenous to land ownership due to omitted variable bias. Tenant’s idiosyncratic managerial ability is not directly observable. The sample doesn’t provide good proxy on tenant’s managerial ability. On the one hand, managerial ability could affect the decision to double crop the land. On the other hand, managerial ability could also have impact on ownership. A tenant with better managerial ability may need less managerial directions and aids from landlords, thus more likely to become independent topsoil owner.

In this section, I outline a bivariate probit model that allows for the possibility of endogeneity. Suppose the tenant decides to double crop by comparing costs and benefits using a net benefit function or latent index that is linear in covariates and excluded instruments, with a random component or error term, \( \mu_i \). The determination of Doublecropping can be specified as:

\[
\text{Doublecropping}^*_i = X_i'\gamma_0 + Z_i\gamma_1 + \mu_i
\]  

\( Z_i \) is an instrumental variable that increases the benefits of adopting wheat-soybean double cropping system. The tenant will double crop the plot if the net benefits of double cropping exceed the threshold.

38 Another potential source of missing variable bias is the unavailability of proxy for soil quality. I do have information on the quality of lands under perpetual fixed-rent contract, but I don’t observe the quality of lands under share tenancy contract. The amount of ground rent was based on the quality of soil. There were three types of soils: top-quality soil, medium-quality soil and low-quality soil. It seems natural to assume that high-quality soils were more suitable for double cropping. But I find that many low-quality plots adopted double cropping as well. Therefore, I think that the missing variable on soil quality under share tenancy would not generate serious bias in the results.
cropping are positive: $Doublecrop^*_i > 0$. Following the latent variable model in equation (3), an outcome of our primary interest is the choice of ownership. The model is identified by assuming that $Z_i$ is independent of these components, and that the random components are normally distributed. Hence, $E[\mu_i] = E[\epsilon_i] = 0$, $\text{var}[\mu_i] = \text{var}[\epsilon_i] = 1$ and $\text{cov}[\mu_i, \epsilon_i] = \rho$. The exogeneity condition is stated in terms of the correlation coefficient $\rho$. The null hypothesis is $\rho = 0$. If we fail to reject the null hypothesis, then we can conclude that the dummy variable $Doublecropping$ is exogenous and the probit model (3) is the appropriate specification.

This bivariate probit system is identified if the instrument $Z_i$ is correctly chosen. I choose the price of wheat as the instrumental variable\(^{39}\). If the price of wheat is a valid instrument, then (1) it must be a determinant of the cropping system, but (2) it must not be a determinant of ownership, i.e., it must not be correlated with the error term $\epsilon_i$. It is straightforward to show that it meets the first criterion. If the price of wheat goes up, tenants would have an incentive to increase wheat-soybean double cropping. In a simple probit model that explains the probability of adopting wheat-soybean double cropping technology, the t-statistic on $Wheat Price$ is 3.44. Thus the credibility of our bivariate probit results turns on our assumption that the price of wheat did not directly impact divided ownership. Wheat price might impact the value of land. But it seems unclear how the increase in the value of land would affect landownership.

Table 9 summarizes the estimation results using wheat price as the instrumental variable. Robust standard errors are clustered at the tenant level. The probit estimates from Table 8 are replicated for comparison.

\(^{39}\)I do not choose soybean price as the instrument, because soybean was much cheaper than wheat. Soybean was an ideal complementary crop for wheat, because soybean, like most legumes, perform nitrogen fixation that can raise the fertility of land.

The likelihood ratio test suggests that the Null hypothesis is rejected at the 1 percent level of significance. This implies that double cropping is correlated with $\epsilon_i$ and therefore endogenous. The bivariate probit regression shows that double cropping has a statistically positive effect on choosing dual ownership after accounting for the endogenous choice of cropping system. The effects of tax reduction and other controls remain similar.
2.5.6 Robustness Check

In this section, I perform a robustness check. I compute results from a more restricted sample: Since paddy fields were more likely to be divided into topsoil and subsoil (see Proposition 1), I am not fully sure if including paddy fields would bias the estimation of the effect of wheat-soybean double cropping. Thus, I exclude paddy fields from the sample. Table 10 summarizes the estimation results from the restricted sample. Again, the probit estimates from Table 8 are replicated for comparison. Table 10 shows that after excluding paddy fields from the sample, the estimation results remain similar.

Table 10 about here.

2.6 Conclusion

A conventional theme of the literature on customary land tenure is that multiple ownership and complex tenure systems are obstacles to agricultural development. By studying the persistence of dual landownership in preindustrial China, I hypothesize that complex property norms could be the endogenous outcome of collective choice under institutional constraints, thus may not be inefficient. Dual ownership acted as a tax shelter for heavily taxed peasants who colluded with lightly taxed gentry to maximize the value of land.

This study has an implication about landholding patterns in Chinese history. Historians have painted two conflicting pictures about landholding patterns in the Ming and the Qing Dynasty. One school of historians claim that in the most advanced areas of China, land was largely concentrated in the hands of the rich and powerful\(^\text{40}\). The majority of peasants were landless and impoverished by rent extraction. The other school of historians reverse this statement. They argue that the majority of independent peasant households owned small fragmented parcels. My study reconciles the conflicting views by showing that subsoil properties were largely possessed by gentry families; small topsoil properties were held by the majority of peasants. These two ownership patterns should not be mixed together.

\(^{40}\)The often cited Confucian scholar Gu Yanwu (1613-1682) described land concentration in the area near Suzhou in the seventeenth century: “Only one out of ten people is a landowner. The other nine people are tenants.” In 1704 Emperor Kangxi (1661-1772) made a similar estimation on landownership in his country: “Lands are owned by the rich and powerful... Only thirty or forty percent of people own land. The rest of them are renters.”
The second implication of the theory challenges the conventional view that China had few managerial landlords in the Ming and the Qing Dynasties. Some scholars consider the lack of managerial farming an important cause of "agricultural stagnation". Their evidence is that most landlords in the advanced areas were rental landlords who extracted surpluses from the agricultural sector but had little incentive to invest in production. This paper shows that secondary landlords (topsoil owners) were in fact managerial landlords. The concept of managerial landlord should include not only landlords who hired wage labor on the farm, but also secondary landlords who sublet their topsoil properties. These secondary landlords provided finance to production, supplied farming tools, supervised subtenants, and made agricultural investment. Some of them consolidated large quantities of topsoil properties to grow cash crops. Some of them rented vast uncultivated areas, divided the properties into small parcels and sublet the parcels to individual peasants. Therefore, secondary landlords played an important role in expanding production and adopting new technologies.

The third implication is that subsoil owners were in fact tax farmers. Tax farming is the principle of assigning the responsibility for tax revenue collection to private citizens or groups. Subsoil owners owed a fixed land tax quota to the state and paid tax out of the rent revenue they collected from peasants. The tax rate differentials enabled subsoil owners to earn commissions from the tax farming practice. However, the risk of rent default was also borne by the tax farmers. The risk of tax farming increased as rent-resistance movements became more rampant in the mid-late Qing Dynasty.

Last but not least, the tax shelter hypothesis also sheds light to current property right issues in China. Nowadays some firms in the private sector are called "red hat enterprises". The term "red hat" means that the firm can obtain a collective or state license for production and operations by paying administrative fees to the collective unit of local government organization (especially TVEs). After paying these fees, private owners are able to evade government prohibitions, surcharges and ideological harassment on their firms. The operational efficiency of these red hat firms is often higher than their counterpart in the public sector. Just as the peasants who colluded with the gentry to obtain a tax shelter, these red hat firms collude with the TVEs to obtain a shelter to evade surcharges and fees.
Figure 2.1: The ratio of plots under dual ownership in the 1930s, by province

Table 2.1: Inequality of Effective Tax Rate between Social Classes

<table>
<thead>
<tr>
<th>Province and District</th>
<th>Commoner’s Effective Tax Rate/Gentry’s Effective Tax rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shui-an County (Zhejiang Province)</td>
<td>1.56-1.65</td>
</tr>
<tr>
<td>Chenghou County (Fujian Province)</td>
<td>1.3-1.86</td>
</tr>
<tr>
<td>Anchi County (Fujian Province)</td>
<td>1.31</td>
</tr>
<tr>
<td>Longchi County (Fujian Province)</td>
<td>1.20</td>
</tr>
<tr>
<td>Shanghang County (Fujian Province)</td>
<td>1.20</td>
</tr>
<tr>
<td>Kushi County (Honan Province)</td>
<td>1.18-1.69</td>
</tr>
<tr>
<td>Kaiyuan Country (Fengtian Province)</td>
<td>1.63</td>
</tr>
<tr>
<td>Tianling County (Fengtian Province)</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Source: The figures are calculated from Table 2.2, in page 40 of Wang Yejian’s Land Taxation in Imperial China, 1750-1911.
Table 2.2: Inequality of Land Tax Rate between Urban and Rural Areas in Fujian Province

<table>
<thead>
<tr>
<th>District</th>
<th>Rural Tax Rate/Urb. Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yongfu County</td>
<td>1.01</td>
</tr>
<tr>
<td>Nanping County</td>
<td>1.07</td>
</tr>
<tr>
<td>Shunzhang County</td>
<td>1.37</td>
</tr>
<tr>
<td>Zhangding County</td>
<td>1.03</td>
</tr>
<tr>
<td>Yongan County</td>
<td>1.01</td>
</tr>
<tr>
<td>Guihua County</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Source: The index was calculated from Table 2.3, Wang, 1973, p. 41

Table 2.3: Transaction of Manorial Land of Confucius’s Lineage in the Qianlong period

<table>
<thead>
<tr>
<th>Year</th>
<th>Manor</th>
<th>Type of Manor</th>
<th>Size of land (mu)</th>
<th>Fees (tales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1743</td>
<td>Meihua</td>
<td>Private</td>
<td>50</td>
<td>5,000</td>
</tr>
<tr>
<td>1767</td>
<td>Meihua</td>
<td>Private</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>1770</td>
<td>Yangjialou</td>
<td>Private</td>
<td>908</td>
<td>-</td>
</tr>
<tr>
<td>1787</td>
<td>Yangjialou</td>
<td>Private</td>
<td>15.6</td>
<td>112.32</td>
</tr>
<tr>
<td>1788</td>
<td>Yangjialou</td>
<td>Private</td>
<td>196.73</td>
<td>1120.73</td>
</tr>
<tr>
<td>1789</td>
<td>Yangjialou</td>
<td>Private</td>
<td>90</td>
<td>612</td>
</tr>
<tr>
<td>1792</td>
<td>Yangjialou</td>
<td>Private</td>
<td>1275.57</td>
<td>2178.94</td>
</tr>
</tbody>
</table>

Source: Lai Huimin, Imperial Power and Nobilities in the Qing Dynasty, p. 148.

Table 2.4: Land Donated to Confucius’s Lineage in the Jiaqing Period

<table>
<thead>
<tr>
<th>Year</th>
<th>Identity of Donor</th>
<th>Size of Land (mu)</th>
<th>Type of Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>1810</td>
<td>Commoner</td>
<td>-</td>
<td>Riverbank Land</td>
</tr>
<tr>
<td>1811</td>
<td>Commoner</td>
<td>300</td>
<td>Waste Land</td>
</tr>
<tr>
<td>1812</td>
<td>Lower-ranked Gentry</td>
<td>500</td>
<td>Riverbank Land</td>
</tr>
<tr>
<td>1812</td>
<td>Lower-ranked Gentry</td>
<td>700</td>
<td>Waste Land</td>
</tr>
<tr>
<td>1812</td>
<td>Lower-ranked Gentry</td>
<td>600</td>
<td>Sandy Land</td>
</tr>
<tr>
<td>1812</td>
<td>Lower-ranked Gentry</td>
<td>500</td>
<td>Sandy Land</td>
</tr>
<tr>
<td>1812</td>
<td>Lower-ranked Gentry</td>
<td>-</td>
<td>Sandy Land</td>
</tr>
<tr>
<td>1817</td>
<td>Lower-ranked Gentry</td>
<td>-</td>
<td>Unregistered Meadow</td>
</tr>
</tbody>
</table>

Source: Selected Historical Archives of Kong Fu, Qufu, vol. 6.
Table 2.5: Sample Size

<table>
<thead>
<tr>
<th></th>
<th>Manor</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1759-1788</td>
<td>Junchengchang, Qiwang, Da</td>
<td>207</td>
</tr>
<tr>
<td>1789-1818</td>
<td>Qiwang, Da, Xiaoqiwang</td>
<td>277</td>
</tr>
<tr>
<td>1819-1848</td>
<td>Nanchi, Shijing, Quantou</td>
<td>121</td>
</tr>
<tr>
<td>1849-1878</td>
<td>Nanchi, Zhangyang</td>
<td>158</td>
</tr>
<tr>
<td>1879-1901</td>
<td>Anji, Chunting, Qiwang, Hetao, Da, Nanchi, Zhangyang</td>
<td>475</td>
</tr>
<tr>
<td></td>
<td><strong>Total N = 1,238</strong></td>
<td></td>
</tr>
<tr>
<td>Size (acre)</td>
<td>Millet</td>
<td>Sorghum</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>s.d.</td>
<td>0.66</td>
<td>1.10</td>
</tr>
<tr>
<td>Number of plots under sole ownership</td>
<td>90</td>
<td>127</td>
</tr>
<tr>
<td>Number of plots under dual ownership</td>
<td>90</td>
<td>127</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>289</td>
<td>172</td>
</tr>
</tbody>
</table>

Table 2.6: Cropping System Statistics
### Table 2.7: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Ownership</td>
<td>=1 if land operated under dual ownership</td>
<td>0.578</td>
<td>0.014</td>
</tr>
<tr>
<td>Double Cropping</td>
<td>=1 if land was double cropped</td>
<td>0.280</td>
<td>0.449</td>
</tr>
<tr>
<td>Tax Reduction</td>
<td>=1 if under the reign of Qianlong</td>
<td>0.379</td>
<td>0.014</td>
</tr>
<tr>
<td>Size</td>
<td>Size of a holding (in mu)</td>
<td>2.250</td>
<td>0.077</td>
</tr>
<tr>
<td>Kin Tenant</td>
<td>=1 if kin tenant</td>
<td>0.117</td>
<td>0.321</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>=1 if there was a natural disaster in that year</td>
<td>0.402</td>
<td>0.491</td>
</tr>
<tr>
<td>Wheat Price</td>
<td>Wheat price in tale/cang shi</td>
<td>206.87</td>
<td>61.239</td>
</tr>
<tr>
<td>Tax Reduction</td>
<td>=1 if under the reign of Qianlong</td>
<td>0.379</td>
<td>0.014</td>
</tr>
</tbody>
</table>

N = 1,238

The minimum and maximum values for all variables except plot size and wheat price are zero and one, respectively. The minimum value of plot size is 0.011, and the maximum value is 24.948. The minimum value of wheat price is 127.25, and the maximum value is 579.17.
Table 2.8: The Probability of Dual Ownership on a Plot

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Cropping</td>
<td>0.385</td>
<td>0.642</td>
</tr>
<tr>
<td></td>
<td>(0.097)***</td>
<td>(0.132)***</td>
</tr>
<tr>
<td>Tax Reduction</td>
<td>-3.083</td>
<td>- 2.958</td>
</tr>
<tr>
<td></td>
<td>(0.130)***</td>
<td>(0.168)***</td>
</tr>
<tr>
<td>Size</td>
<td>-0.674</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.063)***</td>
<td></td>
</tr>
<tr>
<td>Size$^2$</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)***</td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>-0.051</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.214)</td>
<td></td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.208)</td>
<td></td>
</tr>
<tr>
<td>Manor Dummy</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>County Dummy</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constant</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Number of obs</td>
<td>1,238</td>
<td>1,217</td>
</tr>
</tbody>
</table>

***significantly different from zero at 1 percent level; ** significant at 5 percent level; * significantly different from zero at 10 percent level. Robust standard errors are clustered at the tenant level.
Table 2.9: The Probability of Dual Ownership on a Plot: Bivariate Probit

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>single probit</th>
<th>bivariate probit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Dependent Variable:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was a plot operated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>under dual ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or sole ownership?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Cropping</td>
<td>0.385</td>
<td>0.642</td>
</tr>
<tr>
<td></td>
<td>(0.097)***</td>
<td>(0.132)***</td>
</tr>
<tr>
<td></td>
<td>(0.130)***</td>
<td>(0.168)***</td>
</tr>
<tr>
<td>Size</td>
<td>-0.674</td>
<td>-0.534</td>
</tr>
<tr>
<td></td>
<td>(0.063)***</td>
<td>(0.071)***</td>
</tr>
<tr>
<td>Size^2</td>
<td>0.030</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>(0.003)***</td>
<td>(0.003)***</td>
</tr>
<tr>
<td>Kong</td>
<td>0.333</td>
<td>0.214</td>
</tr>
<tr>
<td></td>
<td>(0.0208)</td>
<td>(0.293)</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determinants of Double Cropping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Price</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.0007)***</td>
<td>(0.0007)***</td>
</tr>
<tr>
<td>Size</td>
<td>0.075</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>(0.032) **</td>
<td>(0.031)***</td>
</tr>
<tr>
<td>Size^2</td>
<td>-0.004</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Kong</td>
<td>-0.056</td>
<td>-0.065</td>
</tr>
<tr>
<td></td>
<td>(0.147)</td>
<td>(0.144)</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>-0.036</td>
<td>-0.042</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>Manor Dummy</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>County Dummy</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disturbance Correlation

| ρ                      | -0.892        | -0.804           |
|                        | (0.070)       | (0.130)          |

Number of obs. 1225 1204 1225 1204

LR test for ρ = 0 χ²(1) = 17.901, p = 0.0000

χ²(1) = 9.123, p = 0.0025

*** significantly different from zero at 1 percent level; ** significantly different from zero at 5 percent level; * significantly different from zero at 10 percent level. Robust standard errors are clustered at tenant level.
### Table 2.10: Robustness Check

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Full Sample</th>
<th>Full Sample Excluding Paddy</th>
<th>Excluding Paddy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Cropping</td>
<td>0.385</td>
<td>0.642</td>
<td>0.819</td>
</tr>
<tr>
<td></td>
<td>(0.097)***</td>
<td>(0.132)***</td>
<td>(0.131)***</td>
</tr>
<tr>
<td>Tax Reduction</td>
<td>-3.083</td>
<td>-2.958</td>
<td>-3.627</td>
</tr>
<tr>
<td></td>
<td>(0.130)***</td>
<td>(0.168)***</td>
<td>(0.228)***</td>
</tr>
<tr>
<td>Size</td>
<td>-0.674</td>
<td>-0.525</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.063)***</td>
<td>(0.671)***</td>
<td></td>
</tr>
<tr>
<td>Size²</td>
<td>0.030</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)***</td>
<td>(0.003)***</td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>-0.051</td>
<td>-0.336</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.214)</td>
<td>(0.229)</td>
<td></td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>0.333</td>
<td>0.504</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.208)</td>
<td>(0.096)***</td>
<td></td>
</tr>
<tr>
<td>Manor Dummy</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>County Dummy</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constant</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Number of obs 1,238 1,217 1,056 1,035

***significantly different from zero at 1 percent level; ** significant at 5 percent level; * significantly different from zero at 10 percent level. Robust standard errors are clustered at tenant level.
3.1 Introduction

China’s population grew massively in its preindustrial period - increasing from roughly 120 to 150 million in the late Ming (c. 1620) to 350 million c. 1800. Throughout this period, China was able to accommodate the increasing population whilst maintaining agricultural production per capita more or less stable. During the years that China’s population increased so dramatically (1740-1850), China’s arable land increased only 8.5 percent. To maintain living standards the Chinese were under great pressure to find new ways of extracting more food per hectare. Double cropping, intercropping, seed-bedding and transplantation were methods for economising land (Maddison, 2007).

While the dramatic increase in agricultural output per acre in pre-industrial China has been established as consensus among China historians, debates about the stagnation of agricultural technology are going on. According to Huang (2002), growth in Chinese agriculture took the form of “involution” that exhibits technical stagnation and stagnation in output per person in 1800. That is, growth arose from the more intensive application of traditional techniques, such as fertilizing, weeding and seeding. Pomeranz (2000) argues that agriculture in England and the Yangzi delta in 1800 was roughly comparable. Perkins (1969) explains that most of the rise in yields have resulted from greater capital and labor inputs in conditions of a stagnant technology, even though there was an increase in the proportion
of double cropped land and adaptation of new crops from the Americas. Maddison (2007) points out that Perkins’ definition of technical change was too narrow, as the long term “improvement in average practice and a successful effort to absorb and adapt knowledge” should also be recognized as technical progress. Li (1998) and Goldstone (2003) discuss the facts and evidence that the expansion of agricultural intensification, such as double cropping and intercropping, greatly increased labor productivity and released labor from agriculture.

This paper adds to the agricultural stagnation debate by providing new micro level empirical evidence. We exploit a novel dataset from the rent collection archives preserved by Confucius’s Lineage in Shandong Province from 1759 to 1901. The dataset features a quasi-experiment- the adoption of wheat-soybean double cropping, which remains an important production technology in northern China today. As far as we know, this project was the first attempt at studying plot-level agricultural activities in pre-industrial China. In line with Angus Maddison’s view on technical progress, we also recognize wheat-soybean double cropping as a new agricultural technology. Wheat-soybean double cropping began to spread in northern China during the late Ming through the early Qing period. Three hundred years later or so, American agricultural experts report that “double cropping soybeans and small grain (primarily wheat) constitutes a relatively new but rather extensively used production technology in the southeastern United States” (Marra and Carlson, 1987, Beuerlein, 2001). If wheat-soybean double cropping was viewed as a new production technology in 20th century America, there is no reason not to recognize it as a new technology in 17th century China.

What was the institutional response to the new agricultural technology? Using land tenure information, we assess the effects of technological change on agricultural contractual choice. We find that fixed rent contracts were more likely to be chosen than share contracts after the risky production technology, wheat-soybean double cropping, was adopted. By making the tenants residual claimants, the landlord delegated more decision rights to the tenants under the fixed-rent arrangement. The decision rights that were delegated to the tenants include sublet option, flexible rent payment methods and co-plowing option. These findings contribute to the large empirical literature on agricultural tenancy (see Braido, 2006 for a review of this literature). The main focus of this literature has been the optimal

---

1 See Lingfu Li (1995) for a discussion about the timing of invention of wheat-soybean double cropping.
choice of contractual forms under various types of risk events, transactions costs and agency problems.

Standard agency theories posit a negative trade-off between uncertainty and incentive. That is, optimal tenancy contracts should balance incentives and insurance on environment with moral hazard (see, for example, Stiglitz, 1974, Holmstrom, 1979). Share contracts display lower incentive power than fixed-rent contracts, since share tenants receive only a fraction of the total output and fully bear the costs of many inputs. Nevertheless, share contracts provide better risk-sharing mechanism between the landlord and the tenant in an uncertain environment. The productivity loss under sharecropping arrangements would be compensated by the welfare gain of sharing risk.

However, insurance and incentives are not the only motives to explain the design of tenancy contracts. Prendergast (2002) argue that the value of a tenant’s managerial effort and entrepreneurial activities is much higher in risky environments. Risky farming activities would be associated with contracts with high incentive power. This prediction is in sharp contrast with those based on insurance. This strand of literature posits that landlords tend to delegate responsibility to tenants in risky environment since the role of entrepreneurship in response to uncertainty is important\textsuperscript{2}. For example, Rao (1971) examines the frequency of renting versus sharecropping for rice and tobacco farmers in Andhra Pradesh. Although rice yields are characterized by much less uncertainty than tobacco yields, rice farmers are less likely to have fixed rent contracts than tobacco farmers. Rao argues that it is because the marginal return to effort in response to price uncertainty is lower in rice than in tobacco. However, Rao’s paper didn’t account for endogeneity issues. To be more specific, differences in risk aversion, which typically are not controlled for in the empirical analyses due to the absence of data, might explain why more risk averse tenants select safer markets as well as contracts with lower-powered incentives\textsuperscript{3}.

Our paper overcame this limitation. We show that after accounting for the endogenous heterogeneity in tenants’ risk attitudes, there’s a positive relationship between risk and incentive. We recognize that unobservable risk attitudes might be correlated with contractual

\textsuperscript{2} The delegation theory has also been applied to empirical research on the boundary of firm and franchise recently.

\textsuperscript{3} See Ackerberg and Botticini (2002) for an explanation based on endogenous matching and some corroborating evidence in the context of sharecropping.
choice and cause omitted variable bias. If more risk averse tenants were less likely to choose
the risky double cropping technology over the traditional technology, they might also want
more risk sharing with the landlord. To deal with the endogeneity issue, we use a bivariate
probit model that allows for these possibilities to depict two decision mechanisms: 1) How
was the decision to double crop made? 2) Which factors determined contractual selection
in the context of the double-cropping quasi-experiment? It turns out that the overall ef-
fect of the wheat-soybean double cropping technology on contractual choice, controlling for
omitted variable bias, was to raise the proportion of fixed-rent contracts. Thus, our findings
support the delegation hypothesis rather than the standard agency theory.

The other interesting finding is the role of kinship in contractual choice. Using family
names as the indicator for kinship, we find that plots managed by kin tenants were more
likely to have fixed rent contracts. Kinship ties may reduce the possibility of using threat
of eviction as an incentive device. The higher the social distance between the tenant and
landlord, the less the tenants might be secure about renewal of the contract, and this may
give extra incentive to use resources more intensively and to work harder to qualify for
contract renewal (Kassie and Holden, 2007). Lacking the threat of eviction as a credible
incentive device, the landlord might use higher-powered incentive contracts with the kin
tenants. This explanation is in contrast with the hypothesis that kinship ties guarantee
more trust between the landlord and the tenant, and therefore reduces the moral hazard
problem in sharecropping (Sadoulet, et al.1997).

The paper is organized as follows. Section II provides a discussion of institutional back-
ground of land tenancy in Confucius’s lineage and historical background of wheat-soybean
double cropping. Section III describes the data and statistics. Section IV outlines the con-
ceptual framework and the hypotheses for test. Section V presents the empirical strategy
and regression results. Section VI provides more qualitative evidence. VII offers concluding
remarks.
3.2 Historical Background

3.2.1 History of Double Cropping

As early as the Period of Spring and Autumn (chun qiu zhan guo, 722BC-481BC), Chinese peasants began to practice crop rotation and apply manure to maintain land fertility. Based on the production technology of crop rotation and shortened crop seasons, double cropping system was invented in the Han Dynasty (206 B.C. - 220 A.D.).

Double cropping took various forms: wheat-rice, early ripening rice-late ripening rice (zao dao-wan dao), and wheat-bean double cropping, etc. Not all regions were suitable for double-cropping. Whether a region could adopt this agricultural production technology largely depends on its natural conditions, such as temperature, type of soil, irrigation conditions, and land fertility, etc. For instance, soils in Tianjin were overall rocky and sandy. Double cropping could hardly develop in Tianjin. Secondly, different regions are suitable for different double cropping systems. Wrong crop combinations could result in decrease in yields and fertility of land. Wheat-rice and the early ripening rice/late ripening rice combinations were prevalent in southern China, because growing rice demands better irrigation, warm weather, and sufficient fertilizers that southern provinces can provide. Northern China mainly adopted wheat related double cropping systems that were suitable to cold and dry weather. Thirdly, the diffusion of double cropping took place at different paces across China. For instance, wheat-rice double cropping has become common in the Jiangnan area since the late 10th century. Wheat-soybean double cropping didn’t appear in northern China until the late Ming to the Early Qing period. As explained by agricultural historians, the regional adoption rates depended on population density, which corresponded with Boserup’s theory (Boserup, 1993). Population density wasn’t high enough until the Qing Dynasty in many northern provinces, therefore the diffusion of double cropping in the north was much slower. In contrast, the more populous southern provinces adopted double cropping much earlier.

Intensive input of labor during the harvest and seeding seasons was required for the double cropping system. The harvest and seeding seasons could create labor shortage problem.

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4 Chinese historians have been debating about when double-cropping was invented. The earliest written records seem to show that double cropping already existed in the Han Dynasty. However, some scholars argue that it wasn’t invented until the Tang Dynasty or Song Dynasty (See Li Lingfu, 1995).

5 See, for example, Liang Jiamian (1989), Chinese History of Agricultural Science and Technology, pp. 341.
Chao (1986) points out that "the Chinese methods of fertilization and multi-cropping are so labor consuming that they yield a considerably lower average output per man-hour than other, simpler methods of fertilization and annual cropping". According to the Handbook of Agriculture and Mulberry written in 1705, tenants on double cropped fields need to work for almost 10 months annually. Abundant rural labor force was a crucial factor for intensive cultivation and fertilization.

The focus of this research is wheat-soybean double cropping in Shandong Province. Wheat was the main crop in most double cropping systems because it was one of the few crops that can endure the cold winter in the north and its price was higher than many coarse crops. After trials and errors, Chinese peasants figured that late maturity varieties of soybeans were the ideal complementary crop with wheat as it had shorter cropping season and contained sufficient amount of Nitrogen, which can raise the fertility of land and save the fertilizer costs. According to agricultural books, all soybean varieties were seeded in March and April before the Ming Dynasty. This schedule had conflicts with the cropping season of winter wheat which was not harvested until May. Since the late Ming Dynasty, new cultivation methods and new soybean variety made summer seeding possible, paving the way for wheat-bean double cropping.

### 3.2.2 Risk and Cost of Double Cropping

Even though double-cropping was potentially a profitable system, high costs, time constraints, intensive labor input and high risk had to be taken into account. Switching from single cropping to double cropping, the schedule of agricultural activities had to be completely adjusted to suit the new farming activities. It would take years for peasants to figure out the best schedule of seeding, fertilization and harvest. Thus double cropping incurred a fixed amount of information and knowledge acquisition cost. Beuerlein (2001) has summarized the crucial conditions for double cropping from today’s Ohio farmers’ practices. These procedures have been followed by Chinese peasants for hundreds of years. First, the soybean planting date is critical in determining productivity of the system. At the time of

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6See Pu Songling’s Handbook of Agriculture and Mulberry.
7Li Lingfu (1995) explains why summer millet wasn’t the ideal second crop after wheat harvests. The yield of summer millets was much lower than that of summer beans. It also consumed too much fertilizer.
8Huang(1985) argues that double cropping increased crop yield by 20-25% compared with annual crops.
wheat harvest, the potential yield of soybeans is decreasing by at least one bushel per acre for each day that planting is delayed. Secondly, selecting an early-maturity wheat variety can allow for harvest five to seven days before the late variety is ready. An ideal wheat variety in a double-crop system consistently produces high yields of high-quality grain, yet matures early enough to permit timely establishment of soybeans. Every effort must be made to get the wheat harvest and the soybeans seeded as early as possible. Thirdly, the straw remaining after wheat harvest needs to be rearranged. While excessive amounts of straw can interfere with the soybean planting, some wheat stubble (12 inches) should be left to provide mulch cover for the soybean crop. Fourthly, selection of the proper soybean variety is critical. Early-maturing varieties do not yield as well as later-maturing varieties. In addition, soil moisture and weed control also play an important role in determining the yield of the system.

It was crucial to harvest wheat timely so that soybeans could be immediately seeded in late spring. Unless peasants fertilize lands adequately, land would deplete faster under double cropping systems. Weeding and pest control must be operated regularly. Hence, wheat-soybean double cropping requires very careful management. Timely reaction to emergent situations was especially important, since late response might result in the loss of both crops. The managerial effort of tenants became more valuable and shirking would have a greater impact on yields under the double cropping system than the annual cropping system.

Adoption of new technology increased the risk of production especially in the introductory period. Marra and Calson (1987) comment that "Double-cropped soybeans are usually planted thirty to fifty days later than full season soybeans and usually have lower yields and more yield variability". A recent American agricultural article says: "Planting double crop soybeans is not recommended in Michigan due to the high risk associated with this practice. However, the high soybean price has increased interest in planting soybeans after wheat harvest this summer." (Staton, 2011). With today’s technology and facilities, American farmers are still concerned about the high risk of double cropping. Chinese peasants in the Qing Dynasty worried about production uncertainties for the following reasons: Under the traditional annual cropping system, soybeans mainly grew in spring. In contrast, double cropped soybean varieties grew in summer when floods and rainstorms were much more frequent. Soybeans also suffered from more severe pest attacks in summertime than
in springtime. Due to the high soybean yield variability in bad years, the soybean output could be even lower than the soybean rent due. Moreover, the early maturity wheat varieties used in double cropping might have greater production uncertainties than later maturity varieties. For example, if planted too early, early-heading wheat varieties produce excess fall and winter vegetation, which increases the risk of plant damage and yield loss from early spring freezes. As a result, yield variability under the wheat-soybean double cropping system was higher than traditional cropping systems, which can be seen in Table 1 section III.

3.2.3 Land Tenure on Confucius’s Lands

Confucius was born near the city of Qufu in Shandong Province. The direct descendants of Confucius lived in the Kong family Mansion (Kong Fu) located in the city of Qufu for thousands of years. In the Qing Dynasty, the Kong Family was in control of the largest private rural estate (min tian), scattered in four provinces (Shandong, Henan, Zhili and Jiangsu). They were also in charge of huge amount of public land (guan tian), the rent from which was viewed as gifts from the emperors to show their great respect to Confucius. For example, the Hongwu Emperor (1328-1398), the founder and the first emperor of the Ming Dynasty, bestowed on the Kong Family 75,000 acres of public land in 1368. Their public land amounted to 135,000 acres in 1926, most of which were free of tax and duties.

In 1705, there were 5,014 tenants working on the public land in the city of Qufu. In 1760, the number of tenants increased to 10,243. Many tenants had multiple holdings scattered in different locations. It was common for a tenant to plant several types of crop at the same time. Since insurance market was absent in traditional society, diversification in crop types and scattering could be an important way to spread risk. The following map shows the distribution of holdings in a Confucius’s village, the Qiwang Village.

Confucius’s estates had three types of tenants- share tenants, fixed-rent tenants and a small number of wage employees working on self-operated lands. Some of the holdings were leased to kin tenants who paid rent at the same rate as non-kin tenants. To supervise

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91 mu=0.375 acre under the Kong Fu measurement system.
11See McCloskey (1989) for the risk spreading function of scattering.
thousands of tenants, the Kong family designated managing agents in every village, known as jiashou. Jiashou monitored farming activities as well as collected rent for the landlord. They were selected from permanent tenants whose rent was exempted as compensation for the tasks they performed. The number of supervisors was adjusted according to the number of tenants in a village so that the supervision intensity was roughly constant. After mid Qing, as the fraction of fixed-rent tenancy increased, less supervision work was needed and the role of supervisors became less important. This was reflected from the falling compensation of supervising agents.

Sharecropping contracts usually stipulated a 50-50 division between the tenants and the landlord, excluding the seeds borrowed from landlord’s storage in the previous year and its interest. After harvest, the Confucius Family sent agents into the villages to estimate the output and divide the grain. Under sharecropping arrangements, the output of both the primary crop (wheat) and the secondary crop (soybeans) were divided equally between the landlord and the tenants.

The fixed-rental on Confucius’s lands was paid after harvest, unlike the prepayment arrangements that were popular in some more developed areas in Southern China. The rent was called iron-sheet rent, which means that the landlord did not allow any rent reduction even in years of famine, drought or flood. The amount of rent was determined by the size of the holdings and the quality of soil. The holdings under the fixed-rent arrangement were classified into two types: Two crops, wheat and soybean, were grown annually in the so-called wheat land. But only one crop of millet, sorghum or some other coarse grain was planted annually in the so-called autumn land (qiu tian) (Chao,1986).

The practice of planting soybeans immediately after wheat harvest first appeared in the Confucius’s Lineage during the early Qing period. In the early experimenting period, double cropping was sporadic. Sometimes the practice would stop for a few years due to bad weather and poor soil conditions and resumed afterwards. Wheat-soybean double cropping system in Qufu wasn’t fully established until mid Qing (Tan Xu, 1995). On the wheat-soybean lands, crop rent was collected twice each year, in equal volumes of wheat and soybeans respectively. This rental convention was different from what Goldstone (2003) discusses about the rent payment method in southern China: ”Since the land rental was already paid from the primary rice crop, the entire product of the second crop (less costs of
seed and fertilizer, of course) was retained by the peasant household.” Confucius’s Family charged the same volumes of crop rent on wheat-soybean land to ensure the same incentive to grow both crops.

3.2.4 Delegation of Decision Rights

Due to the high soybean yield variability in bad years, the soybean output could be even lower than the soybean rent due. According to the rent collection books, the landlord allowed the tenants to substitute “soybean rent” with “millet rent” with a 1:1 ratio in case that the soybean harvest failed. This was an important decision right delegated to the tenants under the fixed-rent contracts, for it allowed the tenants to decide the allocation of lands for different crops.

The second decision right delegated to the tenants under fixed-rent contracts was the sublet option. Sublet was restricted under sharecropping for the convenience of supervision. However, it was allowed under fixed rent arrangements. Both the original lease holder and the sublease holder should be registered in the rent collection book if there was a sublease. With the sublet option, land could be transferred to more skillful tenants and the value of land was raised. The original lease holder also obtained some rent from the increase in the value of land.

The third decision right delegated to the tenants was the co-plowing option. There was no co-plowing case under share contracts. All thirty co-plowing cases occurred under fixed-rent arrangement. Co-tenants could be related or unrelated, judging from their last names. Several explanations for co-plowing are the following: As double cropping spread, more intense input of labor was required. When a single tenant was unable to finish all the farming work timely in a busy season, several neighboring tenants formed a cooperative. Ten out of the thirty co-plowing cases involved double-cropping. The other explanation rests on the risk-sharing hypothesis. Under fixed rent arrangement, tenants had to bear all the risk of production. Joint plowing was good for risk sharing. Under sharecropping arrangement, the landlord and the tenant bore the production risk together, so there was little need for other types of risk sharing mechanism.

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12 The mean size of co-plowed plots was 0.62 acre. The mean size of plots with a single tenant was 0.42 acre. This may suggest that the co-plowed lands were potentially divisible.
3.3 Data

A conclusive study of crop yields and land tenancy is made possible by the publication of the extensive archives of the Mansion of Confucius (Kong Fu). The archives include detailed rent collection records and grain crop reports from the farms of office land in eleven villages in the county of Qufu throughout the Qing Dynasty. Plot-level data is available from 1759 to 1901\(^{13}\). The total number of observation is 1,217. The data has a pooled cross sectional structure\(^{14}\). Rent collection records were based on individual tenant’s account that contains information about the size of plot, type of grain, amount of rent paid to the landlord, rent owed to the landlord, type of contract (share contracts vs. fixed-rent contracts). Unfortunately there is no plot-level input information in our sample. Crop yields can be obtained indirectly from the rents under share contracts, as the total output was divided equally between the landlord and the tenant.

3.3.1 Crop Characteristics

Millet, sorghum, wheat and beans were the main crops on Confucius’s lands. There were also a small number of holdings growing rice and barley. Millet had been one of the traditional crops favored by Chinese people since ancient times because of its high yield. Sorghum was popular in the north, especially in Shandong Province, not only because it can survive saline and sodic soils in the dry North, but also because the stalks can be used as building materials to repair the dikes. Wheat was viewed as the most profitable crop in the north hence very popular in northern China. There was an old saying that “One wheat harvest is as profitable as three coarse grain harvests”. The saying is proved by Figure 2 which shows the prices of the four major crops from 1759 to 1901. The price of wheat was approximately three times that of the other crops.

The following table summarizes the statistics of the four major crops, including number of plots, size of plots, number of share contracts vs. fixed rent contracts. Following Allen and Lueck (1999), we also calculate the coefficient of variation of yields of different crop types to measure the exogenous variability of yields\(^ {15}\). As Table 1 shows, double cropped

\(^{13}\)We do have many years’ rent records missing in the data.
\(^{14}\)Because the rents were recorded under the accounts of individual tenants rather than plots, we don’t have time-series data during this long period of time.
\(^{15}\)Note that yields data can only be obtained under sharecropping arrangement, not under fixed rent
wheat and soybeans had much higher coefficient of variation than annually cropped wheat and soybeans\textsuperscript{16}. The double cropping system also had higher coefficient of variation than other coarse grains\textsuperscript{17}.

Adoption of wheat-soybean double cropping was first observed around the turning of the 19th century in our sample\textsuperscript{18}. Wheat-soybean double cropping was widely adopted no later than mid 19th century, as over half of the lands were double cropped around 1850. After the adoption of double cropping, the percentage of plots growing soybeans increased dramatically, while millet and sorghum became less important. The distribution of plots growing different crops is demonstrated by Figure 3.

### 3.3.2 Tenant Characteristics

Although our data doesn’t contain information about tenants’ age and wealth, we do know their names and gender\textsuperscript{19}. Tenants with the surname "Kong" is regarded as a kin tenant. In the sample, 142 among the 1,217 tenants were kin tenants. Following the literature on the effects of kinship or caste, we study how agent’s characteristics of being a kin tenant impact contractual choice (Pandey, 2004). We create the dummy variable “Kong” to characterize kinship.

Kinship ties may reduce the possibility of using threat of eviction as an incentive device (Kassie and Holden, 2007). Lacking threat of eviction as a credible incentive device for kin tenants, the landlord could use higher-powered incentive contracts for kin tenants, making them the residual claimants. Another possibility is that kin tenants might be less risk-arrangement. We use the actual amount of rent collected under sharecropping to infer the quantity of crop yield. It’s likely that the selection bias tends to exaggerate coefficient of variation since riskier crops are more likely to be sharecropped. However, the coefficients of variation are probably biased up to the same extent for different crop types.

\textsuperscript{16}It should be noted that we only have 20 observations of annually cropped soybeans. So the statistics of soybeans may not be accurate.

\textsuperscript{17}To calculate the crop yields under the double cropping system, we simply add the volume of output of wheat and soybean crops from the same plot, although the value of output might be a better measurement. The convention of rental payment in the Confucius’s Family seems to suggest that one bushel of wheat rent was equivalent with one bushel of soybean rent and that one bushel of soybean rent was equivalent with one bushel of millet rent.

\textsuperscript{18}We indentified the first appearance of double cropping by matching the size of soybean plots with wheat plots under the same account of tenants. The year 1803 was the first year observed to have double cropping in our sample. However, due to the missing years from the late 1790’s to 1803, it’s safer to say that wheat-soybean double cropping was adopted around the turning of the 19th century.

\textsuperscript{19}It should also be noted that all the tenants in the sample are male. This all-male tenure system is quite different from the conventions in Southern China, where female tenants were not uncommon.
<table>
<thead>
<tr>
<th></th>
<th>Millet</th>
<th>Sorghum</th>
<th>Wheat</th>
<th>Soybeans</th>
<th>Wheat-Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Plots</td>
<td>289</td>
<td>172</td>
<td>287</td>
<td>21</td>
<td>148</td>
</tr>
<tr>
<td>Size (acre)</td>
<td>0.66 (0.68)</td>
<td>1.00 (0.79)</td>
<td>1.54 (1.43)</td>
<td>2.34 (0.19)</td>
<td>0.85 (0.95)</td>
</tr>
<tr>
<td>Number of Share Contracts</td>
<td>90</td>
<td>127</td>
<td>147</td>
<td>20</td>
<td>102</td>
</tr>
<tr>
<td>Number of Fixed Rent Contracts</td>
<td>199</td>
<td>45</td>
<td>45</td>
<td>0</td>
<td>245</td>
</tr>
<tr>
<td>Coefficient of Variation of Yield</td>
<td>0.50</td>
<td>0.99</td>
<td>0.522</td>
<td>0.35</td>
<td>1.36</td>
</tr>
</tbody>
</table>
averse than non-kin tenants, because the Confucius’s lineage provides insurance among its kin members and permits borrowings of larger amount to smooth the exogenous shocks (see for example, Goldstein and Sadoulet, 2002, Fafchamp and Lund, 2003, Angelucci et al., 2008, Kinnan and Townsend, 2011). However, since most of the non-kin tenants were customary tenants who were also connected with their own lineage, it’s not clear if the kin tenants of Confucius’s Family were less risk averse than the non-kin tenants20. We therefore tested two things: First, we tested if the size of holdings of kin tenants was greater than that of non-kin tenants. The t-test fails to reject the null hypothesis that the mean size of holdings of kin tenants and non-kin tenants were equal21. We then tested if kin tenants had lesser degree of scattering of holdings than non-kin tenants. Again, the t-test suggests that there was no significant difference in the degree of scattering between kin and non-kin tenants22. Therefore, we conclude that the risk attitude of kin tenants and non-kin tenants were not significantly different.

3.3.3 Aggregate Shocks

The rent collection records specify the years with bad harvest due to flood, locusts and frozen rains. Shandong Province was located at the downstream of the Yellow River where flood was a major threat in the summer. Throughout the Qing dynasty, the Yellow River changed its channel twice and created disastrous consequence to Shandong province. Moreover, the dry spring in Shandong Province made this area especially vulnerable to locusts.

Information about wars and rebellions in the 19th century was also included in the archives. Wars and rebellions were rampant in Shandong throughout the mid and late 19th century. The Opium War, the Nianjun Rebellion, the White Lotus Rebellion, and other wide spread civil wars occurred from the 1840s to the end of the 19th century. However, most of the wars had limited impact on the farming activities of Confucius’s Family in Shandong because the Mansion was under heavy military protection of the Qing Court. The emperors paid close attention to the security of the family and sent troops to protect the temples and the grave of Confucius. Following Botticini (2000), we summarize the exogenous shocks.

20The family names of the tenants concentrated on a few names and repeatedly occur, which suggests that the non-Kong tenants might also have their own clan.

21The mean size of kin tenants is 0.696. The mean size of holdings of non-kin tenants is 0.831. The t-statistic is 1.54.

22We use the number of holdings of each tenant as the proxy for scattering.
Table 3.2: Major Aggregate Shocks in Qufu, 1759 - 1901

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1759</td>
<td>Locust, Frozen rain</td>
</tr>
<tr>
<td>1803</td>
<td>Flood</td>
</tr>
<tr>
<td>1821</td>
<td>Flood</td>
</tr>
<tr>
<td>1853</td>
<td>The Nianjun Rebellion</td>
</tr>
<tr>
<td>1855</td>
<td>Flood, The Nianjun Rebellion</td>
</tr>
<tr>
<td>1881</td>
<td>Rebellions against American missionaries</td>
</tr>
<tr>
<td>1885</td>
<td>Flood, China-France War</td>
</tr>
<tr>
<td>1892</td>
<td>Flood, Frozen rain</td>
</tr>
<tr>
<td>1901</td>
<td>Tax Rebellions</td>
</tr>
</tbody>
</table>


that might have impacts on agricultural activities in Table 2. The shocks include natural disasters and wars that were recorded in the archives and provincial gazettes.

3.3.4 Changes in the Size of Holdings

While the number of tenants kept increasing, the size of holdings had been diminishing over time. Some China historians believe that population pressure was the main source of economic backwardness. For instance, the decline in man-to-land ratio was considered as the indicator for economic deterioration in China (Chao, 1986, Deng, 2000). The following table summarizes the statistics of the size of holding on a 30-year-period basis, from 1759 to 1901. It can be seen that plot size had been steadily shrinking over time as a result of increasing population.

3.3.5 Percentage of Contractual Mix

Braverman and Stiglitz (1986) posit that share contracts had advantages over other contracts which specify the level of inputs when there are environmental changes and technological changes. According to their theory, when new technology was adopted, more risk-sharing contracts should be observed. However, this was not the case in our sample. We observe that before the adoption of wheat-soybean double cropping, share contracts were the predominant

\footnote{23The mean size of holdings from 1819 to 1848 might have been biased down due to the over-representation of rice crops in this period compared with other periods. Rice plots were much smaller than plots growing other crops. Nevertheless, the overall declining trend of the size of holdings is clear.}
<table>
<thead>
<tr>
<th>Years</th>
<th>Mean (acre)</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1759-1788</td>
<td>1.506</td>
<td>1.269</td>
<td>0.311</td>
<td>9.169</td>
</tr>
<tr>
<td>1789-1818</td>
<td>1.347</td>
<td>1.258</td>
<td>0.075</td>
<td>9.356</td>
</tr>
<tr>
<td>1819-1848</td>
<td>0.505</td>
<td>0.907</td>
<td>0.013</td>
<td>5.438</td>
</tr>
<tr>
<td>1849-1878</td>
<td>0.455</td>
<td>0.562</td>
<td>0.012</td>
<td>3.75</td>
</tr>
<tr>
<td>1879-1901</td>
<td>0.477</td>
<td>0.428</td>
<td>0.004</td>
<td>2.625</td>
</tr>
</tbody>
</table>
form of contract. Fixed rent arrangements gained popularity after the new technology was adopted (see Figure 4). The increasing percentage of fixed-rent contracts seems to be a trend all over China during the Qing dynasty. As Chao (1986) puts it, “The archives of the Qing Ministry of Justice provide evidence of the decreased proportion of share tenancy contracts.” Could double cropping be one of the factors causing this pattern? Section IV attempts to answer this question.

### 3.3.6 Summary Statistics

### 3.4 Main Empirical Hypotheses

Several competing hypotheses seek to explain which factors determine agricultural contract choice, i.e. share contracts or fixed rent contracts (see Dasgupta et al, 1999 for a review of this literature). The difficulty of testing these hypotheses is to find appropriate proxies to sort out the most relevant implications since one piece of evidence can be supported by several hypotheses. For example, tenant’s wealth, a frequently used proxy for risk aversion under the risk-sharing hypothesis, is also related to the credit constraint hypotheses. Therefore, interpretation of the results should be proceeded with caution. With the quasi-experiment, adoption of double cropping, our sample is used to test two hypotheses: the standard agency hypothesis and the delegation hypothesis. Standard agency theory predicts that optimal tenancy contract should balance incentives and insurance on environment with moral hazard. Higher risk should be associated with greater probability of choosing share contracts. But the delegation hypothesis holds that the value of tenant’s managerial effort and entrepreneurial activities is much higher in uncertain environments. Risky farming activities would be associated with contracts with high incentive power. Higher risk should be associated with greater probability of choosing fixed-rent contracts.

The dichotomous variable, *doublecrop*, indicating the choice between old technology and new technology, takes on the value 0 when old crops were cultivated on a given land plot, 1 when wheat-bean double crops were planted. *Doublecrop* indicates higher risks of production, for the reasons mentioned in Section II B. In the contractual choice equation, when the dependant variable is the likelihood of choosing share contracts, standard agency theory would predict a positive coefficient for the variable *Doublecrop*. But the delegation hypoth-
Table 3.4: Summaries Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Size of a holding (in acres)</td>
<td>0.844</td>
<td>1.012</td>
</tr>
<tr>
<td>Share</td>
<td>=1 if share contract</td>
<td>0.422</td>
<td>0.494</td>
</tr>
<tr>
<td>Kong</td>
<td>=1 if kin tenant</td>
<td>0.117</td>
<td>0.321</td>
</tr>
<tr>
<td>Millet</td>
<td>=1 if millet was grown</td>
<td>0.233</td>
<td>0.423</td>
</tr>
<tr>
<td>Sorghum</td>
<td>=1 if sorghum was grown</td>
<td>0.139</td>
<td>0.346</td>
</tr>
<tr>
<td>Wheat</td>
<td>=1 if wheat was grown</td>
<td>0.155</td>
<td>0.362</td>
</tr>
<tr>
<td>Doublecrop</td>
<td>=1 if land was double cropped</td>
<td>0.280</td>
<td>0.449</td>
</tr>
<tr>
<td>Shock</td>
<td>=1 if there was an exogenous shock in that year</td>
<td>0.402</td>
<td>0.491</td>
</tr>
<tr>
<td>Nplot</td>
<td>Number of holdings in a village</td>
<td>121.366</td>
<td>47.196</td>
</tr>
<tr>
<td>Pre-adoption</td>
<td>=1 if before 1803</td>
<td>0.167</td>
<td>0.373</td>
</tr>
</tbody>
</table>

Note: The minimum and maximum values for all variables except plot size and the number of holdings in a village are zero and one, respectively. The minimum value of plot size is 0.004, and the maximum value is 9.355. The minimum value of Nplot is 19, and the maximum value of Nplot is 190.
Table 3.5: Main Hypotheses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypothesis</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kong</td>
<td>Standard Agency Theory</td>
<td>+</td>
</tr>
<tr>
<td>Kong</td>
<td>Delegation Theory</td>
<td>-</td>
</tr>
<tr>
<td>Doublecrop</td>
<td>Standard Agency Theory</td>
<td>+</td>
</tr>
<tr>
<td>Doublecrop</td>
<td>Delegation Theory</td>
<td>-</td>
</tr>
<tr>
<td>Shock</td>
<td>Standard Agency Theory</td>
<td>+</td>
</tr>
<tr>
<td>Shock</td>
<td>Delegation Theory</td>
<td>-</td>
</tr>
</tbody>
</table>

The thesis would predict a negative coefficient, since double cropping requires more intensive labor inputs and the value of tenant’s managerial efforts is higher. Double cropping system involves more decision making by the tenants. For example, tenants need to decide on an early maturity wheat variety. They also need to decide on the timing of wheat seeding and soybean seeding. Besides, sublet options and rent substitution options were also delegated to the tenants.

What was the role of kinship in contractual choice? As discussed in Section II B, the landlord would be more willing to use higher-powered incentive contracts for kin tenants or delegate more authority to kin tenants, because of the lack of eviction threat. The delegation hypothesis would predict a negative coefficient of the variable Kong in the equation of contractual selection. On the other hand, there was probably less moral hazard problem with kin tenants under sharecropping arrangements, because the kin network reduced the information asymmetry problem. So the standard agency theory would predict a positive coefficient.

The variable Shock is a proxy for exogenous risk. Standard agency theory would predict a positive coefficient of the variable Shock. But the delegation hypothesis would predict the opposite since higher incentive and more delegation is needed when there is greater production uncertainty. Table 5 summarizes the main hypotheses and the expected signs of the variables accordingly.
3.5 Estimation Results

3.5.1 Single Equation Probit Model

In this section, we outline a naive single-equation probit model to estimate the effects of risk and monitoring costs on contractual selection assuming that the adoption of double cropping is exogenous. The contractual selection problem is described by the latent variable model

\[ Share_i^* = X_{1i}' \beta_0 + Doublecrop_i \beta_1 + \epsilon_i \]  

where \( Share_i^* \) is the propensity of choosing share contracts, and the dichotomous variable, \( Doublecrop \), indicates the choice between old technology and new technology. It takes on the value 0 when old crops were cultivated on a given land plot, and 1 when wheat-soybean double crops were cultivated. \( X_{1i} \) is a vector of exogenous variables, including crop type, size of a plot acres, acres\(^2\), Pre-adoption (which indicates the period before the adoption of double cropping), exogenous shocks, and kinship variable \( Kong \). \( \epsilon_i \) is a normally distributed random error with zero mean and unit variance. Results from the multinomial probit specification are presented in Table 6. We also report the marginal effects at the mean.

The results in Table 6 show that \( Doublecrop \) has a significantly positive impact on the choice of share contracts, if it is taken as exogenous. This seems to support the standard agency theory which posits a negative trade-off between incentive and risk. The kin relationship variable \( Kong \), has a negative effect, which supports the delegation hypothesis, according to Table 5. Since there was less eviction threat with kin tenants than with non-kin tenants, higher-powered incentive contract (in the form of fixed-rental) was more likely to be chosen. The exogenous variable Shock exerts a strong negative impact on the dependant variable, which is also consistent with the delegation hypothesis that the value of tenant’s managerial effort and entrepreneurial activities is much higher in risky environments and higher-power incentive contracts should be chosen.
Table 3.6: Probability of Sharecropping versus Fixed Rent

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Probit Coefficient</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.521***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td></td>
</tr>
<tr>
<td>Acres</td>
<td>1.707***</td>
<td>0.669</td>
</tr>
<tr>
<td></td>
<td>(0.134)</td>
<td></td>
</tr>
<tr>
<td>$Acres^2$</td>
<td>-0.197***</td>
<td>-0.077</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.9 8***</td>
<td>0.367</td>
</tr>
<tr>
<td></td>
<td>(0.178)</td>
<td></td>
</tr>
<tr>
<td>Millet</td>
<td>0.454**</td>
<td>0.179</td>
</tr>
<tr>
<td></td>
<td>(0.185)</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>1.113***</td>
<td>0.415</td>
</tr>
<tr>
<td></td>
<td>(0.197)</td>
<td></td>
</tr>
<tr>
<td>Doublecrop</td>
<td>0.320*</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>(0.170)</td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>-0.581***</td>
<td>-0.210</td>
</tr>
<tr>
<td></td>
<td>(0.171)</td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>-1.128***</td>
<td>-0.464</td>
</tr>
<tr>
<td></td>
<td>(0.613)</td>
<td></td>
</tr>
<tr>
<td>Pre-adoption</td>
<td>2.268***</td>
<td>0.662</td>
</tr>
<tr>
<td></td>
<td>(0.191)</td>
<td></td>
</tr>
<tr>
<td>Number of obs.</td>
<td>1,217</td>
<td>1,217</td>
</tr>
</tbody>
</table>
3.5.2 Testing for Omitted Variable Bias

The single-equation model we presented in the previous section assumes the decision to double crop to be exogenous. Existing research shows that farm size, risk attitudes, credit constraints, fixed costs of adoption, and learning effect all affect technology adoption decisions (See, for example, Marra and Carlson, 1987; Feder et. al, 1982). Risk attitudes and farm size also have direct impact on the choice of land tenure contracts as standard agency theories and the delegation theory predict. The decision to double crop may be endogenous to contractual choice. If more risk averse tenants were less likely to choose the riskier double cropping technology over the traditional technology, then they might also want more risk sharing with the landlord. Ideally we need to find a good proxy for risk attitudes to eliminate the omitted variable bias. However, good proxies for risk attitudes are hard to obtain. Our result could be biased because the double cropping variable in the contract selection equation would be correlated with the error term. Similar problem will arise if the landlord was able to screen tenants on factors such as risk attitudes towards the risky technology in determining the form of contracts.

In this section, we outline a recursive bivariate probit model that allows for these possibilities. Suppose the tenant decides to double crop by comparing costs and benefits using a net benefit function or latent index that is linear in covariates and excluded instruments, with a random component or error term, $u_i$. The bivariate probit first stage can be written

$$Doublecrop_i^* = X_{2i}'\gamma_0 + Z_i\gamma_1 + \mu_i$$

Where $Z_i$ is an instrumental variable that increases the benefits of adopting wheat-soybean double cropping technology. A tenant will double crop if the net benefits of double cropping are positive; i.e. if $Doublecrop_i^* > 0$. Following the latent variable model in equation (1), an outcome of our primary interest is contractual choice. The source of omitted variable bias in the bivariate Probit setup is correlation between $\mu_i$ and $\epsilon_i$. In other words, unmeasured determinants of technology adoption are correlated with unmeasured determinants of contractual choice.

\[^{24}\text{Ackerberg and Botticini (2002) discuss the endogenous matching problem that less risky crops may be "matched" with more risk averse tenants and would be associated with share contracts.}\]

\[^{25}\text{For more technical details, see Most Harmless Econometrics, P. 148.}\]
of these components, and that the random components are normally distributed. That is,
\( E[\mu_i] = E[\epsilon_i] = 0, \var[\mu_i] = \var[\epsilon_i] = 1 \) and \( \cov[\mu_i, \epsilon_i] = \rho \). The exogeneity condition is
stated in terms of the correlation coefficient \( \rho \). The null hypothesis is \( H_0 : \rho = 0 \). If we fail
to reject the null hypothesis, then we can conclude that the dummy variable Doublecrop is
exogenous and the single probit model is the appropriate specification.

This bivariate Probit system is identified if the instrument \( Z_i \) is correctly chosen. Following
Ackerberg and Botticini (2002) who suggest the use of geographical-based instruments
to solve the endogeneity problem, we use the number of a village’s holdings, \( Nplot \), as our
instrument. If \( Nplot \) is a valid instrument, then (i) it must be a determinant of the decision
to double crop, but (ii) it must not be a determinant of contractual choice, i.e., it must
not be correlated with the error term \( \epsilon_i \). Not surprisingly, it’s straightforward to show that
it meets the first criterion. In a probit model that explains the probability of adopting
wheat-soybean double cropping technology, the t-statistic on the \( Nplot \) variable is 9.63. In
a simple OLS model where Doublecrop is regressed on \( Nplot \), the t-statistic is 10.26. Intu-
itively, the knowledge of double cropping could be shared within a village. The number of
holdings in a village reflects population density. Since higher population spurs technological
change, the number of holdings in a village should have a positive impact on the probability
of adopting the double cropping technology (Boserup, 1993). Thus the credibility of our
bivariate probit results turns on our assumption that the number of holdings in a village
didn’t affect contractual choice. One mechanism through which \( Nplot \) could have impacted
contractual choice is that the supervision costs in a larger village with more holdings were
higher. However, the Confucius’s Family hired more supervisors for larger villages so that
the tenant/supervisor ratio was kept roughly constant across villages. Hence, there’s little
reason to assume supervision intensity was significantly different across villages. A more
straightforward calculation makes this point clear. We include \( Nplot \) in the single-equation
probit model we discussed before. Its estimated coefficient is nearly zero and statistically
insignificant. The estimated marginal effect is very small compared with the effect of Doublecrop.
Although this is not a direct test of whether this instrument is valid, it does indicate
that the number of holdings had no important role in determining contractual choice.

Table 7 summarizes the maximum likelihood estimation of the bivariate probit model
that relies on the instrument \( Nplot \). We repeat the naive single-equation probit estimation
results from Table 6 for comparison. To obtain MLE of the bivariate probit model, we resorted to the command "biprobit" of STATA 10, which exploits the Newton-Raphson maximization method and allows for Hessian-based estimation of the asymptotic covariance matrix.

The likelihood ratio test suggests that the Null hypothesis is rejected at the 1 percent level of significance. This implies that \textit{Doublecrop} is correlated with $\epsilon_i$ and therefore endogenous. The credibility of the bivariate probit regression shows that \textit{Doublecrop} has a statistically significant negative effect on choosing share contracts after accounting for the endogenous technology adoption problem. Lands that were double cropped were 30% more likely to be managed under a fixed-rent contract. On the contrary, as the single-equation probit model shows, double cropping seems to have a positive effect on the choice of share contracts if we take it as exogenous.

Except for the double cropping variable, the coefficients of other factors remain the same signs with those in the single-equation probit model. For example, the kin relationship indicator “Kong” still has a statistically significant negative effect on choosing share contracts. Kin tenants were 29.6% more likely to use fixed-rent contracts. This result supports the delegation hypothesis, as the standard agency theory would have predicted a positive coefficient. Since there was less eviction threat with kin tenants than with non-kin tenants, higher-powered incentive contract (in the form of fixed-rental) was more likely to be chosen with kin tenants. Exogenous shocks, such as natural disasters and wars, made fixed rent contracts more likely to be chosen. This is also consistent with the delegation hypothesis that stresses the positive trade-off between risk and incentives in times of turbulence or disasters\textsuperscript{26}.

Moreover, existing research shows that farm size, risk attitudes, credit constraints, and fixed costs of adoption affect technology adoption decisions (See, for example, Marra and Carlson, 1987; Feder et. al, 1982). The regression results in the technology adoption equation supports the hypothesis that tenants with smaller plots were less likely to adopt new technology when there were fixed cost of adoption (Just and Zilberman, 1984). The

\footnote{We also tried a 2SLS specification. The dependant variable is the likelihood of selecting share contracts, the endogenous variable is the dummy variable Doublecrop. The instrumental variable is Nplot. The estimation results are similar with those in the bivariate probit model. As Angust and Pischke (2008) points out, “in practice the average causal effects produced by bivariate probit are likely to be similar to 2SLS estimates provided the model for covariates is sufficiently flexible.”}

59
Table 3.7: The Probability of Sharecrop: Bivariate Probit Model

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Coefficient (single probit)</th>
<th>Marginal Effect (single probit)</th>
<th>Coefficient (bivariate probit)</th>
<th>Marginal Effect (bivariate probit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.521***</td>
<td>0.942***</td>
<td>-0.942***</td>
<td>0.669</td>
</tr>
<tr>
<td></td>
<td>(0.124)</td>
<td>(0.266)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acres</td>
<td>1.707***</td>
<td>0.669</td>
<td>1.894***</td>
<td>0.669</td>
</tr>
<tr>
<td></td>
<td>(0.134)</td>
<td>(0.182)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acres&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-0.197***</td>
<td>-0.077</td>
<td>-0.231***</td>
<td>-0.082</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.026)</td>
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<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.968***</td>
<td>0.367</td>
<td>0.756***</td>
<td>0.284</td>
</tr>
<tr>
<td></td>
<td>(0.178)</td>
<td>(0.215)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millet</td>
<td>0.454**</td>
<td>0.179</td>
<td>0.972**</td>
<td>0.360</td>
</tr>
<tr>
<td></td>
<td>(0.185)</td>
<td>(0.236)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>1.113***</td>
<td>0.415</td>
<td>2.299***</td>
<td>0.569</td>
</tr>
<tr>
<td></td>
<td>(0.197)</td>
<td>(0.499)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doublecrop</td>
<td>0.320*</td>
<td>0.126</td>
<td>-0.800**</td>
<td>-0.300</td>
</tr>
<tr>
<td></td>
<td>(0.170)</td>
<td>(0.378)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>-0.581***</td>
<td>-0.210</td>
<td>-0.790**</td>
<td>-0.296</td>
</tr>
<tr>
<td></td>
<td>(0.171)</td>
<td>(0.211)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>-1.128***</td>
<td>-0.464</td>
<td>-1.803***</td>
<td>-0.607</td>
</tr>
<tr>
<td></td>
<td>(0.613)</td>
<td>(0.222)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-adoption</td>
<td>2.268***</td>
<td>0.662</td>
<td>1.821***</td>
<td>0.819</td>
</tr>
<tr>
<td></td>
<td>(0.191)</td>
<td>(0.288)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The adoption of doublecrop

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Coefficient</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<tr>
<td></td>
<td>(0.094)</td>
<td></td>
</tr>
<tr>
<td>Acres</td>
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</tr>
<tr>
<td></td>
<td>(0.094)</td>
<td></td>
</tr>
<tr>
<td>Acres&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-0.072***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td></td>
</tr>
<tr>
<td>Nplot</td>
<td>0.005***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>0.127</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.136)</td>
<td></td>
</tr>
</tbody>
</table>

Disturbance Correlation

<table>
<thead>
<tr>
<th>ρ</th>
<th>0.742</th>
<th>(0.177)</th>
</tr>
</thead>
</table>

LR test for ρ = 0: $\chi^2(1) = 7.036$, $Prob = 0.008$

Number of obs: 1217, 1078

*** significantly different from zero at 1-percent level; ** significantly different from zero at 5-percent level; * significantly different from zero at 10-percent level. Standard errors are in parentheses. Marginal effects are computed at mean.
variable Acres has statistically significant positive effect on the choice of double cropping technology. The fixed transactions costs and information costs of double cropping made it uneconomic for small farms to adopt the riskier technology. Not surprisingly, $Nplot$, the number of holdings in a village, has a positive effect on the decision of technology adoption, since higher population spurs technological change. The kinship variable, $Kong$, has no statistically significant impact on technology adoption.

3.6 Conclusion

In this paper, we provide micro-level evidence for the Chinese agricultural stagnation debate in late Imperial period. The debate has been going on for decades, however, there has been little quantitative evidence and econometric analysis due to data unavailability. To fill this gap, we construct a novel dataset from archives of rent collection books preserved by Confucius’s Lineage in Shandong Province from 1759 to 1901. The dataset features a quasi-experiment, adoption of wheat-soybean double cropping, which remains an important production technology in northern China today.

We use land tenure information to assess the effects of technological change, wheat-soybean double cropping, on agricultural contract choice between share contracts and fixed rent contracts. The dataset is used to test two competing hypotheses: the standard agency hypothesis that stresses a negative trade-off between risk and incentives, and the delegation hypothesis that stresses the role of entrepreneurial effort and high-powered incentives in a risky environment. Our results support the delegation hypothesis that risky farming activities would be associated with contracts with high incentive power. We find that fixed rent contracts were more likely to be chosen than share contracts after wheat-soybean double cropping was adopted, after accounting for the omitted variable problem due to unobservable risk preferences. Although the risk of production went up dramatically under double cropping system, the concern about risk sharing was dominated by the concern about incentivizing tenants to obtain higher level of managerial efforts. We also find that kin tenants were more likely to use fixed-rent contracts, controlling for other factors. That’s because there was less eviction threat with kin tenants than with non-kin tenants. Lacking threat of eviction as a credible incentive device for kin tenants, the landlord would be more
willing to use higher-powered incentive contracts for kin tenants, making them the residual claimants. In addition, we test for the relationship between plot/farm size and the adoption of the risky double cropping technology. Our result supports a positive relationship between farm size and the likelihood to adopt new technology. That is, smaller farms were less likely to adopt new technology when there were fixed cost of adoption.

This paper is still a preliminary attempt to study agricultural productivity and tenancy choice using the vast Chinese historical materials, i.e. private land contracts and rent collection books. Cross-regional comparison needs be done to test the robustness of the findings in this paper. The rich source of private land contracts and rent collection books offers potential opportunities for more empirical research from different perspectives.
Figure 3.1: Map of Qiwang Village, 1787

Source: Selected Historical Archives of Kong Fu, Qufu. Vol.11. To best demonstrate scattering, we only marked the plots that were rented to three tenants. The plots shaded by the same strips were rented to the same tenant.
Figure 3.2: Grain prices, 1759 - 1901

Sources: Grain Price Database in the Qing Dynasty. Note: Price information was gathered from Mianzhou, Shandong Province. Price is measured in tael per shi. 1 shi = 100 liters. The Grain Price Database contains information of the lowest monthly price and highest monthly price in a given year. We use the average price on a yearly basis from the high-price group, because the lands of Confucius’s family were of high-quality in general. Therefore, the quality of grains was likely to be good.

Figure 3.3: Percentage of Crops before and after the Adoption of Double Cropping
Figure 3.4: Percentage of Share Contracts and Fixed Rent Contracts
SERFDOM IN LATE IMPERIAL CHINA: A TIEBOUT MODEL

4.1 Introduction

The dominant form of serfdom in late Imperial China was the surrender of peasants to powerful landlords for protection (tou kao). Burdened with the official corvée obligation imposed by the government, peasants escaped from the official sector and sought protection from private landlords, thereby became serfs. The arrangement between private landlords and serfs was called sheltering (yin bi). Once entering the shelter, serfs agreed to provide corvée to their landlords. In return, landlords were obliged to supply protection and justice to their serfs. Thus, sheltering was a voluntary contractual relation between the protector and the protected rather than an exploitative arrangement imposed by landlords.\(^1\)

The formation of serfdom through the arrangement of sheltering, though not unique to China\(^2\), has received little attention in the economic literature on serfdom. An economic theory that can explain sheltering needs to characterize two essential features: First, local governments and private landlords competed for corvée labor and supplied protection and justice to peasants. Second, rational peasants could choose optimally to be independent peasants in the official sector or serfs in the unofficial sector according to the level of corvée.

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\(^1\) There has been debate on whether serfdom should be viewed as a voluntary contractual relation. For instance, Brenner (1976) refutes economic theories that treat serfdom as equal exchange between contracting individuals. Among economists, Domar (1970) also views serfdom as coercive labor or involuntary servitude, whereas North and Thomas (1971) view serfdom as voluntary contractual relations.

\(^2\) A similar arrangement can be found in pre-modern Western Europe. In his well-known piece The Rise of Dependent Cultivation and Seigniorial Institutions, Marc Bloch wrote: “North of the Alps, contractual relations between individuals played an insignificant part in the inner life of a seigneurie... The agreements for protection, of which we shall speak later, usually went with a grant of land. Often enough the generosity of the lord was, in truth, only apparent; he was merely giving back some property which his client had previously surrendered to him, now burdened with fresh obligations; and the game of surrender and regrant simply transformed a holding formerly autonomous into one under authority.”
obligation and quality of protection and justice in each sector. Thus, a political economy theory that takes into account the behavior of private landlords as well as local governments is needed to explain the formation of serfdom through sheltering.

The existing economic theories on serfdom largely focus on pure economic forces, while treating political variables exogenous. Domar (1970) argues that man-to-land ratio was the key factor that determined the position of peasants, admitting that the absence of endogenous political variables “seriously weakens the effectiveness” of his model. Although North and Thomas (1971) mention the role of the “central political power of the state” in preventing the lords from competing for labor, the emphasis of their paper is how transaction costs under manorial customs determined various contractual forms of serfdom. More recently, Conning (2004) briefly discusses how comparative politics of land grabs and frontier policies shaped serfdom, nevertheless his focus is economic forces, such as factor endowments and production technologies.

This paper proposes a political economy theory on serfdom from the public finance perspective, taking economic factors as exogenous. Our basic framework is a Tiebout model. We assume that rational peasants with varying skills of farming could choose optimally to be independent peasants in the official sector or serfs in the unofficial sector. If they choose to work in the official sector, they provide corvée to the state and receive the government’s protection and justice. If they choose to work in the unofficial sector, they provide corvée to the landlords and receive landlords’ private protection and informal justice. Our model predicts that a larger fraction of peasants would escape from the official sector and work as serfs when the government-imposed corvée was heavy and the local public goods supplied by the government were inadequate.

Our approach to view serfdom as the unofficial sector in a feudal society is closest to the analysis of unofficial economy in transition countries by Johnson et. (1997), who suggest that firms tend to escape from the official sector when taxes are prohibitive in the official sector and public goods provision is inadequate. Both their research and ours emphasize the fiscal competition between the official sector and unofficial sector from a public finance perspective. However, our model differs from theirs on an important aspect: Their model assumes no fiscal interaction between the official sector and the unofficial sector. The fees firms in the unofficial sector (the counterpart of serfs in our model) pay to the private protection...
agencies (the counterpart of private landlords in our model) remain in the unofficial sector. By contrast, we assume that the unofficial sector has to turn in some revenue to the official sector. Private landlords have to transfer a proportion of feudal dues and rent to the public treasury. In other words, private landlords are incorporated into the fiscal system of the state as indirect tax collectors or tax farmers.

Our theory not only depicts the fiscal competition between the official sector and the unofficial sector, but also models the fiscal interaction between the central authority and the unofficial sector. The fact that the unofficial sector indirectly contributes to the fiscal revenue of the state, we think, is a fundamental characteristic of the fiscal system in a feudal state, as opposed to a modern state. The methods of transferring revenue from the unofficial sector to public treasury of the state include tax farming, informal loans to the crown, venality of offices, and purchases of monopoly right. Abstract from these details, in this paper, we assume that private landlords pay a lump sum fee to the central authority, which transfers a portion of feudal rent in the unofficial sector to the public treasury of the state.

To model the fiscal interaction between the central authority and the unofficial sector, we ask under what conditions the ruler allows or has to allow serfdom to exist. To maximize fiscal revenue, the ruler relies on indirect tax collection performed by private landlords, because direct collection operated by tax collection bureaucrats often results in large deadweight losses, due to agency problems in the bureaucracy. When tax collection bureaucrats are less efficient than private landlords in exacting agricultural surpluses from peasants, the ruler prefers to let private landlords collect taxes. Our model suggests that for the ruler to allow serfdom to exist, the rent that private landlords could effectively exact under serfdom must be greater than the direct tax that the ruler gives up by allowing peasants to voluntarily enter the unofficial sector.

Although we cannot perform formal empirical test of our model because gathering data from the unofficial sector has always been difficult historically or contemporarily, we provide case studies from the Qing Dynasty as qualitative evidence. In the first case study, we discuss the *tanding ranu* tax reform that merged corvée quota into land tax launched in mid-Qing Dynasty. We argue that one consequence of the abolition of corvée was the decline of serfdom and increasing mobility of free peasants. As our model predicts, after the state abolished
peasants’ corvée obligations in the official sector, serfs who had to provide corvée to private landlords would switch into the official sector. Thus serfdom was abolished. In the second case study, we discuss serfdom under the native chieftain system. Although serfdom was officially abolished in most of China by the mid-Qing Dynasty, it remained the dominant institution under the native chieftain system in ethnic communities and frontier areas. We argue that serfdom was more enduring in these areas because native chieftains were more efficient in supplying protection and justice than local governments to indigenous peasants, due to cultural barrier and religious diversity.

The paper is organized as follows: Section 2 describes the historical background of serfdom in the form of sheltering. Section 3 constructs a model that explains serfdom from the perspective of public finance. Section 4 uses the model to interpret important events about serfdom in late Imperial China. Section 5 concludes.

4.2 Historical Background

4.2.1 Corvée System

The provision of corvée labor was an essential feature of serfdom. The official corvée system persisted in China from ancient times until the mid Qing Dynasty. Corvée labor was used for large construction projects, maintenance of irrigation systems, military missions and miscellaneous works. Under the corvée system, peasants were pressed into labor services by the government for required periods, such as one month per year in the Han Dynasty and twenty days per year in the Tang Dynasty. In return, peasants received protection and justice provided by the state.

To enforce corvée provision, the state imposed restrictions to legally bind peasants to a fixed region. When the corvée burden was too heavy, peasants would abscond. To prevent peasants from absconding, the central government strived to maintain a reasonable amount of corvée quota. However, the actual corvée burden borne by peasants was the formal quota plus off-budget corvée imposed by local governments according to their actual needs. The off-budget corvée can be excessive when local governments had budget deficits or local government officials expropriated corvée for private use. Absconding was often the consequence if the corvée burden was excessive. The cost of absconding was high when the
central government was strong enough to track down runaways. Runaway peasants faced the risk of being sent back. Once discovered, those who welcomed runaways and helped them settle down could be punished as well. The longer the distance of moving, the more likely absconding became successful. Moving long distance, however, tended to be costly for those who had properties and large families. Under such circumstance, another option seemed to be more appealing: seeking local strong men’s protection.

4.2.2 Serfdom as Shelter

The dominant form of serfdom in late Feudal China was the surrender of peasants to powerful landlords for protection (Chao 2006, Li 2007). Burdened with the official corvée burden, peasants sought protection from powerful landlords. The practice was called sheltering (yin bi). In the late Ming Dynasty, sheltering was popular in the areas where powerful landlords clustered. A famous scholar in the late Ming Dynasty, Gu Yanwu, estimated that a large landlord could shelter over a thousand serfs and that in an average county of the Yangzi delta almost 20 to 30 percent of the peasants were serfs (Li 2007).

Sheltering involved an agreement between private landlords who provided protection and justice and serfs who committed to supplying a certain amount of corvée labor in return. Once entering the shelter, serfs were exempted from the official corvée burden and only had corvée obligations for their landlords (Ye 1983). There were three types of serfs in a manor, household servants who received a wage, sharecroppers and fixed-rent serf tenants. All three types of serfs were obliged to provide labor services to the landlord. Household servants’ job was to perform a variety of labor services upon the everyday needs of their masters. Sharecroppers and serf tenants mainly worked on their own customary holdings, but would be called upon to perform labor services for a number of days every year. The provision of corvée in the private sector, even in its lightest form, could characterize the status of a serf.

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3 The landlords’ corvée obligation was officially exempted or reduced. In Chinese fiscal system, the amount of corvée borne by adult laborers depended on the political status of the family. The higher the social status, the lower the corvée. For instance, in the Han Dynasty, government officials ranked above level 9 (out of 20) were exempted from labor services. In the Tang Dynasty, households were categorized into nine ranks. Those with the lowest status afforded the heaviest burden of labor services. Corvée reduction benefits can be extended to serfs who were adopted as sons or daughters of the family.

4 By contrast, free tenants, who sometimes worked side by side with serf tenants, did not have such obligations.

5 Labor services include repairing roads, building bridges, chopping trees, maintaining houses, preparing for religious rituals and so on.
The cost of entering the unofficial sector of serfdom was more than losing the status of free peasantry. Serfs and their descendants were deprived of most of their official rights. First, serfs lost their land titles. If they previously owned land, landownership should be transferred to their masters. The transfer of ownership created a tenure\(^6\) and allowed serfs to work on their own fields as long as they paid rent and provided corvée. Second, serf households were not registered in the official population register system (*huang ce*). Serfs were adopted as sons or daughters of their masters (Ye 1983) and viewed as members of the masters’ lineage. Without an independent social status in the official system, serfs were not eligible for the benefits provided by the government, such as food subsidies and disaster relief. Third, serfs and their descendants had no access to civil service examination, thus upward mobility opportunity in the official sector was closed for them. Fourth, the serf status was hereditary. Intermarriage between serfs and free peasants was banned. If that so happened, the children would “degenerate” into serfs too (Ye 1983).

### 4.2.3 Protection and Justice as Club Goods

Public goods, such as protection and justice, can increase the productivity of peasants. In the official sector, peasants paid taxes and supplied corvée in exchange for legal protection and formal justice. In the unofficial sector, serfs paid rent and supplied corvée to private landlords in exchange for private protection and informal justice\(^7\).

Protection and justice provided by private landlords can be viewed as “club goods” that were excludable and subject to rivalry in the form of congestion. Private protection and informal justice were only accessible to the members of landlords’ lineage including serfs. Landlords’ military force and lineage court were used for members within the lineage (Liu 1988)\(^8\). Thus, non-members were excluded from the ”club goods”. The utility an individual serf receives from protection and justice depends upon the number of other serfs with whom he must share its benefits. Thus, the ”club goods” were subject to rivalry.

According to the theory of the club, the optimal number of serfs in a lineage should be determined by the marginal cost and marginal benefit of supplying protection and jus-
tice (Buchanan 1965). Because of economy of scale, powerful landlords often sheltered a large number of serfs and dependant cultivators. Sometimes, powerful landlords were more efficient providers of such services than local governments. They competed with local governments for tax/rent and corvée and provided non-governmental alternative for peasants who sought protection and justice.

4.2.4 Indirect Tax Collection

By absorbing peasants into the unofficial sector, the practice of sheltering seemed to undermine the tax base of the state. corvée and land tax revenue paid by free peasants would decrease as the number of serfs went up. If so, why would the ruler allow serfdom to exist at his own expense?

To understand the rationale of serfdom, three facts need to be recognized: First, private landlords did transfer to the public treasury of the state a portion of rent and monetized they collected from serfs. Thus, landlords can be viewed as indirect tax collectors or “tax farmers”. Second, from the ruler’s point of view, indirect tax collection managed by landlords was often more efficient than direct tax collection managed by salaried tax bureaucrats. Third, when state capacity was weak, the ruler would appreciate indirect control that kept peasants in the unofficial sector as opposed to mess and chaos. “Let every lord put pressure on his dependants, that they may better and better obey and accept imperial orders and instruction” (Bloch).

The transfer of rent and monetized corvée revenue from private hands to the state went through two channels- the formal taxation system and the informal contribution system (juan na and bao xiao). In the formal taxation system, private landlords were responsible to pay land tax for the properties registered under their names and the corvée revenue (ding yin) on behalf of their whole lineage. Landlords then assigned tax quota and corvée quota to individual members within the lineage. In the informal contribution system, rent and monetized corvée revenue were transferred from landlords into the public treasury through contributions as an “effort to return the imperial grace” (Wang 1983). Contributions were in fact informal loans to the emperor.

Indirect tax collection appealed to the ruler who faced the difficulty of collecting taxes directly in the vast empire for the following reasons. First, it was costly to maintain and
monitor a big body of salaried tax collection bureaucracy due to the backward communication and transportation technologies. Revenue losses in corruption and tax expropriation rendered direct collection a less efficient arrangement than tax farming in the areas that were far from the central government. Second, private landlords had an advantage in exacting agricultural surpluses from peasants than government officials. Landlords as residual claimants of agricultural production had greater incentive to enforce rent collection. Third, private landlords also had more accurate information about the productivity of land because of repeated interactions with their tenants.

4.3 A Tiebout Model of Serfdom

4.3.1 Assumptions

The following assumptions of the model are made. First, rational peasants with varying farming skills could choose to be free peasants in the official sector or serfs in the unofficial sector. If they chose to work in the official sector, they paid taxes and corvée to the state. If they chose to work in the unofficial sector, they paid rent and corvée to the landlords. In equilibrium, the marginal peasant was indifferent to being a serf in the unofficial sector or being an independent peasant in the official sector. The assumption is based on the voluntary servitude theory that serfdom was a contractual arrangement where corvée was exchanged for protection and justice (North and Thomas 1971, Barzel 1997). The fact that serfs were attached to land and free peasants were legally bound to a fixed region seems to be inconsistent with the perfect mobility assumption in the original Tiebout model at first glance (Tiebout 1956). In fact, our model replaces the perfect mobility assumption with the voluntary servitude assumption - peasants could stay in the same region but still switch between sectors and between landlords.

Second, we assume that the club goods, protection and justice, provided by one landlord has no spill-over effect to peasants in the official sector as well as serfs who belonged to other landlords. This is consistent with the condition of exclusion in the original Tiebout model and the theory of the club. In informal lineage justice system of traditional China,

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9 We do not consider the situation of size expansion by extending the lineage through marriage.
10 Serfs could purchase their own freedom and enter the official sector. Serfs could be sold to another landlords under certain terms.
private landlords acquired the power to make judicial decisions and the right to issue orders and punish serfs who disobeyed customary law without the intervention of the state. The informal lineage justice systems can be viewed as independent of the imperial justice system, thus the condition of exclusion holds.

Third, we assume that peasants had full knowledge of differences in the amount of corvée and taxes between the official sector and the unofficial sector. For simplicity we assume that the amount and quality of protection and justice provided by local governments and private landlords was exogenous. In other words, in this paper we don’t consider how protection and justice could be endogenously determined by the size of population in the official sector and unofficial sector.

4.3.2 A Simple Model

The society consists of a government, a landlord, and a unit mass of peasants. Each peasant $i$ is characterized by his productivity $a_i$, which is uniformly distributed on $[0, 1]$. Let the cumulative function of $a_i$ be $F(a_i)$, and $\bar{a} = \int_0^1 a_i dF(a_i) = 1/2$ be the average productivity of peasants. Peasants can choose to pay tax in the official sector, or work as a serf for the landlord. If the peasant chooses to be a free peasant, his output is $y_i = Ga_i$, where $G$ is the predetermined protection and justice provided by the government accessible to free peasants only. By contrast, if the peasant becomes a serf, his output then is $y_i = Ma_i$, where $M$ is the informal protection and justice provided by the landlord.

For the peasant, the distinction between free peasantry and serfdom stems from the in-kind or monetary rent and taxes to be conceded and the amount of corvée he affords in the official and unofficial sectors. Formally, the utility of an independent peasant is $u_i^O = (1 - \tau)Ga_i - c$, where $\tau$ is the tax rate implemented by the government and $c$ is the amount of corvée imposed by the government. By contrast, the utility of a serf is $u_i^S = (1 - \pi)Ma_i - w$, where $\pi$ is the rent, or the share of products taken by the landlord, and $w$ is the amount of corvée imposed by the landlord. We assume that only $\tau$ and $\pi$ are strategies chosen by the government and the landlord respectively. $c$ and $w$ are exogenous.

Following this formulation, a peasant $i$ will be independent if:

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For simplicity, we only characterize the competition between the local government and the landlord, rather than the competition between landlords. The analysis applies to the competition between landlords too.
\[(1 - \tau)G - (1 - \pi)M | a_i \geq c - w \]  \hspace{1cm} (4.1)

**Proposition 4.** Suppose \((1 - \tau)G - (1 - \pi)M > 0\) and \(G\) is sufficiently large, serfdom exists only when the government-imposed corvée is greater than that imposed by the landlord: \(c > w\).

We assume that legal protection from the government, \(G\), is sufficiently large, such that for all values \(\tau\) and \(\pi\) in their viable domains, \((1 - \tau)G - (1 - \pi)M\) is always positive. It then follows that if \(c < w\), all peasants will choose to be independent. A peasant will only voluntarily become a serf when the government-imposed corvée is large: \(c > w\), and \(a_i < \frac{c - w}{(1 - \tau)G - (1 - \pi)M} = \hat{a}\). Of course, the value \(\hat{a}\) is determined by the choices of \(\tau\) and \(\pi\). For simplicity, in what follows we assume that \(\hat{a}\) is located within \([0, 1]\). The fraction of peasants working under serfdom is \(\hat{a}\).

Intuitively, this proposition suggests that if the local government is able to provide more effective protection and justice than the landlord, and charges a higher corvée for these public goods, those whose productivity is lower will choose to enter the unofficial sector; whereas those whose productivity is higher will work in the official sector. This is consistent with the fact that productive peasants preferred to remain free because of the upward mobility opportunities in the official sector. \(^{12}\) By contrast, upward mobility opportunity in the unofficial sector was not open to serfs. Thus, those with low productivity due to credit constraints or low farming skills would ”self-select” into unofficial sector.

**Proposition 5.** Given a pair of policies \(\tau\) and \(\pi\), a larger fraction of peasants would work as serfs when the protection and justice provided by the landlord (\(M\)) is greater than that provided by the government (\(G\)).

The proposition suggests that if the private landlord is a more efficient provider of protection and justice than the government, more peasants will enter the unofficial sector as serfs. This can explain why serfdom was more enduring in ethnic communities and frontier areas. In these areas, the power of the state was relatively weak relative to the local chieftains or landlords. When the local government cannot not effectively provide protection

\(^{12}\)In Chinese history, when peasants made a fortune in the agricultural sector, they would often consider ”upgrading” their social status through civil service examination or purchase of official degrees. In the later phase of feudalism, many gentry families were originally wealthy peasant families.
and justice to peasants, the unofficial sector tends to be large and powerful. In section 4.2 we discuss serfdom under the native chieftain system in detail.

Next, we consider the fiscal interaction between the central authority and the unofficial sector, thus we incorporate a ruler into our model. The objective of the ruler is to maximize its tax revenue. A point of departure is that the ability of government bureaucrats in exacting agricultural surpluses from the peasant is often lower than that of the landlord in exacting rent, due to the agency problems in the tax collection bureaucracy described in section 3.3. Formally, we assume that for each unit of tax, there is a deadweight loss in direct tax collection \( \eta \tau^2 \). By contrast, under serfdom serfs are more closely supervised and rent collection is better enforced, therefore we assume that there is no deadweight loss in the exaction of agricultural surplus by the landlord. We are interested in under what circumstances the ruler would allow serfdom to exist. Consider the following arrangement between the ruler and the landlord: By charging a lump sum fee \( K > 0 \), the landlord transfers a portion of rent and monetized corvée from the unofficial sector to the public treasury.

**Proposition 6.** *In order for serfdom to exist, the rent that the landlord could effectively exact under serfdom must be greater than the direct tax that the ruler gives up by allowing peasants to voluntarily enter the unofficial sector.*

**PROOF.** The payoff of the ruler is:

\[
U_{GOV} = K + \int_{\alpha_i > \bar{a}} [(\tau - \frac{\eta}{2} \tau^2) G a_i + c] d a_i \tag{4.2}
\]

The payoff of the landlord in this circumstance is:

\[
U_{LORD} = -K + \int_{\alpha_i < \bar{a}} [\pi M a_i + w] d a_i \tag{4.3}
\]

Assume that the government a Stackelberg leader in the game, i.e. the government sets \( \tau \) first and then the landlord decides \( \pi \). Also assume a unique pair of solutions \( \{\tau^*, \pi^*\} \) exists. Let the corresponding values be \( U_{GOV}^* \) and \( U_{LORD}^* \).

Instead of allowing serfdom, the government can also prohibit it. By putting all peasants under the official control, the government is able to collect revenue of \( \int_0^1 [(\tau - \frac{\eta}{2} \tau^2) G a_i + \)
\[ c[i \, da_i = \frac{G}{2} (\tau - \frac{\eta}{2} \tau^2) + c. \] When internal solution is available, the optimal tax rate in this case is \( \frac{1}{\eta} \). This yields a payoff of \( U_{GOV} = \frac{G}{4\eta} + c \). For the government to allow serfdom, the participation constraint requires that:

\[ K + \int_{a_i > \hat{a}} [(\tau^* - \frac{\eta}{2} (\tau^*)^2)Ga_i + c] \, da_i \geq \frac{G}{4\eta} + c \quad (4.4) \]

Further we normalize the outside payoff of the landlord to zero. The participation constraint for the landlord is:

\[ -K + \int_{a_i < \hat{a}} [\pi^* Ma_i + w] \, da_i \geq 0 \quad (4.5) \]

Thus, serfdom will exist only if there is some \( K \) such that the two inequalities simultaneously hold. The conditions boil down to:

\[ \int_{a_i < \hat{a}} [\pi^* Ma_i + w] \, da_i + \int_{a_i > \hat{a}} (\tau^* - \frac{\eta}{2} (\tau^*)^2)Ga_i - \frac{G}{4\eta} - c\hat{a} \geq 0 \quad (4.6) \]

Inequality (4) implies that for the ruler to allow the landlord to “shelter” serfs, the benefit of indirect tax collection has to be greater than the opportunity cost foregone if the government collected tax directly. Inequality (5) implies that the amount to be transferred from private hands to public treasury has to be smaller than the amount of tax and corvée revenue the landlord exacted from serfs. During times of wars and famine, the taxes and the lump-sum fees (“contribution”) the government asks for can be greater than the amount of rent and corvée the landlord collected from the serfs. In this situation the pressured landlord might mobilize the serfs and tenants to protest against taxation or demand tax reductions from the government. \(^{13}\)

\(^{13}\)Similar tax reduction arrangement can be found in India. “Being always in the intermediate position between government authorities and people, he (the headman) would complain to government of excessive demand of revenue and corvée, request it to reduce or exempt it, and sometimes resort to absconding along with villagers.” (Hiroshi 1971)
4.4 Discussion

4.4.1 The Abolition of corvée and the Decline of Serfdom

In the early 18th century, the Manchu emperors launched one of the most important tax reforms in Chinese history, the *tanding rumu* tax reform. The reform abolished the corvée system that had persisted in Chinese history for over two thousand years\textsuperscript{14}. The purpose of the tax reform was to create a progressive structure of taxation and reduce inequality in the allocation of tax burden between the rich and the poor. A consequence of the abolishment of corvée was the decline of serfdom and increasing mobility of free peasants (Li 2007).

From the Ming Dynasty to the early Qing Dynasty, the land tax system (the *di-ding* tax system) consisted of two taxes, the *di* tax (land tax proper), and the *ding* tax\textsuperscript{15}. The *ding* tax was a commutation of labor services required of the adult males levied at the household level, thus can be viewed as a monetized corvée quota for each household\textsuperscript{16}. After the *tanding rumu* tax reform, the *ding* tax was abolished and incorporated by apportionment in the *di* tax. The new land tax was called the *di-ding* tax, meaning “the land tax and the labor services combined” (Wang 1983). For instance, in Zhili province, the *ding* tax was apportioned upon the land tax proper by adding one fifth to the latter. In Shandong province, the *ding* tax was apportioned upon the land tax proper by adding one tenth to the latter.

The rationale of the abolition of the *ding* tax (corvée quota) can be explained by our model. In the early Qing Dynasty, due to the heavy corvée burden (*c* in the model) imposed by the local governments, a large proportion of peasant population absconded or entered the unofficial sector as serfs and un-free tenants. After paying feudal dues (*w*) to the landlords, serfs and un-free tenants were exempted from the official corvée obligation. Landlords acted as an indirect tax collector who gathered rent (*π*) and feudal dues from serfs and transferred a lump sum amount (*K*) to the state. According to equation (3), to increase their payoff landlords wanted to shelter as many serfs as possible by offering protection and justice at a lower “price” to achieve economy of scale. As more and more peasants entered the unofficial

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\textsuperscript{14}The tax reform officially started in 1713 under Emperor Kangxi’s reign and reached its peak in Emperor Yongzheng’s reign (1722-1735) and was completed under Emperor Qianlong’s reign (1736-1796).

\textsuperscript{15}In many places, landowners also had to pay to the government a grain tax in addition to the *di-ding* tax (Wang, ).

\textsuperscript{16}Property and other criteria were also taken into account in the assessment of the corvée quota (Wang, ).
sector and the lump sum fee ($K$ in the model) paid by the landlords remained unchanged, the government lost greater and greater ding tax revenue (equation (2)). When the size of the unofficial sector increased so much that it generated threatening fiscal problems to the state, the Manchu rulers had to reform the taxation system: The central government incorporated the ding tax ($c$) into the $di$ tax ($\tau$) by apportionment, and imposed a larger fee ($K$) on landlords\textsuperscript{17}. The reform, in some sense, forced landlords to purchase labor services of their serfs from the state\textsuperscript{18}.

A consequence of the tax reform was the decline of serfdom. As Proposition 1 implies, as the official corvée ($c$) goes to zero, the fraction of peasants who worked for landlords ($\hat{a}$) in the unofficial sector will decrease, thus serfdom will decline. Intuitively, if the state abolished labor services for landless peasants, serfs would enter the official sector to work as free peasants\textsuperscript{19}. Instead of paying customary feudal dues to landlords for protection and justice, free peasants could obtain protection and justice from the state by paying low taxes. As there were more peasants paying the $di$ tax ($\tau$) to the state and large landowners pay higher lump sum fees ($K$), the tax revenue of the state increased, thus the fiscal problems were resolved.

Next, we provide historical evidence that are consistent with the discussion of social transformation described above. The tanding rumu tax reform reduced the tax burden of the poor and made the landed elites pay more tax. Before the tax reform, landless households had to pay the ding tax (monetized corvée). After the tax reform, landless households were exempted from all taxes. The ding tax burden fell on the shoulders of landowners in the form of the $di$ tax (land tax proper). Hence, the inequality in the allocation of tax burden was reduced. The low tax burden for landless peasants attracted serfs and unfree tenants to work as wage laborers in the official sector. To enter the official sector, serfs and unfree tenants had to break up with their masters. It was probably not a coincidence that during the same time, the Manchu rulers issued a series of emancipation decrees to grant serfs citizenship.

\textsuperscript{17}In 1676, the Kangxi Emperor implemented a policy that required the landed elites to increase grain tax payment by 30\%. (Li 2007)

\textsuperscript{18}A similar arrangement of increasing the fee paid by the landlord to compensate the loss of corvée can be found in Egypt. “In 1878, a Frenchman, the Marquis de Blignieres, became Minister of Public Works. In response to the two problems of rising exemptions and fiscal crisis, de Blignieres led the government in imposing a new system: all peasants would be liable to corvée labour. Those who wished an exemption for their tenants would have to pay a fee (badaliyya). Landowners protested against the proposal, but it was implemented and reaffirmed in a series of decrees. In theory, estate owners were to buy peasants freedom - that is, owners could free peasants to work all the year round on their estate.”

\textsuperscript{19}In fact, wage laborer began to appear after the decline of serfdom. (Li 2007)
For instance, in 1727, Emperor Yongzheng announced that “Serfs and serf tenants should be freed and upgraded. Their descendants should not be distained from the ancestors’ servitude status.” (Ye 1983) In 1769, Emperor Qianlong reinforced the emancipation act and emphasized that serf-tenants should to Since then serfdom was officially abolished in most of China, except some remote areas and ethnic communities.

Meanwhile, peasants in the official sector gained freedom to move from place to place to seek better opportunities. The main purpose of binding peasants to soil was to ensure the provision of corvée. After the corvée system was abolished, it was no good from the rulers’ standpoint to stop peasants from moving. Therefore, the rural institutions that were designed to facilitate the collection of taxes and the recruitment of corvée labor in the village communities, the *lijia* system, gradually collapsed.

### 4.4.2 Serfdom under the Native Chieftain System

Although serfdom was officially abolished in most of China in the Qing Dynasty, it remained the dominant institution under the native chieftain system (*tusi zhidu*) in many ethnic communities and border areas, including Tibet, Mongolia, the frontier areas of Yunnan and Guangxi. Native chieftains (*tusi*) were tribal leaders recognized by imperial officials. Chieftains were obliged to provide troops, suppress local rebellions, and pay tribute to the central government. Committed to performing such obligations, their political legitimacy as tribal leaders was justified. In this section, we apply our model to answering the following questions: Why was serfdom the dominant institution under the native chieftain system? What was the fiscal relationship between the central government and native chieftains? Under what conditions did the state allow the native chieftain system and under what conditions did the state abolish the native chieftain system?

The dominant organizational form of agricultural activities under the native chieftain system was serfdom. A typical manor owned by chieftain was divided into three portions: the demesne under the chieftain’s own management, the land granted to lower-ranked lords and temples, and the land leased to serfs. Lower-ranked lords also divided their land into two portions, the directly operated land and the serf’s customary holdings. The basic working units on these different types of land were serf households. Serfs plowed their customary holdings as well as the masters’ demesnes. Serfs paid feudal dues, rent and corvée to their
masters. In return, they obtained protection and justice provided by their masters.

Why was serfdom the dominant institution under the native chieftain system? In ethnic communities and remote areas, native chieftains often had comparative advantage in providing protection and justice \((M\) in the model) to indigenous people than the government \((G)\). Many of the indigenous tribes were closed economies that had little interaction and market exchange with the outside world. Due to language barrier, cultural gaps and religious differences, native chieftains were often more efficient providers of protection and justice than the local governments. According to Proposition 2, when protection and justice provided by the chieftain \((M)\) is far greater than that provided by the local government \((G)\) and the corvée burden \(c\) is close to \(w\), the majority of peasants would work as serfs within the tribe.

The fiscal relationship between the native chieftains and the central government was defined in the tribute system. Native chieftains were obliged to pay tribute to the central government that symbolized their loyalty and obedience. The tribute \((K\) in our model) consisted of two parts, the formal land tax plus corvée quota, and the informal contribution of local specialty products. The formal land tax was supposed to be delivered in the stipulated time and amount. Chieftains were also expected to send their serfs to provide for the state military support in times of wars and corvée labor in large construction projects. There was no requirement on the amount of informal contribution—quantity of local specialty products to be delivered. In short, the tribute system was in fact a form of indirect tax collection system described in section 3.4.

Under the tribute system, native chieftains enjoyed greater political autonomy and exercised considerably more control over the frontier societies in the first half of the Qing Dynasty than did their Ming predecessors. Since the Yongzheng reign, however, the Qing state started to abolish the native chieftain system and extend direct bureaucratic control \((gaitu guiliu)\) over the former autonomous areas. All together 220 native chieftains were removed from their posts, including 15 from Guizhou, 17 from Yunnan, 10 from Guangxi, 69 from Sichuan and 109 from Huguang\(^{20}\). The movement of replacing native chieftains with the Qing bureaucrats lasted till the end of the Qing Dynasty.

Under what conditions did the rulers allow the native chieftains to remain in power within the tribute system and under what conditions did the rulers remove the native chieftains?
In our model, native chieftains were indirect tax collectors who transferred a portion of rent and corvée revenues to the state. According to Proposition 3, for the rulers to adopt indirect taxation, the benefit of indirect tax collection has to be greater than the opportunity cost foregone if the government were to collect tax directly.

In the early Qing Dynasty, the state capacity of the Manchu Dynasty was relatively weak. Direct control and direct tax collection in ethnic communities and border areas were difficult, due to cultural differences, language barriers and most importantly the resistance of native chieftains. The military power of the Manchu ruler was not strong enough to quench the native chieftains. In the mid-Qing period, the Manchu rulers had built up state capacity and strengthened bureaucratic control after several decades’ economic development. The cost of direct control and direct taxation fell. The state was able to provide protection and justice more efficiently than before. Under such conditions, Emperor Yongzheng decided to establish direct bureaucratic control over the border areas and ethnic communities.

A series of economic policies were implemented to destroy the authority of native chieftains. First, the government confiscated the land of the native chieftains and rented them or sold them to serfs. By levying taxes directly on tillers the government turned serfs into free peasants. Thus, serfdom was abolished. Second, the government kept the land tax and corvée burden relatively low, in order to prevent peasants from seeking shelters in local tribes. Thirdly, the central government set up schools to educate peasants and promote its ideology. Education eliminated language barriers and cultural barriers, therefore made protection and justice in the official sector more effective and appealing to the peasants. Fourth, the state absorbed well-educated peasants into the bureaucratic system through civil service examinations. By granting opportunities of upward mobility to peasants, the government attempted to avoid the resurgence of the native chieftain system.

An implication of our model is that productivity under the native chieftain system would be low. This is because the chieftains wanted to keep tight control over the serfs thus deliberately kept serfs illiterate. Educated serfs were more likely to abscond or enter the official sector; illiterate serfs had more attachment with their masters. The government, by contrast, had an incentive to increase literacy and increase productivity. Therefore, production technology was much more backward inside the tribes than the prevalent level in the official sector. The abolishment of the native chieftain system was followed by the
surge of productivity. Local tribes were integrated into the market thus the degree of specialization greatly improved.

4.5 Conclusion

Based on the facts about serfdom in late Imperial China, we propose a political economy theory of serfdom from the perspective of public finance. Viewing serfdom as the unofficial sector of a feudal society, our model characterizes the competition for corvée labor and tax revenue between the official sector and the unofficial sector. The model predicts that a larger fraction of peasants would escape from the official sector and work as serfs when the government-imposed corvée was heavy and local public goods supplied by the government were inadequate. We further study the fiscal interaction between the central authority and the unofficial sector. Our model suggests that for the ruler to allow serfdom to exist, the tax revenue that private landlords could effectively exact under serfdom must be greater than the direct tax that the ruler gives up by allowing peasants to voluntarily enter the unofficial sector.

Our research may shed new light on the Brenner debate. Robert Brenner (1976) argues that the neo-classical approaches that build on the laws of supply and demand cannot possibly explain the wide divergence in the patterns of serfdom in Western Europe and Eastern Europe: While serfdom declined during the fifteenth and sixteenth century in Western Europe, it re-emerged at the end of the fifteenth and the sixteenth century in Eastern Europe. Our political economy theory of serfdom provides a new angle to interpret the divergence: When the state capacity was weak, the ruler had to rely on indirect taxation managed by private landlords. When the state capacity was strengthened, the ruler preferred to let his own agents and bureaucrats to collect tax directly. Therefore, the divergence between Western Europe and Eastern Europe might be caused by differences in state capacity, i.e. the central state’s ability in tax collection. This echoes with Perry Anderson’s conjecture that the decline of serfdom in Western Europe coincided was driven by the rise in Absolutist states, while serfdom intensified in Eastern Europe because the central states were too weak (Anderson 1974).


Angelucci, Manuela; De Giorgi, Giacomo; Rangel A. Marcos; and Imran Rasul. “Insurance and the Extended Family”, working paper, 2008.


Chao, Kang and Deng Yongcheng. *Qing Dai Liang Shi Mu Chan Yan Jiu* (Studies on Grain yield per Mu in the Qing Dynasty): Chinese Agriculture Press, 1995.


Li,Wenzhi. *Ming Qing Shi Dai Feng Jian Tu Di Guan Xi De Wa Jie* (The Loosing of the Feudal Land Relationship in the Ming and Qing Dynasties). Beijing: China Social Science Publisher, 2007.


Marra, Michele C. and Carlson A. Gerald. “The Role of Farm Size and Resource Constraints


Pu, Songling. *Nong Song Jing* (Handbook of Agriculture and Mulberry), 1705.


Tan Lihua, Qing Dai Zhu Jiang San Jiao Zhou De Sha Tian (Sandy Land in the Pearl delta of the Qing Dynasty). Guangzhou, Guangdong: Guangdong People’s Press, 1993.


Wang, Yejian. Qing Dai Liang Shi Zi Liao Ku, Qing Dai Liang Shi Zi Liao Ku (Database on Grain Prices in the Qing Dynasty) http://140.109.152.38/Default.asp, accessed on 7/26/2011.


Xu, Tan. “Ming Qing Shi Qi Shan Dong Jing Ji De Fa Zhan (Economic Development in
Shandong during the Ming and Qing Dynasties), *Studies of Chinese Economic History*, no.3 (1995).


Zhu, Chengru. “Jia Qing Chao Zheng Dun Qian Liang Kui Kong Shu Lun” (Studies on Budget Deficit in the Jiaqing Period), *Ming Qing Lun Cong* (A Collection of Essays on the Ming and the Qing Dynasties), no. 2(2001).
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