Land Tenure and Productivity:

Evidence from Rural China

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For the 640 million farmers (i.e. 47% of the total population) living in rural China as of 2012, land is a resource of significant value. China has experimented with different forms of land tenure arrangements, which have been widely recognised as being vital to the productivity of agriculture which in turn is critical to poverty alleviation. The changes in land tenure arrangements over the past half a century have included a shift from privately owned to collectively owned land, from the offer of 15-year use rights to perpetual use rights to the land under cultivation, from the issue of informal land certificates to the currently (i.e. as of 2014) ongoing formal land certification program (RLRC). All these changes have the potential to affect farm productivity and thus impact rural poverty.

This thesis aims to examine how the changing land tenure arrangements have affected productivity at the level of individual farms, and the policy lessons on how to improve productivity and household income. To answer the aforementioned questions, two levels of research were conducted.

Firstly, data at the level of the 31 provinces over a 60-year period was analysed to investigate the link between grain productivity and land tenure arrangements. The findings show that land tenure dummies that stand for land use rights and the right to transfer rights to use the land have had positive effects on grain productivity.

Secondly, farm-level data was collected via a purpose-designed survey. This data was analysed using regression and matching methods on certified and uncertified plots. The quantitative estimates on the impact of land certification on farm-level productivity and income shows that use rights secured through certification induces farmers to: (i) invest more in land; (ii) transfer land to more productive farmers, thereby increasing land productivity; and, (iii) participate in the land rental markets which contributes to household income and improves allocative efficiency.

In summary, the thesis is that land tenure reform is critical to growth in productivity and income for small holders. These findings lend support to the ongoing land reforms throughout China.

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Signed .....

Date .....

I dedicate my PhD dissertation work to my family: my beloved parents, my sisters, and my brother. Their support, encouragement, and constant love have sustained me throughout my life

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Abstract

For the 640 million farmers (i.e. 47% of the total population) living in rural China as of 2012, land is a resource of significant value. China has experimented with different forms of land tenure arrangements, which have been widely recognised as being vital to the productivity of agriculture which in turn is critical to poverty alleviation. The changes in land tenure arrangements over the past half a century have included a shift from privately owned to collectively owned land, from the offer of 15-year use rights to perpetual use rights to the land under cultivation, from the issue of informal land certificates to the currently (i.e. as of 2014) ongoing formal land registration and certification program (RLRC). All these changes have the potential to affect farm productivity and thus impact rural poverty.

This thesis aims to examine how the changing land tenure arrangements have affected productivity at the level of individual farms, and the policy lessons on how to improve productivity and household income. To answer the aforementioned questions, two levels of research were conducted.

Firstly, data at the level of the 31 provinces over a 60-year time horizon was analysed to investigate the link between grain productivity and land tenure arrangements. The findings show that the form of land tenure and its role in determining the rights to use and to transfer land have had a positive effect on grain productivity.

Secondly, farm-level data was collected via a purpose-designed survey. This data was analysed using regression and matching methods on certified and uncertified plots. The quantitative estimates on the impact of land certification

on farm-level productivity and income shows that use rights secured through certification induces farmers to: (i) invest more in land; (ii) transfer land to more productive users, thereby increasing land productivity; and, (iii) raise participation in the land rental markets which contributes to household income and improved use of this scarce resource.

In summary, the thesis is that land tenure reform is critical to growth in productivity and for growth in income of small holders. These findings lend support to the ongoing land reforms throughout China.

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4. Yuepeng Zhou & Satish Chand. 2014. The Development of Rural Land Transfer Market: a Case Study of a Certified Qun'an Village.

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Abbreviations and Acronyms

A.D.	Anno Domini
AIC	Akaike Information Criterion
ATE	Average Treatment Effect on the Overall
ATT	Average Treatment Effect on the Treated
B.C.	Before Christ
CLPF	Cultivated Land Protection Fund
CPC	Communist Party of China
FAO	Food and Agriculture Organization
FE	Fixed Effect
GDP	Gross Domestic Product
GPS	Global Position System
HRS	Household Responsibility System
KMT	The Kuomintang, Chinese Nationalist Party
NBS	National Bureau of Statistics of China
OECD	The Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
pci	Per Capita Income
PRC	People's Republic of China
PSE	Producer Support Estimate
PSM	Propensity Score Matching
RE	Random Effect
RLRC	Rural Land Registration and Certification Program
TFP	Total Factor Productivity
UK	United Kingdom
USA	The United States of America

Chapter 1 Introduction

1.1 Motivation

China is facing a serious challenge of land scarcity. As is shown in Table 1.1, with a population of 1.3 billion in 2011, the arable land[1] as a ratio of total land area in China is 11.6%, which is much lower than that for India (47.9%) and the United States of America (USA) (16.3%). The issue becomes more serious when measuring on a per capita basis: the arable land per capita in China is 830 m^2 (1.25 *mu,*[2] or 0.08 hectare), which is only two-thirds that of India, less than a quarter that of Brazil, less than one-fifth that of the USA, and less than one-tenth that of Russia.

Table 1.1 Comparison of Population and Land Indicators in 2011

	Population (million)	Land area (1000 km^2)	Arable land (1000 km^2)	Arable land per capita (m^2)
Brazil	197	8,515	719	3,658
China	1,344	9,600	1,116	830
India	1,241	3,287	1,574	1,267
Russia	143	17,098	1,215	8,499
USA	312	9,832	1,602	5,140
World	6,974	134,272	13,963	2,002

Source: Data are from The Helgi Library online database, available at: http://helgilibrary.com/indicators/index/arable-land-area.

[1] Arable land includes land defined by the Food and Agriculture Organization (FAO) as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land that is temporarily fallow.

[2] *mu*: Chinese unit of area, 1 hectare = 15 *mu*.

Despite the huge population and land scarcity mentioned above, China has impressed the world with its rapid economic growth and being able to successfully feed 20% of the world's population with just 8% of the world's arable land (data from 2011). Since initiating market reforms in 1978, China has shifted from a centrally planned to a market-based economy and experienced rapid economic and social development. Gross Domestic Product (GDP) growth averaging about 10% a year has lifted more than 500 million people out of poverty (World Bank, 2014). China has achieved a decade of consecutive growth in grain production since 2003, with an average growth rate of 3.4% and is currently producing 436 kilograms of grain per capita.[3] China has now become the second-largest economy and is increasingly playing an important and influential role in the global economy (World Bank, 2014).

However, the economic miracle of China comes at the cost of an increasing income inequality between urban and rural residents and a series of land disputes. The urban income was about 3.23 times that of the countryside in 2010, making China among the top countries with largest urban-rural gaps (He, 2011). About 65% of mass incidents in rural areas are triggered by land disputes, which are mainly caused by forced land acquisition, low compensation, and unfair appropriation of the compensation (China Daily, 2010).

With the property rights owned collectively by the local collective organisations in rural China, land is the most important asset farmers have. According to the latest law in respect to land—Property Rights Law of the People's Republic of

[3] Data are from the website of National Bureau of Statistics of China, available at: http://data.stats.gov.cn/workspace/index?m=hgnd.

China—which came into effect in 2007, instead of ownership rights, Chinese farmers currently enjoy the rights to “possess, utilize and obtain profits from the farmlands” (Article 125) and “the contracted term for the farmland should be thirty years” (Article 126). It also entitles farmers to circulate (transfer) their contracted land by adopting such means as “subcontract, exchange and assignment in accordance with the provisions of the *Rural Land Contract Law* [which took effect in 2003]” (Article 128). In spite of the above rights, Chinese farmers still faced two uncertainties. First, there was continued and village-wide readjustment of farmland which intended to maintain an egalitarian distribution of land in response to demographic change in the villages, even after the Rural Land Contract Law in 2003 had disallowed large-scale reallocations and limited small-scale readjustments (Deininger and Jin, 2009, Mullan et al., 2011). Second, there was the risk of expropriation of land by the government according to public interest in the process of urban expansion and infrastructure development (Jacoby et al., 2002, He et al., 2009).

Due to these characteristics of property rights, most Chinese farmers still lack secure and marketable land rights which allow them to make long-term investment in land, decisively improve productivity, and use their land as collateral to get access to credit and obtain loans via formal channels. Therefore, compared with their urban counterparts, rural households are in a disadvantageous position with respect to capital accumulation, which is regarded as the main cause of the widening urban-rural income gap (Zhu and Prosterman, 2007, Li, 2013).

The issue of land rights for individuals has the potential to increase grain productivity and enrich farmers whilst reducing inequality between rural and urban residents. To address these issues, for 11 consecutive years during 2004 – 14, the No.1 Central Documents, issued by the Central Committee of the Communist Party of China (CPC) and the State Council at the beginning of every year, have focused on agriculture, farmers, and the countryside (the Three Rural Issues), taking grain security and boosting farmers' incomes as a priority. Through the documents, agricultural tax has gradually been reduced and was finally abolished in 2004, fiscal expenses to agriculture and subsidies to farmers have been increased every year, and most strikingly, a Rural Land Registration and Certification (RLRC, known as land titling in other contexts) program has been piloted and carried out nationwide since 2008. RLRC, which aims to secure land rights for farmers by enforcing clearly defined land certificates throughout rural China, is the first step of a significant new-round land reform.

The role of reforms to land tenure arrangements in enhancing agricultural productivity and bridging the income gap between the rural and urban sectors of the Chinese economy is central to this thesis.

1.2 Research gaps

Numerous global literatures have tried to detect the relationships between land titling and agricultural productivity in a particular context such as Africa, Asia, and Latin America. In their pioneering study, Feder et al. (1988) provided a standard conceptual model to examine the links between land title, land productivity, and household income. The model depicts two complementary

channels, investment and credit, which positively affect productivity. First, they posit, from the farmers' point of view, secure and enforceable property rights to land will increase certainty thus providing the incentives for investment, which then lead to increased production and income. Improved incentives for investment result in land improvements. Second, from the lenders' viewpoint, farmers with secure legal land titles are less risky clients. Therefore, lenders are more willing to supply credit at lower interest to titled farmers who demand credit to meet both capital (investment) and operational (variable input) expenses through exchange for the land title as collateral. The increased level of investment and supply of credit lead to improvements in the productivity of land. This in turn translates to higher land prices and incomes.

Subsequent studies have corroborated the findings of Feder et al. (1988) such as those by Alston and Libecap (1996) in Brazil, Zaibet and Dunn (1998) in Tunisia, Smith (2004) in Zambia, Holden et al. (2009) in Ethiopia, Chand and Yala (2009) in Papua New Guinea, and Galiani and Schargrodsky (2010) in Argentina. Each of the above-mentioned came to the conclusion that land titling has a significant effect on farm-level investment and productivity, and, moreover, that titling contributes to land value (see Alston and Libecap 1996), soil conservation (see Holden et al. 2009), and human capital investment (see Galiani and Schargrodsky 2010).

However, the links between tenure security and productivity are yet to be fully resolved. Establishing the direction of causality has been problematic. And the empirical evidence for the link between tenure security and investment has been less than universal. The positive link between land tenure security and

productivity is present in some contexts, but not in others. Moreover, formalisation of property relations through the registration of land and the issuance of titles could be counterproductive, as they may erode and displace existing social networks and arrangements that do offer some security (Bromley, 2009). Therefore, land titling does not guarantee increased investment and improved productivity in every context. There is more to tenure security than just legal title and more to investment than just security of tenure (Meinzen-Dick et al., 2002, Miceli and Kieyah, 2003, Abdulai et al., 2007), such as the support of government and local administration (Bouquet, 2009). Thus, the impact of land reform on the levels of investment and farm productivity remains an issue to be resolved empirically.

China is the new context here to test the impact of land titling on investment and productivity. Since the RLRC program in China was launched in 2008, the empirical study on the impact of the RLRC on agricultural productivity is yet to be investigated. This thesis fills this void in the literature. Thus, the central research question is: what are the impacts of land reform on productivity and income? The research question has been further divided into four specific hypotheses:

- RLRC program will increase farm-related investment (Chapter 5);
- RLRC program will contribute to higher agricultural productivity (Chapter 5);
- RLRC program will improve rural household income (Chapter 6);
- RLRC program will enhance resource allocation efficiency through land rental markets (Chapter 7).

1.3 Research structure and key findings

To answer the research questions, the thesis is structured as shown in Figure 1.1. The respective chapters are also shown in the figure. A unifying theme of the thesis is that the land tenure arrangements have an important impact on agricultural productivity and household income in China.

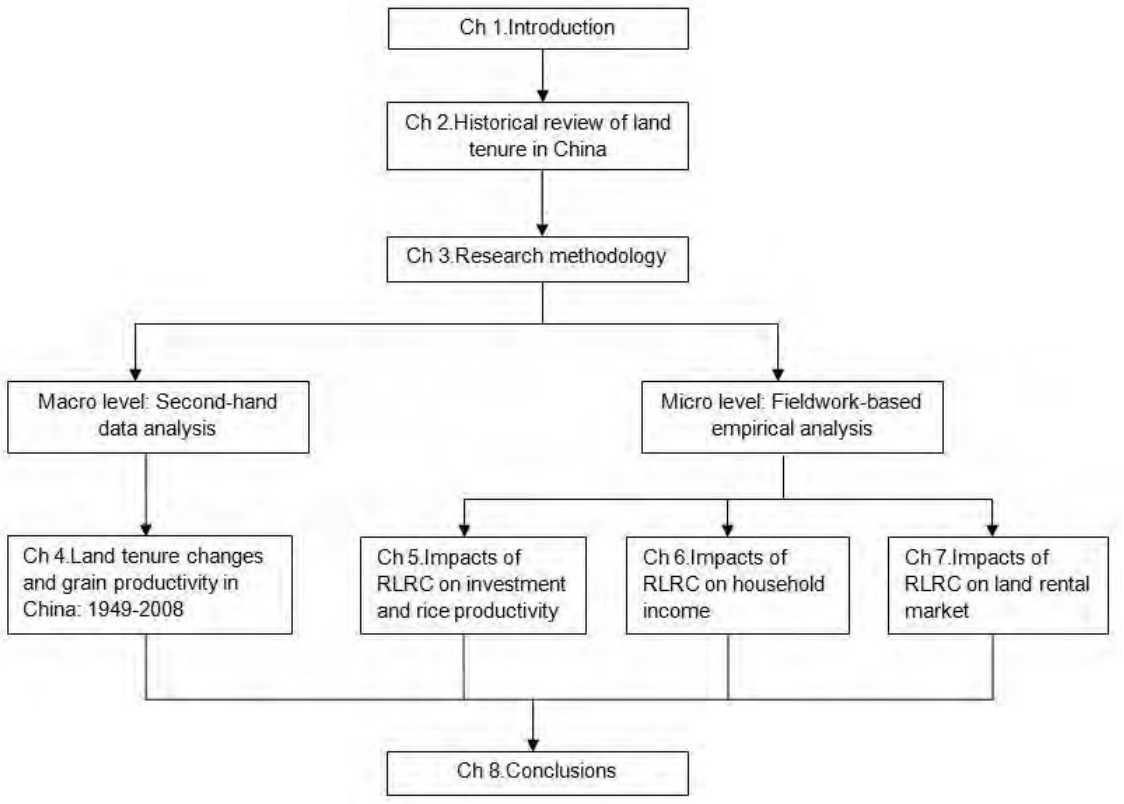


Figure 1.1 Thesis Structure

Following the introductory chapter, Chapter 2 reviews the land tenure change trajectory during the long history of China. Rural land ownership in China evolved from clan public ownership during the primitive period (1.7 million years ago – 2100 B.C.), king's ownership in the slave society period (2100 – 221 B.C.), to private ownership throughout the imperial period (221 B.C. – 1949 A.D.), and then to collective ownership since 1956. For the past 2,000 years,

land tenure in China has involved a struggle between the tendencies of governments to allocate land administratively and the tendencies of a commercial economy to make land available as a freely exchangeable commodity. The tensions between equitable sharing of land and that of raising output of the resource have played throughout China's recorded history. The historical survey in this chapter shows that history has repeated itself in terms of having gone in a circle from concentration and anti-concentration of individual title to land with peasant protests and land reforms in China.

Chapter 3 depicts in detail the research framework and research methodology applied in this thesis. I use one village where the RLRC program was trialled (the treatment group) and compare the results with the counterfactual of another village left out of the program (the control group). Both the villages grow rice—a homogenous crop grown with similar inputs and technology. Furthermore, I employ ordinary least regression (OLS) analysis to net out the effects of the observed differences across the treatment and control groups as well as between households. To account for the selection bias, propensity score matching (PSM) has also been employed. In addition, a secondary panel data set has been used.

The thesis proceeds to a macro-level analysis to decipher the contribution of land tenure reforms to productivity. Secondary panel data from 31 provinces of China from 1949 – 2008 has been used in Chapter 4 to investigate the impacts of land tenure arrangements on grain productivity. The results of a fixed-effect model and a random-effect model have been compared to examine whether the changes in ownership, duration of contracts, and permission of land transfer

explain the growth of grain productivity since the founding of the People's Republic of China (PRC). The estimates demonstrate that grain productivity growth cannot be analysed in isolation from change in land tenure arrangements. The private ownership of land, longer duration of land contracts, and permission to transfer land are all significant variables contributing to growth of grain productivity in China.

In Chapter 4 I draw on the data from the 13 major grain-producing provinces and the seven major grain-marketing provinces to look at the productivity differences between these two areas. Results reveal that grain productivity in the major grain-producing provinces is sensitive to both the changes of land contract duration and transfer rights. However, the major grain-marketing provinces are more sensitive to whether transfer of land has been permitted. Therefore, to ensure grain security, farmers in the two areas need longer duration and more flexible land rights to allow them either to focus on farming or transfer land to more productive individuals or agricultural organisations to reap the benefits of scale from farming, and thus increase grain productivity. Results from Chapter 4 provide support to the ongoing RLRC program which lays the basis for the analysis of the next three chapters.

Chapters 5 and 6 use the fieldwork survey data to address the research questions; specifically, whether the RLRC has unlocked a channel by which certified land use rights has encouraged farmers to invest more in land, transfer land to more productive individuals/agricultural business, and thereby increase land productivity and household income. Chapter 5 examines the effects of the RLRC on rice-related investment and rice productivity. Both OLS regression

and matching estimates yield similar results, i.e., the implementation of the RLRC program encouraged the certified farmers to spend more on rice seeds, herbicide, and machinery than their uncertified counterparts. The results also indicate that increased land tenure security enhances rice productivity.

In addition to the productivity effect, the welfare effect of the RLRC program has been evaluated in Chapter 6. Rural households in China mainly have three sources of income: farm income from sale of crops, wage income from off-farm employment, and transfer income from governmental subsidies and land leasing. The implementation of the RLRC program is found to raise household transfer income, whilst its impacts on farm income and wage income are insignificant. The RLRC program allows households to earn rents that will improve welfare.

Chapter 7 focuses on the participation of land rental markets by the certified households and discusses the benefits and determinants of an active land rental market. Based on a subset of the data, participation in a land rental market has been found to redistribute rural resources, i.e., land and labour, resulting in increased income. On the one hand, individual farmers who have a revealed comparative advantage in farming are more inclined to lease land through land transfer markets to expand the farm size. Thus the benefits of economies of scale may be realised, resulting in increased per capita income. On the other hand, households with higher levels of land-labour ratios and more family members working in off-farm sectors tend to lease out more land to earn rental income and concentrate on off-farm employment.

Finally, Chapter 8 concludes, providing a summary of the key findings of this thesis, discussion of some policy implications, and directions for future research.

1.4 Contribution

This thesis makes several contributions to the extant literature.

First, the thesis provides empirical evidence of the contribution of the land certification program to income and productivity in China. Despite the vast literature exploring the impacts of land certification on productivity (Feder et al., 1988, Place and Hazell, 1993, Smith, 2004, Holden et al., 2009), investment (Besley, 1995, Deininger and Chamorro, 2002, Place, 2009), household welfare (Holden and Ghebru, 2011), and land market (Deininger et al., 2011, Jin and Jayne, 2013), there is little literature studying land titling program effects in China. This is not surprising: the RLRC program was first piloted in 2008, and as of June 2014 it is ongoing. Literature on the impact of the RLRC is slowly expanding (China Center for Economic Research (CCER), 2010, Li, 2012). However, to the best of my knowledge no empirical analysis has been undertaken that compares the performance of farms with and without RLRC. The analysis undertaken in this thesis further extends the literature by providing the firsthand empirical farm-level case study of China.

Second, this thesis provides a new set of original farm-level survey data. The topic of land in China can be sensitive as it often comes along with land disputes and conflicts between local governments and farmers. As a result, collecting data in rural China is painstakingly difficult (as explained in Chapter 3) for individual researchers, particularly in the absence of social connections

(*guanxi*). The firsthand farm-level data collected in this thesis could be used as a baseline for future research.

Third, this research has categorised land tenure rights into land ownership (binary variable), duration of land contract, and permission of land transfer (binary variable), and brings them into the analysis of grain productivity in China. Among the literature identifying the determinants of grain productivity in China (Lin, 1992, Yao and Liu, 1998, Tian and Wan, 2000, Jin-Tao et al., 2012), only Chen and Qu (2003) have subdivided land tenure rights into land use right, transfer right, and usufruct right, and examined the productivity effects of these rights. Rural China has long been experiencing a land system which separates ownership right from use right. Therefore, the study of the effect of individual type of right to land could shed light on where the future land reform should be targeted. Based on the study of Chen and Qu (2003), this thesis contributes a new set of panel data from 1949 – 2008 and consideration of land ownership right in the model.

Chapter 2 Land Reform Trajectory in China: Going the Full Circle

Chinese agriculture has a long history which could date back to some 10,000 years ago. The land tenure system in China has evolved from public land ownership by clan communes during the primitive stage (1.7 million years – 2100 B.C.), to the king owning all land in the slavery stage (2100 – 221 B.C.). Compared with medieval Europe, the feudal system during this period could be described as similar to the manor system in Europe, which was a feudal lord economy from beginning to end (Fu, 1981a). Landlord's private ownership replaced the feudal lord economy and dominated for more than 2,000 years throughout the whole imperial and republic era of China (221 B.C. – 1949 A.D.). Since the foundation of the PRC in 1949, land privatisation was gradually abolished. After the reforms in 1978, all land is state owned and rural land is cultivated under the household responsibility system (HRS).

Since land privatisation ownership was prevailing, China has seen a great deal of back and forth movement between concentration and anti-concentration of land-ownership. The vital problem facing each dynasty was how to ease the class contradictions between the big landlords and the peasantry, and to maintain social stability. The past plays an important role in shaping the structure of land ownership in the following era. Hence, it is important to see how the ancestors arranged land ownership. In presenting the evolution of land tenure, this chapter reviews the history in a chronological order starting from the primitive stage (as is shown in Appendix 1).

2.1 The primitive society (1.7 million years – 2100 B.C.): public land ownership

China is a country with a very early civilisation and a long, rich history. It passed through a long prehistoric stage, which endured for about 1.7 million years (Chinese Government Website, 2004). When China stepped into the clan commune period, which originated from the late Paleolithic Age (about 10,000 years ago), agriculture emerged. Since the means of agricultural production remained primitive, agricultural production was in the stage of “roving cultivation” (*yougeng*), people could not settle down at fixed places, and the only form of landowning was clan public ownership (Fu, 1981a). Under the public land system, land tenure changed according to the development of agricultural productivity. In the matriarchal clan commune era, land was cultivated by all members, who worked together and distributed the food equally. There were no privileges or private properties among clan members.

Around 5,000 years ago, when agriculture and animal husbandry became more important than hunting and fishing, males replaced females to take charge in these primary economic activities. Females gradually became subordinated and thus the patriarchal clan commune replaced the matriarchal clan commune. In this stage, clan members had surplus products which could be used as private property to exchange with other members. The private property included consumption goods, farming tools, livestock, houses, etc., but not land which remained under the clan’s ownership (Yan and Yin, 1992). The land was still commonly owned by the clan communes. The primitive means of production and low production efficiency required the clan members to work together.

2.2 The slavery society (2100 – 221 B.C.): the king's land ownership

When the primitive society collapsed, the first class society emerged in China—the slave society, which lasted for around 1,900 years (Feng, 2005). Under the slave society system, the whole kingdom, including all the land and population, belonged to the slave owner—the king, as the poem says "under the wide heaven, all is the king's land; within the sea-boundaries of the land, all are the king's servants".[4] No one other than the king could have full claim to their land.

The king (*tianzi*) created five hereditary ranks (*gong*, *hou*, *bo*, *zi,* and *nan*) for feudal lords (*zhuhou*), which were very similar to the current European nobility system (Duke, Marquees, Earl/Count, Viscount, and Baron). Below the feudal lords, there were ministers (*dafu*), servicemen (*shi*), freemen (*pingmin*), and slaves. Under an enfeoffment system, the king granted the feudal lords an amount of land, with its natural products and the population, and also jewels and precious objects. The lords then allocated certain land, population, etc., to the next level of aristocrats (see Figure 2.1).

[4] 《诗经·小雅·北山》[Shi Jing], available at: http://xtf.lib.virginia.edu/xtf/view?docId=Chinese/uvaGenText/tei/shi_jing/AnoShih.xml;chunk.id=AnoShih.2.6.205en;toc.depth=100;brand=default;query=beifeng.

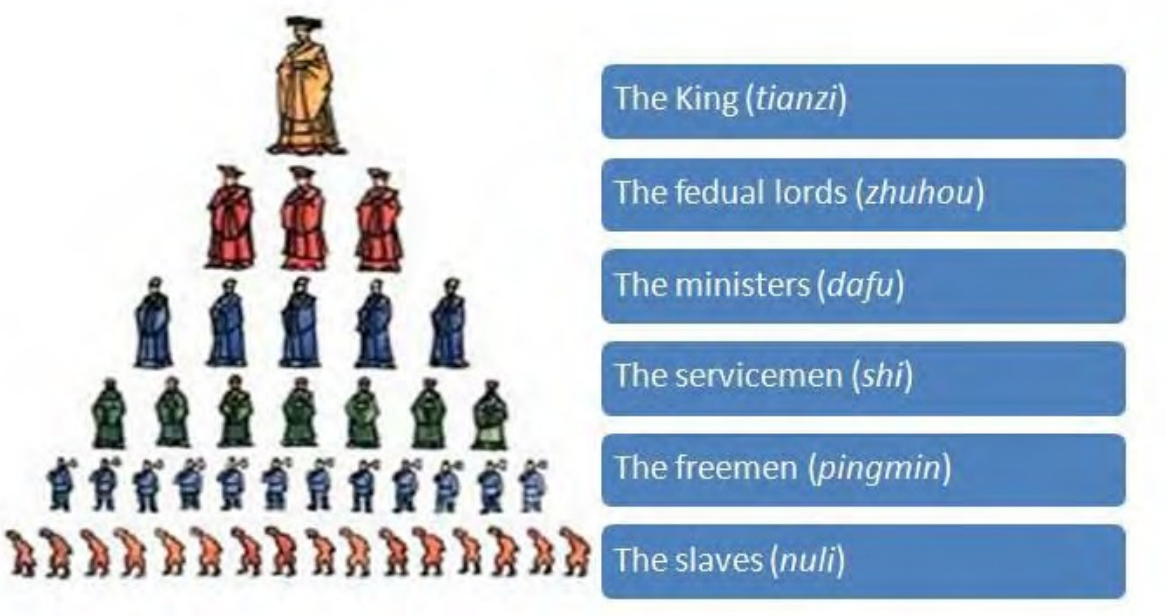


Figure 2.1 The Enfeoffment System in Zhou Dynasty (1046 – 221 B.C.)

Source: http://www.guoxue.com/?p=7695

The aristocrats had the right of use of the bestowed objects, and these were transmitted by descent. Land was not allowed to be sold. It was mostly cultivated by the slaves. The slaves did not have freedom and were compelled to work on the land for their lords. All the harvest from the land went to the aristocrats. The aristocrats, on the other hand, were obliged to present tributes (*gongfu*) to their higher level of aristocrats. Over time, the land and slaves became the private property of the aristocrats. In this period, based on historical documents, it is generally agreed that the *jingtian* system was the main type of land tenure (Feng, 2005), which is explained as follows. The name for *jingtian* system, also known as well-field system, was derived from the Chinese character for “well” (*jing*, 井), which provides a graphic representation of the central shared field surrounded by eight outlying fields (see Figure 2.2).

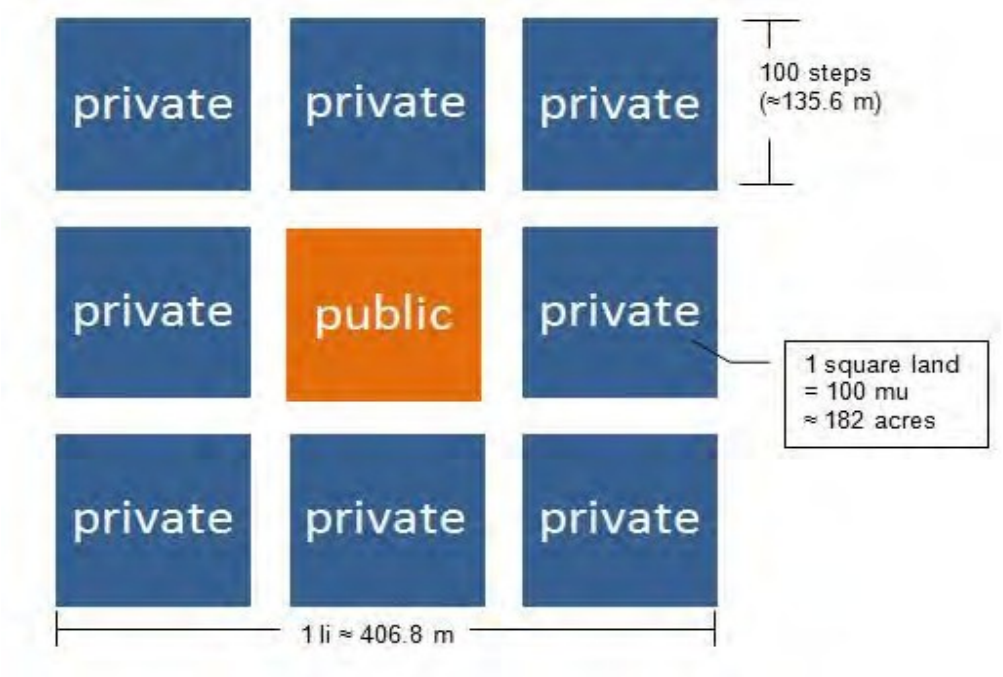


Figure 2.2 The *jingtian* System
(derived from Chinese character for "well" – 井)

Source: http://www.zwbk.org/MyLemmaShow.aspx?lid=98914, the unit conversions are based on data from http://baike.baidu.com/view/1092094.htm.

According to Mencius, one large square of land, with a side length of one *li* (around 405 m), was divided into nine smaller plots. The eight outer ones were allocated to eight serf families for private cultivation, while the eight families should first cultivate the central one together for their lord. In this system, the peasant paid the lord in services, which was also known as labour rent. The peasants were serfs rather than slaves; while they were required to work on the "public land" compulsorily to guarantee the serf owner's income, they probably had a degree of discretion with respect to their productive activities on the "private land" (Fu, 1981a, Hsu, 1999). With one serf family as a production unit, animal husbandry, sericulture and domestic handicrafts (such as brewing, silk

reeling, and weaving) were managed and developed in conjunction with food production for self-sufficiency. This was a major form of the rural economy known as “man-farming and woman-weaving” in ancient China (Hsiung et al., 1995).

The *jingtian* system prevailed throughout the period of the Eastern Zhou (770 – 256 B.C.), but the feudal system built on this foundation began wavering in the early days of the Eastern Zhou and collapsed during the period of the Warring States (475 – 221 B.C.). The collapse of the *jingtian* system can be attributed to three reasons.

Firstly, the low productivity of the public land determined that the gains from the public land were far from enough to satisfy the aristocrats’ increasingly large spending on their luxurious lifestyle. Therefore, on the one hand, the aristocrats raised tax from the serfs, which resulted in them escaping or rebelling. On the other hand, they started wars to grab land from other aristocrats.

Secondly, the aristocrats needed more population to create wealth and for service in the military. Hence, they encouraged population propagation, or even attracted population from other states. However, the *jingtian* system allocated the land on a per head basis (*ji kou shou tian*), so the rapid population growth made cultivated land much scarcer.

Thirdly, with the spread of the cow plough and the use of iron farm tools, former wasteland was widely exploited and privately owned by the serfs. The amount of newly cultivated land far exceeded the amount of public land, consequently the public land was lying fallow (Fu, 1981b). In order to increase income, the aristocrats had to admit the legality of the land privately owned by the serfs, and

change the tax system. The serfs did not need to work on public land; however, they were obliged to pay tax in kind for the amount of land they owned. The rate of tax was supposed to be one-tenth of the crop. Adoption of taxes in kind fundamentally changed the *jingtian* system. A tax based on production from land held by the peasant was tacit recognition that the farmer was entitled to use the particular piece of land, which indicated it entailed secure tenure of land. By the late Zhou dynasty, the selling and buying of land had become widespread (Yan and Yin, 1992, Hsu, 1999).

Therefore, the *jingtian* system could only exist when the farming tools were primitive (thus lead to low agricultural productivity), and the population was small (relative surplus land). With the gradual emergence of the private ownership of land, the development of manufacturing and commercial activities, coupled with demographic growth, the *jingtian* system could not adapt to the new context and eventually died out.

2.3 Land tenure under Imperial and Republic China (221 B.C. – 1949 A.D.): the dominance of private land ownership

Following the end of the *jingtian* system, a private land ownership system based on the free sale of land emerged in its place. Throughout the long period of more than 2,000 years following the Warring States, the landlord system prevailed and constituted the dominant pattern of China's feudal economic structure (Fu, 1981a). The other two co-existing patterns were: feudal state land ownership and peasant land ownership.

In the feudal landlord system, the landowners had use rights, and could also sell, give away, and bequeath the land they owned. Compared to the king’s land

ownership in the slavery period, the feudal landlord system broke the strict social hierarchy and led to an increasing social mobility among the top political strata. In the slavery society, the bestowed land was hereditary and not allowed to be sold. Hence, it was impossible for the common people at that time to become landowners. However in the feudal landlord society, except for the old noble families, many of the upstarts came from the lower fringe of the aristocrats or were men of plebeian birth such as merchants. By the late Warring States period a new class of landlords and officeholders had already came into being and the direct ancestors of that class of scholar-gentry was to continue as the dominant elite throughout Chinese imperial history (Bodde, 1987).

The privatisation of land did not mean the extinguishment of state-owned land. The stated-owned land, also called *gongtian* or *guantian*, included all land which was not privately owned. The stated-owned land was usually used: to generate income for the emperors and the feudal official departments; to provide army provisions and fill the empire treasury; as grants to those who made contributions (Yan and Yin, 1992). The state lands were on occasion worked directly by slaves and hired labour, but were more often let to peasants whose rents formed part of the state revenue (Sadao, 1987).

Apart from the landlords from the bureaucracy and those with large holdings, there were also small peasant landholders. The small holdings were privately owned by the peasants. They acquired the land mainly through: the allotment that historically belonged to them; the wasteland they cultivated; and, purchasing. The land the peasants owned was usually in small plots which were

more fragmented. The peasant landlords were obliged to turn in taxation to the state (Yan and Yin, 1992).

The changes in the land ownership system during feudal China can be divided into three stages: the establishment of private land ownership from the Warring states to the Eastern Han Dynasty, the suppression of private land ownership from the Three Kingdoms period to mid Tang Dynasty, and the development of private land ownership from mid Tang Dynasty to modern China (Yan, 1986).

2.3.1 The establishment of private land ownership (475 B.C. – 220 A.D.)

The Warring States to the Eastern Han Dynasty witnessed the transition from the *jingtian* system to private ownership of land. During the Qin dynasty (221 – 206 B.C.), a reform was carried out to reduce the power of the hereditary landholders, redistribute nobles' land based on military merit, and allowed private ownership of land by replacing the *jingtian* system with the *mingtian* system. The *mingtian* system encouraged the cultivation of unsettled lands, gave titles of nobility to soldiers who performed well in battle, and allowed anyone, rich or poor, to own a plot of land as long as they paid a yearly tax to the Emperor. The reform made it possible for the people to sell and buy farmland. It altered the status of Qin's peasants and encouraged the peasants of other states to come to Qin in the hope of acquiring land (Zhu, 1985, Bodde, 1987).

When land was turned into a commodity for free exchange, the concentration of land in the hands of the nobles became more and more serious. As a result, when it came to the Western Han Dynasty (206 B.C. – 25 A.D.), the phenomenon of the polarisation of land possession appeared, where "the rich

possess fields crisscrossed with footpaths, while the poor have not a tiny bit of land" (Fu, 1981a, p.11). Urban industry and commerce could not provide enough job opportunities to absorb the landless peasants. It was also hard for landless peasants to rent land from landlords. Therefore, part of peasantry had to sell themselves to the nobility as slaves, and part of them turned to banditry (Fu, 1981c). Peasant uprisings happened time to time.

2.3.2 The suppression of private land ownership (220 – 780 A.D.)

One of the attempts of land reforms was to ease the conflict between landlords and landless peasants. Several striking efforts were made to suppress the consolidation of land by giving out land to peasants and restricting the amount of land that aristocrats could own. For example, in 9 A.D., Emperor of the Xin Dynasty, Wang Mang, instituted a revolutionary land redistribution system, stipulating that all land in the empire become the property of the empire. This land system was known as the *wangtian* system, similar to the *jingtian* system. All land transactions and slavery were prohibited. If a household had less than eight males but had more than one "well" (900 *mu*) of land, it was required to distribute the excess to fellow clan members, neighbours, or other members of the same village (Fu, 1981c). However, with strong resistance from the landlords, Wang was forced to repeal the reform in 12 A.D. Wang's reform did not resolve the social conflicts; in contrast, his policies intensified the social unrest.

During the Three Kingdoms period, the famous statesman and militarist Cao Cao implemented the *tuntian* system. The constant chaos led to a large amount of uncultivated land and refugees, and the stagnation of economic growth. In

order to resume production, landless peasants, refugees, and soldiers were assigned a certain amount of land to farm. In exchange for this, the peasants were required to give half (or 60% if they used the oxen from the government) of their harvest to the government (Zhao, 2002). *tuntian* had its origins in the Western Han Dynasty. In order to supply army provisions more efficiently, the land in the frontier was farmed by soldiers and all the harvest was kept by the military (Zhao, 2002). This kind of land was called military *tuntian* (*juntun*). Cao Cao's innovation was the introduction of the civilian *tuntian* (*mintun*) for both common people and for soldiers during peacetime. It was under these circumstances that Cao Cao's usage of the *tuntian* system contributed to the economic revival of China.

However, at the end of the wars, the land was gradually taken by government officials and aristocrats. Some aristocrats became very powerful and threatened the emperor's interests. Therefore, with the establishment of a new dynasty—the Western Jin Dynasty—the *tuntian* system was replaced by the *zhantian* system to limit the amount of land, tenant farmers, servants and slaves that aristocrats could own according to their official positions. It also capped the amount of land a person, depending on age and gender, was distributed and the average size of taxable land (*ketian*) within the distributed land. Each male was allocated up to 70 *mu* of land and taxed at the rate of 50 *mu* if his age was between 16 – 60 (*ding nan*), or 25 *mu* if he was between 13 – 15 or 61 – 65 (*ci ding nan*). Each female, on the other hand, was allotted up to 30 *mu* of land, within which 20 *mu* was taxed if she was aged 16 – 60 (*ding nǚ*), or exempt of tax if she was aged 13 – 15 or 61 – 65 (*ci ding nǚ*) (see Table 2.1).

Table 2.1 Land Distribution for Common People under the *zhantian* System

	zhantian (*mu*)	*ketian* (*mu*)
males aged 16 – 60	70	50
males aged 13 – 15 or 61 – 65	70	25
females aged 16 – 60	30	20
females aged 13 – 15 or 61 – 65	30	0

Source: Based on Zhao (2002) who cited from "The Book of Jin" (《晋书》).

Note: *zhantian* is the area of land that could be owned, *ketian* is the area of land that was subject to tax.

The *zhantian* system did not clarify how to solve problems if the aristocrats occupied more land than they were allowed to. Consequently, the land was again gradually taken by the aristocrats. Wars broke out again and large tracts of land were abandoned. As a new dynasty was established through the chaos, it was able to provide the abandoned land to peasants and collect tax in kind based on the allocated land. Thus the *juntian* system started to play its role after 200 years of the *zhantian* system.

The *juntian* system, also known as the equal-fields system—first established in 485 and prevailing for nearly 300 years until mid-Tang Dynasty—was one of the most typical and influential land ownership institutions. It was regarded as state-owned land ownership. "Equal" was reflected by the total land area that one couple could hold, which was 140 *mu*, whereas the standard of land distribution differed among dynasties under the equal-fields system, as set out in Table 2.2. For example, during the Sui dynasty, land was divided into the following

categories. First, arable land (*lutian*) was to be held and worked by the recipient aged 16 – 60 to mainly grow grain and was not allowed to be sold and should be returned to the authorities for redistribution when the recipient was over 60 or died. Second, inheritable land (*yongyetian*) was usually used to plant mulberry (*sangtian*) or hemp (*matian*), and was owned by the recipient for life and was inheritable. The *yongyetian* could be sold, but the quantity one held could not exceed the limit. Third, there was land for house and garden (*yuanzhaitian*), which was also inheritable (Wright, 1979).

Table 2.2 Comparison of Land Allotments under the *juntian* System in Each Dynasty

Dynasties	Male		Female	Area of land that one couple could hold	House land (*mu*)
	Arable land (*mu* [5])	Inheritable land (*mu*)	Arable land (*mu*)		
Northern Wei (386 – 534 A.D.)	40 *mu*, plus 40 mu rotation land (*beitian*)	20	20 *mu*, plus 20 *mu* rotation land (*beitian*)	140	1 *mu* for 3 people, and 1 *mu* for 5 servants
Northern Qi (550 – 577 A.D.)	80	20	40	140	---
Northern Zhou (557 – 581 A.D.)	Single adult male: 100 *mu*, Married couple: 140 *mu*		---	140	According to household size: < 5 persons: 2 *mu*; 5-9 persons: 4 *mu*; > 10 persons: 5 *mu*
Sui (581 – 618 A.D.)	80	20	40	140	same as Northern Wei
Tang (618 – 907 A.D.)	80	20	30 (for widows)	100	same as Northern Wei

Source: Zhang, Decui 张德粹. 1990. Land Economics [土地经济学], p. 422.

[5] 1 mu=467.046 m^2 in Wei Dynasty, 522.150 m^2 in Sui Dynasty, and 580.326 m^2 in Tang Dynasty. Source: http://zh.wikipedia.org/wiki/%E5%9D%87%E7%94%B0%E5%88%B6.

The *juntian* system generally worked best at the beginning of any regime when land was confiscated from the ruined elite of the previous regime, giving the emperor a large supply of land available for distribution. But difficulties in maintaining the initially generous scale of allotment (designed to get vacant land into cultivation) in the more populated regions happened as early as 592 (Wright, 1979). Although all land nominally belonged to the government, the aristocratic class were still able to legally acquire land and controlled vast agricultural tracts. Peasants often became tenant farmers or servants during times of natural disaster or social chaos. The decline of land-labour ratio, plus the rebellions, eventually saw the fall of equal-field system. After the middle Tang Dynasty, with the disintegration of the equal-field system, the empire did not limit the transaction and concentration of land.

The *tuntian*, *zhantian*, and *juntian* systems mentioned above all originated in the context of social disorder and transition of dynasties which were mostly caused by the significant land concentration. They had a positive impact on gathering landless peasants and refugees to work on the large amounts of abandoned land, and thus reviving agricultural production. In the early stages of implementation, they contributed to easing the conflict of land concentration to some extent. However, the suppression of land concentration resulted in strong resistance from the powerful aristocratic class, and the policymakers were aristocrats. As long as the empire existed, in order to guarantee income from tax collection, the empire did not intend to abolish landlords. Instead, the aristocratic class, who were backed by the entire state machinery, used government power to ensure and protect the existence of the private land ownership system (Fu, 1981a). Therefore, it was impossible to prevent the land

being concentrated in the hands of the mighty landlords. Most of the landlords did not work on the land but leased it to the farmers. They did not care about investing in the land or improving the agricultural technology to achieve higher productivity. They were only interested in obtaining as much land as possible. The style of small-scale farming and land fragmentation continued until the present day.

2.3.3 Laissez faire private land ownership (780 – 1911)

State land allocation as a means of centralised control was abandoned in the late Tang period and no future dynasty ever succeeded again in imposing a system of state land allocation, until land reform was carried out under the Communist regime (Twitchett, 1979). Since the time of the Song Dynasty (1114 – 1234), private ownership of land has been the dominant form of tenure in China. The state, at one time or another, reserved royal lands for its own use to sustain the central and local government, military and temples which amounted to 50% of all land at the beginning of the 18th century; the remaining 50% was in the hands of private holders, either individuals or clan corporations (Wolf, 1969).

The development of landlord ownership was not constrained. All the empire did was to adjust land tax systems within the framework of the private land ownership system. Freed of the restraints on the land market and commerce, and fuelled by the increasing productivity of agriculture and the opening up of new territories in the south, the Chinese economy began to grow at such a rate that some historians have seriously suggested that by late Song times the conditions were ripe for the emergence of a modern capitalist society (Twitchett, 1979).

Although the Chinese economy grew rapidly, the laissez faire policy of private land ownership also made the extent of land concentration and rural poverty more and more severe. Until the late Qing Dynasty, the population had increased to 300 million and there was a shortage of uncultivated land. Small peasant farming constituted the overall rural economy characterised by a low level of labour productivity and agricultural technology and declining farm size. A lot of peasants were often unable to survive the interval between sowing and harvesting without borrowing. Indebtedness was a major source of rural discontent. The National Agricultural Research Bureau estimated that, in 1933, 56% of farms had borrowed cash and 48% had borrowed grain for food. The rural debt had been incurred to meet household consumption needs rather than for investment in production. Interest rates were high. On small loans in kind, an annual rate of 100% – 200% might be charged. Agricultural credit came largely from individuals—landlords, wealthier farmers, merchants (Feuerwerker, 1983).

Rebellions were therefore caused by both political (corruption of the Qing officials) and economic hardship from as early as the 1770s. The Taiping Rebellion (1851 – 1864) was the culmination of this trend. Most of the rebels were impoverished farmers, unemployed artisans, petty merchants, and dissatisfied intellectuals. According to the *Land System of the Heavenly Kingdom*, which took effect in 1853, all land was the possession of the heavenly Father and Heavenly Elder Brothers and was bestowed equally on all by the Heavenly Emperor. Land was classified into nine grades and was to be distributed in proportion to the size of families, men and women being counted equally. All surplus products were to revert to the Taiping state. No goods were to be held as private property. Slavery was made illegal. All these reforms were

in accord with peasant demands. But afterwards, Hong Xiuquan, the leader, abandoned these utopian goals to established a traditional dynastic structure called the Taiping Heavenly Kingdom, which soon degenerated into bloody factionalism and ultimately led the peasant masses to abandon the movement (Chou, 1974).

Despite the dominance of private ownership of land in China's imperial economy, the absence of legal protection against official abrogation of property rights obliged private owners (peasant landlords) to seek protective alliances with incumbent officials and local power holders (gentry-scholar landlords). The rise of widely dispersed "**patronage economy"** obstructed innovation and encouraged widespread corruption (Brandt et al., 2014). The land arrangement system, as discussed above, seemed to repeat itself during China's imperial period as shown in Figure 2.3.

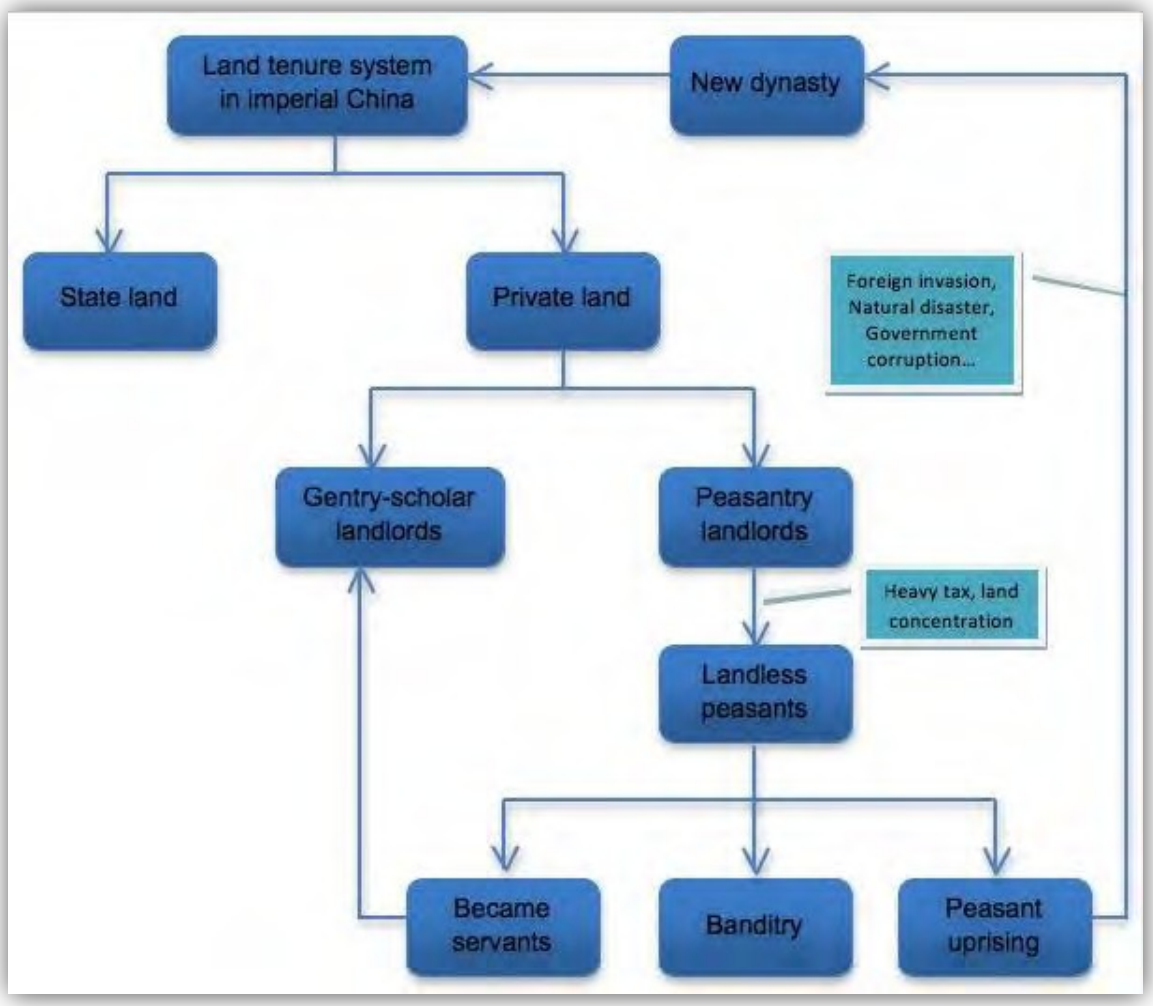


Figure 2.3 The General Route of Land Tenure System Change in Imperial China

Source: Author's compilation.

2.3.4 Land reforms in Republican China (1912 – 1949)

After the demise of the Qing Dynasty brought about by the Chinese Revolutionary Army in 1911 when Sun Yat-Sen was elected the first President of the Republic of China, rural China was in a state of destitution. Sun Yat-sen, founder of the Nationalist Party (also known as Kuomintang, KMT), made land reform the cornerstone of his program of economic reconstruction. He

advocated the “equalisation of land rights” (*pingjun diquan*) and coined the slogan "land to those who till it" (Chang, 1951). Sun saw both landowners and capitalists as insignificantly small. He also found that the ordinary people could use land freely in rural China. He considered that a land problem would arise only when land was suddenly made valuable as a result of progress, such as urbanisation, industrialisation, and the development of communications. Therefore, Sun’s land policy was to buy land from the landlords and distribute it to the landless peasants. The landlords were required to self-assess their land values, and a standard rate of about 1% was taxed on the assessed value. The government had the right to purchase any piece of land at any time according to its declared value. Sun's land policy was truly reformist in principle. It aimed at the redistribution of land and stopped there. It focused on urban, rather than agrarian, at preventing future problems, rather than solving the urgent needs of the present. It was never applied (Schiffrin, 1957).

Mao Zedong, who rose to leadership in the CPC in the 1930s, began where Sun ended. Mao inherited Sun’s Principle of People’s Livelihood (*minsheng*), trying to win the support of the KMT left-wingers who were dissatisfied with Chiang Kai-shek. The goal of peasant movements changed from reducing land rents to more rigorously addressing the nature of China’s land problems. The CPC claimed that its political agenda priority was the representation of the interests of the vast poor—peasants and industrial workers. This ideology distinguished it from the KMT and won the support of the peasantry. The Communists started their land reform, characterised by indiscriminate confiscation and bloodshed during 1931 – 1934. This was followed by an interval in which the class war was abandoned in favour of an all-out effort

against Japanese aggression. At the outbreak of the Sino-Japanese conflict in 1937, the Communists adopted the Nationalist law of rent limitation; land expropriation was practised only in cases of landlords being accused of aiding or collaborating with the enemy. As the war went on, however, the relations between the Communists and the Nationalist Government became increasingly estranged, and land reform in the sense of confiscation and redistribution was gradually resumed (Chang, 1951, Schiffrin, 1957).

2.4 Land tenure reforms since the founding of the PRC (1949 – now)

2.4.1 Agrarian Reform (1949 – 1953): peasant private land ownership

After the founding of PRC in 1949, the most important thing for the new government was to revive the economy, which was adversely affected during the civil war between the CPC and KMT, and the Sino-Japanese War. In 1950, the *Agrarian Reform Law* was adopted to continue the land reform in the new liberated areas, so as to reduce social inequality, stimulate farmers' incentives, and promote agricultural production nationwide.

The basic frame of the Agrarian Reform was to confiscate land from the former landlords and then equally redistribute it to the landless peasants and owners of small plots, as well as the landlords themselves, who now had to till the land to earn a living. The new land owners were granted land certificates by the government, and they were allowed to farm, sell, or lease out their land (Communist Party of China (CPC), 1950).

The land reform had great significance. Firstly, it overturned the feudal land tenure system by confiscating the land from the landlords and reallocating the

land to the vast number of poor farmers, and through which the old dream (each tiller has his land) of every peasant revolt since Qin Dynasty came true for the first time. Secondly, farmers were entitled with land ownership and rights of use, which greatly promoted agricultural productivity. The law defined the principles and methods for the expropriation and re-allocation of land. It protected the interests of rich peasants, middle peasants (self-sufficient peasants) and renters of small plots, as well as the nation's bourgeoisie, so as to preserve and develop the productive forces as rapidly as possible. As a result, the reform laid the basis for the industrialisation of China.

Nearly 310 million people were involved in carrying out the land reform movement in the newly liberated areas. Around 300 million peasants who had little or no land were assigned some 47 million hectares of land plus farm implements, livestock, and buildings. The peasants were relieved of rent payments equivalent to 35 billion kilograms of grain per year (China.org.cn, 2009). By the spring of 1953, with the exception of Taiwan and the ethnic minority regions of Xinjiang and Tibet, land reform was basically complete. The feudal system of land ownership that had existed for more than 2,000 years was completely destroyed and the landlord class was eliminated.

However, there was also obvious weakness under this type of land tenure. It was a small peasant economy based on private ownership and household operation. Therefore, it was hard to support the rapid growth of national industry.

In order to work out the problems of the small-scale peasant economy and improve farming productivity, the government encouraged households to unite and help each other in busy seasons. This was the sprouting of collective

ownership. Since then, private land ownership stepped down from the stage of Chinese history.

2.4.2 Socialist transformation (1953 – 1978): collective land ownership

By 1953, the government began to install a Soviet-style central planning system designed mainly to spur industrialisation. Since agricultural productivity was too low to support the ambitious industrialisation program, the government therefore adopted a unified procurement and marketing system for farm products, using state power to transfer agricultural surplus to industry by setting agricultural prices far below their market level. Then the government began a campaign of collectivisation of agriculture, and during the process individual farmers were compelled to join collectives (Wu, 1997). The collectivisation developed from the Elementary Cooperative to a bigger institution called the People's Commune, with property rights centrally controlled and a misapplied egalitarian principle of distribution.

(1) Elementary Cooperative (*chu ji she*, 1953 – 1956): land privately owned but collectively used.

Under this land system, farmers still owned the land rights but the cooperative decided how to use the land and how to allocate other means of production, such as cattle, farming tools, and fertiliser, etc. Farmers obtained the income that depended on work points (*gong fen*), share of land, and labour force.

By comparing the incomes, farmers were free to decide whether or not to join the cooperatives. On the one hand, farmers' ownership of the land was

maintained, and on the other hand, land could be joined together to pursue the goal of economy of scale (Wang, 2009b).

(2) Advanced Cooperative (*gao ji she*, 1956 – 1958): land collectively owned and collectively used.

Based on the Elementary Cooperative, the Advanced Cooperative was set up under which land rights, cattle, and land tools all belonged to the cooperatives. By 1956, most of China's agricultural production was on a collective basis, under which land ownership was vested in a collective that usually consisted of around 200 families. Farmers were allowed to keep a certain percentage (5%) of land as private plots (*zi liu di*) and enjoyed the rights of the residual production, whereas the private land they obtained since 1949 was taken back. They did not have the rights to sell, lease, or transfer their land under the Advanced Cooperative (Fan and Chan-Kang, 2005, Wang, 2009a).

The land under the Advanced Cooperative became collectively owned which resulted in some negative impacts: i) the government applied most of the agricultural income to support the building of urban cities and development of industry; ii) the agricultural residual was allocated to farmers on the principle of egalitarianism which led to "free ride" problem; [6] and iii) the Advanced Cooperative mostly went against the principle of farmers' own free will. All of these significantly damaged the enthusiasm of farmers (Wang, 2009b).

[6] The free ride problem refers to a situation where many people are unwilling to pay for their share of a public good. They try to get others to pay for it, so they can get a free ride: they benefit from the actions of others without paying. PERLOFF, J. M. 2008. *Microeconomics (Pearson International Edition),* Boston, USA, Pearson Education.

(3) The People's Commune (*ren min gong she*, 1958 – 1978): land collectively owned and collectively used.

During the Great Leap Forward (d*a yue jin*),[7] within two or three months the Advanced Cooperatives were quickly transformed into the much bigger People's Communes, underneath which all kinds of land (including collectively owned land, private plots, graveyards, and house sites, etc.), farming cattle, farming tools, and other means of production all belonged to the communes. In order to make a good impression about the success of collectivisation, overzealous local officials tended to exaggerate grain production, which misled the central planners into believing that China had adequate grain supplies for export and for urban populations (Gørgens et al., 2012). Along with three years of natural disasters, widespread famine in the rural areas occurred during 1959 – 1961 (the Great Chinese Famine), a period in which tens of millions of people starved to death. This led the Chinese government to implement an adjustment policy after 1961 (Fan and Chan-Kang, 2005). Production was decentralised into three levels (*sanji suoyou, duiwei jichu*): People's Commune, Production Brigades (*sheng chan da dui*), and Production Teams (*sheng chan dui*). Production teams, each consisting of an average of 20 – 30 neighbouring households and farming 15 – 20 hectares of arable land, were the basic units of production and distribution (Dong, 1996).

[7] The Great Leap Forward (*da yue jin,* 1958 – 1961) was an economic and social campaign of the CPC, which aimed to use China's vast population to rapidly transform the country from an agrarian economy into a modern communist society through the process of agriculturalisation, industrialisation, and collectivisation.

The original purpose of the People's Commune was to change the decentralised operation of the rural land. During this period, the land had unified planning, production, and management by the People's Communes and the gains were distributed according to labour input. Under the state's unified procurement and marketing system, agricultural output was then sold under a rationing scheme to urban consumers and industries at subsidised prices. As a result, a large surplus was transferred from agricultural producers to urban consumers and industries. It is estimated that through the so-called "scissors effect" of low state prices for agricultural products and high prices for industrial output (consumed by farmers inter alia), the government squeezed about 600 billion *yuan* out of the agricultural sector during the central planning period 1952 – 1977 (Wu, 1997).

The most severe problem with collective farming was inefficiency. The communes' income distribution system provided no work incentives to farmers because it did not adequately reward individual effort and did not solve the problem of egalitarianism. Most team members presented themselves in the field to obtain work points but did not make a serious effort. Consequently, farm productivity was stagnant (Lin, 1988).

2.4.3 Household Responsibility System (HRS, 1978 – 2008): land collectively owned and privately used

The reforms since 1978 started with the creation of a new land tenure system in which land property and usufruct rights were redistributed. In the spring of 1979, Xiaogang Village, Fengyang County, Anhui Province, allocated collective land resources to individual farm households, raising the curtain on China's land

reform. The reform was to return land usufruct rights to individual farmers and to change collective labour into household management. Consequently farmers' remuneration was closely linked to their output, so the "free ride" problem mentioned above was resolved to a large extent (Qu et al., 1995).

One distinctive feature of HRS is the separation of use rights from the ownership of land. Under the HRS, the land use rights of the former People's Commune were assigned to individual households. The land itself remained jointly owned by the collectives in the same village, but individual households contracted the land use rights to several parcels of land in their village area. By the end of 1984, about 99.1% of production teams adopted the output-linked responsibility system, which was called "contracting all work to the household" (*bao gan dao hu* or simply *da bao gan*) (Cheng and Tsang, 1996). Under the *da bao gan* system, the households had the freedom to make most decisions about what crops to plant, what inputs to use, and what to do with the crop output (to consume it, sell it to the state, or sell it in the private market). In return for the use of village land, households must turn over a portion of their output to village authorities to fulfil grain quotas and meet other requirements. In essence, the HRS reform shifted the basic unit of production in Chinese agriculture from the collective team to the individual village household, but the HRS did not fully privatise village agricultural land (Krusekopf, 1999).

Although the HRS contributed to rapid growth in agricultural production and farmers' economic welfare during the initial stage of reforms, it suffered from some limitations.

(i) Land fragmentation problem. Farmland in a village was owned by all its members collectively. As a result, every member had equal claim on land property rights, and the principle for distributing land was based on the size of the rural households. Given the abundant population and limited land, the amount distributed to each household was very small. Moreover, farmland differed from parcel to parcel in terms of soil fertility, irrigation conditions, location, and so forth. A household had to obtain parcels from each of the grades. Thus, the total was not only insufficient but also fragmented and scattered around villages (Chen and Davis, 1998).

In 2006, the cultivated land **per rural resident** in China was 0.1 hectare, which was 1/2 of that in Vietnam, 1/3 of that in India, 1/12 of that in South Korea, 1/60 of that in UK, and 1/300 of that in USA (Xinhuanet, 2009).

(ii) Land tenure insecurity. As a leading principle, the egalitarian entitlement of farmland for peasants in a collective ownership framework jeopardised land tenure security in an environment of rapid demographic and economic changes (Cheng and Tsang, 1996, Fan and Chan-Kang, 2005). As the population changed, villages had to readjust the distribution of farmland. The frequent redistribution of farmland resulted in many problems. For example, farmers worried about the risk of losing land through the land redistribution process and had no incentives to improve land-related investment. Instead, the insecurity of land tenure made farmers overexploit the soil to pursue short-term return (Chen and Davis, 1998).

To sum up, the HRS greatly improved farm productivity, but it maintained the egalitarian distribution of farmland which led to land fragmentation and

insecurity of property rights. Consequently, new land reforms were still called for. The year 1984 marked the beginning of a new stage, as the government announced that the contracting period of farmland to peasant households could be extended to 15 years. Besides, it encouraged the sub-contracting of the land to the more productive farmers. The transfer of rural land use rights by contract has gradually developed since then. After years of experimentation, it was eventually decided, at the end of 1993, to allow the extension of land tenure contracts for 30 additional years on top of the original contract period, which was reaffirmed in the Land Management Law that took effect in 1999.

China is now undergoing a large-scale process of urbanisation. Rapid urbanisation has been accompanied by enormous urban expansion and has resulted in a lot of arable land being used for non-agricultural purposes and millions of farmers being dispossessed. Each year, approximately 150,000 hectares of arable land was transformed for urban development purposes, and 2.5 to 3 million farmers were dispossessed as a result of urban expansion (Cao et al., 2008). However, under China's current land expropriation system, farmers who lose their land typically receive only little compensation and they can easily end up landless and unemployed. The governments, on the other hand, may legally expropriate land which is under collective ownership, if it is in the public interest (Guo, 2001). What is public interest remains ambiguous, though. Therefore, the local governments are enthusiastic to expropriate rural land from farmers at a low price, and then, on the one hand, use it to attract manufacturing investors by lowering land leasing fees, hoping that such temporary revenue losses are offset by future gains such as generating GDP and creating job opportunities, which would signal stronger political

performance and a better chance for political promotion. On the other hand, for the real estate and commercial sectors, the governments can take advantage of their monopolistic positions to control the supply of land for residential and commercial purposes and maximise the extra-budgetary revenue from auctioned or tendered land leasing (Cao et al., 2008). As a result, social conflicts arising from state land expropriations have significantly intensified recently. About 65% of mass incidents in rural areas are triggered by land disputes, which are mainly caused by forced land acquisition, low compensation, and unfair appropriation of the compensation (China Daily, 2010).

2.4.4 New-round land reform in current China (2008 – now): still owned by rural collectives, rural land has come with more secure use rights

In order to protect farmers' interests and ease the social conflicts triggered by excessive land expropriation mentioned above, the Chinese central government's No. 1 Document issued in 2008 suggested that rural land use rights contracts should be maintained and unchanged. It also proposed to push forward a RLRC program, and allow farmers for the first time to voluntarily sub-contract, lease, exchange, and swap their land use rights, or joined shareholding entities with their contracted farmland. This new policy intended to boost agricultural productivity and thus tackle the growing urban-rural wealth gap by allowing farmers to use land as collateral to secure loans, invest in irrigation, and expand plot sizes to create larger, more efficient farms.

In the 2012 No. 1 Document, the government urged that relevant land laws are amended to protect and maintain permanent land use rights for farmers. It

encouraged that farmland be transferred on a voluntary basis, in an effort to develop moderate-scale farming. Meanwhile, the RLRC program would be expanded to more areas and was required to be finished in most rural areas by the end of 2012.

In 2013, a reform blueprint dubbed the “383 Plan” was released by the Development Centre of the Chinese State Council. The “383” is shorthand for:

- Reform trinity: government, corporate, and market
- Eight key areas of the reform: governance, basic industries, **land system**, finance system, fiscal and tax system, state-owned assets reform, innovative and green development, and liberalisation of international trade
- Three breakthroughs: lowering barriers to entry so as to encourage investors and increase competition, setting up a basic social security package for citizens, and **allowing collective lands to be traded on the markets**.

One of the eight key reform points of the 383 Plan was to launch a land reform aimed at giving both rural and urban land equal rights, having a unified land market, and sharing the rise in land values fairly (CaixinOnline, 2013).

Also in 2013, in the Third Plenary Session of the 18th CPC Central Committee held in November, China pledged to provide farmers with more property rights. Farmers were encouraged to develop a shareholding system from which they could realise benefits. Meanwhile, they could also sell a share or use it as collateral to access finance from the banks. They also had the right to transmission of ownership across generations. Moreover, the homestead

system in rural areas would be improved, and farmers' usufruct rights of homestead would be made secure. A pilot program would be carried out in some areas to discover other channels for improving farmers' income. A rural property-rights trading market would be established.

The 2014 No.1 Document vowed to deepen the rural land reforms to further clarify the rights and made the rural land rights more flexible. In addition to staying with the strictest cultivated land protection system (a minimum line of 1.8 billion *mu* or 120 million hectares of arable land), farmers were granted a bundle of rights:

- A right to maintain the land contracts in perpetuity
- A right to occupy the land
- A right to use the land
- A right to derive income from the land
- A right to transfer the land contracts to other people
- A right to mortgage the land contracts
- A right to use the land as collateral.

Within these, the permanent duration of contracts, mortgages, and collateral functions were activated in 2008. Large and medium-sized commercial banks were urged to extend their networks to townships and reinforce their capability of providing services to rural areas. The implementation of the RLRC program would be partly subsidised by the central government.

2.5 Conclusions

Rural land ownership in China evolved from clan public ownership during the primitive period, king's ownership in the slave society period, to private ownership throughout the imperial period, and then to collective ownership since 1956, and now to private ownership once again—i.e. a full circle from public to private ownership and use of land. For the last 2,000 years, land tenure in China has involved a struggle between the tendencies of governments to allocate land administratively and the tendencies of a commercial economy to make land into a freely marketable commodity. The tensions between equitable sharing of land and that of raising output for the resource have played out throughout the recorded history of the PRC. The governments' efforts to limit land concentration, such as the *tuntian*, *zhantian*, and *juntian* systems, inevitably ended up giving way to private land ownership.

The privatisation of land ownership tended to cause the concentration of land in the hands of a few mighty landlords who took advantage of their privilege and wealth to grab land from the poor. During a series of collectivisation campaigns in the middle of the 1950s, land privatisation was abolished, and land transactions were prohibited. The socialist transformation culminated in the establishment of the large, centralised Peoples Communes in 1958, which were soon proved to be inefficient and unworkable. Productivity declined and the system could not be sustained. The reform of 1979 returned rural land rights (except for purchase and sale) to individual households. The well-known HRS improved peasants' incentives to farm and led to rapid growth in rural production, however, the government could requisition land from the farmers

through legal process. Another form of land concentration—land expropriation—appeared as a result. Land was expropriated at a low price from the farmers, and then used, on the one hand, to attract manufacturers to generate greater GDP and achieve a higher employment rate; on the other hand, to transfer the land to the real-estate and commercial sectors at an extremely high price through land auction. With this background, farmers easily become landless and unemployed, and urban residents have a heavy burden of high housing prices. Land reforms are continuing.

History seems to repeat itself in the circle of concentration and anti-concentration, peasant protests and land reforms in China. Land tenure appears to be the permutations and combinations of privately owned, publicly owned, or a mixture. As noted, since the founding of the PRC in 1949, there have been four types of land tenure in China (see Figure 2.4): i) privately owned and privately used (1949 – 1953); ii) privately owned and collectively used (1953 – 1956); iii) collectively owned and collectively used (1956 – 1978); and, iv) collectively owned and privately used (1978 – now).

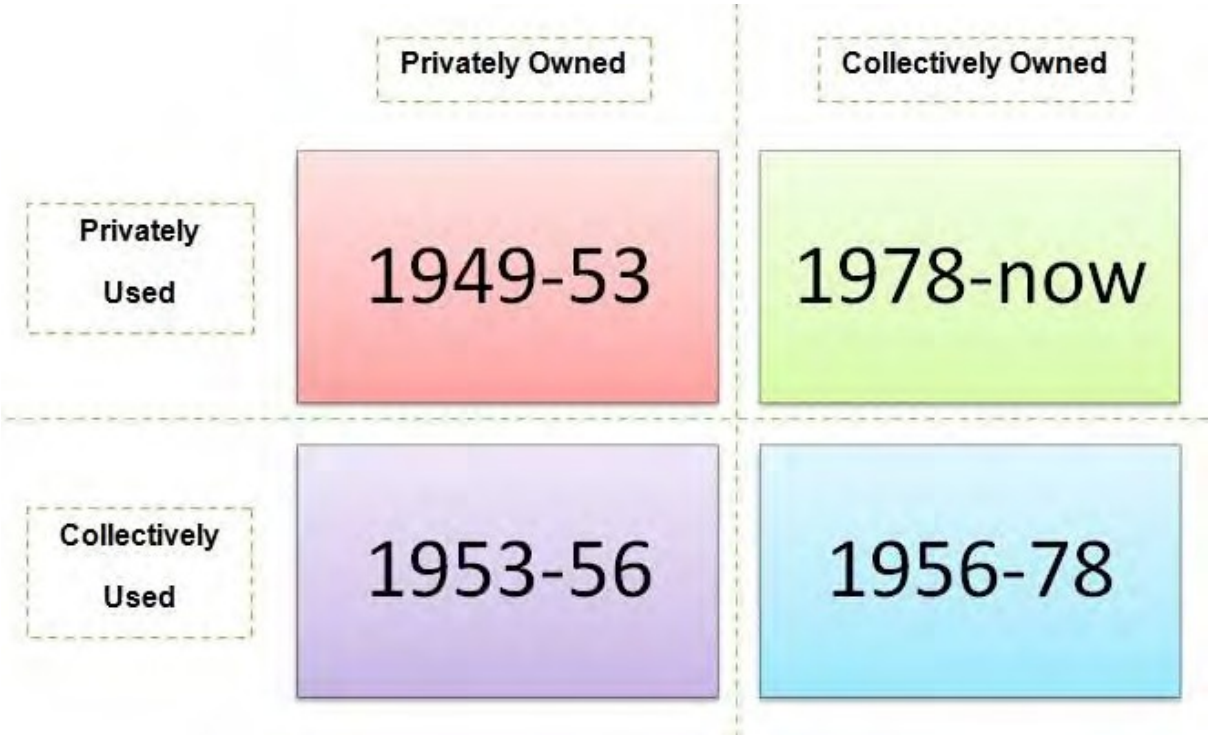


Figure 2.4 China's Land Tenure Arrangements since 1949

Source: Author's compilation.

The review of land tenure transformation in the long history of China paves the way for the following chapter, which examines the relationship between land tenure arrangements and agricultural productivity.

Chapter 3 Research Methodology

3.1 Introduction

As discussed in Chapter 2, there is a new round of ongoing land reforms throughout China, which is as important as the Land Reform in 1950 and the HRS since 1978. The RLRC program is the first and fundamental step of this new round of land reforms.

How will the RLRC program affect agriculture, rural areas, and farmers? In his research on Thai agriculture, Feder (1988) provided a standard conceptual model to examine the links between land title, land productivity, and household income (see Figure 3.1). The model depicts two complementary channels—investment and credit—impacting positively on productivity.

From the farmer's point of view (left side of Figure 3.1), the granting of a land title will increase his certainty that he will be able to benefit from the investments he makes—in equipment, structures, irrigation infrastructure or land conservation measures—to retain or improve the productive capacity of his farm. With increased security of land, the farmer has more incentive to engage in productive investment activities. This is due to the fact that investments yield benefits over time, and the farmer's incentive is affected by his expectation regarding how soon he could reap benefits from the investment made up-front and how long he could hold the land (Feder and Nishio, 1998).

Farmers with secure title, moreover, will have better access to credit. This is because from the lender's point of view (right side of Figure 3.1), farmers with secure legal titles are less risky clients as they now have collateral in the form of

a secure title. Therefore, lenders are more willing to supply credit at a lower interest rate to titled farmers who demand credit to meet both capital (investment) and operational (variable input) expenses through exchange for the land title as collateral.

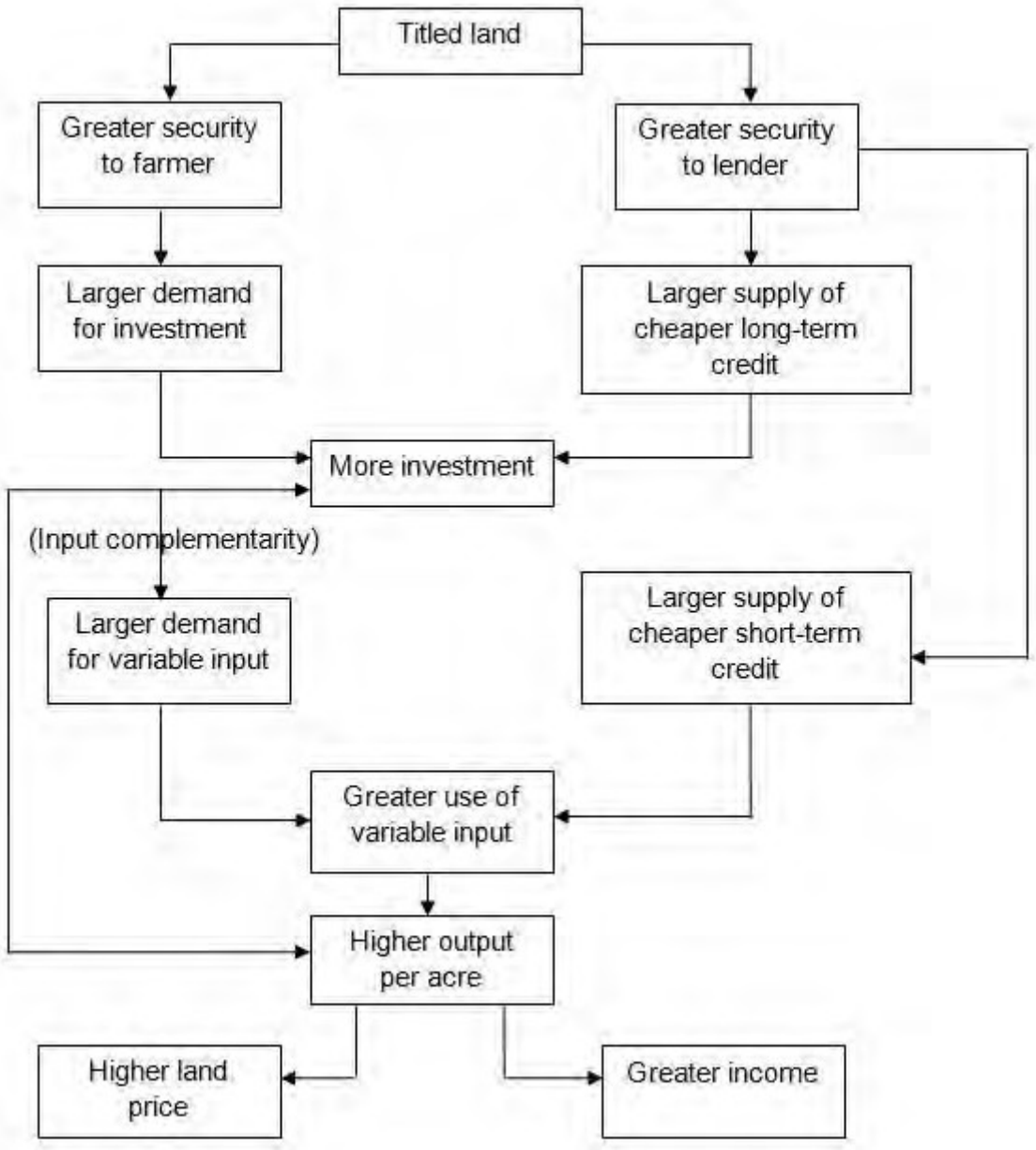


Figure 3.1 Security of Landownership and Farm Productivity: A Conceptual Framework

Source: Feder et al. (1998, p.7)

Access to credit increases the farmer's ability to plan and develop the land optimally. At the same time, the titleholder has more incentive to invest. The increased level of investment and supply of credit leads to improvements in the productivity of land. This in turn translates to higher land prices and incomes (Feder et al., 1988, Fairhead et al., 2010).

The previous chapter reviewed the background of the land tenure evolution during China's long history and the new land titling reform recently being carried out in China. The research gaps have therefore been identified based on Feder's conceptual framework presented above, i.e., what are the impacts of a new and ongoing RLRC program on agricultural productivity in China? The research goal has been further sub-divided into three hypotheses:

- RLRC program will increase farm-related investment
- RLRC program will contribute to higher agricultural productivity
- RLRC program will improve rural household income
- RLRC program will enhance resource allocation efficiency.

To test the hypotheses, a purposed-designed cross-sectional survey was employed.

The research framework in this chapter underlies the empirical analyses of the remaining chapters. The chapter is organised as follows: Section 2 explains why the quantitative method has been selected; Section 3 describes the data collection process; Section 4 presents the data analysis methods; followed by a conclusion in Section 5.

3.2 Research design

Since the research objects refer to farm-related investment, productivity, and income, which all emphasise quantification in the collection and analysis of data, the quantitative research strategy is therefore employed rather than the qualitative strategy. Bryman (2008, p.22) defined quantitative research as “a deductive approach to the relationship between theory and research, in which the accent is placed on the testing of theories”. In this study, quantitative data was collected to test the propositions drawn from theory on the relationship between land tenure security and productivity in the context of China.

The research goal is specifically to compare the agricultural productivity, farm-related investment, and household income among different populations of certified farmers and non-certified farmers at a single point in time. Consequently, a cross-sectional research design was employed. The advantage of a cross-sectional design is that it enables the comparison of many variables at the same time when time and budget are limited. An important point to be noted is that it is the relationships between variables that a cross-sectional design uncovers, not a causal direction (Bryman, 2008).

The cross-sectional design is also called a survey design, which often entails administration of questionnaires. Thanks to its standardisation and accuracy during the asking of questions and the recording of answers (Bryman, 2008), a questionnaire with close-ended questions was carefully designed to collect original farm-level data.

The population is the “universe of units from which the sample is to be selected” (Bryman, 2008, p.168). The study population in this study consists of all rural

households in China, which can be stratified into two groups: certified and uncertified rural households.

3.3 Data collection

3.3.1 Select study sites

The selection of the sites was conducted as follows. An area comprising a large number of farms with and without land certification was first selected. Ideally, it is best to look for potential survey objects that come from the same village. If an area that consists of both certified households and uncertified households could not be found, it is better to select an uncertified village which is adjacent to the selected certified village.

A certified area, Chengdu city, was firstly targeted based on the information that is available online. Thanks to its abundant human resources and relatively cheaper labour cost, Chengdu has attracted many manufacturing and service enterprises in recent years that relocated from the coastal region. As a result, there is huge demand for land. But there is not enough land in urban districts. Therefore, the rural land is a good option. In 2003, Chengdu started to promote more efficient use of land through a policy of “Three Concentrations”: the concentration of industries in development zones, the concentration of rural population in the township, and the concentration of land for scale farming. The motivation for the above was to capitalise on the benefits of scale economies. The emphasis is on coordination across government levels to manage land use and conversion. In the countryside, rural land would be concentrated by transferring land use rights to firms and farmers.

In 2007, Chengdu was named one of the pilot areas for the “Comprehensive Reform for Balanced Urban-Rural Development” by the State Council of China, in order to explore a way forward to a society with modern industrialisation, urbanisation, and modernised agriculture, and thus minimise the urban-rural gap. In February 2008, the Chengdu government found a breakthrough to urbanisation—a RLRC program—which would allow farmers to transfer their certificated contracted land more securely or use it as a mortgage to obtain loans from the banks, and therefore stimulate the farmers’ participation in urban development. By the end of 2010, certifications for land ownership were assigned to the brigade level (each administrative village contains a dozen brigades). Regarding the entitlement of land use rights, 1.8 million rural households got the new certifications (see Figure 3.2) for contracted agricultural land and 1.66 million households got the certifications for their housing land (Li, 2012).

A registration certificate, as shown in Figure 3.2, for agricultural land includes the following information:

- Personal details of the household with rights to the land
- The plot’s number, area, and quality grade
- Classification in terms of produce (paddy/wet field or dry field)
- Contract holders of four boundaries (names have been processed with mosaic in order to protect the interviewees’ information)
- A brief description stating whether the plot is the basic farmland or general farmland. Basic farmland is defined as land growing field crops

such as grain, cotton, oil, and vegetables, while general farmland is usually used for cash crops like flowers, herbs, etc.

Figure 3.2 Certifications for Contracted Agricultural Land

Source: Author's compilation based on fieldwork data.

Chengdu was chosen for the survey for three reasons. First, it was the initial pilot chosen by the central government of China. Second, the piloted area is surrounded by small landholders who are as yet to be given permission for registration. Third, the certified and uncertified lands are homogenous in terms of quality and crops grown. Furthermore, the lessons from Chengdu have

applicability for China as a whole, given its similarity with other agricultural regions of the nation.

Despite all the forward planning and preparatory work in deciding on the survey sites, sample size, and the design of the questionnaire, problems were encountered during fieldwork. While approval from the UNSW Human Research Ethics Panel was secured for the survey, securing official permission for conducting fieldwork in China proved problematic. In particular, accessing households within the predetermined survey areas proved difficult. Due to the sensitiveness of rural land issues and my lack of social networks (*guanxi*) in Chengdu, local governmental departments of some counties I visited declined my request to do fieldwork in their area. It did not work either when I visited one village directly in an effort to conduct the survey without official permission from a higher-level authority. Fortunately and following repeated attempts to secure official endorsement for fieldwork, a county-level city named Chongzhou gave me approval. Through consultation with the Chongzhou government, Qun'an village was identified as one of the study sites to represent the certified group. Qun'an was one of the pilot areas in Chengdu city where a land reform project was ongoing. At the time of survey, the households in Qun'an had held land certification for about two years.

As per the survey design, another village within Sichuan province that was identical with Qun'an, except for land certification, was to be chosen as the control group. However, the Chengdu municipal officials refused to disclose the list of uncertified areas in Sichuan, arguing strongly that this was an "internal confidential file". As a result, after exhausting all other options, I had to choose

solely for convenience my hometown as the control group—Xiayong village in Fujian province. The land registration program had not yet reached Xiayong, and small landholder agriculture is a common occupation for many.

Therefore, the two study sites were determined, as Figure 3.3 shows. Although the two villages are within different provinces, they have many similarities with respect to smallholder rice production. These include:

- Both villages are located in southern China and have a subtropical climate
- Both villages are a similar size, with about 800 households each
- Both villages have an annual rainfall of about 1,100 millimetres per year
- Both villages have an average temperature of 16 degrees Celsius
- Both villages are the main rice-producing regions in their counties
- Both villages are about 50 kilometres via paved road to the main market.

Despite their resemblance, there are some differences that had to be accounted for in creating the counterfactual for the treatment (i.e. those with registration) sample. In particular:

- Qun'an is located on the plains, while Xiayong is located in a mountainous district with a mixture of terrace and flat land.
- Farmland in Qun'an often produces two crops (rice and wheat) per year, while most farmland in Xiayong is used to growing only rice each year.

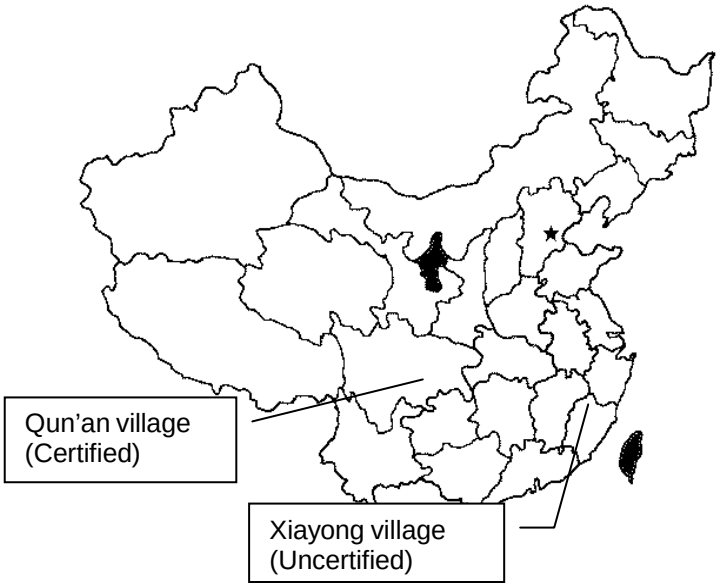


Figure 3.3 Geographic Locations of the Study Sites

Source: Author's compilation based on fieldwork data.

Although Xiayong is located in a mountainous area, the farmers grow crops mainly on the flat plots, leaving many of the terrace plots uncultivated. Therefore, based on the similarities and control for the disparity such as soil conditions, Xiayong was identified as a suitable comparison group to Qun'an (certified).

3.3.2 Sampling method

With the referral letters from official departments in the counties, I made appointments with the village heads to set up times for the survey. In addition to budget and time constraints, the fact that many household heads were working outside villages after the rice harvest made random sampling difficult. The village heads therefore arranged the brigade leaders to assist the survey through:

- Recruiting as many household heads as possible to do the questionnaires
- Guiding us to visit household heads house by house
- Interviewing farmers that we came across on the road. They were confirmed as one of the villagers by the brigade leaders.

Such a sampling strategy produced a convenience sample in which the interviewees were selected “by virtue of accessibility” (Bryman, 2008, p.183), i.e., only farmers who happened to be in the village at the time of survey could be interviewed. While convenience sample is very commonly and frequently used in social sciences due to the difficulty and costs involved in probability sampling, it should be noted that convenience samples do not produce representative results. One cannot generalise the findings with such a sampling strategy. However, though not ideal, it could still be used as a legitimate way of carrying out some preliminary analysis (Bryman, 2008).

Data was collected in November 2011, about two months after the rice harvest. The questionnaire is provided at Appendix 2 and focused on information relating to:

- The GPS coordinates of houses visited (see Figure 3.4)
- The socioeconomic characteristics of the household head including his or her age, gender, and education level
- Information about the cultivated land, including tenure status, land area, whether leased in or out
- The value and tonnage of rice outputs

- The use of rice-related inputs per unit of land including seeds, fertilisers, herbicides, labour, and machinery
- The access to credit (formal and informal) in the last 12 months
- The household income sources, including farm income, wage income, off-farm income, and other income.

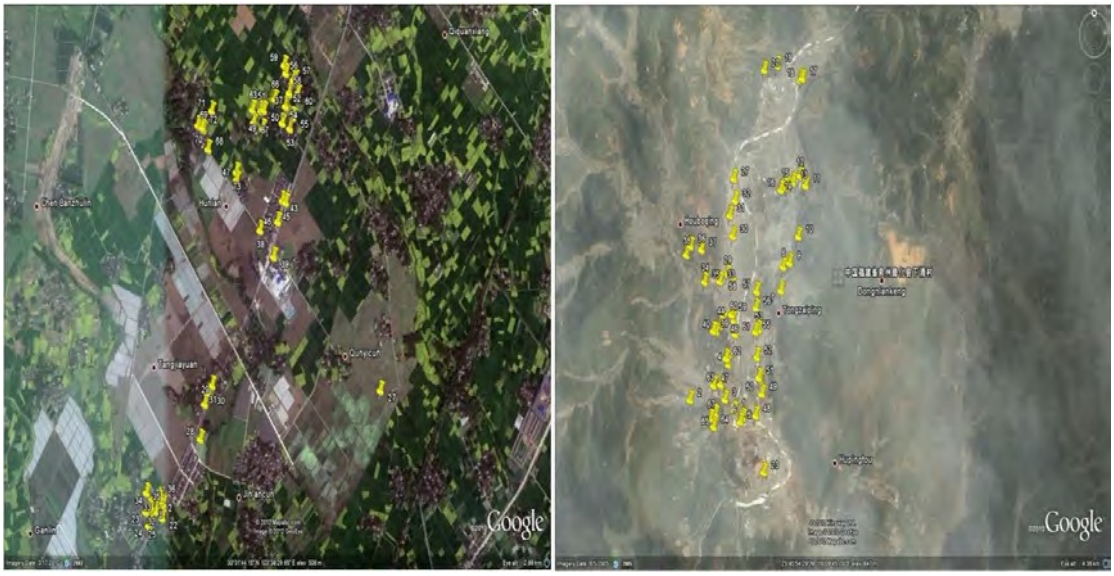


Figure 3.4 Sample Distribution in the Study Sites (Left: Qun'an;; Right: Xiayong)

Source: Author's compilation based on fieldwork data.

The questionnaire was in Chinese so that the interviewees could understand. During the survey, I often had to read the questions and record answers for the interviewees.

3.3.3 Sample size and statistical power

In preparing for fieldwork, I had to decide on the size of the sample so as to be able to detect the impact of tenure if it was present. This is the statistical power of the research which is elaborated next. Statistical power of a hypothesis refers

to the probability of rejecting the null hypothesis when the alternative hypothesis is actually true (Cohen, 1970). In this particular context, it is the probability of rejecting the impact of tenure when it is present. Two types of error, as Figure 3.5 shows, may occur when testing a hypothesis:

- Type I error: the treatment has no real effect in the population while the results of the sample may lead to a conclusion that it has an effect, i.e., a null hypothesis is rejected when it is true (i.e. a false positive)
- Type II error: the results of the sample fail to reject the null hypothesis when the alternative hypothesis is in fact true (i.e. a false negative).

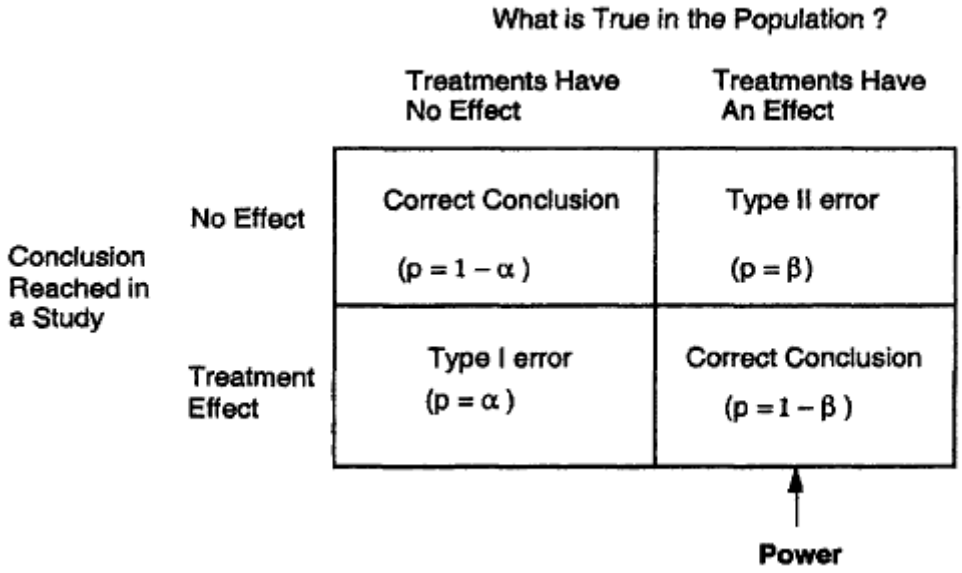


Figure 3.5 Outcomes of Statistical Tests

Source: Figure is from Murphy and Myors (2004, p.5).

For any given statistical test, the four parameters, power, effect size, alpha, and sample size, are so related, as elaborated next, that any one of them can be written as a function of the remaining three (Cohen, 1970). Therefore, before conducting fieldwork, I estimated the sample size in advance of fieldwork based

on a desired level of power, effect size estimated from the literature, and significance criteria (alpha).

Effect size is a key concept in statistical power analysis. Effect size measures the probability to reject the null hypothesis, i.e., effect size measures how much effect a treatment has (Cohen, 1970, Murphy and Myors, 2004). The effect size depends on the treatment, phenomenon, or variable being studied, and is usually not known in advance (Murphy and Myors, 2004). Therefore, effect size could be estimated using the data from existing literature that studies similar questions in a similar context.

One of the most common effect size measures is the standardised mean difference, d, defined as $d = (M_t - M_c)/SD$, where M_t and M_c are the treatment and control group means, respectively, and SD is the pooled standard deviation (Murphy and Myors, 2004). Examples of effect size are presented in Table 3.1.

Table 3.1 Calculation of Effect Size Based on Literature

Literature	Dependent variables	Effect size
Holden et al (2009)	Log of yield value in Ethiopia between certified and uncertified households	0.15
Dong (2000)	Crops production in China of different income level of villages	0.33
Chand and Yala (2009)	Crops outputs in tons in PNG between different tenure types of plots	0.50

Source: Author's compilation based on the cited references.

The literature represents different effect size under different contexts, ranging from 0.15 to 0.5. Concerning the potential effect of the RLRC program, I used a conventional "medium" effect size (d=0.5), as Cohen (1970) introduced, to determine my survey sample. Given a desired power of 0.80, and significance criteria (alpha) at the conventional 0.05 level, the implied sample size in each group is 64.[8]

Finally, data were collected from 140 households, including 73 from Qun'an (certified) and 67 from Xiayong (uncertified). Respondents were usually the household heads except when they were absent, in which case they were mainly replaced by their spouses or other adult household members. No respondent refused to complete the questions.

3.3.4 Ethical principles

It is important to consider ethical issues when conducting human research. Those that are critical to my research, and noted in Diener and Crandall (1978, as quoted by Bryman, 2008), include: i) harm to participants, ii) lack of informed consent, iii) invasion of privacy, and iv) deception. Each of the above is elaborated next with reference to my own fieldwork.

Harm could be identified as both physical and psychological, such as loss of self-esteem and stress. The potential for causing harm to the participants in the survey was minimal. Collection of information on crop output is unlikely to cause real or potential harm to participants as such information is regularly collected by officials.

[8] The calculation was computed using package "pwr" of the R software.

On the second issue, informed consent was sought through the participant being informed of the survey and requested, if agreeable, to sign a participant information consent form. Ethics approval for this research was obtained from UNSW Human Research Ethics Panel (see Appendix 3). The questionnaire was administered only after agreement was secured, and the survey was conducted as stipulated in the approval. All the interviewees were informed of the purpose of the survey. They were also informed of their rights to voluntarily consent and their rights to decline to participate, and to withdraw participation at any time (see Appendix 4). Interviewees' consent was obtained before they answered any of the survey questions.

In order to ensure confidentiality, privacy, and anonymity, the names of household heads were transcribed with numbered household ID. The GPS coordinates that could make an interviewee identifiable were only used to generate the figure of sample distribution as Figure 3.3 shows. The results of the study would be used in a thesis as partial fulfilment for a Doctoral degree.

3.3.5 Reliability and validity

The two most important criteria for the evaluation of social research are reliability and validity. According to Bryman (2008), reliability refers to the consistency of a measure of a concept, involving whether a measure is stable over time; and validity refers to whether a measure of a concept really measures that concept.

In this thesis, the standardisation of a close-ended questionnaire ensures that the indicators are consistent between the two study sites which meet the criteria of "internal reliability". Besides, I was the only observer to conduct the survey,

which made sure that I presented a similar attitude to all interviewees when asking and recording questions. This corroborates the criteria of “inter-observer consistency”.

When it comes to validity, the indicators used in the questionnaire were based on the literature (Feder et al., 1988, Place and Otsuka, 2002, Bresciani, 2004) to ensure they were capable of testing the hypotheses mentioned above. Specifically, the challenge of establishing causal relationships from the data (i.e. ensuring internal validity) and the inferences arising from the above (i.e. external validity) are two tasks at hand. Internal validity relates to the separation of cause from effect, i.e., whether a conclusion incorporates a causal relationship between two or more variables. External validity, on the other hand, is concerned with the question of whether the results of a study can be generalised beyond the specific research context (Bryman, 2008).

I employed convenience sampling solely because of the difficulty of obtaining random samples (as explained in chapter 3). A consequence of non-random sampling is that the results of the analysis cannot be generalised beyond the context, i.e., the external validity may have been weakened. Nevertheless, the use of propensity score matching (PSM) models allows me to control for the relevant characteristics. Thus PSM models redresses some of the problems of non-random sample selection thus helps me infer causality from the models. Corroborating the observed cause-effect relationship from the survey data with the literature allows me to draw out the general conclusions discussed in the concluding chapter.

3.4 Data analysis

Following the collection of the survey data, these were analysed using econometric techniques of propensity-score matching and regression analysis. The statistical analysis was done using R, which is free software for statistical computing and graphics.

Summary statistics on demographic variables such as age, gender, and education level were first calculated to compare the two survey sites and to identify outliers in the information collected. The means of independent variables was compared (in Chapter 5) to test the differences between the two villages. The OLS regression model was estimated to examine the relationships between the independent and dependent variables (reported in Chapters 5 and 6). To control for selection bias, propensity score matching (PSM) was employed to further examine the links between productivity and tenure type, controlling for all other observables (Chapters 5 and 6).

Analysis of the impacts of land tenure reforms on grain productivity in China from a macro level using secondary data was conducted in Chapter 4. The dataset is a 60-year panel data extending across 31 provinces of China. The data was downloaded from the website of the National Statistics Bureau of China. This analysis paved the way for the empirical chapters (Chapters 5, 6 and 7) which are based on the fieldwork data and studies the links between land tenure status and rice productivity at a micro level. The macro level analysis corroborates the more granulated findings from analysis of survey data.

3.5 Conclusions

This chapter described the research method used to collect survey data from households from two villages: one of which had land certification (i.e. tenure security) and the other did not. Every attempt was made to select sites that were similar except for land certification, the treatment variable. Success in selecting the villages for the above was constrained by problems of securing official endorsement for the survey. A considerable amount of energy was expended in getting approval from the authorities, both in the provincial and local level governments and from the village heads. Furthermore, a random sampling approach was dropped for convenience sampling due to problems of accessing household heads. One important lesson learnt from fieldwork was that compromises had to be made in conducting empirical research. Importantly, questions on the extent to which the compromises have affected the key findings had to be answered.

The key issue for this chapter is the extent to which the compromises made in data collection have contaminated the findings. The quantitative analysis employed on the data has, to the extent possible, taken into account the differences in the treatment and control villages and the potential bias resulting from convenience sampling.

The goal of this thesis is to investigate the links, if any, between land tenure status on the one hand and farm productivity, investment, and household income on the other. A quantitative research strategy has been employed. A close-ended questionnaire was designed and administered to collect firsthand the requisite data from a sample of 140 households, including 73 from the

certified village and 67 from the uncertified. The sample size was estimated before the survey based on statistical power, effect size, and significance criteria.

Ethics approval was obtained from the UNSW. Consent was obtained from the interviewees. Confidentiality, privacy, and anonymity were maintained throughout the study. The purposed-designed questionnaire based on the extant literature ensured that the theoretical constructs were measured and the research questions posed answered, i.e., the construct validity requirement was fulfilled. The questionnaire was administered and the data analysed by the researcher herself. Consequently, the consistency of measurement reliability was maintained.

Notwithstanding the above-mentioned problems, the analysis that follows provides an answer to the hypothesis that land certification has a statistically significant impact on farm level productivity—the evidence for which is presented in Chapters 5, 6, and 7.

Chapter 4 Determinants of Grain Productivity in China: Can Land Tenure Changes be an Explanation?

4.1 Introduction

Grain production has always been a subject of great concern to China. This is understandable as China is home to 20% of the world's population but has just 8% of the world's arable land to feed its population. The Chinese government deems maintaining a comparatively high level of food self-sufficiency (i.e. being able to provide for 90% and above of the domestic demand through domestic production) as a matter of national security (Food and Agriculture Organization, 1999). Considering China's huge population base (1.35 billion in 2012), decision-makers cannot take risks with food security. Security of the domestic sourcing of grain is central to attaining food security. Therefore, the importance of sufficient grain supply has been repeatedly stressed in the Chinese government's policy pronouncements, as was reiterated in a central rural work conference in December 2013 (Xinhuanet, 2013):

> The bowls of the Chinese, in any situation, must rest soundly in our own hands. Our bowls should be filled mainly with Chinese grain. Only when a country is basically self-sufficient in food can it take the initiative in food security and grasp the overall situation for economic and social growth.

The grain output growth determines whether China has the ability to feed itself in the future because rapid industrialisation and urbanisation will lead to competition for resources, land, and labour in the main, between agricultural and non-agricultural sectors (Huang et al., 2000). The conversion of cultivated land to non-agricultural uses, such as for industrialisation, the building of

residences, and the construction of infrastructure is inevitable to create jobs and maintain relatively rapid economic growth (Deng et al., 2006). However, the high profits of turning agricultural land into state-owned land, then into construction land may encourage local governments to over-convert agricultural land into construction land for “irrational urbanisation”, and therefore may bring about a grain crisis (China Daily, 2008). According to statistics, about 200,000 hectares of farmlands are taken from farmers across China every year (People's Daily Online, 2006). Moreover, a Chinese government report released in April 2014 admitted that one-fifth of China’s agricultural land has been polluted (The Economist, 2014a). Illegal land confiscation and polluted farmland have become serious problems affecting grain security.

At the same time, there is an obvious shift of the labour force from agriculture to industry and service sectors, as shown in Figure 4.1. In 1952, the ratio of employment in agriculture, industry, and service was measured at 84:7:9; except for the sudden change during 1958 – 1960 due to the Great Leap Forward, the labour force shifted smoothly from the agricultural sector to the industry and service sectors. The latest data in 2012 shows that the ratio was 34:30:36. Initially most of the workforce was employed in agriculture. Over time as the economy grew, non-agricultural employment rose with it. Employment in the service sector, as shown in Figure 4.1, exceeded that in agriculture from 2011.

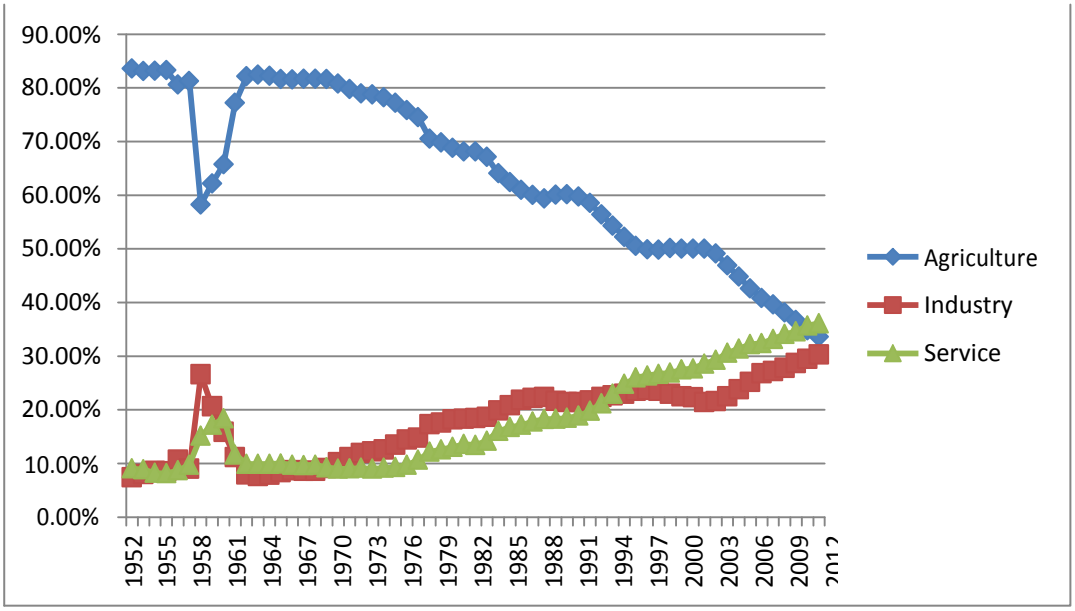


Figure 4.1 Employment in Agriculture, Industry, and Service (% of Total Employment) in China 1952 – 2012

Source: Author's compilation based on data from the website of National Bureau of Statistics of China, http://www.stats.gov.cn/english/.

With limited resources (of land and labour force) and growing urbanisation, the policy challenge is how to allocate land and labour to reach a balance between urbanisation and food security.

To ensure grain security, for 11 consecutive years between 2004 – 2014, the No. 1 policy documents[9] of the Chinese central government have focused on agriculture, farmers, and the countryside (the Three Rural Issues) (Xinhuanet, 2014). For instance, as Appendix 5 shows, in 2004, the central government

[9] These documents are issued by the Central Committee of the CPC and the State Council at the beginning of every year. They are indicators and guidelines of the Central Government's policy priorities in that year. The No. 1 Central Documents which focus on agriculture can be obtained online at http://news.xinhuanet.com/ziliao/2006-02/09/content_4156863.htm.

started to subsidise grain farmers; in 2005, agricultural tax was eliminated in most provinces; in 2006, the government vowed to implement the strictest farmland protection system; in 2012, the government's target was to complete the registration and certification of rural land; and in 2013, the land certification program was proposed to be completed within five years.

In addition, according to the *National Land-Use Planning Outline 2006 – 2020* released in 2008, China set a "red line" that the arable land should not shrink to less than 1.8 billion *mu* (i.e. 120 million hectares) (State Council of China, 2008). One of the eight key reform points of the "383 Plan" released in 2013 was to launch a land reform which aims at giving both rural and urban land equal rights, having a unified land market, and sharing the rise of land values fairly (CaixinOnline, 2013).

The continuing emphasis on the rural land reforms explains the government's position on protecting farmers' property rights to land, promoting rural land market development, maintaining grain security, and increasing farmers' property income.

Among the factors that affect grain production, for example, arable land area and land-related investment, land tenure policies are also recognised as an important part of ensuring food supplies (Maxwell and Wiebe, 1999, Economic Commission for Africa, 2004).

As mentioned in Chapter 2, China has tried nearly all possible changes in tenure reform since 1949: private ownership (1949 – 1952), cooperatives (1953 – 1958), people's communes (1958 – 1978), and HRS (from 1978 and ongoing). As land tenure changed, the growth rate of grain output also fluctuated during

this period, which is shown in Figure 4.2. For example, the growth rate of grain production exceeded 8% during the first years that the Communist Party took power in 1949 and rural land was privately owned by farmers. However, the grain output sharply declined after 1958 when rural land became collectively owned and collectively used. Does the fluctuation of grain output relate to the change in land tenure policies in China? Can land tenure change be an explanation of changes in grain productivity in China? If so, how much of the change in production can be attributed to changes in land tenure policies? It is the last question that this chapter attempts to answer.

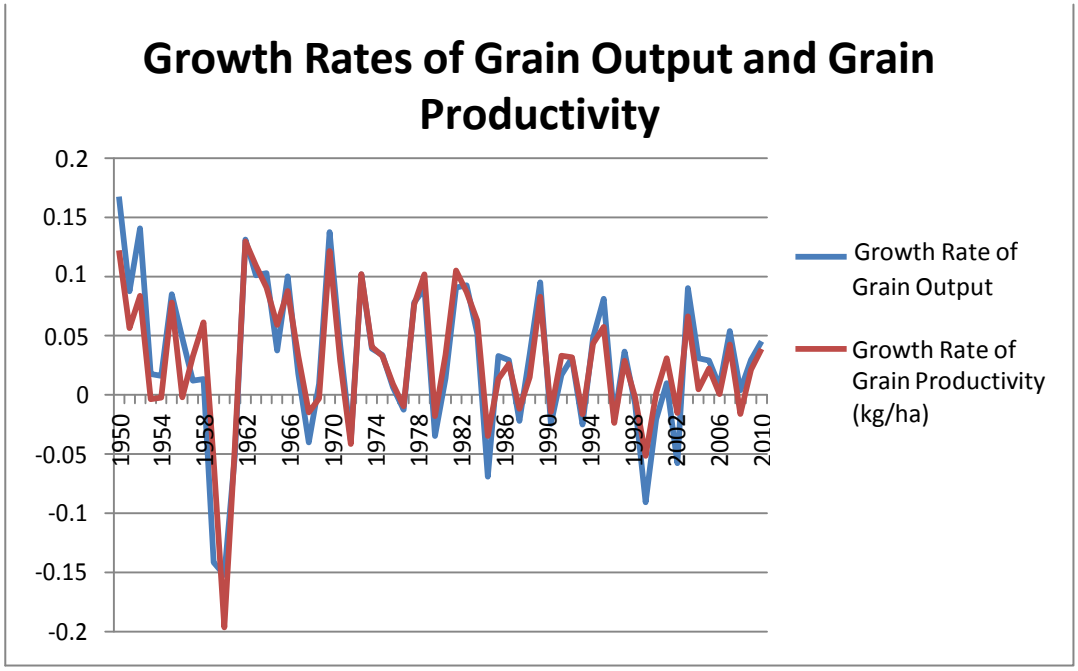


Figure 4.2 The Growth Rate of Grain Output in China 1950 – 2011

Source: Author's compilation based on data from the website of National Bureau of Statistics of China, http://www.stats.gov.cn/english/.

The answer to the question posed above can only be addressed empirically. The empirical analysis that follows draws on the literature and the theory on the

causal links between land tenure and productivity. Section 2 briefly reviews the key land policies related to land-tenure security. Section 3 discusses the methodology that will be employed to estimate the impact of land-tenure security on grain productivity. The next two sections present the empirical results of the analysis, followed by the conclusions in Section 6.

4.2 Background: agricultural policies and grain production

4.2.1 Impacts of rural land-related policies on grain production

Who owns the land, how long can the land be held, and can the land be traded? Answers to all these questions have a bearing on the farmers' decisions about: what to grow, what inputs to use, and how much effort to put into the farm plots.

(1) Impact of land ownership

After the founding of the PRC in 1949, rural land was confiscated from landlords and redistributed to rural households. The area of land allocated to each household was proportional to household size. Rural land was privately owned until 1956, when the CPC decided to implement Advanced Co-operatives, where rural land was collectively owned and collectively used. This period lasted to 1978, a total of 20 years (details of the reforms to land tenure arrangements are in Chapter 2).

(2) Impact of land use rights

In November 1978, the HRS was experimented in Xiaogang village, Anhui province. HRS was officially approved and written into the central government's No. 1 Central Document in 1982, and was then promoted throughout the country. Since then the Chinese farmers had reclaimed land use rights.

The duration of rural land contracts were up to 15 years, as was promulgated in the 1984's No. 1 Central Document, in order to "encourage the farmers to increase their investment, improve the soil fertility, and practise the intensive farming". The logic of the above was to raise productivity and to provide incentives for investments into soil fertility.

When the first batch of rural land contracts were about to expire in 1993, the central government's No. 11 document of that year stated that the duration of the initial contracts (i.e. leases) will be extended for another 30 years on the expiry of the 15-year rural land contracts.

However, as the rural land was still owned by the rural collectives, each individual member of the collectives should have equal rights to access the land. In order to maintain equality of access to land, most villages in China adopted the practice of periodically readjusting or reallocating land in response to changes in individual household makeup, total village population, and loss of land through land takings or expropriations (Zhu et al., 2006). As a result, the "30-year policy" was widely ignored in the 1990s (Li, 2003). In response, the extension of land use rights for another 30 years was emphasised in the 1998 Central Document "*Decision of the CPC Central Committee on Several Major Issues Concerning Agriculture and Rural Work*" and further written into the Rural Land Contracting Law in 2002 under Article 20.

When it came to 2008, the No. 1 Document specified that it was important to stabilise the current HRS and keep the existing land contracts "unchanged for a long time". It was hard to define "for a long time", but it would be definitely longer than 30 years, said Chen Xiwen, Director of the Office of Central

Rural Work Leading Group of the Chinese Central Government. Thus contracts of land use rights were progressively extended over longer time periods with a view to providing greater tenure security to the farmers.

(3) Impact of land transfer rights

Transfer of land use rights was banned until 1988, when the Constitution was amended, stating that land use rights might be transferred according to law. However, allowing land transfer in the *1988 Constitution Amendment* actually focused on state-owned urban land rather than rural land held under collective ownership (Kong, 1993, Zhou, 2012). The legitimacy of the transfer of rural land was not acknowledged until the 1995 No.1 Central Document. The document regulated that the transfers “should not change the agricultural use of farmland”. Consequently, while the right to use a given piece of land could change through the transfer of rural land between users, the particular purpose for which the piece of land was designated (say for grain production) could not be altered.

4.2.2 Impacts of agricultural supporting polices on grain production

The central government has used policies to encourage farmers to grow more grain and maintain grain security. For instance, the agricultural tax imposed on farmers has been gradually eliminated. The above has been supplemented with increasing fiscal support for agriculture. The quantum of fiscal support for agriculture has increased almost five times from 169.4 billion *yuan* in 2004 to 993.7 billion *yuan* in 2011 (an average of 28.75% growth rate every year), while the agricultural tax has been decreased to 0 from 2009, see Figure 4.3.

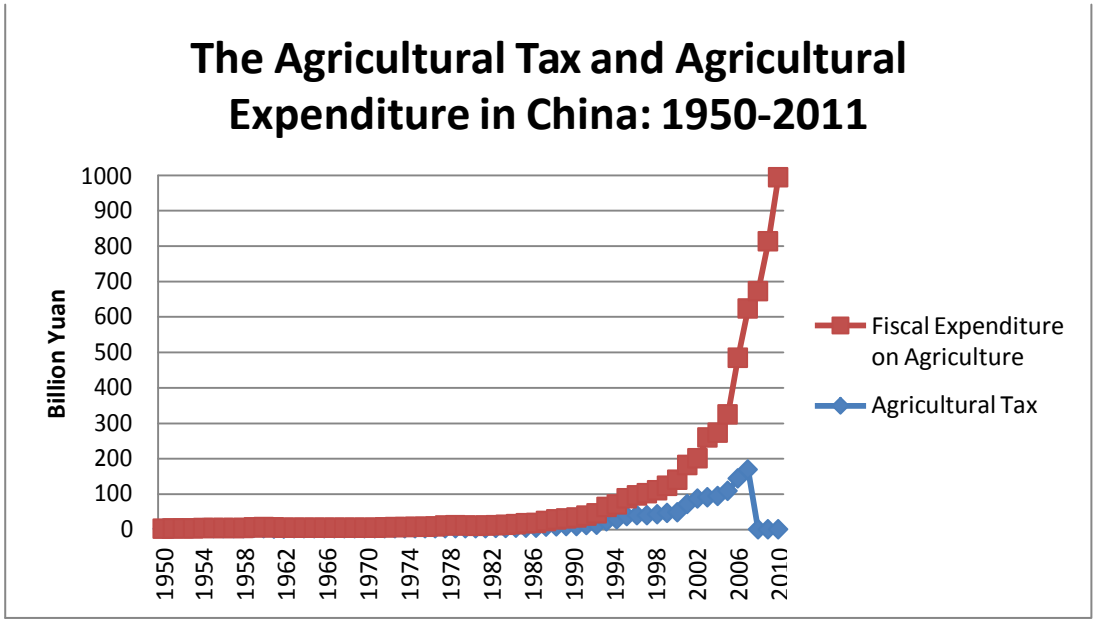


Figure 4.3 The Agricultural Tax and Fiscal Expenditure on Agriculture in China 1950 – 2011

Source: Author's compilation based on data from the website of National Bureau of Statistics of China, http://www.stats.gov.cn/english/.

(1) Abolition of agricultural tax

Agricultural tax has always been the main source of the government's revenue in China's history. For example, data for 1753 show that land tax accounted for 73.5% of officially recorded revenue of the Qing Dynasty (Brandt et al., 2014). In order to reduce farmers' financial burden, narrow the income gap between urban and rural residents, and encourage farming effort in growing grain, China began to phase out agricultural tax as early as 2000. Agricultural tax has been the centrepiece of the Chinese state for around 2,600 years, thus its abolition in 2006 was a major policy shift. From 2001 – 2004, the tax reform helped to reduce farmers' burden by 23.4 billion *yuan* (Chinese Government Website, 2006).

(2) Fiscal support for agriculture

Fiscal support for agricultural refers to the central government's expenditure on agriculture, forestry, and water resources. Specifically, it consists of expenditure on:

- agricultural infrastructure investment, such as rural road construction and water utilities
- agricultural science and technology
- subsidies for farmers
- operating departments of farming, forestry, water conservation, and meteorology.

The level of agricultural support in China was equal to 3.3% of GDP during 2000 – 2003, which is higher than the average level (1.25%) of the Organization for Economic Co-operation and Development (OECD) members for the same period. However, the level of support for farmers, calculated using OECD's Producer Support Estimate (PSE), was only one-fifth of the average level of OECD countries (Stewart and Ma, 2007).

Given the above, land tenure reforms pertaining to grain production include direct land-related policies such as extension of use rights to farmers, issuing of tenure security over extended periods of time, and releasing of land transfer rights, as mentioned in Section 4.2.1, as well as agricultural supporting policies such as the abolition of tax on agricultural output, and the provision of financial support, as mentioned in Section 4.2.2. The impact of the above policies on grain output will be examined in the following sections.

4.3 Literature review: linking land tenure changes to grain production

Since the importance of grain security has always been a priority in rural development tasks, there have been several studies on the determinants and technical efficiency of China's grain production. For example, using a stochastic frontier production function to a panel data set on 30 provinces in the post-reform period from 1987 – 1992, Yao and Liu (1998) suggested there is vast potential for China to raise its total grain output through more intensive use of land-augmenting inputs such as fertilisers and irrigation. However, as more fertilisers and irrigation are used on a shrinking area of land, their marginal returns will eventually diminish. Therefore, in the long run, the growth of grain output could only rely on improvements in technical efficiency. Also using a frontier production function, Tian and Wan (2000) argued that the grain sector in China is not optimistic, as: i) the improvement in irrigation and drainage facilities involves huge costs; ii) the expansion of farm size faces social and psychological obstacles; and iii) the technical progress in the Chinese grain sector is not encouraging, only 0.84% during 1983 – 1996.

Despite the ample literature assessing the technical efficiency of the Chinese grain sector mentioned above, studies linking land tenure changes to grain production are limited. In an important and classic paper, Lin (1992) employed a national panel data from 1978 – 1984 and found that de-collectivisation (the adoption of HRS) accounted for half of the output growth during 1978 – 1984. Under the increasingly prevalent opinions since 1998 that rural land should be privatised, Chen and Qu (2003) argued that land ownership rights do not mean complete land property rights. Based on a 20-year national data after the reform

and opening-up policy in 1978, they decomposed land tenure into three kinds of rights: namely, rights of ownership, rights to transfer, and usufruct. They found that the use and transfer rights of farmland have statistically significant and positive impacts on grain productivity. The impact of usufruct may not have been detected given the static policies of the state with respect to the use a particular plot of rural land may be put to. Therefore, when it is difficult to change the ownership rights of rural land, improvement in grain productivity could be reached through improvement in land use rights, transfer rights, and usufruct rights.

The study of total factor productivity (TFP) growth may be appealing, whereas there is little need to be overly concerned with obtaining the accurate TFP growth rate (Mahadevan, 2003). The impact of land tenure change is the focus of productivity analysis in this chapter. However, the data used in the existing literature are mainly after 1978. The goal of this chapter is to fill in the gap by applying the 31-province panel data from 1949 – 2008 and examining the impacts of land tenure changes, namely, land ownership rights, duration of land use rights, and land transfer rights on grain productivity.

4.4 Methodology

4.4.1 Econometrical model and data

To study the impact of land tenure changes on grain productivity, empirical analyses were conducted using data at the provincial levels.

Two methods are commonly used to estimate the unobserved effects for panel data: fixed effects estimator and random effects estimator. Fixed effects

estimator allows for correlation between the unobserved effect and the explanatory variables, while the random effects model assumes that the unobserved effect is uncorrelated with each explanatory variable (Wooldridge, 2006).

At the provincial level, there are no statistics on agricultural tax. The level of the tax is assumed to be uniform across the provinces and a dummy is used to capture changes in the tax over time. Thus the tax variable takes the value of 0 during the period of nil agricultural tax, and 1 otherwise.

The estimated model takes the following form:

$$\begin{aligned}\ln Y = C &+ \beta_1 \ln(\text{labour}) + \beta_2 \ln(\text{ferti}) + \beta_3 \ln(\text{irrigation}) + \beta_4 \ln(\text{machinery}) \\ &+ \beta_5 \text{private} + \beta_6 \text{use} + \beta_7 \text{transfer} + \beta_8 \ln(\text{agri\_expense}) + \beta_9 \text{tax} + a_t + \mu_t\end{aligned} \quad [4.1]$$

where a_t is the unobserved effect, which is allowed to be correlated with the explanatory variables in the fixed effects model, but assumed to be uncorrelated with the explanatory variables in the random effects model.

Data are from *China Compendium of Statistics 1949 – 2008*, which records the statistics of national and 31 provinces, autonomous regions, and municipalities. Data after 2008 is from the website of the National Bureau of Statistics of China. Data of subsidies and tax are from various documents from the website of the Ministry of Agriculture of PRC. Variable names, their description, and transformation of the data are given below in Section 4.4.2.

Data for some years are missing. Due to the background of Great Leap Forward (1958 – 1960), and the Cultural Revolution (1966 – 1976) at that time, it is hard

to estimate the missing data. Thus, missing data are omitted in the following analyses. The dataset for the national level is therefore a sample with 40 observations, and for the provincial model is thus an unbalanced panel data with 1,036 observations.

4.4.2 Variable description and transformation

In Equation 4.1, data on labour, fertilisers, machinery, and irrigation area for grain production are not directly available. The data for these variables in the statistics yearbooks are the total amount for all crops, including grain crops and other crops such as cotton, sugar, fruits, etc. Since grain production is the object of interest, the inputs that are specific to grain production need to be derived from the total crops according to the grain share in total crop sown area. Therefore, the basic assumption here is that the total quantity of each of the inputs is allocated between grain and other crops in proportion to their respective shares in total crop sown areas. The above is equivalent to assuming that labour intensity across agricultural sectors is the same, i.e., soybean has the same labour intensity as wheat in terms of area under cultivation.

The per hectare land of inputs on grain production are transformed as follows:

(1) Grain-related inputs

- V1: Grain productivity (kg/ha), represented as *Y*, grain output per unit area of land.

$$Y = \frac{\text{Grain outputs}}{\text{Grain sown area}}$$

- V2: Grain sown area (1000 ha), represented as *sown area*, and could be obtained directly from the yearbooks.
- V3: Labour input in grain production (persons/ha), indicated as *labour*.

$$labour = (\text{Number of employment in the agricultural sector} \times \frac{\text{Gross output value of farming}}{\text{Gross output value of agriculture}} \times \frac{\text{Grain sown area}}{\text{Total crops sown area}}) \div \text{Grain sown area}$$

Here, agricultural sector refers to a broad sense of agriculture, including farming, forestry, animal husbandry, and fisheries. Thus gross output value of agriculture includes output value of these four sectors. In China's statistics, farming includes the production of grain crops (consisting of cereals such as rice, wheat, and corn; pulses such as soybeans, and tubers such as sweet potatoes and potatoes) and cash crops (peanuts, rapeseeds, sesame, cotton, jute, sugarcane, beetroots, tobacco, vegetables, tea, and fruits), see Figure 4.4. According to the study by Zhou and Tian (2006), the output of tuber crops (sweet potatoes and potatoes) was converted on a 4:1 ratio, i.e., four kilograms of fresh tubers were equivalent to 1 kilogram of grain, up to 1963. Since 1964, the ratio has been raised to 5:1. The output of beans refers to dry beans without pods.

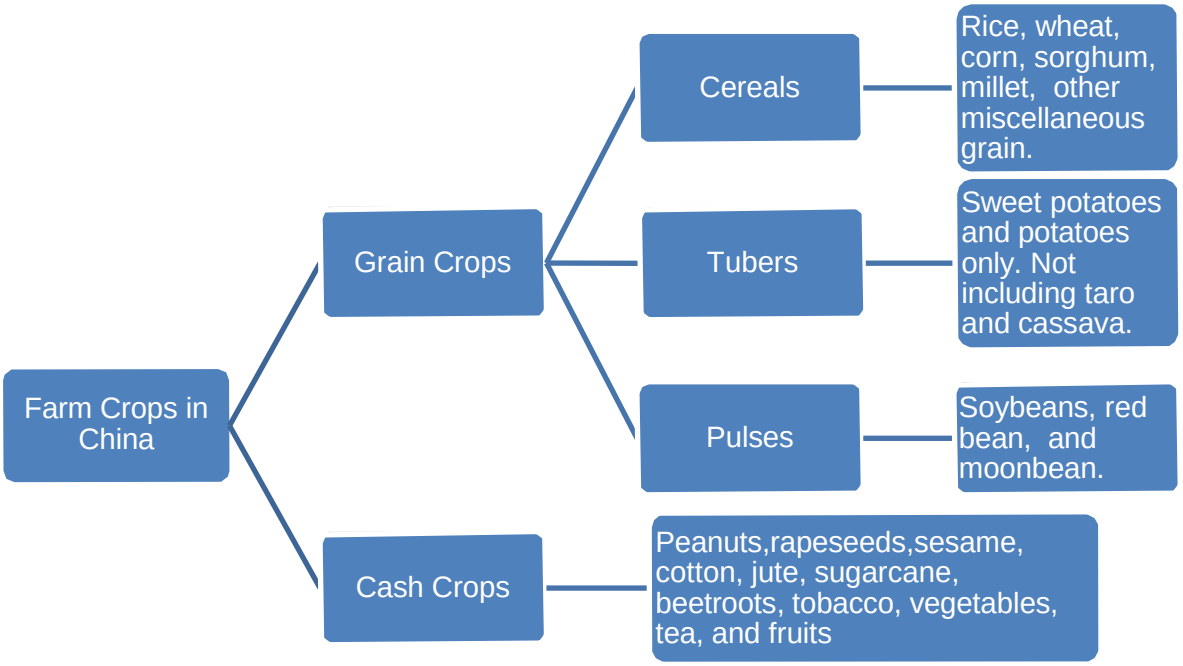


Figure 4.4 The Composition of Crops in China

Source: Author's compilation based on information from the website of National Bureau of Statistics of China and the study by Zhou and Tian (2006).

Correspondingly, the number employed in the agricultural sector—which is available in the yearbooks—includes the labour force working in farming, forestry, animal husbandry, and fishery production. To estimate the number employed in grain production—which is the parameter of interest in the econometric model—firstly, the labour input in the farming sector was estimated by a weighting coefficient: the value share of farming output in total agricultural output; the farm labour force was further weighted by the share of grain sown area in the total crops sown area. Therefore, the labour input per hectare is described as above. Similar transformation of labour input could be found in the study of Lin (1992) and Chen and Qu (2003):

- V4: Fertilizer usage (kg/ha), indicated as *ferti*, indicating all fertilisers used in agricultural production processes, such as nitrogen, phosphate, potassium fertilisers, and compound fertilisers.

$$ferti = (\text{Total fertiliser use} \times \frac{\text{Grain sown area}}{\text{Total crops sown area}}) \div \text{Grain sown area}$$

×

- V5: Machinery use (kwh/ha), indicated as *machinery*. Total power of agricultural machinery use (measured as kwh) covers the power used in agriculture (cultivating, irrigation, harvesting, and transportation, etc.), forestry, animal husbandry, and fishery. There is no direct data measuring machinery use in grain production. So total power of agricultural machinery has been applied to estimate.

$$machinery = (\text{Total power of agricultural machinery use} \times \frac{\text{Grain sown area}}{\text{Total crops sown area}}) \div \text{Grain sown area}$$

- V6: The effective irrigation rate on grain (%), stated by *irrigation*.

$$irrigation = (\text{Total effective irrigation area} \times \frac{\text{Grain sown area}}{\text{Total crops sown area}}) \div \text{Grain sown area}$$

All input variables are in natural logarithms form.

(2) Land tenure changes

Regarding land tenure, dummy variables are introduced to reflect its change. A bundle of rights could be held under a land tenure system, such as land

ownership, land use rights, land transfer rights, and land usufruct rights (Food

and Agriculture Organization, 2002). Based on Section 2, the private ownership dummy (V7) is valued at 1 from 1949 to 1956 and 0 otherwise. Land use rights (V8) are indicated by the duration of rural land contracts, which regulate how long the farmers could hold and use the land. There were three significant changes for the duration of rural land contracts: 15 years since 1984 and then decreased year by year; 30 years since 1999 when the first round of rural land contracts were due and decreased year by year; and 99 years to represent the period of private land ownership which was in effect from 1949 – 1956 and the policy of “unchanged for a long time” since 2008. The land tenure in 1953 – 1956 was also regarded as privately owned, although during this period farmers were encouraged to join the Elementary Cooperatives and production materials were pooled. If farmers did not participate in or wanted to quit the cooperatives, they still had rights to sell or lease their land (Zhou, 2013). The dummy assignment of land use rights is adapted from the values used by Chen and Qu (2003). The dummy of transfer rights (V9) is assigned to 1 after 1995 and 0 otherwise (see Appendix 6).

(3) Agricultural supporting policies

The agricultural tax (V10, indicated as *agri_tax*) and government expenditure on agriculture (V11, indicated as *agri_expense*) are used as indexes standing for farmers’ usufruct rights to their land. The tax variable is expressed by a dummy that takes the value of 0 during the period of the abolition of agricultural tax, and 1 otherwise. The times of the abolition of agricultural tax across provinces are not uniform as shown below:

(a) Since 2004: Heilongjiang, Jilin, Beijing, Shanghai, and Tianjin

(b) Since 2006: Hebei and Shandong

(c) Tibet is a province that has never introduced agricultural tax

(d) The rest of the provinces eliminated agricultural tax in 2005.

Each provincial government's expense in agriculture is expressed as a proportion of the gross output value of agriculture:

$$agri\_expense = \frac{\text{Agricultural expenditure}}{\text{Gross output value of agriculture}}$$

Due to the 0 values included, the logarithm was not applied to the tax variable in Equation 4.1.

The summary of variable names, definition, and descriptive statistics are given in Appendix 7.

It should be noted that there are several shortcomings in Equation 4.1. For example, the variable of machinery does not include bullock hours due to the absence of data for this variable. However, the omission of this variable for all of the farms probably does not affect the parameter estimates because most of the observations (i.e. 95%) are for the period after 1970s, when farmland was gradually fragmented as a result of the frequent land redistribution. Farmers began to think that it was not cost-effective to raise a bullock for 12 months but only for tiny plots and only used it for a couple of days during busy farming seasons (Huang, 2014). They tended to use labourers and machinery instead, which have been considered in Equation 4.1. Another potential variable that

may affect grain productivity is land quality. While there is no direct data collected on this particular variable across provinces, one of the traditional

measures is to map the land quality by the percentage of farmland that is irrigated (Adamopoulos and Restuccia, 2013), which is represented by the irrigation rate in Equation 4.1.

Some other variables that may affect grain productivity, such as use of family labour or part time labour, and soil erosion, have been contained in the error term because they are unobservable.

4.5 Estimated results

Table 4.1 provides the estimates of the fixed effects model and random effects model based on provincial panel data 1949 – 2008. Both model 1 and model 2 fit well according to the R square and F statistics. Judging from the Hausman test of fixed effect versus random effects, the chi square and p value could not reject the null hypothesis that the preferred model is random effects. Thus, the results from the random effects model are used in the discussion that follows.

Furthermore, the Breusch-Pagan test demonstrates the presence of heteroskedasticity under the assumption of random effects. Model 3 is thus preferred since it accounts for heteroskedasticity in light of the random effects model. The discussion below is based on results from model 3.

Based on the results of model 3, at the provincial level, the conventional farm inputs such as fertilisers, irrigation rate, and machinery use have the expected positive and statistically significant effects on grain productivity. The grain productivity could be improved by more intensive use of irrigation, machinery, and fertilisers.

Specifically, coefficient estimates from model 3 show that water is the most important factor of grain production: an increase of irrigation rate by 10% raises grain output per hectare of land by 2.59%. A study by Coxhead and Warr (1995) on agricultural productivity in the Philippines shows that irrigated agriculture exhibits greater land productivity than non-irrigated agriculture. The importance of effective irrigation rate is also found in China. The study by Yao and Liu (1998) based on a panel dataset on 30 provinces, where the elasticity of irrigation was 0.051. The agriculture sector consumes the most water resources: global rice farmers use almost one-third of the Earth's fresh water (The Economist, 2014b); in China, the agricultural sector consumed 65% of the total national water use in 2004 (World Watch Institute, 2013). However, China has long been experiencing a water shortage and flood irrigation methods in most farmlands often cause significant waste. Better use of available water (rather than increased use of water) could improve grain productivity.

Machinery use is the second most important factor for increased grain production. The parameter estimate implies that a 10% increase in machinery use raises grain productivity by 1.44%. The use of machinery helps promote the efficiency in the process of ploughing, sowing, irrigating, fertilising, spraying of weeds and insects, and harvesting. It saves working hours and enables those tasks to be undertaken in the most appropriate conditions and thus increases grain productivity. Given that heavy machinery requires access to finance, land tenure security could improve access to farm machinery via easing access to formal-sector credit (see Figure 3.1 in Chapter 3).

Another important factor that influences grain productivity is fertiliser. With a 10% increase in fertiliser application, grain productivity would rise by 0.76%. Soil fertility falls through erosion, and fertilisers are required to supplement the nutrition that the grain crops need. Although fertiliser contributes to grain productivity, caution needs to be applied in determining the quantity to be applied. The excessive use of fertilisers, especially nitrogen fertilisers, causes environmental problems such as groundwater pollution (Wang et al., 1996) and crop contamination (Zhen et al., 2006). So how much fertilisers should grain producers use? The answer has been given in the study by Gowdy and O'Hara (1995): their assumption is that grain producers are rational when making decisions, i.e., they seek to maximise their profits. For fertiliser use, the marginal revenue a producer can gain from using an additional unit of fertiliser is the marginal product gained from the extra input of fertiliser (MP_F) multiplied by the grain price (P_g). The additional cost of using more fertiliser is determined by the fertiliser price per unit (P_F). To achieve Pareto optimality in grain production, the condition needs to be met: $MP_F * P_g = P_F$.

However, in reality, farmers often ignore the external costs imposed through nitrogen pollution. Therefore, in order to gain allocate efficiency, the condition of Gowdy and O'Hara above needs to be adapted as: $MP_F * P_g = P_F +$ cost of externality. The social costs of fertilisers vis-à-vis the value of their marginal product will have to be taken into account in maximising profitability.

Table 4.1 The Estimated Results for Panel Models (n=1036)

	1	2	3
Variables	**Fixed effects**	**Random effects**	**Account for heteroskedasticity**
(Intercept)	----	7.508 (116.039)***	7.508 (51.094)***
Grain-related inputs			
log(labor)	0.003 (0.118)	0.011 (0.405)	0.011 (0.157)
log(ferti)	0.071 (7.510)***	0.076 (8.149)***	**0.076 (3.485)*** **
log(irrigation)	0.264 (12.335)***	0.259 (12.349)***	**0.259 (5.459)*** **
log(machinery)	0.148 (18.286)***	0.144 (17.978)***	**0.144 (6.940)*** **
Land tenure dummies			
private ownership	0.130 (2.341)*	0.116 (2.086)*	**0.116 (1.003)***
duration of use rights	0.001 (5.555)***	0.001 (5.708)***	**0.001 (6.607)*** **
transfer rights	0.086 (6.905)***	0.089 (7.211)***	**0.089 (4.396)*** **
Agricultural supporting policies			
agri_tax	-0.050 (-3.019)**	-0.052 (-3.104)**	**-0.052 (-2.175)** **
log(agri_expense)	-0.137 (-15.075)***	-0.137 (-15.190)***	**-0.137 (-6.850)*** **
R square	0.885	0.911	
F-statistic	859.108	1174.6	
Hausman test	chi square= 10.894, p-value = 0.283		
BP test for RE model	28.643, df = 9, p-value = 0.0007		

Source: Authors' calculation with R software. Data in parentheses are t-values.

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The land tenure dummies present statistically significant effects on grain productivity: the private ownership of land turns out to be positive at a 5% significance level; the duration of land use rights and the entitlement of transfer rights are both positive signs at 0.1% significance level. The grain productivity was higher during those years (1949 – 1956) when farmers had private ownership of land than after that period. Although private ownership of land greatly contributed to grain productivity, China has no intention of privatising land and cannot do so at the current stage: for one, it would take a revision of

the Chinese Constitution (China Daily, 2007). Ideology remains the biggest obstacle to privatising ownerships rights to land (Bezlova, 2008).

From the results, the approval of land transfer rights is more important for grain productivity than the duration of use rights of land. Importantly, the parameter estimates on the variable representing duration of use rights are statistically significant and similar in magnitude across the three models. The approval of land transfers is one of the central government's efforts to promote the modernisation of agriculture, encourage large-scale farming, and boost productivity. From these provincial results, the policy has had the desired effect.

The abolition of agricultural tax, represented by a binary variable with 1 denoting the tax being present and 0 otherwise, has a positive impact with grain productivity rising by 5% compared to the period when the tax was in existence. The abolition of agricultural tax, which has maintained for 2,600 years in China, not only reduces the burden on farmers, but also boosts grain productivity.

The government's expenditure on agriculture, however, presents a negative and statistically significant impact on grain productivity at the provincial level: an increase by 10% would lead to 1.37% reduction of grain productivity. This finding is consistent with Li and Qian (2004) who noted a failure of government fiscal support for agriculture. This may be due to the fact that financial support for agriculture was more on administration management (e.g., 64% in 2004) than on agricultural production activities such as agricultural infrastructure construction, technology, or subsidies (China Economic Net, 2006). Therefore, the expenditure on operating departments of farming, forestry, water

conservation, and meteorology need to be reduced in order to improve grain productivity.

4.6 Effects of land tenure on productivity: regional differences

Since 2004, China has marked out 13 major grain-producing provinces and 7 major grain-marketing provinces, as is shown in Figure 4.5. Major grain-producing provinces are regions that have comparative advantages in producing grain, including: Liaoning, Hebei, Shandong, Jilin, Inner Mongolia, Jiangxi, Hunan, Sichuan, Henan, Hubei, Jiangsu, Anhui, and Heilongjiang. Major grain-marketing provinces are regions that have more developed economies, but a low self-sufficiency rate of grain due to large population and relatively little arable land, including: Beijing, Tianjin, Shanghai, Zhejiang, Fujian, Guangdong, and Hainan. In 2011, the 13 regions contributed to 75% of China's total grain output and 95% of the nation’s increased grain output (chandi.cn, 2011). The gaps between grain producing and consuming in the major grain-marketing provinces are filled mainly by importing grain from the major grain-producing provinces. The consecutive growth in grain outputs since 2004 could largely be attributed to distinguishing between the major grain-producing area and the major grain-marketing area.

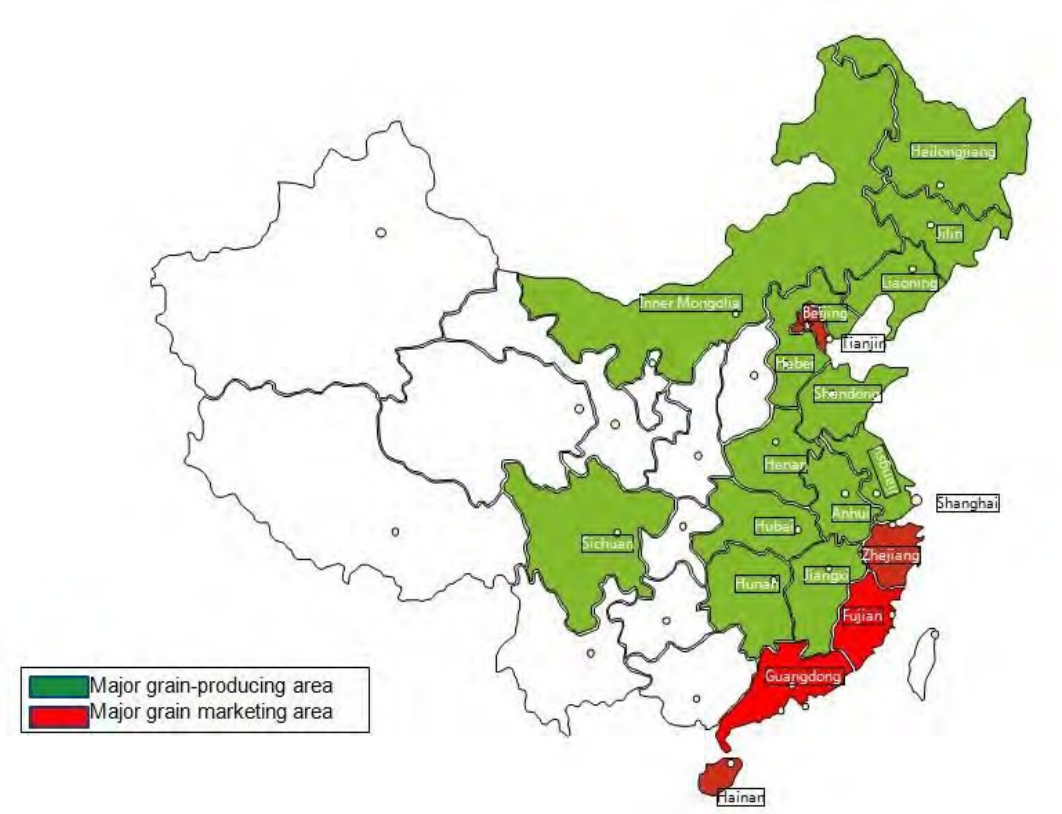


Figure 4.5 The Major Grain-producing Area and the Major Grain-consuming Areas

Source: Author's compilation.

Farmers in different areas may demand different land rights. For example, in the major grain-marketing provinces, farmers have more opportunity to work in non-agricultural sectors. For most rural households in this area, farm income accounts for a relatively small proportion of the total household income. As a result, farmers in these provinces may have a preference for land transfer rights so that they can lease out farmland and seek off-farm employment. In the major grain-producing area, however, industrial development has been limited because these areas are responsible for grain production and guarantee grain security. For the sake of boosting grain productivity, farmers may ask for longer land use rights than farmers in the major grain-marketing area.

Table 4.2 The Estimated Results for Different Regions (Random Effects)

	1	2
Variables	**Major grain-producing area (RE)**	**Major grain-marketing area (RE)**
(Intercept)	**7.504 (84.444)*** **	**7.661 (68.853)*** **
Grain-related inputs		
log(labor)	-0.041 (-0.848)	**0.169 (2.805)** **
log(ferti)	**0.070 (5.179)*** **	**0.120 (5.312)*** **
log(irrigation)	**0.259 (9.263)*** **	**0.327 (6.273)*** **
log(machinery)	**0.160 (14.080)*** **	**0.037 (2.439)***
Land tenure dummies		
private ownership	0.082 (0.946)	-0.225 (-1.280)
duration of use rights	**0.001 (3.569)*** **	0.0007 (0.780)
transfer rights	**0.068 (2.992)** **	**0.223 (5.624)*** **
Agricultural supporting policies		
agri_tax	**-0.046 (-1.649) .**	0.012 (0.212)
log(agri_expense)	**-0.155 (-11.169)*** **	-0.032 (-0.939)
R square	0.94	0.70
Observations	467	196

Source: Authors' calculation with R software. Data in parentheses are t-values.
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4.2 presents the estimated results of the determinants of grain productivity based on the random effects models. The estimates from the random effect models appear to be more suitable than the fixed effect models, because the major grain-producing/marketing areas are two subsets of the 31 provinces, autonomy regions, and municipalities of China (for comparison, the estimates based on fixed effects models are also given in Appendix 8).

For the conventional farm inputs, Table 4.2 shows that fertiliser inputs, irrigation rate, and machinery use have significantly positive effects on grain productivity in the 13 major grain-producing and the 7 major grain-marketing provinces,

which are not statistically significantly different from the estimates reported in Table 4.1. What is different is that there is an increasing marginal return to labour input in the major grain-marketing area. With labour increases by 10%, the grain productivity would rise by 1.69%. There is much potential in the major grain-marketing area to improve grain productivity through more labour input and at the same time absorbing the excessive rural labour force.

In terms of the three land tenure dummies, the land ownership dummy turns out to be insignificant in both major grain-producing/marketing areas. Duration of land use rights has the expected positive impact on grain productivity in the major grain-producing area. A 10-year increase in duration of land contracts generates a 1% increase in grain productivity. In addition, the policy of relaxing land transfer rights also demonstrates its importance for grain production in both areas, and its effect has exceeded the effect of use rights. The encouragement of farmland transfer helps in integrating the fragmental land plots held by different households. This makes scale farming possible and raises grain productivity (evidence in support of the proposition of the benefits of economies of scale is presented in the next chapter).

The tenure coefficients show that duration of land use rights and land transfer rights are more important in the major grain-producing area in comparison to the grain-marketing area. This contrast may be due to the fact that farmlands are more vital assets to farmers in the major grain-producing area, as Figure 4.6 shows, 49% of per capita income of rural households comes from farm activities and 40% comes from wages income. Things are quite different in the major grain-marketing rural area: with only 25% coming from farm activities and 57%

from wages income. In addition, the per capita farmland endowment is 3.84 *mu* in the major grain-producing area, which is more than five times that in the major grain-marketing area (0.70 *mu*/person). Therefore, the higher the dependency on land in the major grain-producing area results in more sensitivity of the grain productivity to the changes of land tenure policies.

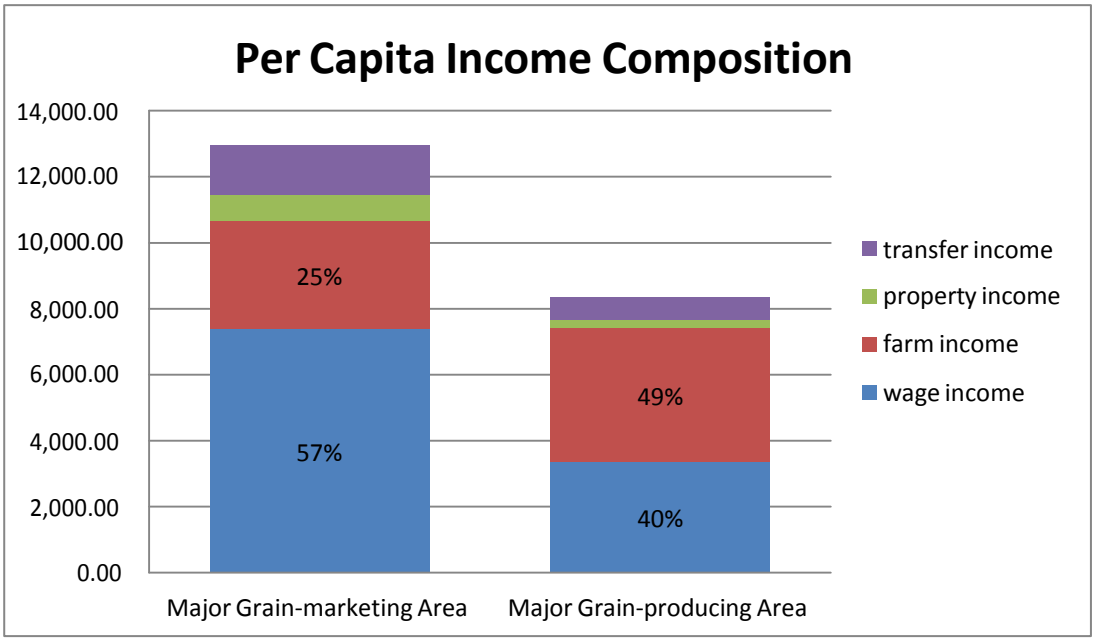


Figure 4.6 Per Capita Income Composition in the Major Grain-marketing and producing Areas in 2012

Source: Author's plotting based on data from website of Nation Bureau of Statistics of China.

The grain productivity in the major grain-producing provinces rises significantly after the elimination of agricultural tax, while the grain productivity in the grain-marketing provinces is not affected by the agricultural tax. The impact of agricultural expenditure has been proved as negative once more in both areas and is statistically significant in the major grain-producing area. This suggests that reducing such expenditure would not affect the grain productivity (and even

has the potential to increase grain productivity in the major grain-producing area). It also saves outlay for the central and local governments. Besides, the agricultural expenditure needs to be more efficient and more transparent.

4.7 Conclusions

The impact of land tenure reform on grain productivity in rural China has been quantitatively analysed in this chapter. Three variables have been introduced to capture land tenure reforms, namely, private land ownership (a binary variable), duration of land use rights (number of years), and land transfer rights (another binary variable). The key findings from this chapter are: in addition to conventional farm inputs such as fertiliser, irrigation rate, and machinery use, land tenure policies such as duration of land use rights and land transfer rights are also important factors to explain the growth of grain productivity in China from 1949 – 2008.

Specifically, at the provincial level, based on the random effects model after controlling for heteroskedasticity, private land ownership, land transfer rights, and duration of land use rights have been identified as significant explanation variables. Since China has no intention of privatising land and cannot do so because it would take a revision of the Chinese Constitution and change in ideology, land use rights and transfer rights are particular important. The approval of land transfers is one of the central government's efforts to promote modernisation of agriculture, encourage large-scale farming, and boost productivity. From the provincial results, the policy has achieved its intended effect. The results highlight the importance of maintaining a long and

“unchanged” duration of land use rights while meanwhile allowing the transfer of the land use rights.

In addition to land policy changes, the conventional inputs still play important roles in grain production, for example, fertiliser use, machinery use, and the effective irrigation area, which all present increasing marginal returns, either at the 31-provincial level or in the major grain-producing and marketing provinces. In the short run, there is great potential for China to increase its grain productivity and thus ensure grain security.

The elimination of the agricultural tax from 2006, which aimed to ease farmers’ financial burden, has a positive impact on grain productivity. It could be long term, thus the impact estimated in the model may be conservative. However, financial support to agriculture has a negative impact on grain productivity, which suggests that the use of funding has been inefficient.

In terms of the comparison of grain productivity determinants between the 13 grain-producing provinces and the 7 major grain-marketing provinces, the former are more obviously affected by the changes in land tenure. For these 13 provinces, duration of land use rights and availability to transfer land use rights are statistically significant. Therefore, the launching and maintenance of a well-worked RLRC program is particularly essential for the 13 major grain-producing provinces.

Chapter 5 Land Certification, Farm Investment, and Rice Productivity: Evidence from the Farms

5.1 Introduction

Land tenure problems continue to receive considerable attention in the development literature, as access to land is seen as being vital to investment and agricultural productivity (Food and Agriculture Organization, 2002). Research on the contribution of land tenure reforms to economic growth in transition economies, however, is scant. This chapter assesses the impact of land reform in rural China on rice production and related investment.

The extant literature shows that property rights to land affect economic growth through three principal channels. Secure rights to land increase the incentive for households to invest, provide them with the collateral to access credit from the formal banking sector, and improve the allocation of land through land markets which collectively raise productivity (World Bank, 2003). Here, I examine evidence in support of the proposition that the RLRC program being piloted in Chengdu, in southwest China, has had the desired effects as claimed in the literature.

I used a purpose-designed farm-level survey to collect data two months after the 2011 harvest from 140 households engaged in the production of rice in two villages: one with RLRC (henceforth referred to as certified) and the other without (uncertified). My statistical analysis shows that tenure security is a significant determinant of agricultural productivity. It also indicates that the certified village attracted more farm-related investment.

The rest of the chapter is structured as follows. Section 2 reviews the global literature on links between land tenure, productivity, and investment. Section 3 provides the background to land tenure reforms in China. This is followed by testing of the hypothesis—that land certification has a positive impact on farm productivity. The methodology employed and basic data from the two sites surveyed are described in Section 4, followed by a discussion of the results in Section 5. Section 6 concludes.

5.2 A brief literature review

In situations of land scarcity, recent literature supports the importance of tenure security to economic development. Feder et al. (1988) examined the difference in performance of Thai farmers with titled land and untitled land. It was found that land titles eased access to credit from the formal sector and contributed to increased farm productivity, in turn leading to higher incomes and higher land values. Their research fuelled research on the links between land titling and access to credit, investment, output, and income, as well as land markets and other policy instruments.

Subsequent studies that have corroborated the findings of Feder et al. (1988) are those by Alston and Libecap (1996) in Brazil, Zaibet and Dunn (1998) in Tunisia, Smith (2004) in Zambia, Holden et al. (2009) in Ethiopia, and Chand and Yala (2009) in Papua New Guinea. Each of the above came to the conclusion that land titling has had a significant effect on farm-level investment and productivity, and, moreover, that titling contributes to land value (see Alston and Libecap 1996) and soil conservation (see Holden et al., 2009).

However, the links between tenure and investment are yet to be fully resolved. Establishing the direction of causality has been problematic. And the empirical evidence for the link between tenure security and investment has been less than universal. For example, the studies by Migot-Adholla et al. (1994) show that the positive link between land tenure security and investment is present in some regions of Ghana and not in others. Besley (1995), together with studies by Hayes et al. (1997) in Gambia, and Brasselle, et al. (2002) in Burkina Faso, reinforce the previous findings by Migot-Adholla et al. (1993) and Place and Hazell (1993) on the ambiguous relationship between tenure security and investment in sub-Saharan countries. They all come to conclusion that in these African societies, indigenous tenure systems are dynamic in nature and evolve in response to external changes. This means that traditional forms of land tenure are not synonymous with insecure land rights and land titling programs do not necessarily improve the performance of the agricultural sector in Africa (Barrows and Roth, 1990, Atwood, 1990, Migot-Adholla et al., 1993).

Moreover, formalisation of property relations through the registration of land and the issuance of titles could be counterproductive as they may erode and displace existing social networks and arrangements that do offer some security (Bromley, 2009). Therefore, land titling does not guarantee increased investment and improved productivity in every context. Furthermore, there is more to tenure security than just legal title and more to investment than just security of tenure (Meinzen-Dick et al., 2002, Miceli and Kieyah, 2003, Abdulai et al., 2007). The support of government and local administration is also important (Bouquet, 2009). Thus, the impact of land reform on levels of investment and farm productivity remains an issue to be resolved empirically.

In China, there are also a number of works examining the links between land tenure security, farm investment, and agricultural productivity. Earlier studies focus on the effect of post-1978 rural reform and suggest that the adoption of the HRS has contributed a lot to agricultural productivity (McMillan et al., 1989, Lin, 1992). By comparing grain productivity under different ownership structures during 1949 – 1978, Huang et al. (2005, p.59) found that the "individual ownership of land and operation by farmers" would be better tenure arrangement than "unified ownership and unified management".

Other studies pay attention to investment in land quality improvements, providing evidence that longer land use rights and lower risk of expropriation (land tenure security) encourage the use of organic manure (Li et al., 1998, Jacoby et al., 2002) and maintenance of irrigation canals (Ma et al., 2013). In addition, land tenure security (strengthened by the Rural Land Contracting Law in 2002) was also found to enhance villagers' negotiation ability with land takers, raise land value, and eliminate the risk of expropriation (Deininger and Jin, 2009).

Little research has been carried out, however, on the impact of the land certification program on farm investment and productivity in China. Therefore, the objective of this chapter is to test the impact of the land certification on investment and productivity in the context of China. I use villages where the land certification program was trialled (these being the treatment group) and compare the results with villages left out of the program (the control group) that grow rice—a homogenous crop grown with similar inputs and technology. Furthermore, I employ regression analysis to net out the effects of the observed

differences across the treatment and control groups as well as between households. The RLRC program is ongoing throughout rural China and Chengdu is one of the pilot areas that completed the program in 2009. This chapter contributes to the existing literature on the impacts of land certification programs on investment and productivity.

5.3 Background and hypotheses

5.3.1 Land tenure in China

China has a land tenure system with dual tracks: one for urban land which is state owned; and, the other for rural (collectively owned) land (discussed in detail in Chapter 2). Based on the classifications of the Land Administration Law of the PRC (2004b), Figure 5.1 presents the allocation of land schematically.

According to the provisions of the Land Administration Law:

> Land in urban districts shall be owned by the State, land in the rural areas and suburban areas, except otherwise provided for by the State, shall be collectively owned by farmers including land for building houses, land and hills allowed to be retained by farmers (Article 8);
>
> Land collectively owned by farmers shall be contracted out to be run by members of the collective economic organizations for use in crop farming, forestry, animal husbandry and fisheries production under a term of 30 years (Article 14).

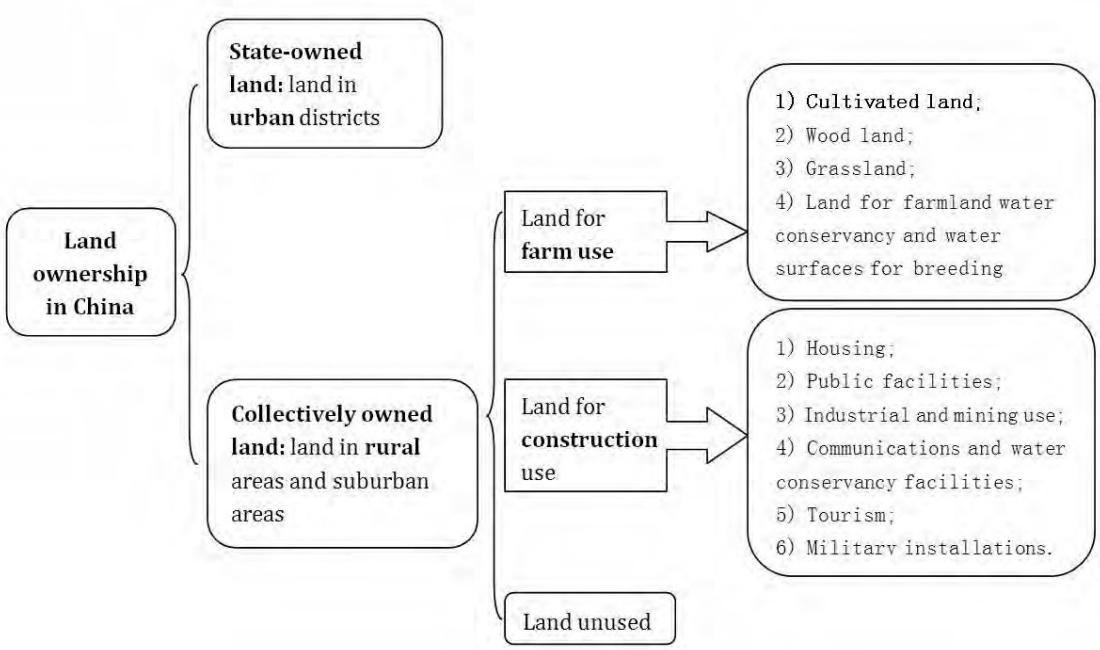


Figure 5.1 Land Ownership and Usage in China

Sources: Authors' compilation based on Land Administration Law (Revision 2004).

Land tenure in China is widely considered to be insecure because of ambiguous ownership, frequent land redistribution, and a rent-seeking bureaucracy (Kung, 1995, Kung and Liu, 1997, Rozelle and Li, 1998, Brandt et al., 2002, Jacoby et al., 2002). Furthermore, farmers may only use the land for the stipulated purpose; that is, either to grow crops or to build houses for their own use. Consequently, land values in rural areas remain suppressed compared to land values in urban areas.

The government has been experimenting with improving tenure security for rural land. In 1984, especially, the No.1 Central Document stipulated a minimal lease of 15 years with the options for amalgamation of small blocks through sub-leasing (Communist Party of China (CPC), 1984). By then cultivated land was allowed to be transferred on the condition that its agricultural purpose was

not changed. In addition, land rental markets, which were non-existent up to the mid-1990s, have emerged rapidly since then (Deininger and Jin, 2005a).

5.3.2 The treatment and control villages

In June 2007, Chengdu city, the capital of Sichuan province, received permission from the State Council of China to proceed with a land reform pilot project that would allow farmers to lease out and mortgage their land. The RLRC program was the first step of the pilot land reform that ended in 2010.

The goal of the RLRC was to address the problems of land tenure insecurity, establish an effective land market, and thus narrow the income gap between urban and rural residents (Zhou, 2011). The key features of this experiment are that: being granted with formal land certificates, farmers can transfer their land to more productive farmers or to private agricultural companies. They can also be employed in these agricultural companies and share the bonuses from increased output. In the presence of scale-economies the above has the potential to increase productivity of the farms and incomes of the households. In addition, the program also allows farmers to use their land as collateral to secure loans from the formal sector.

Uncertified villages in Fujian province comprise the control group. In their case, although the land farmed could be leased or collateralised via the Rural Land Contracting Law which was implemented in 2002 (People's Republic of China, 2002), the absence of a formal codified land certificate to confirm their legal rights to the land made this impractical.

Comparisons of investment and productivity across farms in the treatment and control villages allow us to decipher the impact of the RLRC program.

5.3.3 Hypotheses to test

We test three specific hypotheses on the impact of tenure security:

H1: Having a certificate for a farm plot enhances investments on the plot

H2: More investment on the plot improves land productivity

H3: Land certification leads to higher land productivity net of the impact of investment.

5.4 Data and methodology

5.4.1 Study sites and data collection

The purpose of the study is to investigate the impact of RLRC on rice productivity and rice-related inputs. Thus the survey sample was stratified into two groups: i) treatment group comprising: households on certified land in Qun'an village, Sichuan province in Southwest China (flat terrain); and ii) control group comprising: households on uncertified land in Xiayong village, Fujian province in Southeast China (mountainous area) (see Figure 3.3). Ideally the treatment and control villages ought to be identical except for certification, but this was not the case as explained below.

These two sites were selected in consultation with local government officials. Qun'an village was identified as one of the pilot areas in Chengdu city where a land reform project is ongoing. At the time of survey, the households in Qun'an village had land certification for about two years. Due to the difficulty in finding another village in Sichuan province where the land certification program had not

been implemented, I chose solely for convenience my hometown as the other study site.[10] Both the villages are located within the main rice-producing regions in their counties, and some 50 kilometres via paved road to the main market. As to the uncertified village (Xiayong), although it is located in a mountainous area, the farmers grow crops mainly on the flat plots. All these similarities make the untitled village a suitable comparison group to the certified village.

With referral letters from official departments in the counties, I made appointments with the village heads to set up times for the survey. In addition to budget and time constraints, the fact that many household heads work outside villages after rice harvest made random sampling difficult. The village heads arranged the production team leaders to assist the survey through: i) recruiting as many household heads as possible to complete the questionnaires; and ii) guiding me to visit household heads house by house. All the interviewees were informed of the purpose of the survey and their written consent was sought before the interview.[11] The GPS coordinates of houses visited were recorded and this is plotted as Figure 3.4.

Data was collected in November 2011, about two months after the rice harvest. The questions focused on information relating to the socioeconomic characteristics of the household head; the value and tonnage of rice outputs; use of purchased inputs and labour; and the tenure status of the land on which

[10] The officials refused to disclose the list of uncertified areas in Sichuan, as they described it as an “internal confidential file”. Land issues are sensitive in rural China. As a result, this choice was made only after exhausting all other options.

[11] Ethics approval for this research was obtained from UNSW, and the survey was conducted as stipulated in the approval.

the rice was grown. Data were therefore cross-sectional with responses from 140 households, including 73 from Qun'an village (certified) and 67 from Xiayong village (uncertified). Of these, a total of 33 households interviewed from Qun'an village did not grow rice any more since they had leased out their land to private plantation companies who now grow grapes, lotus, kiwi fruit, or honeysuckle. In the analysis of rice productivity, these 33 households were excluded. This reduced the number of observations to 107. Respondents were usually the household heads except when they were absent, in which case they were mainly replaced by their spouses or other adult household members.

5.4.2 Methodology

Comparisons are made on productivity and input usage between households with and without land certification. In the discussion that follows, having an RLRC is interpreted as having tenure security. The comparisons in terms of productivity and investments can be made between matched households in the treatment and control groups. Alternatively, a regression model can be used for the comparisons where differences between households are explicitly controlled for. The goal of both methods is to construct comparisons of treated and control units that are balanced in the sense that the sample distribution of covariates determining selection into treatment is the same in the treated and control groups (Brand and Halaby, 2006). Matching method was used to address the problem that beneficiaries of the RLRC program might not form a randomly selected sub-group of all farmers in the sample. Matching has the advantage of reducing sensitivity to parametric assumptions but relies on common support (Rosenbaum and Rubin, 1983, Petracco and Pender, 2009). This chapter

describes how these methods are used to construct estimators of treatment effect parameters.

(1) Regression vs. matching models on investment

OLS regression model

To test whether the uses of inputs were affected significantly by land tenure type, an investment response function is estimated. Following Li et al. (2000), Equation 5.1 was developed for the investment response function. Since the levels of inputs are the dependent variables, Equation 5.1 is really a derived input demand equation and as such accounts for important household characteristics (Besley, 1995).

$$x_{ij} = \alpha_0 + \beta_0[D_i] + \gamma_0 \sum_i H_i + \varepsilon_0 \qquad [5.1];$$

where x_{ij} is a vector inputs where 'i' and 'j' are indexes for the respective households and inputs. The latter comprises seeds, fertilisers, herbicide, labour inputs, and machinery use. All components of x are measured on a per *mu* basis, thus the sum of the elasticity allows a test of the returns to scale of the production function (Khan, 1977). D is a dummy variable that stands for land tenure status which takes a value of 1 when the land has been certified and 0 otherwise. Since the certified and uncertified farms are spatially clustered together, D also acts as a site dummy. H_j represents the household and farm-level characteristics which were not affected by the RLRC program.

Given the land title status D (1 – titled, 0 – otherwise), and household characteristics H, household *i* will then make decisions on farm-related inputs x_j.

β_0 is the parameter of interest which captures the impact of land certification on rice-related investment for given household characteristics. γ_0 measures the effects of household characteristics. ε_0 captures measurement errors in the data as well as the effects of any unobserved variables.

Matching model

The matching methods involve the construction of counterfactual expectations of the dependent variable, i.e., constructing estimates of E ($Y_0|D_i=1$, X) for the mean outcome of ***titled households*** if they ***had not*** participated in the RLRC program, and estimates of E ($Y_1|D_i=0$,X) for the mean outcome of ***untitled households*** if they ***had*** participated in the RLRC program. These two unobserved quantities are estimated by averaging over the observed outcome values of Y for households that are similar on the covariates X.

Our goal is to estimate the average treatment effects over all observations (ATE), and the average treatment effects on the treated (ATT).

$$ATE = \frac{1}{n}\sum_{i=1}^{n} E\left[Y_i(1) - Y_i(0) \middle| X_i\right] = \frac{1}{n}\sum_{i=1}^{n} E\left[Y_i(1) \middle| X_i\right] - E\left[Y_i(0) \middle| X_i\right] \quad [5.2];$$

$$ATT = \frac{1}{\sum_{i=1}^{n} D_i}\sum_{i=1}^{n} D_i E\left[Y_i(1) - Y_i(0) \middle| X_i\right] = \frac{1}{\sum_{i=1}^{n} D_i}\sum_{i=1}^{n} T_i \left\{E\left[Y_i(1) \middle| X_i\right] - E\left[Y_i(0) \middle| X_i\right]\right\} \quad [5.3];$$

If causal effects are constant over each observation, then the ATE and ATT are identical (Ho et al., 2007).

The matching estimators based on propensity score are widely used to estimate treatment effects. Rosenbaum and Rubin (1983) defined the propensity score

as the conditional probability of assignment to a treatment given a vector of covariates X including the values of all treatment confounders:

$$P(X) = Pr(D = 1|X) \quad [5.4];$$

After running a probit of household characteristics on tenure status, a propensity score will be predicted for each household. This score is the predicted probability of being treated (whether or not actually treated is not relevant at this stage), allowing households to be matched using this score that represents observable characteristics of the household (in the second stage of the analysis).

In terms of matching algorithms, nearest neighbour matching (1:1) with replacement has been chosen to guarantee using most similar observations. In addition, common support was used to decrease the bias by dropping outliers that are incomparable.

A better procedure of after-matching analysis is to use the same parametric analysis as used to analyse the original raw data set without pre-processing (Ho et al., 2007). Therefore, least square estimates were chosen in the matching model.

(2) Regression vs. matching models on rice productivity

To investigate the effect of the RLRC program on rice production, I used a model which not only controlled for variables used in the matching process, but also controlled for rice-related investment and an interaction term:

$$y_i = \alpha_1 + \beta_1[D_i] + \gamma_1 \sum_i H_i + \varphi_1 \sum_i x_{ij} + \varepsilon_1 \quad [5.5];$$

where y_i is the rice yields per *mu* of land, representing rice (partial) productivity in this chapter. β_1, γ_1 and φ_1 are the parameters of interest which capture the impact of land certification on rice productivity, the impact of land/household attributes, and the inputs elasticity, respectively. ε_1 captures measurement errors in the data as well as the effects of any unobserved variables.

Two data sets were used to compare: one is the full rice-grower sample, and the other is the new dataset with common support after the matching process.

5.4.3 Description of data

Table 5.1 provides summary statistics on the variables for which data were collected from the two villages. Tests statistics on the equality of means across certified and uncertified village are also presented. Of the 107 households who grew rice in the past season, 40 (i.e. 37%) were certified.

Table 5.1 Variable Descriptions and Summary Data for Sample of Rice Growers

Variables	Description	Total	Qun-an	Xia-yong	Difference: t test (p-value)
Characteristics of household head and the household					
Age	Age of household head	53.03	52.95	53.07	0.062 (0.951)
Gender	1 =Male, 0 = Female	0.94	0.90	0.97	1.339 (0.186)
Education	Categorical variable valued from 1 (never been to school) to 6 (university)	2.30	2.43	2.22	-1.498 (0.138)
Experience	Years of farming	35.97	34.10	37.09	1.065 (0.291)
Household size	Number of household members	4.51	4.50	4.51	0.019 (0.985)
Number of adults (14<age<65)	Number of adults	3.67	3.20	3.96	**2.495 (0.015)***
Number of males	Number of males	2.33	2.33	2.33	0.014 (0.988)
Outside employment	Number of members working outside village (migrant workers)	2.27	1.75	2.58	**2.770 (0.007)****
Characteristics of land on which rice is grown					
Hold a new land certification	1=Certified, 0=Uncertified	0.37	1	0	**∞ (0.000)*****
Land area (*mu*)	Total area of cultivated land distributed from village collective	4.03	4.41	3.81	-1.463 (0.149)
Rice growing area (*mu*)	Area of cultivated land to grow rice	3.16	2.58	3.50	**2.941 (0.004)****
Rice productivity (*jin*/*mu*)	Rice productivity = rice outputs/rice growing area	944.4	939.50	947.37	0.310 (0.757)
Soil quality	Categorical variable valued as: 1-inferior, 2-medium, 3-good, and 4-supreme.	2.72	3.12	2.48	**-3.641 (0.001)*****
Input usage					
Seed (*yuan*/*mu*)	Expense in rice seeds per unit of land	35.73	53.35	25.22	**-15.689 (0.000)*****
Fertilizers (*yuan*/*mu*)	Expense in fertilizers per unit of land	108.4	90.75	118.94	**2.874 (0.006)****
Herbicide (*yuan*/*mu*)	Expense in herbicide per unit of land	31.23	44.85	23.10	**-5.283 (0.000)*****
Working days (man-days/*mu*)	Human capital input per unit of land = days*labourers/rice growing size	13.64	10.45	15.55	**5.006 (0.000)*****
Machinery (*yuan*/*mu*)	Machinery hired to plough and harvest	60.61	160.88	0.75	**-27.126 (0.000)*****
Observations		107	40	67	

Source: Author's survey in 2011.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

Household characteristics

In terms of household characteristics, the age of the household head in the sample varies from 30 to 77 with an average of 53 years. The average years of farming experience is 36 years. Some 94% of the household heads were males. The average education level for the household head sampled was 2.3, where data on education was collected as a categorical variable valued from 1 (never been to school) to 6 (university): thus, the average household head in our sample had “primary school” education. Furthermore, the distribution of education by age was less than uniform. Figure 5.2 shows that education levels dropped with age while farming experience had the opposite trend, an observation similar to that from Ethiopia (Ahmed et al., 2002).

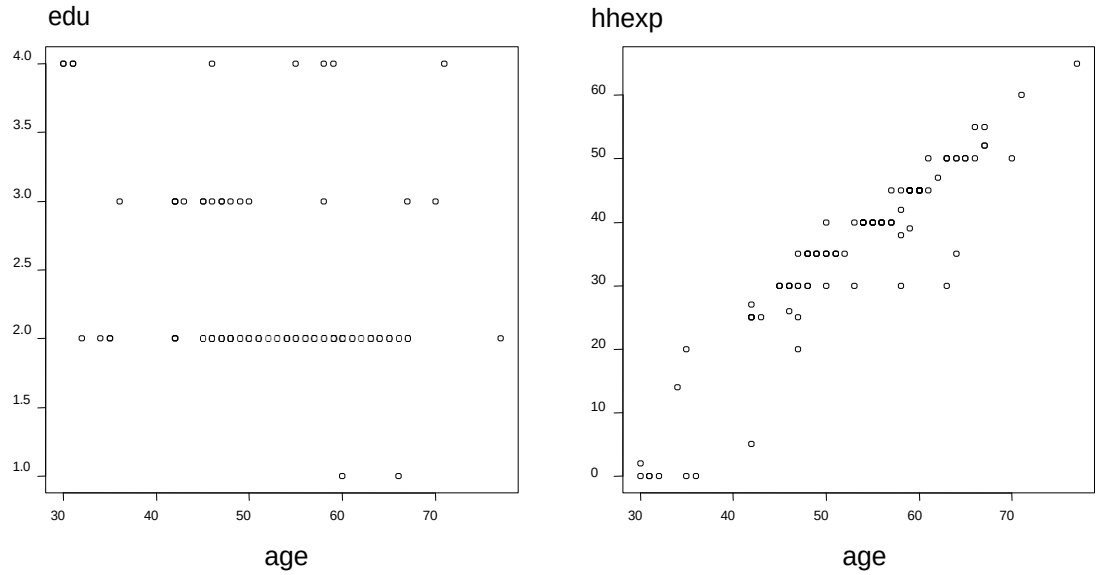


Figure 5.2 Distributions of Education and Experience by Age (n=107)

Source: Computed using R.

In both villages, the majority of the household labour force was employed outside the farm: an observation consistent with the widely observed

phenomenon of rural to urban migration in China. One of the driving forces behind this is the urban-rural income disparity (Zhang and Song, 2003). This fact implies a large opportunity cost for younger farmers. Therefore, many migrant workers are temporary migrants and have “dual occupations” (Hu et al., 2002). While they work in the fields during planting and harvesting seasons, they take up jobs in the cities during the slack agricultural seasons. These workers commute between their home village and the city of employment across seasons, as their young children are normally left behind in the villages and usually cared for by their grandparents

Land characteristics

In terms of land quality, measured as a categorical variable where 1 depicts the lowest and 4 the highest, the average soil quality was 3.12 in Qun’an village (i.e. good soil), which was better than that in Xiayong village (closer to 2, medium soil quality). The mean land area per household was 4.41 *mu* in the certified village and 3.81 *mu* in the uncertified village. In these two villages, land area per capita in each household ranged from 0.7 to 1.3 *mu*.

Farmers in Qun’an used 2.58 (58%) *mu* of cultivated land to plant rice, which is significantly less than in Xiayong (3.50 *mu*, 92%). This is because farmers in Qun’an leased out some of their land to the private plantation companies mentioned above. In Xiayong village, farmers left 8% of cultivable land fallow due to poor soil fertility, bad location (especially plots on the mountainside), or unwillingness to farm.

The study distinguishes the rice-growing area from the total land area. For the analysis of the determinants of rice productivity and rice-related inputs, the rice

growing area is used because it has more obvious links with investment supply and demand (Smith, 2004), and this helps to detect the marginal returns to land as one of the factors of production. For the analysis of income, however, land area is used rather than rice-growing area to account for the possibility of income generated from leasing land.

The first and stark finding was that none of the interviewees accessed credit from the formal sector. Thus the land certification did not improve access to credit from the formal sector.

Rice outputs

The average rice production was 940 *jin*[12] per *mu* in Qun'an village, 7 *jin* less than the corresponding figure for Xiayong village, but this difference is not statistically significant at 10% significance level. The median of rice productivity in both villages was 1000 *jin* per *mu*.

Inputs

Purchased inputs consist of rice seeds, fertilisers, herbicides, machinery hiring, and labour input. Labour input was measured in man-days per *mu* of land, while the other inputs were valued to compute the total costs of inputs per *mu* of land.

There were significant differences in the level of short-term investment between the two villages. In Qun'an village, farmers spent more on rice seeds and herbicide per unit of land, while farmers in Xiayong village invested more in fertilisers and labour per unit of land. Family labour and hired labour were

[12] *jin*: Chinese unit of weight, 1 kg = 2 *jin*; 1 *jin*/*mu* = 7.5 kg/ha.

aggregated because in both the sites the common practice is the use of all available labour during the harvesting season. The differences in the inputs of fertilisers, herbicides, and seeds between the two sites were unchanged, even after the effects of the differences in their prices were factored in.[13]

In terms of machinery inputs, Qun'an villagers spent an average of 160 *yuan*[14] per *mu* of land on hiring machinery for ploughing and harvesting (generally a tractor and reaping machine, respectively). In Xiayong village, on the other hand, farmers till the land and harvest the crops by hand, requiring more labour input. Of the 67 households interviewed, only 1 household hired a reaping machine to harvest rice. This shows that tenure security could encourage farmers to spend more on hiring machines, acquiring rice seeds, and purchasing herbicides. Machinery use, mainly for ploughing and harvesting, may in turn reduce the costs of labour use and fertiliser inputs on the certified farms.

5.5 Econometrics results

5.5.1 Effects on farm investment

(1) OLS regression estimates

OLS regressions were estimated on the five inputs based on Equation 5.1 with the estimates reported in Table 5.2. The land tenure dummy was statistically significant on all input variables at the 0.1% level. Compared to farmers in the

[13] Data were from "Agricultural Production Means in China" (http://www.ampcn.com/). In 2011, average prices in Sichuan/Fujian provinces respectively were: fertilisers: 2,080/2,000 *yuan*/ton, herbicides: 33.5/28.82 *yuan*/kg, seeds: 47.3/56.7 *yuan*/kg.

[14] *yuan*: Chinese unit of money, *renminbi* (RMB) or China Yuan (CNY), 1 USD = 6.31 CNY (2012-03-16).

uncertified village, certified farmers spent 26 *yuan* more on rice seed, 18 *yuan* more on herbicides, 159 *yuan* more on machinery inputs; while spending 33 *yuan* less on fertilisers and 6.7 man days less on labour input. The former positive effects are plausible and conform to the hypothesis that land certification encourages farmers to invest more in their plots. The negative impacts of the tenure dummy on fertiliser use and labour input may be attributed to site-specific factors: in the certified village, better soil quality and machinery use enable less fertiliser use and less labour input, respectively. Moreover, the increasing chance of leasing out the land due to land certification may discourage farmers from investing in soil conservation inputs (such as fertilisers).

Table 5.2 Regression Results for Inputs (n=107)

Model/variable	1	2	3	4	5
	Seeds	**Fertilizers**	**Herbicide**	**Labours**	**Machinery**
(Intercept)	**40.261**	**217.186**	**92.740**	**27.898**	9.961
	(5.353)* **	**(5.357)*** **	**(6.100)*** **	**(5.319)*** **	(0.420)
tenure	**26.069**	**-33.475**	**18.248**	**-6.711**	**159.480**
	(14.323)* **	**(-3.412)*** **	**(4.959)*** **	**(-5.287)*** **	**(27.773)*** **
age	-0.131	**-1.034**	**-0.652**	**-0.102**	0.028
	(-1.547)	**(-2.255)***	**(-3.790)*** **	**(-1.722) ·**	(0.106)
gender	-3.301	-13.882	-11.214	-1.962	6.611
	(-0.984)	(-0.767)	(-1.653)	(-0.838)	(0.624)
education level	0.278	1.528	**-4.553**	-0.539	**-6.436**
	(0.227)	(0.231)	**(-1.838) ·**	(-0.631)	**(-1.665) ·**
household size	0.878	2.915	**5.246**	0.900	3.538
	(0.893)	(0.550)	**(2.639)** **	(1.314)	(1.141)
adults	0.418	2.577	-3.018	-1.215	0.510
	(0.390)	(0.445)	(-1.391)	(-1.624)	(0.151)
males	-0.693	-1.021	**-7.142**	-0.517	-2.833
	(-0.544)	(-0.149)	**(-2.773)** **	(-0.582)	(-0.705)
migrant labourers	-0.856	**-9.421**	-1.842	0.218	-4.256
	(-1.053)	**(-2.151)***	(-1.122)	(0.385)	(-1.660)
rice growing area	**-1.780**	-3.170	-0.480	**-0.801**	-0.060
	(-3.277) **	(-1.082)	(-0.437)	**(-2.114)***	(-0.035)
soil	-0.416	-7.591	-1.072	0.152	-1.211
	(-0.467)	(-1.580)	(-0.595)	(0.245)	(-0.431)
R^2	0.80	0.22	0.48	0.29	0.92
F statistic	38.25	2.67	8.82	4.01	119
(p-value)	(0.0000)	(0.0063)	(0.0000)	(0.0001)	(0.0000)

Source: Author's survey in 2011. Values of t-statistics are reported in parentheses.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

Age of household head has negative and significant effects on the inputs of fertilisers, herbicides, and labour force, which implies that older farmers may tend to be more conservative with respect to investment in plots (Ahmed et al., 2002). Farmers with a higher education level invest less in herbicide use and machinery hiring. More education increases the chance of getting a waged job in the off-farm labour market (Huang et al., 2009). When more household members, especially male members, migrate to urban areas, farming becomes

the household's subsidiary business (which is evidenced by the fact that farm income only constitutes an average of 16% of the total income for the 107 households in the sample), and the household may decrease investment in farm plots, as can be seen from the row of "males" and "migrant labourers" in Table 5.2. In the case of the use of herbicides and machinery, more education is correlated with lower use of these inputs.

In addition, large household size has a positive and significant impact on herbicide use, contrary to the effect of males. The positive effect of household size on herbicide use may reflect the fact that it is used as a substitute for labour to remove weeds and kill insects in the rice plots. The negative coefficient on males may reveal that females tend to spend more time on the land than males.

Rice-growing area has a negative impact on all the input variables, and the coefficients on "seeds" and "labour" input were significantly different from zero. This can be explained by the argument that "small farms use more variable inputs per unit of land" (Berry and Cline, in Khan, 1977, p.320). It also suggests that there may be economies of size in input use. Similar results also are found by Besley (1995) in Ghana and Li et al. (2000) in China.

Households with land registration certificates use more input than those without, after household characteristics and soil quality is controlled for as shown in the results reported in Table 5.2 above. This difference could be due to the fact that the certified village is different from the uncertified village, thus the impact of tenure security may be due to selection for treatment. I test this conjecture using matching method estimates as explained next.

(2) Matching estimates

The first step of matching is to estimate the propensity score. The important point is selecting the relevant variables in the model. Bryson et al. (2002) stated that only those variables that influence both the likelihood of participation and the outcome of treatment, but unaffected by participation, should be included. Therefore, our covariate X contains household head's age, gender, and education level; plus data on household size, number of adults, number of males, and soil quality, which may not have significantly changed before and after the RLRC program. However, number of migrant labourers, and rice-growing area might have changed. To deal with this problem, two models were used in the matching process: i) a restricted model, which includes only those variables that existed for certain at the beginning of the RLRC program; and ii) a full model, which also contains variables that may have changed over the years (Zikhali, 2010).

Table 5.3 presents the probit results of the likelihood of benefiting from the RLRC program. The full model was selected on the basis of the Akaike Information Criterion (AIC) and Log-likelihood ratio. The probit results suggest that the likelihood of benefiting from the land reform increases with larger household size and better soil quality. And the more adults and migrant labourers in a household, the less likely it is to benefit from the land certification program, which implies that resident farmers were favoured in the program rather than farmers working outside the village.

Table 5.3 Likelihood of RLRC Program Participation (probit, n=107)

Variables	Restricted model		Full model	
	Coefficient	Std. error	Coefficient	Std. error
(Intercept)	-0.771	1.402	-0.269	1.423
Age	-0.005	0.015	-0.011	0.015
Gender	-0.630	0.660	-0.666	0.692
Education	0.291	0.224	0.256	0.227
Household size	**0.302 ·**	0.181	**0.361***	0.182
Number of adults (14<age<65)	**-0.729*****	0.183	**-0.519***	0.205
Number of males	0.255	0.248	0.253	0.250
Soil quality	**0.477****	0.159	**0.457****	0.164
Number of migrant workers			**-0.320***	0.161
Rice growing area (mu)			-0.117	0.104
AIC	121.7		119.51	
Log-likelihood	-52.849		-49.756	

Source: Author's survey in 2011.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

Following the propensity score, t-tests of equality of means before and after the matching was run to evaluate if the propensity score matching succeeds in balancing the characteristics between treated and control groups. Table 5.4 shows results of balance checking by tests of equality of means between certified and uncertified farmers. Matching mitigates the differences between the certified and uncertified villages for all variables except rice-growing area and soil quality.

The distributions of the propensity scores for treated and control groups are plotted in Figure 5.3. The visual inspection in Figure 5.3 reveals a clear

overlapping of the distributions between matched treated and control observations.

Table 5.4 Differences in Means before and after Matching

Variables	Before (n=107)	After (n=80)
Age	0.062 (0.951)	0.404 (0.686)
Gender	1.339 (0.186)	0.842 (0.402)
Education	-1.498 (0.138)	-0.939 (0.350)
Household size	0.019 (0.985)	-0.278 (0.781)
Number of adults (14<age<65)	**2.495 (0.015)***	1.115 (0.268)
Number of males	0.014 (0.988)	0.000 (1.000)
Number of migrant workers	**2.770 (0.007)****	1.054 (0.295)
Rice growing area	**2.941 (0.004)****	**1.711 (0.090)** ·
Soil quality	**-3.641 (0.001)*****	**-2.085(0.040)***

Source: Author's survey in 2011. p values are in parentheses with t test statistics.
Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

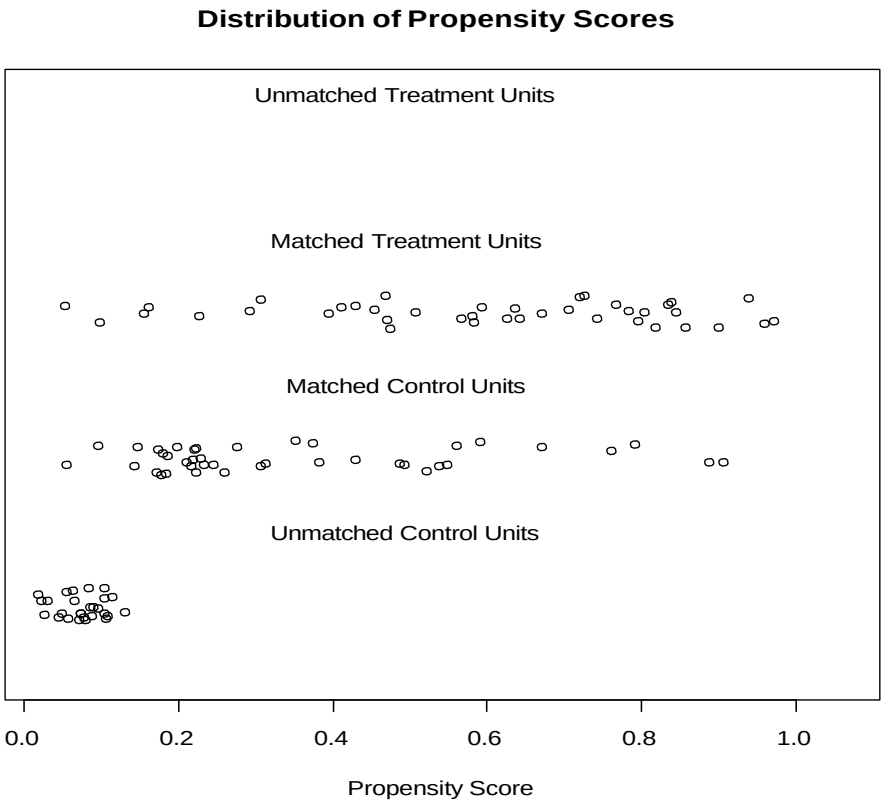


Figure 5.3 The Distribution of Propensity Scores

Source: Computed using software R.

Based on propensity score and balance checking, the average treatment effect could be calculated, as presented in Table 5.5. For the convenience of comparison, the OLS results are also included in Table 5.5.

Both matching estimates of ATT and on the overall ATE suggest a statistically significant effect of the land certification program on all the five rice-related investments. The estimates are also in close agreement with the corresponding regression estimates without the matching process.

Table 5.5 Matching Estimates of Average Treatment Effects of RLRC Program on Farm Inputs

Farm inputs	ATT	ATE	OLS	Rosenbaum Sensitivity Test (Γ, max p value)
Seeds	26.663 (10.591)***	25.757 (12.054)***	26.069 (14.323)***	（11, 0.053）
Fertilizers	-34.325 (-2.497)*	-31.636 (-3.057)**	-33.475 (-3.412)***	(3, 0.058)
Herbicide	26.663 (10.591)***	25.757 (12.054)***	18.248 (4.959)***	(3, 0.061)
Labour	-8.137 (-4.296)***	-5.299 (-3.002)**	-6.711 (-5.287)***	(4, 0.057)
Machinery	160.880 (19.612)***	156.12 (28.989)***	159.480 (27.773)***	(12, 0.05)
Total number of observations				
Treated	40	40	40	
Control	67	67	67	
Number of observations within common support				
Matched treated	40	40	--	
Matched control	40	40	--	

Source: Author's survey in 2011. t-statistics are in parentheses.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

As for inputs such as herbicide use, the OLS estimates fall short of ATT and ATE. For effects on rice seeds, fertilisers, labour, and machinery input, the OLS estimates fall between ATT and ATE. For all farm investment, the ATT estimates exceed the other two estimates, thereby indicating that the RLRC program has more impact on the treated group.

Sensitivity analysis

Both ATT and ATE estimates are very close to the OLS estimates. These analyses, however, assume that all relevant characteristics have been matched

and there is not an unobserved confounder that may account for the differences across the treatment and control groups. If there is hidden bias arising from an unobserved variable, then the matching estimates may be not robust (Rosenbaum, 2005). A sensitivity test has therefore been employed to assess how reasonable the treatment effect is. Rosenbaum's method of sensitivity test is one of the various sensitivity tests used with matching method that is employed here. It relies on the sensitivity parameter Γ that measures the degree of departure from random assignment of treatment. For example, for Γ = 2, two subjects that are identical on matched covariates then one might be twice as likely as another to receive the treatment because of the unobserved pre-treatment differences (Rosenbaum, 2005). The larger it is, the more likely the inference will change due to the hidden bias. A study is highly sensitive to hidden bias if the conclusions change for Γ just barely larger than 1, and it is insensitive if the conclusions change only for quite large values of Γ (a Γ value of 6 is very large and most findings in the social sciences are not robust to hidden biases of this magnitude (Keele, 2010)).

According to Rosenbaum's method of sensitivity test, as is shown in Table 5.5, the treatment effect of the RLRC on the seed input is quite insensitive to hidden bias because it requires an enormous Γ (=11) to alter the conclusion ($p>0.05$) that the RLRC program has significant effects on the treated group to increase seed investment. Therefore, the treatment effect of the RLRC program on the seed input is significant. Similarly, the treatment effect on the machinery use (Γ =11) is also insensitive to hidden bias. The inference about the treatment effects on the use of fertilizers, herbicide, and labourers would change if Γ

increases to 3-4. Although the Γ is not as large as 11 or 12, it still suggests that it is insensitive to hidden bias.

The general conclusion of the Rosenbaum sensitivity test is that the RLRC program has significant effects on the five inputs. The findings are robust to possible hidden bias due to unobserved confounders.

5.5.2 Effects on rice productivity

Rice productivity is defined as *jin* of rice output per *mu* of cultivated land used for growing rice. Model 1 in Table 5.6 reports the regression results of the tenure status and the five input variables on rice productivity. While land tenure has a positive and statistically significant impact on rice productivity at the 10% level, the coefficient estimates for expenditure on seeds, fertilisers, herbicides, labour, and machinery are not significantly different from zero.

Model 2 of Table 5.6 provides estimates based on Equation 5.5. The tenure dummy is also statistically significant at the 10% level. The coefficient implies that land certification, on average, delivers 191 *jin* more rice per *mu* of land. In terms of the remaining variables compared to the results reported in model 1, machinery use seems to have a significant negative impact on rice productivity. This may be due to the high correlation (of 0.96) between machinery use and land tenure status. The large standard error on this variable makes it difficult to estimate the partial effect of machinery on rice productivity. However, machinery use is an indicator of the difference in geography between the two villages. Including “machinery” among variables in the models isolates the effect of geographical difference, thus allowing us to control for the effects of tenure across the treatment and control groups.

In an expanded OLS regression model (reported in model 3 of Table 5.6), an interaction term between land tenure dummy and rice-growing area was added. The positive and statistically significant impact of "tenure" on rice productivity is evidence in support of Hypothesis 3. The estimates suggest that on average, and all else being equal, farmers in the certified village produce 368 *jin* per *mu* more rice than those in the uncertified village.

Table 5.6 Regression Results for Rice Productivity

Model/variable	**1**	**2**	**3**	**4**
	y=f(D,x)	**y=f(D,H,x)**	**y=f(D,H,x,D*H)**	**Matched data**
Constant	**978.591(18.368)*** **	**889.279(5.405)*** **	**753.310 (4.598)*** **	**764.673(3.825)*** **
age		-0.475 (-0.321)	-0.111 (-0.078)	-0.164 (-0.098)
gender		69.125 (1.263)	**91.333 (1.726) ·**	88.172 (1.456)
education level		-14.828 (-0.723)	-22.068 (-1.116)	-21.657 (-0.918)
household size		14.495 (0.876)	21.630 (1.350)	24.336 (1.269)
males		4.586 (0.215)	-5.963 (-0.288)	0.613 (0.023)
adults		-8.861 (-0.500)	-12.561 (-0.739)	-23.543 (-1.144)
migrant labourers		-2.349 (-0.175)	-1.633 (-0.127)	-0.033 (-0.002)
tenure	**190.867(1.822) ·**	**191.731 (1.746) ·**	**368.362 (3.064)** **	**404.729 (2.867)** **
rice growing area		-3.843 (-0.413)	**20.121 (1.690) ·**	17.281 (1.143)
soil		22.576 (1.565)	**24.798 (1.792) ·**	24.296 (1.465)
seed	-2.194(-1.398)	-2.359 (-1.410)	-2.071 (-1.290)	-2.405 (-1.238)
fertilizers	0.207(0.637)	0.275 (0.793)	0.310 (0.935)	0.481 (1.246)
herbicide	0.216(0.285)	0.361 (0.415)	0.241 (0.289)	0.065 (0.067)
working days	-0.319(-0.143)	-0.579 (-0.243)	0.608 (0.263)	0.694 (0.241)
machinery	-0.858(-1.641)	**-0.969 (-1.763) ·**	**-1.165 (-2.197)***	**-1.342 (-2.169)***
*tenure*ricesize*			**-47.334 (-3.031)** **	**-44.079 (-2.289)***
R^2	0.04	0.11	0.20	0.22
F statistic (p-value)	0.77(0.5909)	0.79 (0.6895)	1.38(0.1199)	1.10(0.3747)
Observations	**107**	**107**	**107**	**80**

Source: Author's survey in 2011. Values of t-statistics are reported in parentheses.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

Notes: Model 1 is a regression of rice output per *mu* of land on tenure status and the five regular farm inputs; model 2 is a regression of rice productivity on tenure status, five inputs, and

other household characteristics variables; model 3 is an expanded regression of model 2 with an interaction term between tenure status and rice growing area; and model 4 is the regression using matched data.

The negative coefficient on the interaction term "*tenure*ricesize*" shows that in the context of more secure land tenure, rice output per *mu* of land declines about 27 *jin* as the rice-growing area increases 1 *mu*, controlling for other factors. This may suggest that the farm plots in the certified village are being operated within sizes where diminishing rates of return are being experienced. The inverse relationship between farm size and productivity has also been found in India and Sri Lanka (Cheung, 1967, Herath, 1983). However, the significant and positive effect of rice-growing area on rice production indicates that, in the uncertified village, the opposite has happened. The negative effect of "*tenure*ricesize*" may also suggest that tenure security allows land to be used for other purposes. Thus when the land area increases, the area devoted to rice falls, as this land is now used for other purposes, i.e., many of the certified farmers kept only a small proportion of land for growing rice while the other land had been leased out to agricultural plantations.

The other variables that are important determinants of rice productivity include the "gender" dummy, categorical variables "soil quality", and "machinery" expenditure. The positive and significant coefficient of the "gender" dummy plausibly signals that male-headed households achieve higher rice productivity. This may be due to the resource poverty and poor substitutability between factors of production of female-headed households (Holden et al., 2001). The coefficient estimate for soil quality is negative and statistically significant, which suggests that higher soil quality leads to higher rice productivity. Similar to the

results reported in model 2 of Table 5.6, there is statistically significant negative impact of “machinery” use on rice productivity.

The significantly positive impact of land tenure on rice productivity was further confirmed in model 4, which was estimated based on model 3 but using a matched dataset instead. Compared to the three models above, the tenure effect in model 4 was even greater and this provides strong evidence in support of the proposition that tenure security raises productivity.

5.6 Conclusions

This chapter has focused on the impact of the RLRC program on the use of rice-related inputs and rice productivity. To address the issues surrounding selection bias, I employed OLS regression and PSM estimates for convenience of comparison. It turns out that both methods yield rather similar results, especially for the impact of land tenure on input use and the rice output of rice per unit of land.

The empirical results show that certified farmers, in comparison to their uncertified counterparts, spent more on rice seeds, herbicides, and machinery, but less on fertilisers and labour. The reasons may be that in the certified village, better soil quality and wide use of machinery allows farmers to conserve use of fertilisers and labour. Moreover, given that the land rent is fixed, the option of leasing out the land in the certified (treatment) village may discourage farmers from investing in soil conservation inputs such as using fertilisers.

The results also indicate that increased land tenure security enhances rice productivity. Importantly, farms on uncertified plots were cultivated within sizes

of increasing marginal product of land, while the certified farmers were in an opposite situation. One interpretation of the above is that farms on uncertified land were being operated at a scale well short of those necessary for profit maximisation while the converse may be the case for farms on certified land.

Chapter 6 Assessing the Impact of the Land Certification Program on Rural Household Income in China

6.1 Introduction

The land that farmers are allocated is among the few resources they can use to generate income, particularly due to limited access to formal sector employment. Property rights to land are thus one of the most powerful resources available to farmers to increase and extend their sources of sustainable livelihood (Food and Agriculture Organization, 2002). Although there is a lot of research on the investment and productivity effects of land tenure (Feder and Onchan, 1987, Dong, 2000, Place and Otsuka, 2002, Holden et al., 2009, Deininger et al., 2011), very few quantitative studies focus on the welfare impacts of land reforms. While Chapter 5 examines the effects of the RLRC program on farm investment and rice productivity, this chapter uses the same fieldwork dataset to report on the role of the RLRC program on rural household income in China.

As previously mentioned, land is an asset that farmers have had access to, but the property rights to this land have been held collectively by the local community. The issue of rights to the individuals has the potential to enrich farmers whilst reducing inequality between rural and urban residents. In China, the income inequality between urban and rural residents is serious. The urban income was about 3.23 times that of the countryside in 2010, making China among the top countries with the largest urban-rural gap (He, 2011). To address the issues, consecutive policy documents issued by the Central Committee of the CPC and the State Council at the beginning of every year (which has been

dubbed as the No.1 Central Document) took boosting farmers' incomes as a priority (Zhang, 2010).

New rules were issued by the Chinese central government in 2008 that would allow farmers to lease their contracted farmland or transfer their land use rights to others. While farmers cannot transfer ownership, the recent reforms are expected to improve rural living standards and double per capita annual net income by 2020 for China's 700 million farmers—who currently earn 4,760 *yuan* (less than US$800) a year on average.[15]

Providing more security to the rights to land occupied by individuals has the potential to ease tensions between rural communities and the developers of this land. In particular, the reforms could also help reduce incentives for corruption within the present system, with property developers conspiring with local officials to illegally seize farmland in exchange for little to no compensation. Of the tens of thousands of rural protests that occur in China annually, nearly half relate to land grabs (Fan, 2008).

Chengdu was in the first wave to pilot this rural land reform which entailed issuing property rights to the land. In the previous chapter, the effect of the RLRC program on rice-related investment and rice productivity was examined. In this chapter, the focus is on the RLRC's impact on rural household income. Section 2 discusses the methodology employed to estimate the income effect of the RLRC program. Section 3 presents the empirical results of the analysis, and the conclusion follows.

[15] Data was from the National Bureau of Statistics of China 2009, http://www.stats.gov.cn/tjsj/ndsj/.

6.2 Methodology

6.2.1 Hypotheses

Research shows that land certification has enhanced tenure security and stimulated the land rental market (Gine, 2005, Deininger et al., 2011, Holden et al., 2011). Therefore, lacking comparative advantage in agriculture the titled farmers can lease their land to others, take up non-agricultural employment, and thus invest in a business as a source of off-farm income (de Janvry et al., 2001, Chand and Yala, 2009).

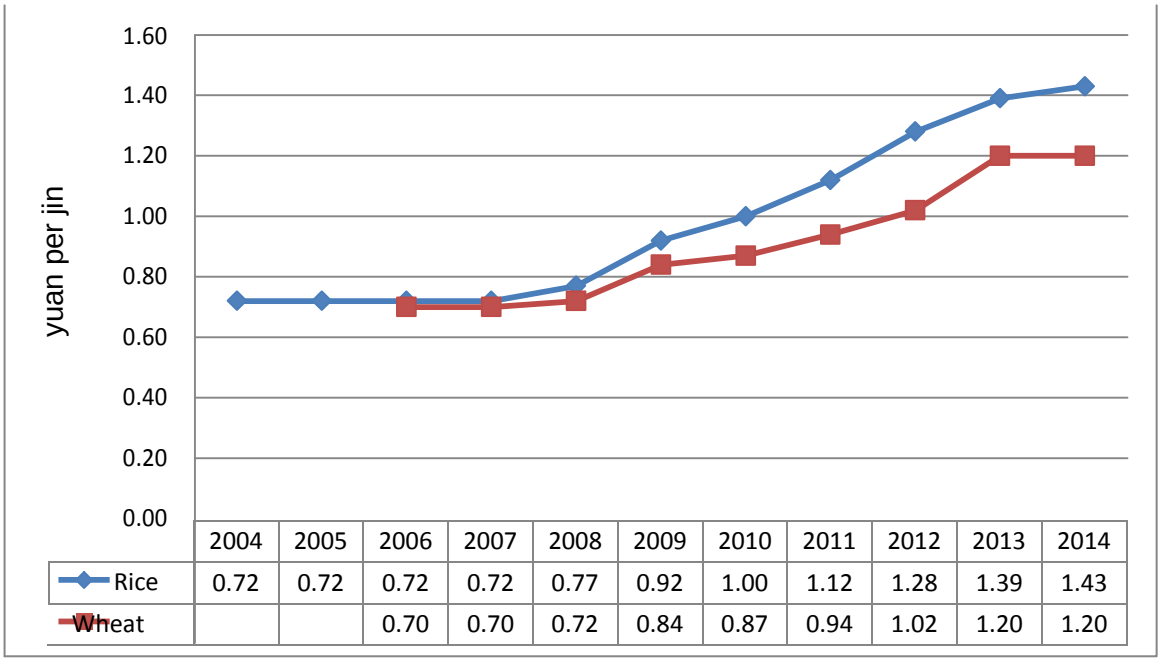
In terms of the relationship between land tenure security and household income, López (1996, cited in Holden and Ghebru, 2011, p.6) found a positive return, net of the cost of titling, to household income from land registration and titling in the Honduras. Moreover, positive impacts of land registration and titling on both income and land values have been found in Thailand (Feder and Nishio, 1998). In Nicaragua, receipt of registered title is also found to increase land values by 30% (Deininger and Chamorro, 2002). Since the rural land registration program has recently started in China, there is a void in terms of empirical research on the welfare effects of land titling.

In rural China, farmers have three main sources of income: farm income, wages income, and transfer income.

(1) Farm income comprises the market value of crops and proceeds from the sale of livestock.

In order to encourage farmers to grow more grains and boost production, since 2004, the central government has set minimum procurement price for grain,

including rice and wheat, in the major grain-producing areas (China Daily, 2013). During 2004 – 2014, the minimum procurement prices for rice have doubled, from 0.72 *yuan*/*jin* in 2004 to 1.43 *yuan*/*jin* in 2014, as is shown in Figure 6.1. At the time of survey, the procurement prices for rice and wheat in 2011 were 1.2 *yuan*/*jin* and 1 *yuan*/*jin*, respectively, higher than the minimum procurement price. The market value of crops was calculated as the crop outputs multiplied by the current-year procurement prices.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Rice	0.72	0.72	0.72	0.72	0.77	0.92	1.00	1.12	1.28	1.39	1.43
Wheat			0.70	0.70	0.72	0.84	0.87	0.94	1.02	1.20	1.20

Figure 6.1 Minimum Procurement Prices for Rice and Wheat 2004 – 2014

Source: Author's compilation based on data from website of Chinese Agriculture News: http://www.farmer.com.cn/zt/zdsgj/.

(2) Wages income that includes wages received from employment outside agriculture plus income from self-employment (entrepreneurship).

(3) Transfer income which consists of: i) rental income from the land being leased out; and, ii) government subsidies, such as Cultivated Land Protection Fund (CLPF) which is available only in Chengdu city.

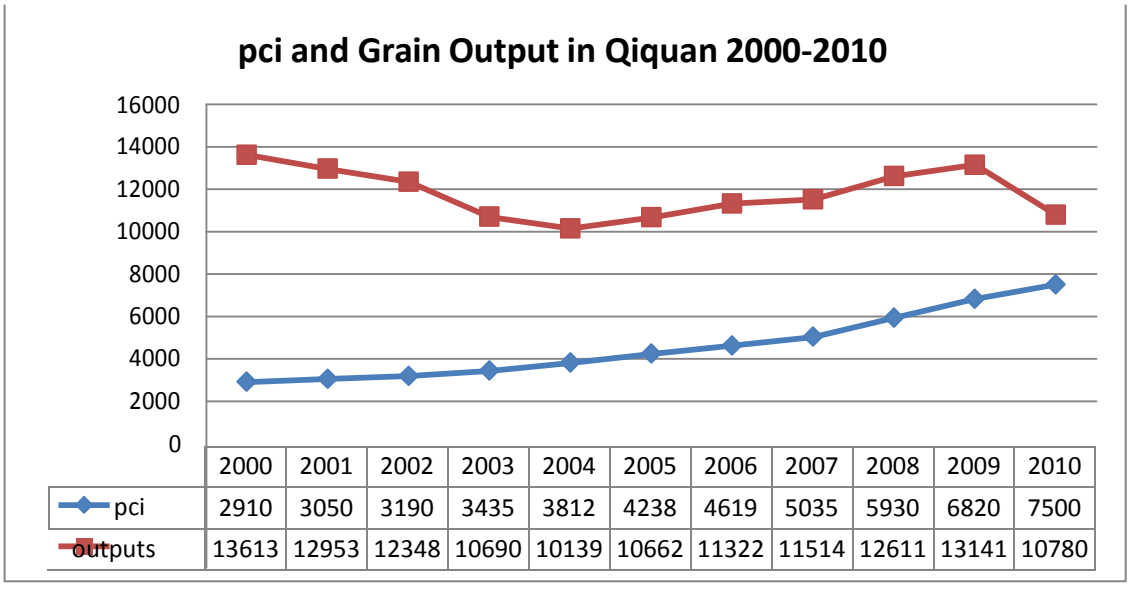
In June 2007, Chengdu city was licensed by the state to proceed with a land reform pilot project that would allow farmers to lease out and mortgage their land. The RLRC program was the first step of the reform. The goal of the RLRC was to address the problems of land tenure insecurity, establish an effective land market and thus narrow the income gap between urban and rural residents (Zhou, 2011). The key features of this experiment are that: being granted with formal land certificates, farmers can transfer their land to more productive farmers or to private agricultural companies. They can also be employed in these agricultural companies and share the bonuses from increased output. To encourage farmers to protect the cultivated land from being converted to non-farm uses, CLPF was established by the Chengdu government.

It should be noted that CLPF was unique to Chengdu city. It was derived from the land transaction revenue of the Chengdu municipal government. To be eligible for the CLPF payment, the land had to be under cultivation. The CLPF payment amounted to 360 *yuan* per *mu* per year for basic farmland (to grow field crops such as grain, cotton, oil, and vegetables) and 270 *yuan* per *mu* per year for general farmland (used for cash crops like flowers, herbs, etc.). In addition, farmers could receive a direct subsidy for growing grain which was 60 – 90 *yuan* per *mu*. Therefore, farmers in the certified village could receive up to 450 *yuan* per *mu* subsidy from the government for growing grain.

Farmers in the uncertified village, however, do not receive CLPF payments or anything similar. The grain subsidy in the uncertified village was only for households that grew grain over 15 *mu*.

(4) Other income: contains income sources which were not categorised into the above three income sources, for example, alimony from the children and pension insurance.

Household incomes were calculated for the 12 months preceding the survey, without deducting the costs of farm inputs and daily expenses, because most of the farmers in the study area are producing crops primarily for household consumption. The net incomes would be close to zero if considering the expense of farms and everyday life, as the interviewees complained.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
pci	2910	3050	3190	3435	3812	4238	4619	5035	5930	6820	7500
outputs	13613	12953	12348	10690	10139	10662	11322	11514	12611	13141	10780

Figure 6.2 Change of Economic Indicators in Qiquan Town 2000 – 2010.

Notes: pci denotes disposable household income (in *yuan*), and outputs denotes tons of grain output.

Source: Author's compilation based on fieldwork data.

Figure 6.2 shows the change of two economic indicators, per capita annual net income (pci, rural households' disposable income, measured in *yuan*) and grain outputs (measured in tons) in Qiquan town, where the certified village Qunan is. As can be seen from Figure 6.2, since the RLRC program began in 2008, the grain outputs decreased sharply while the per capita annual net income increased. It suggests a relationship between the RLRC program, household income, and output.

Based on the first observation of Figure 6.2, plus inspiration from the literature, five hypotheses are to be tested in this chapter using data from Chengdu land reform program:

H1: The RLRC program enables certified farmers to participate more actively in the land rental market

H2: By leasing of land, farms may achieve economies of scale, and therefore obtain higher farm income

H3: Being freed from land by leasing out farm plots, farmers are able to devote themselves to non-agricultural activities, thus raising their wages income

H4: The RLRC program helps in increasing total household income

H5: The RLRC program helps in improving living conditions and quality of life of rural households by increasing per capita income.

6.2.2 Estimating treatment effects

To estimate the impact of the RLRC program on the household income, the households' likelihood of participation in the land rental market is first estimated through a linear probability model (Wooldridge, 2006):

$$P(R=1|X)=\alpha_0+\alpha_1 D+\alpha_2 X+\varepsilon \qquad [6.1];$$

where R is the dummy that is equal to 1 if the household is participating in the land rental market either through leasing in or leasing out some land, and 0 otherwise. D represents the land tenure status (1 – certified, 0 – uncertified). X is a vector comprising variables capturing the characteristics of the household and their land holdings. α_1 and α_2 are the parameters of interest, which capture the partial effects of the variables on the farmer's land market participation.

The impacts of the land certification program on income sources are estimated through both OLS regression and PSM methods, which are the two basic methods to estimate the causal effects of land certification. The goal of both methods is to construct a comparison of treated and control units that are balanced in terms of household socioeconomic covariates except for the land tenure status.

(1) OLS regression model

The parameters estimated by the OLS model are based on a log-linear income equation, which is similar to Equation 5.1:

$$I=\beta_0+\beta_1 D+\sum\beta_2 X+\mu \qquad [6.2];$$

where *I* denotes the income categories: farm income, wages income, transfer income, total household income, and per capita income. β_1 captures the tenure effect on income sources, which is the average treatment effect over all observations. β_2 represents the impact of household variables on household income.

(2) Matching model

The goal of matching is to measure the causal effect of a binary (0 – 1) treatment or policy on the average outcome variable, i.e. average treatment effects (Wooldridge, 2006). The two mostly studied average causal effects in the treatment effects context are the average treatment effects over all observations (ATE), and the average treatment effects on the treated (ATT). By conditioning on observed covariates, X, the two treatment effects can be estimated by (Sekhon, 2011):

$$ATE = E\left(Y_{i1} \middle| D_i = 1\right) - E\left(Y_{i0} \middle| D_i = 0\right) \quad [6.3];$$

$$ATT = E\left(Y_{i1} \middle| D_i = 1\right) - E\left(Y_{i0} \middle| D_i = 1\right) \quad [6.4];$$

Equation 6.4 cannot be directly estimated because the outcome of titled households had not participated in the RLRC program, i.e., E ($Y_{i0}|D_i=1$)), is not observed. Therefore, the matching methods involve the construction of counterfactual expectations of the dependent variable, i.e., constructing estimates of E ($Y_{i0}|D_i=1$) for the mean outcome of ***titled households*** if they ***had not*** participated in the RLRC program. ATT is then actually estimated by averaging over the observed outcome values of Y for households that are similar on the covariates X:

$$ATT = E\left\{ E\left(Y_i \middle| X_i, D_i = 1\right) - E\left(Y_i \middle| X_i, D_i = 0\right) \middle| D_i = 1 \right\} \quad [6.5];$$

where the right-hand side is the estimate of the ATE adjusted for the conditional treatment effect among the distribution of covariates X in the treated group (Sekhon, 2011).

If causal effects are constant over each observation, then the ATE and ATT are identical (Ho et al., 2007).

The matching estimators based on propensity score are widely used to estimate treatment effects. Rosenbaum and Rubin (1983) defined the propensity score as the conditional probability of assignment to a treatment given a vector of covariates X including the values of all treatment confounders:

$$P(X) = \Pr(D = 1 \middle| X) \quad [6.6];$$

After running a probit of household characteristics on tenure status, a propensity score is obtained for each household. This score is the predicted probability of being treated (whether or not actually treated), allowing households to be matched using this score that represents observable characteristics of the household.

As to matching algorithms, the comparison between nearest neighbour matching at ratio=1 and ratio=5 is conducted, with replacement to guarantee using the most similar observations.

A better procedure of after-matching analysis is to use the same parametric analysis as used to analyse the original raw dataset without pre-processing (Ho et al., 2007). Therefore, least square estimates were chosen in the matching model.

6.3 Empirical results

6.3.1 Data description

Table 6.1 presents summary statistics on the variables for which data was collected from the two villages. Test statistics on the equality of means across the certified and uncertified village are also presented.

There are not significant differences among household head's age and gender, and household size in both villages. The age of the household head in the sample averaged 53 years. Some 94% of the household heads are males. The average household contains 4 members. There is nearly 1 additional adult and 1 extra migrant worker in the uncertified village than in the certified. Over 60% of the adults in a household are working in the non-agricultural sectors out of villages.

The average education level in the certified village is higher than in the uncertified; this difference is statistically significant at 10% level. However, they are still both in the category of "primary school" level. The mean land area per household is 4.48 *mu* in the certified village and 3.81 *mu* in the uncertified village, and this difference is statistically significant at 5% level. In these two villages, land area per capita in each household ranged from 0.7 to 1.3 *mu*.

Table 6.1 Descriptive Statistics for Survey Sample

Variables	Total	Qun'an (certified)	Xiayong (uncertified)	Difference: t test (p value)
Characteristics of household head and the household				
Age	53.12	53.16	53.07	-0.05 (0.95)
Gender	0.94	0.91	0.97	1.35 (0.17)
Education	2.38	2.48	2.27	**-1.86 (0.06) ·**
Household size	4.38	4.27	4.50	0.75 (0.45)
Number of adults (14<age<65)	3.53	3.15	3.95	**3.32 (0.001)*** **
Number of migrant workers	2.23	1.91	2.58	**3.01 (0.003)** **
Characteristics of land				
Hold a new land certification	0.52	1	0	--
Land area (mu)	4.16	4.48	3.81	**-2.20 (0.03) ***
Participation in land transfer:	0.47	0.78	0.13	**-10.04 (0.00)*** **
Lease in	0.10	0.09	0.10	0.16 (0.86)
Lease out	0.40	0.75	0.02	**-13.16 (0.00)*** **
Income sources (yuan)				
Farm income	6,123	6,925	5,250	-0.40 (0.68)
Wages income	25,624	24,514	26,833	0.47 (0.63)
Transfer income	1,898	3,640	0	**-11.62 (0.00)*** **
Rent income	1135	2,177	0	**-7.33 (0.00)*** **
Subsidy	763	1,463	0	**-14.61 (0.00)*** **
Other income	125	184	60	-1.46 (0.14)
Total income	33,766	35,256	32,143	-0.50 (0.61)
Per capita income	8,190	9,031	7,273	-0.82 (0.41)
Observations	**140**	**73**	**67**	

Source: Author's survey in 2011.

Significance code: 0.001***, 0.01**, 0.05 *, 0.10·

Some 78% of the certified households engage in land transfer activities, and 96% of land transfer activities are leasing land out to others. Farmers in the uncertified village, however, rarely lease their land. Of the 67 households in Xiayong, only 9 (13%) participate in land transfers: 7 lease in land for a rent

(100 – 390 *yuan* per year per *mu*), and the other 2 allow their relatives to farm the land without charge. Therefore, the average transfer income of the uncertified households is 0. Much more leasing-out activities occurred in the certified village than in the uncertified, indicating that leasing out may deliver economies of scale benefits which could be shared by the households.

As to income variables, the average household has a total income of around 34 thousand *yuan* per year, which is composed of farm income (18%), wages income (76%), and transfer income (6%). In both villages, wages income is clearly more important as a source of income than the other two sources of income. The two study sites differ in transfer income. Farmers in Qun'an village received transfers amounting to 3,640 *yuan* per household from the government, while those from Xiayong received nothing. Thus average household income from renting out land and from transfers from government is greater in the certified village than in the uncertified village. Total income per household, however, is statistically indifferent because households in the uncertified village earn a higher wage income, albeit not statically significant, compared to their counterparts in the certified village. The difference in household income will be tested more rigorously next.

6.3.2 Econometric results

(1) Effect of land certification on land market participation

Table 6.2 tests Hypothesis 1 based on a probit regression model. The clear result is that the land certification program has a positive and significant (at 0.1% level) impact on households' participation in land transfer activities, especially leasing out the land. Hypothesis 1 is therefore strongly supported.

Table 6.2 Probability of Participating in the Land Market (n=140)

Variables	Participation in land leasing (in or out)	Lease-out	Lease-in
(Intercept)	-0.593 (1.340)	**-2.672 (1.474) ·**	1.016 (1.694)
Hold a new land certification	**1.502 (0.298)*** **	**2.477 (0.414)*** **	-0.617 (0.404)
Age	-0.013 (0.015)	-0.021 (0.017)	-0.008 (0.019)
Gender	0.020 (0.614)	0.911 (0.627)	-0.631 (0.578)
Education	0.033 (0.209)	0.168 (0.234)	-0.110 (0.284)
Household size	-0.095 (0.166)	-0.029 (0.187)	-0.228 (0.238)
Number of adults (14<age<65)	-0.270 (0.195)	-0.158 (0.220)	0.032 (0.246)
Number of migrant workers	-0.018 (0.159)	-0.015 (0.188)	**-0.442 (0.210) ***
Land area (*mu*)	**0.423 (0.154)****	**0.351 (0.163)***	0.239 (0.177)
AIC	135.73	102.63	96.28

Source: Author's survey in 2011. Standard errors are in parentheses.

Significance code: 0.001***, 0.01**, 0.05 *, 0.10·

The number of migrant workers is statistically significant at a 5% level and with a negative sign. With more household members working outside the village, fewer are available to work the land, which forms the incentive to lease out the land.

Households' land area has a positive and significant effect on land market participation, particularly in leasing out of land. As the survey data shows, many households did not use all of their farmland to grow crops. On average in these two villages, 75% of the land area was used to grow rice. Therefore, households with a larger land area may have extra land to lease out.

(2) OLS regression estimates

The treatment effects were first estimated with the OLS regression model. Table 6.3 provides the regression results for all the five outcome variables.

(i) Land tenure status and incomes

As Table 6.3 shows, holding a new certification significantly improves transfer income because of the rental income and the CLPF given out in the certified village. In the certified village, transfer income contributes up to 10% of the total household income.

Secure land tenure does not have a discernible impact on the other income sources. There could be two explanations for this result:

Firstly, reinforcing property rights of the farmers by the land certification program, together with matching support of the village leaders' efforts to attract investment, has a substitution effect which boosts farmers' participation in land transferring activities instead of farming or being employed. This can be confirmed by the probit results. In return, households obtain rental income, which is determined by the lessees' performance in the current year. Thus, households earn rental income which raises welfare since farmers save on the effort they otherwise would have expended on farming or working in non-farm activities. The results from column 4 and 5 support the conjecture that leasing is contributing to household income.

Secondly, an income effect may exist if a household receives transfer income large enough to discourage them from using effort to farm or take up waged employment in the cities. The income effect could increase the household's demand for leisure.

Table 6.3 Regression Results for Household Incomes (n=140)

Model/variable	1	2	3	4	5
	Farm income	**Wages income**	**Transfer income**	**Total income**	**Per capita income**
(Intercept)	11474.825 (0.169)	-37410.234 (-0.559)	-4169.364 (-0.948)	-30943.936 (-0.324)	9991.372 (0.281)
tenure	1225.512 (0.178)	1199.047 (0.177)	**1667.792 (3.749)*** **	4097.744 (0.425)	666.670 (0.185)
age	-602.701 (-0.243)	782.283 (0.320)	102.210 (0.636)	295.263 (0.085)	-347.513 (-0.267)
age^2	6.382 (0.270)	-3.391 (-0.146)	-0.749 (-0.491)	2.255 (0.068)	4.325 (0.350)
gender	7094.886 (0.742)	-12762.885 (-1.357)	-101.126 (-0.164)	-5562.618 (-0.415)	1687.803 (0.337)
education level	-1215.923 (-0.326)	3013.774 (0.823)	157.851 (0.655)	2046.300 (0.392)	-15.721 (-0.008)
household size	-916.470 (-0.306)	2587.731 (0.879)	**-539.301 (-2.787) ** **	1128.256 (0.269)	-1595.240 (-1.019)
adults	3603.839 (0.979)	-771.580 (-0.213)	125.963 (0.529)	2926.440 (0.567)	1981.128 (1.028)
migrant labourers	-1645.090 (-0.652)	**11052.784 (4.452)*** **	110.986 (0.680)	**9581.347 (2.706)** **	1405.178 (1.064)
land area	-1491.172 (-0.668)	290.143 (0.132)	**606.862 (4.202) *** **	-671.582 (-0.214)	-1046.650 (-0.896)
lease in land	**27055.866 (3.650)*** **	-2621.967 (-0.360)	-780.607 (-1.629)	**23771.117 (2.286) * **	**11091.726 (2.859)** **
lease out land	5119.819 (0.755)	3245.958 (0.487)	**2198.608 (5.014)*** **	10799.045 (1.135)	5522.496 (1.556)
R^2	**0.12**	**0.37**	**0.66**	**0.21**	**0.10**

Source: Author's survey in 2011.

Values of t-statistics are reported in parenthesis.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

Land tenure status can only increase a household's transfer income on the condition that the household can transfer the land to more productive farmers or private agricultural businesses. This will largely depend on the plot's location, and most importantly, the village committee's ability to attract investment in the agricultural sector.

While conducting the survey, I learnt that those farmers who do not lease out their land, which is largely due to a limited land market, continue to farm to supplement their income. The high living costs and instability of employment opportunities in urban areas also compels them to cultivate their land even when they do not obtain a corresponding return from the land compared to their labour input and other farm-related inputs. For them, farming is like having insurance against the volatile wage income from urban cities. For farmers who leased out their land, especially those who leased out all their land, the problem is how to make sure they can obtain the transfer income in time. In some villages in Chengdu city, it is not unusual for private enterprises to quit in the middle of contracts without paying rent to farmers (Han, 2009). In the village surveyed, 11 households had not received any rent because of the poor performance of the plantations/businesses that had leased their land.

The contribution of land certification on incomes could also be constrained by the short time lapse between when land certificates were issued and when the survey was conducted. The RLRC program had been in effect in Qun'an village for about two years at the time of survey, thus the insignificance of tenure dummy on non-transfer incomes may be due to the limited time for the effect of tenure on income to materialise.

(ii) Non-farm employment and household income

Non-farm employment has strongly demonstrated its importance in improving household income. As shown in Table 6.1, the proportion of total household income derived from wage income accounts for 70% in the certified village, and 83% in the uncertified.

The impact of the number of migrant labourers on wage income and total income are positive and significant, as shown in Table 6.3. With 1 more migrant labour employed in non-agricultural sectors, the household's annual wages income would increase by 11,052 *yuan*, and total income rises to 9,581 *yuan*. All these indicate an increasing importance of wages in household income growth.

(iii) Land market participation and incomes

Participation in the land rental market has manifested its importance in raising household income. Households who leased out land may gain 2,198 *yuan* more transfer income than those who did not.

Compared to households who did not lease in land, households that did had achieved 27,055 *yuan* more of farm income, 23,771 *yuan* more of total household income, and 11,091 *yuan* of per capita income. This may be due to the fact that land was transferred to more productive farmers and economies of scale were reached. The above evidence supports Hypothesis 2.

Who leased in/out the land?

Based on the above observation that leasing in land contributed to more farm income, total household income, and per capita income, further evidence was found about how the households allocated their labour, as shown in Table 6.4.

Each rural household faces a decision as to whether to allocate their members to farming or to urban job markets. To optimise the family income, the households will compare the marginal income and opportunity cost of each member in and off farm employment, and allocate the members to the sectors that maximises income. Therefore, the households that choose to stay in rural areas are those with a comparative advantage in farming and with higher expected rural income (Zhu and Luo, 2010). This is supported by the observation from the two study sites: households who leased in land had distinguished themselves as more productive farmers in farm production, while households who leased out land indicated that they had comparative advantages in off-farm sectors.

Therefore, as can be seen in Table 6.4, those who leased in land achieved nearly 30,000 *yuan* from farming per year, which was far more than other households. It even exceeded the average wage income earned by households who had comparative advantages in off-farm employment. This provides evidence that farming can also be profitable if land can be allocated to more productive farmers, thus realising the benefits of economy of scale.

Table 6.4 Comparative Advantages of the Households (n=140)

		Lease in	Lease out	Non lease
Farm	farm income	**29,979**	16,675	4,959
	wage income	13,286	26,215	25,409
	per capita income	**16,903**	12,181	6,961
	observations	14	26	74
Non-farm	farm income	--	0	--
	wage income	--	**27,916**	--
	per capita income	--	8,332	--
	observations	0	31	0

Source: Author's survey in 2011. The unit of income is Chinese *yuan*.

(iv) Other determinants of income variables

The positive and significant effect of land area on transfer income is plausible since a title (certificate) allows the household to receive transfer income in proportion to the size of their holding.

Household size has a statistically significant and negative impact on transfer income. An increase of a member in a household, according to the estimates presented in Table 6.3, would reduce 539 *yuan* in transfer income. The reason that larger household receives less transfer income per capita is simply because transfers from the government are based on land area rather than household size.

(3) Matching estimates

The goal of matching is to select a subset of the control group that has covariate values similar to those in the treated group. Thus the matching model gives the bias-

adjusted estimates that correct the within-match mean differences in the outcome variables.

One of the most common and easiest matching algorithms to implement is k: 1 nearest neighbour matching (Rubin, 1973). It matches the control to the treated group and discards controls that are not selected as matches. Since there are fewer control individuals (67) comparable to the treated individuals (73) in the sample, the matching method is implemented with replacement (Dehejia and Wahba, 2002), which means control individuals can be used as matches for more than one treated individual. Table 6.5 presents the balance checking before and after matching, based on individual t-tests for each socioeconomic variable. The balance checking is concerned with the extent to which differences in the covariates in the two groups in the matched sample have been eliminated.

As shown in Table 6.5, before matching, there are large differences in the means of education level, number of adults, number of migrant workers, and land area, as the p-values based on the t-test are statistically significant. After performing nearest neighbour one-to-one matching, the sample is reduced from 140 to 98, with the unmatched control group observations discarded. The significant differences in the household head's education level and land area endowment before matching have disappeared. The differences in the number of adults and number of migrant workers have been alleviated. But the difference in the mean of household size becomes statistically significant after the 1:1 matching. In terms of the 1:5 nearest neighbour matching, it only discards 10 unmatched observations, maintaining a larger sample size (130). The difference in education level disappears as well, and the differences in the number of adults and number of migrant workers have been improved.

In order to determine which ratio of nearest neighbour matching to use, the common supports of both ratios matching achieved were also considered. With a higher overlap (see Figure 6.3), the matching at ratio 5 was chosen in the following analyses.

Table 6.5 Differences in Means Before and After Matching

Variables	Before (n=140)	After (1:1)	After (5:1)
Age	-0.05 (0.95)	-0.59 (0.55)	0.04 (0.96)
Gender	1.35 (0.17)	0.03 (0.97)	1.15 (0.24)
Education	**-1.86 (0.06) ·**	0.58 (0.56)	-1.32 (0.18)
Household size	0.75 (0.45)	**1.84 (0.07) ·**	0.50 (0.61)
Number of adults (14<age<65)	**3.32 (0.001)*** **	**2.55 (0.01)** **	**2.59 (0.01)** **
Number of migrant workers	**3.01 (0.003)** **	**2.32 (0.02)* **	**2.38 (0.01)** **
Land area	**-2.20 (0.03) * **	-0.30 (0.76)	**-2.24 (0.02)* **
Sample size	140	98	130

Source: Author's survey in 2011. Results are t-tests estimated by R software based on 1:1 and 5:1 nearest neighbour matching with replacement. p values are in parentheses.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

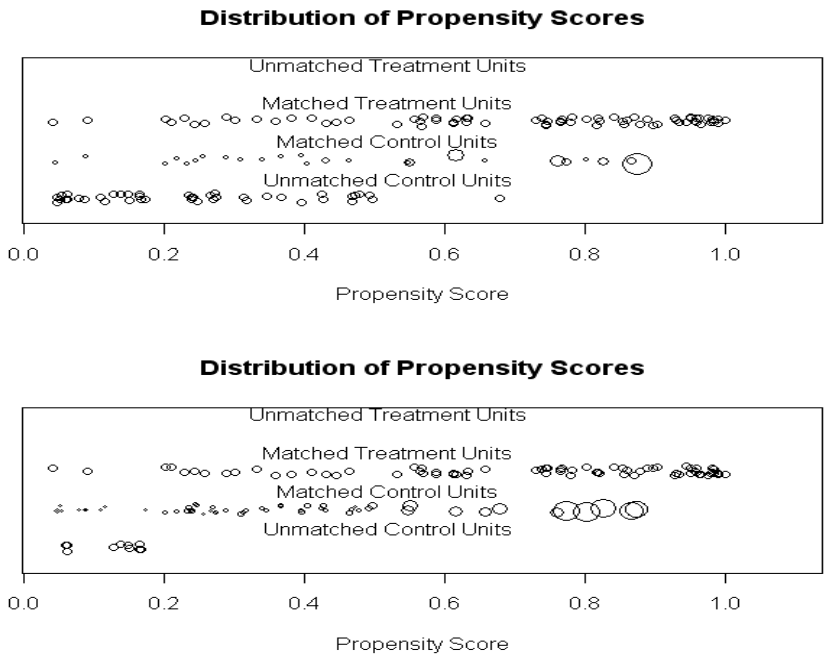


Figure 6.3 The Common Support of 1:1 (upper) and 5:1 (below) Matching

Source: Author's analysis using R software.

The OLS regression from Table 6.3 is also provided as a benchmark in Table 6.6. The models of matching yield similar patterns of statistical significance to the OLS estimates. Both methods show that the land certification program has significantly increased households' transfer income only.

Overall, the average treatment effect on the treated (ATT) exceeds the average treatment effect over all observations (ATE), and both are larger than the OLS estimates, which represents an estimate of the ATE. As can be seen, after discarding the unmatched data, the causal effects become stronger than in the regression model.

Table 6.6 Matching Estimates of Treatment Effects of RLRC Program on Household Income Sources

Income sources	Matching		OLS	Rosenbaum Sensitivity Test ((Γ, max p value)
	ATT	ATE		
Farm income	2918.1 (0.29)	1331.9 (0.24)	1225.51 (0.17)	(1, 1)
Wage income	5991.6 (0.53)	5837.8 (0.73)	1199.04 (0.17)	(1, 0.341)
Transfer income	**3639.7 (4.79)*** **	**2679.7 (5.57)*** **	**1667.79 (3.74)*** **	**(6, 0.000)**
Total income	12721 (0.88)	10001 (1.05)	4097.74 (0.42)	(1.3, 0.128)
Per capita income	4218.9 (0.82)	1977.7 (0.67)	666.67 (0.18)	(2.1, 0.058)
Original number of:				
Observations	140	140	140	
Treated	73	73	73	
Matched number of:				
Observations	73	140	--	
Observations (unweighted)	366	701	--	

Source: Author's survey in 2011. Results are estimated by R software based on 5:1 nearest neighbour matching with replacement. Numbers in parentheses are t ratios.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

The fact that the ATT of certification on transfer income is significantly larger than the corresponding figure for ATE and the OLS estimate suggests that the selection of the village for certification was undertaken in anticipation of large benefits from the RLRC.

Sensitivity analysis

Similar to Chapter 5, the Rosenbaum's method of sensitivity analysis has also been conducted to assess the robustness of the estimates based on matching to the possible presence of an unobserved confounder. A finding is highly sensitive to hidden bias if Γ is just barely larger than 1, and it is insensitive if the conclusions change only for quite large values of Γ (Rosenbaum, 2005). As Table 6.6 shows, the findings of the RLRC's treatment effects on farm income, wage income, and total income are highly sensitive to hidden bias. The treatment effect of the RLRC program on per capita income is slightly sensitive to hidden bias. The treatment effect on transfer income, however, is highly insensitive to hidden bias. The sensitivity analysis then suggests that while it would appear the RLRC program had a positive treatment effect on household's transfer income, the findings on household income sources are sensitive to possible hidden bias due to an unobserved confounder.

6.4 Conclusions

This chapter has demonstrated two key results. First, that the RLRC program encourages farmers to participate in the land market; and second, that the above improves household welfare. On the second, while total per capita household income is not statistically significantly greater in the certified village, the transfer income is. Thus, the RLRC program allows households to earn rents that will improve welfare.

The impact of land tenure security on land market participation has been confirmed: the land certification program makes farmers engage more in land transferring activities, especially leasing out land to plantations or more productive farmers.

However, the average household income or per capita income on certified plots was no greater than on the uncertified. Reasons for this include the fact that certification

may have a substitution effect and an income effect on household's choice between farming, taking waged employment, and enjoying leisure. The land certificate program may stimulate households to engage in the land market to earn rental income, as confirmed above, thus saving on the effort they otherwise would have expended on farming or working in non-farm activities. Besides, if the cash transfer plus land rentals are large enough, the farmers may rely on this source of income and enjoy more leisure.

In addition, leasing in land for farming contributes significantly to increasing the total income and per capita income of the households. This supports the proposition that farmers are using the farmland more efficiently, and that benefits of economies of scale were being realised. Those who had comparative advantages in farming tend to lease in land, while those who had comparative advantages in off-farm employment tend to lease out land. Land certification provides the options to households to lease in or lease out their land and the decisions taken by them have to be welfare enhancing from the revealed preference.

Chapter 7 The Development of Rural Land Transfer Market: A Case Study of the Certified Qun'an Village

7.1 Introduction

Since the RLRC was implemented in Chengdu in 2008, a market in the transfer of land has been developing. Here I look at the impact of the development in the land market on economic efficiency and household income. I compare the effects on household income for households who lease in as compared to those who lease out land relative to incomes of households who do not participate in the land market at all. Thus, the autarkic households are used as a comparison with those who lease in and those who lease out their land. It is important to note that the process of leasing of land is standardised and formalised via the RLRC program.

The three key findings from this chapter can be summarised as follows. First, the RLRC has led to the development of a land transfer market which on the whole has increased incomes of participating households. Second, households with more migrant workers lease out their land while the opposite is true for households who do not have migrant workers. The opportunities for outside work drive leasing out rather than the converse. Third, households that lease in land realise the benefits of economies of scale. Thus they increase their income compared to the autarkic group. A qualification to the above is that the sample for the lease-in group is small.

There are several policy implications emanating out the above findings. Establishing an effective agricultural land transfer system is necessary and urgent for urbanisation and agricultural modernisation. But the rural land market is known to be imperfect in China, because farmers fear they would lose the land once they lease it

out. Through the RLRC program, households are granted formal (i.e. written) records of their land holdings. One implication of the codification of the ownership rights to land is that the land will not be reallocated in the future, even if household size changes. Land use rights through the RLRC therefore is both certified and secured. With the strengthened use rights to rural land, a farmer could use his land certification as collateral to obtain a loan from the formal sectors. This is one of the ways to make rural households' assets (land, house sites) capitalised.

According to the No.1 Central Document in 2013, the RLRC program is expected to be completed throughout rural China by the end of 2018. This chapter will examine the determinants of participation in the rural land market after the completion of the land certification program, and consider means for making the rural land market more efficient. It will provide some policy implications for villages that have finished or are about to embark on a land certification program.

The chapter is structured as follows. Section 2 provides the background of the development of land transfer markets in China. Section 3 briefly reviews the literature concerning the benefits from land transfer markets. Testable hypotheses and an econometric framework are described in Section 4. Section 5 reports the descriptive statistics and econometric results. Section 6 draws the conclusions.

7.2 Background: rural land transfer in post-1949 China

The transfer of rural land was not new in China. During the Agrarian Reform period (1949 – 1953), land was confiscated from the landlords and redistributed equally to the small landholders and former landlords. Article 1 of the Agrarian Reform Law 1950 abolished land ownership by feudal landlords and introduced the peasant land ownership scheme; Article 30 regulated that land owners had the rights to use, sell,

and lease their land (Communist Party of China (CPC), 1950). Therefore, with the formal land certificates issued during the Agrarian Reform period, the transfer of land ownership rights was allowed and legally protected at that time.

In the Elementary Producers' Cooperatives period (1953 – 1956), farmers could choose whether to join the village cooperatives with their land. The pooled land was collectively used and could not be leased. Those who did not join or quit the cooperatives could still sell or lease their land if they wished to. During this short period, the transfer of land was gradually restricted. For example, in order to encourage more households to join the Cooperatives, in Article 18 of the draft of On the Cooperative Transformation of Agriculture (Communist Party of China (CPC), 1955), it was regulated that returns to land should not exceed returns to agricultural production because the revenue of the cooperatives was created by the hard work of the members rather than by land ownership. Article 22 stipulated that the rented land or land operated by relatives should be handed over to be operated by the cooperatives. It also pointed out explicitly that Advanced Producers' Cooperatives were the target of the process of agricultural cooperative transformation, when rent for land that joined the cooperatives would be abolished and all production materials (including land) would become collectively owned by members.

The Elementary Producers' Cooperatives were quickly transformed into the Advanced Producers' Cooperatives (1956 – 1958) and the People's Commune (1958 – 1978). Consequently, rural land was owned and operated by the village collectives. Farmers lost their rights to the land. The transfer of land rights (ownership rights and use rights) by farmers was therefore absent during this period.

With the creation of the HRS in late 1978, farmers reclaimed their use rights to land. However, the No.1 Central Document in 1982 (the first No.1 Central Document) stipulated that the land farmers contracted from the village collectives should not be sold, leased, transferred, or left to lie idle. Otherwise, land would be taken over by the village collectives.

The contracted rural land could be “subcontracted according to law”, as was proposed in the 1984 No.1 Central Document. But sale and leasing were still banned. Subcontracting means that a contractor (Farmer A) signed another contract with a third party (Farmer B) to let Farmer B grow on a part or all of Farmer A’s land, which was originally contracted from the village collectives, under specific conditions. The contract between Farmer A and the village collective was still valid. The difference between subcontracting and leasing is obscure. The main difference may be that the third party in subcontracting can only be a member of the village collective; while in leasing, the third party could be anyone including outsiders of the village. Although rural land could only be transferred between village members, it was the first time since 1956 that the Chinese government relaxed the restrictions on rural land transfer.

However, this regulation could not meet the needs of the Chinese economic reforms since 1979 (also known as the Reform and Opening up). One of the aims of the economic reform was to attract foreign investment, which would require land to build factories. Therefore, the Constitutional Amendment of 1988 authorised that the use rights of land could be transferred in accordance with the law. The transferred land was mainly urban though. When urban residents could use their property rights as a mortgage afterwards, the rural land was still “dead capital” to rural farmers, as

Peruvian economist Hernando De Soto (2003) has described: due to the lack of process (such as titles, registries) to represent property, the assets could not create capital, i.e., they could not be used as collateral for credit. Nevertheless, the Constitutional Amendment of 1988 provided a legal insight to loosen the restrictions of rural land transfer in China.

The transfer of rural land use rights, including subcontracting, leasing, exchanging, and transferring, was not acknowledged until the 1995 No.1 Central Document. The document also regulated that transferring should not change the agricultural use of farmland. In order to further encourage rural land transfer activities, the transfer of rural land use rights was further regulated by the Rural Land Contract Law, which went into effect in March 1, 2003. The 2008 No.1 Central Document proposed to keep the existing land contracts unchanged (no readjustment) for a long time; launch a verification, registration and certification program of rural land to secure land use rights; and establish an effective market of rural land use rights. In the document of the Third Plenary Session of the 18th CPC Central Committee that deliberated in November 2013, it was proposed that farmers would be given more property rights (e.g. mortgage, guarantee, and transfer rights) and a rural property-rights trading market would be established. The rural land transfer had therefore gone a full circle since 1949: from private property to being collectively owned, and then allowed and encouraged to be quasi-private property by 2008.

7.3 The benefits of the rural land transfer market

Rural land transfers in China include the transfer of farmland, forest land, and construction land. Farmland is the research object of this chapter and the whole

thesis. The development of the rural land transfer market illustrates the efforts of the Chinese government to:

(1) Guide the allocation of agricultural land to more productive family farms or cooperatives
(2) Promote modern agriculture and moderate scale farming
(3) Guide the surplus rural labour force to participate in the non-agricultural sectors.

The impact of the rural land transfer market has been positive, as discussed next.

(1) Enhance allocation of land for economic efficiency.

To ensure the egalitarian principle, rural land in China was equally allocated to each member of the village collectives. However, administrative land allocation has been recognised as an inefficient management tool since it cannot distinguish the more productive land users from the less productive (Benjamin and Brandt, 2002, Ho and Lin, 2003). A robust rural land market would help to increase efficiency of land allocation (Ho and Lin, 2003, Deininger and Jin, 2003), allowing those with more agricultural ability to gain access to additional land, increase their operational farm size (Deininger and Jin, 2005b), and reduce the illegal conversion of land designated for farming to construction (Ho and Lin, 2003).

(2) Improve labour allocation efficiency.

Those households with a lower land valuation can rent out their land and allocate their household labour to off-farm sectors to increase wages income (Kung, 2002). For those who are more willing to enhance their farm productivity and increase farm income, the land transfer market is also helpful: if the supply of household labour exceeds the profit-maximising level of labour input in production, then the household

can hire labour out to off-farm activities or rent in more land; if the household labour supply is less than the profit-maximising level, then the household can hire labour in or rent out land through the markets (Bowlus and Sicular, 2003). By allowing households to achieve their desired levels of work and leisure while employing the profit-maximising amount of labour among farm and off-farm sectors, land rental markets may serve to facilitate the transfer of rural labour from agriculture to industry and from households with high labour-land ratios to households with lower labour-land ratios.

(3) Increase agricultural productivity.

Based on a cross-sectional survey in 61 villages of Zhejiang province, Zhang (2008) found that through the land markets, the lessee households had 30% higher land productivity than the ordinary households, while land productivity in the lessor households was only a quarter of that in the ordinary households.

From a wider scale, based on a four-period panel survey in China's nine most important agricultural provinces, Jin and Deininger (2009) showed that agricultural productivity increased by 60% through the land rental market, and the welfare of both lessee and lessor households had been largely improved. Econometric estimates from Table 6.3 in Chapter 6 also show that per capita income in the two surveyed villages increased by 11,091 *yuan* through leasing in land.

(4) Increase rural income and narrow the disparity between urban and rural residents.

Land transfer markets enable farmers who have lower land endowment to cultivate more land and produce higher outputs and farm income. Households that do not want to farm are able to obtain extra rental income through the land transfer market

and at the same time work in the off-farm sectors. Due to this, land markets may lead to a rising disparity in farm income between lessee and lessor households, but more importantly, a decreasing disparity in overall income between these groups. This income effect of land markets have been evidenced in the study of Zhang (2008) and in the previous chapter.

Furthermore, if land (particularly construction land) could be transferred for urban use, farmers may use land to access capital from the formal sector and thus share the bonus of urban development.

Land transferring has already been encouraged and legalised and the benefits of an effective land transfer market have been supported in the literature as well, however the transfer of agricultural land has developed slowly. According to a report by Chen Xiwen, the Director of the Office of Central Rural Work Leading Group in the Chinese central government, throughout the 1980s and most of the 1990s, only 1 – 3% of arable land had been transferred among rural households; and in a national survey on the emerging land markets in 1993, the Chinese Ministry of Agriculture found that only 2.3% of surveyed households had participated in subcontracting or transferring of land rights and 2.9% of arable land had been involved (Chen and Han, 2002). Most of the rental contracts during this period were oral, informal, and often seasonal (Huang et al., 2012). After the mid-1990s, land rental activities expanded more rapidly. In 2008, 8.9% of arable land had been transferred nationwide. In 2009, the figure was 11% (Liu, 2009). The reasons for the underdeveloped land transfer markets follow.

(1) Unsecured land tenure rights.

In many countries, insecure property rights, poor contract enforcement, and stringent legal restrictions limit the functioning of land markets, creating large inefficiencies in both land and labour reallocation and reinforcing existing inequalities in access to land (World Bank, 2008). China is no exception. In China, obscure land use contracts and frequent readjustments of land allocations through administrative edicts are key factors accounting for the insecurity of land use rights. If farmers lease out land, there is a risk that they may lose it during subsequent land reallocation. The village leaders would regard rental transactions as a signal of land misallocation and take back land from those who leased it out (Brandt et al., 2002). Considering this uncertainty, farmers have an incentive to be conservative in transferring land.

(2) Imperfect off-farm labour market.

Benjamin and Brandt (2002) found that farmers with less land are most constrained because smaller farms input more labour and generate higher farm productivity; but high labour intensity leads to low labour productivity and a lower shadow wage. The growth of the labour market promotes the development of a land transfer market. Higher off-farm wage rates are found to activate land rental markets (Kimura et al., 2011). The availability of off-farm jobs prompts them to reallocate their resource (labour, land) endowments strategically. When some households transfer labour out of farming, they create a supply of land that drives rental market activities.

(3) High transaction costs.

Early land transfers mostly occur between kinship groups, such as relatives, close friends, and neighbours (Brandt et al., 2002). There are two main reasons for this phenomenon. On the one hand, in the absence of an effective land market in rural China, there is information asymmetry between potential land providers and

demanders; land transfer information usually only spreads within the village. As a result, the potential land providers' relatives, friends, and neighbours have access to information for decision-making. On the other hand, China is recognised as a low-trust society, and family relations trump other social obligations (Fukuyama, 1995). Because of the low trust, for those eager to transfer land, it comes at more cost and risk when bringing strangers into the transfer process. Specifically, the low trust between unrelated people would bring about high transaction costs in terms of time and bargaining to search for partners, to negotiate, and to enforce contracts, which in turn constrains the development of the land transfer markets. By contrast, the transaction costs are likely to be lower between kinship groups thanks to the higher level of mutual trust.

(4) Land is regarded as insurance.

It is common that agricultural income only consists of a small share of a household's total income in rural China, thus, only a few households have given up farming altogether (Yao, 2000). Farmers want to keep the land – their biggest asset – as a fallback to being laid off from waged employment. When they cannot find jobs in urban areas, they can still retreat to villages and farm.

7.4 Hypotheses and estimation strategy

Hypotheses

In Chapter 6, the results show that participation in land transfer markets (leasing in land) contributes significantly to raising the total income and per capita income of the households. Chapter 6 also identifies land certification as an important determinant that affects land rental participation. In this chapter, the certified Qun'an village will

be the focus and used as a case to study for the factors that influence the development of land transfer markets after the RLRC program. The basic assumption is that after the RLRC program, farmers in Qun'an do not face the risk of expropriation when leasing out land.

Based on the literature review in the previous section, to guide the empirical analysis of determinants of agricultural land transfer markets, the following testable hypotheses have been developed:

H1: Rural land transfer market has a redistribution impact on household resources.

Households with a comparative advantage in off-farm employment tend to lease out their farmland, while households with comparative advantages in farming are more likely to lease in land. Through the transfer market, it is possible that farmland could be concentrated to more productive farmers or organisations.

Families that are better equipped to exploit opportunities in off-farm labour markets transfer their labour force out of agriculture and depart from the land. For families less able to benefit from off-farm job opportunities, the rental markets offer opportunities to expand farm operations, either to meet their greater subsistence needs or to venture into commercial farming.

H2: With off-farm employment opportunities increases, households are more inclined to transfer their land use rights. In the study by Huang et al. (2012) on China's six major agricultural provinces, off-farm employment was found to stimulate households to rent out cultivated land.

H3: In the study by Jin and Jayne (2013), land transfer markets would help equilibrate the land-labour ratio among households and improve efficiency.

Therefore, through land transfer markets, households with lower land endowment tend to lease in land while households with higher land endowment tend to lease out land.

Empirical model

To empirically test the above three hypotheses, a reduced form regression for participation in land rental markets (renting in or renting out) has been employed. Based on the empirical evidence, the renting in and renting out decisions were estimated separately. The empirical model includes two models: one model uses the amount of land rented in as the dependent variable, the other model uses the amount of land rented out as the dependent variable.

In their important study of land rental market, Deininger and Jin (2005b) develop a model of agricultural production and land rental market participation which could be established as: $R_i = \beta_0 + \beta_1 \alpha_i + \eta X_i + \delta O_i + \gamma T_i + \varepsilon_i$, where R_i is a dummy for renting in/out or the actual amount of area rented in/out, α is household's agricultural ability, X_i is the household characteristics (including the age and education of household head, and the per capita land endowment), O_i denotes off-farm opportunities available to household i, and T_i is a vector of characteristics affecting the transaction cost of land rental.

The model has been modified in this thesis in accordance with the attribute of data available and the results of other empirical studies. Since agricultural ability α is unobserved and could not be estimated by cross-sectional data according to Deininger and Jin's model, I use the proportion of farm income instead. The proportion of farm income, which is determined by the household agricultural ability,

has been proved to have significant impacts on renting in/out decisions (Jiao, 2005, Hou, 2012).

Different off-farm opportunities could arise different off-farm income levels, therefore, the proportion of wage income and the number of migrant workers have been used to denote the off-farm employment opportunities (Li et al., 2011).

In regard to transaction cost T_i, Deininger and Jin (2005b) estimate it by a dummy of permission of renting by village leader and the household's past rental experience, while Bizimana (2011) views it as a function of tenure security that depends on trust, costs of obtaining information, and of negotiating, policing and enforcing contracts. As Qun'an village is a pilot area in Chengdu city to implement the RLRC program, the village leaders have searched for the potential land lessees (e.g., the agricultural plantation owners) for their villagers. To some extent, the Qun'an households face the same transaction cost when renting out their land because the village committee has completed the procedure of obtaining information, negotiating, screening, and enforcing contracts. For this reason, the transaction cost T_i is omitted in this thesis.

Therefore, after the completion of the RLRC program, the determinants of the land transfer markets in the Qun'an village could be estimated based on an equation of the form:

$$R_i = a_0 + a_1 X_i + a_2 P_i^r + a_3 P_i^w + a_4 S_i + a_5 I^{in} r_i^{in} + a_6 I^{out} r_i^{out} \qquad [7.1];$$

where R_i represents the land area being transferred (in or out) by household *i*. X_i is a composition of household characteristics, including the age, gender, education attainment of household head, per capita land endowment (household land area/household size), and number of migrant workers working outside the village at

the time of survey. P_i^f and P_i^w stand for the proportion of farming income and wages income out of total household income, respectively. S_i denotes subsidies that household *i* received from the local government. I^{in} is an indicator if household *i* leased in (=1 for leasing in, and 0 otherwise), similarly I^{out} is a dummy for leasing out (=1 for leasing out, and 0 otherwise). r_i^{in} and r_i^{out} are the rent per *mu* of land when leased in and leased out, respectively.

Compared to the model of Deininger and Jin (2005b), variables S_i (government subsidies) and r_i (price of rent in/out) have been included in Equation 7.1. This is due to the particular context of China. The Chinese government has offered subsidies to farmers to encourage them to protect the farmland and enhance grain production. Therefore, the impact of government subsidies on land rental activities is worthy of study in China (Hou, 2012). Besides, due to the abolishment of agricultural tax in 2006 and the local government's stimulus plans to land transfer activities, the rental price of farmland has increased each year. As a result, the rent in/out prices are important factors that may affect household's land rental decisions (Li et al., 2011).

Ordinary least squares (OLS) were used to analyse the determinants of land rental markets. With multiple regression analysis, due to data limitations or ignorance, some factors may not be included (Wooldridge, 2006). If an important factor that is correlated with any of the right hand variables in Equation 7.1 is ignored, then endogeneity may result and the functional form of Equation 7.1 would be mis-specified. To detect the problem of functional form mis-specfication, the regression specification error test (RESET) has been employed after the OLS regression by adding polynomials in the OLS fitted values to Equation 7.1 (Wooldridge, 2006).

Data sources

Data was collected in the Qun'an village, including 73 households. Qun'an is a village about 70 kilometres (one hour's driving) from Chengdu—the capital of Sichuan province. There are about 900 households and 3,351 *mu* of farmland in Qun'an. The per capita income was 4,786 *yuan* in 2008 and was one of the key targets of Chengdu's anti-poverty project. In the same year, Qun'an was selected as a pilot village to explore the transfer of farmland and construction land, promote the smooth flow of production factors between urban and rural areas, and balance the urban-rural development. The first step of the pilot program was to conduct a survey and mapping in order to verify, register, and certify the land use rights of farmland and construction land to each household. The land transfer occurred between households at a slow pace and the amount involved was small. Local governments realised that information asymmetry, as mentioned above, was a key problem that incurred high transaction costs and hindered land transfers. Therefore, they established information channels to provide transfer information for the potential lessors and lessees.

On the other hand, a land cooperative organisation involving 176 households was established to operate a lotus plantation for sightseeing, entertainment, and relaxation (see Figure 7.1). The lotus plantation occupied 1,000 *mu* of land, mostly construction land consolidated through the land consolidation project. However, during the land consolidation, firstly, where was the money acquired from? Based on the new land certificates, the cooperative used it as a mortgage to access credit of 36 million *yuan* (about US$ 6 million) from the Bank of Chengdu. Secondly, where could the farmers living on the land then move to? The affected households had three choices: (i) to live in planned, more concentrated and newly built residential areas; (ii) to select other available housing sites and the cooperative would build

houses for them; or, (iii) obtain compensation money if they did not want to live in the village. Thirdly, how did they operate the plantation? The cooperative attracted five companies outside Qun'an to invest and operate the lotus industry. Ninety per cent of the profits obtained from the company would be given out to shareholders of the cooperative, i.e., the 176 households. The remaining 10% would be kept as a fund to manage land transfer information, attract investors, administer contracts, and for the maintenance of the cooperative.

Figure 7.1 The Lotus Plantation

Sources: The pictures above were from fieldwork and the one below one was from the website: http://www.cdta.gov.cn/vote/content.aspx?moduleid=776&id=17839&child_moduleids=922.

At the time of fieldwork, Qun'an had built the "Three Thousand Industry", namely, 1,000 *mu* each for lotus, grapes, and honeysuckle, respectively. In addition to construction land, a large area of farmland was leased out to the plantations. The following analysis shows the mechanism of land transfer between the individual households.

7.5 Determinants of agricultural land market participation

The variables used in the econometrics analysis are reported in Table 7.1. Households face three alternative rental choices, i.e., leasing in, leasing out, and remaining in autarky. For each group, household characteristics (such as age, gender, education level of the household head, number of household members, number of adults aged 15 to 64, number of migrant workers, and the initial land endowment), income composition (proportion of farm income out of total income, proportion of wages income, and subsidy per *mu* of land), and variables describing the household's participation in land market (rent (in/out) per *mu*, and land area being leased) are reported.

Table 7.1 Household Characteristics by Rental Participation Status

	Total	Lease-in	Autarkic	Lease-out
Head's age	53	53	56	52
Male-headed	0.92	0.71	0.94	0.95
Head's education level	2.48	2.28	2.44	2.51
Household size	4.27	3	4.12	4.42
No. adults (15 – 64)	3.15	2.14	3.12	3.26
No. migrant workers	1.92	**0.57****	1.50	**2.09·**
Land endowment (*mu*)	4.48	3.41	3.59	**4.85***
Proportion of farm income	0.15	**0.55·**	0.28	**0.10*****
Proportion of wage income	0.66	**0.30***	0.61	0.68
Subsidy per unit of land (*yuan*/*mu*)	352.9	300	411.9	**332.2****
Area of land being transferred (*mu*)	3.27	2.71	--	4.00
Rent per unit of land (*yuan*/*mu*)	963.00	515.7	--	1003
Observations	73	7 (9.5%)	16 (21.9%)	55 (75.3%)

Source: Author's computation based on fieldwork data in 2011.

Note: The total amount of leasing in, leasing out, and no participation is 78, larger than 73, because 5 households leased in land from others and at the same time lease out their land.

Significance code indicates a significantly difference from the means of the autarkic group at 0.001***, 0.01**, 0.05 *, 0.1·.

In the sample, 75.3% of households leased-out land in 2011, which is about eight times the proportion of households who leased-in land. Only 21.9% of households did not participate in the land rental market at all. The high level of participation in the land market was connected with the efforts of the village committee to attract agricultural investment. During the time of survey, there were three main agricultural

companies that leased land from the households and developed agricultural plantations such as lotus, grapes, and honeysuckles. These companies earned income through sale of these cash crops and agricultural tourism.

Table 7.1 shows that several of the characteristics of the lessee and lessor families are not statistically significantly different from the autarkic families. In particular, the household head's age, gender and education level, household size, and the number of adults (i.e., aged 15 – 64) are all statistically indifferent between the three groups; that is, the households that lease in, lease out, and do not partake in leasing land.

However, the seven lessee families have the fewest off-farm workers, least amount of land endowment, highest proportion of farm income, and lowest proportion of wages income. In contrast, the lessor families have the very opposite.

According to Zhang et al. (2004), the lessee families are possibly the disadvantaged group and reside at the bottom of the income scale in the absence of rental markets, because they have the lowest education level and fewest off-farm workers—two attributes that have been consistently found to exert downward pressure on income. But participation in rental markets made them significantly better off: as shown in Table 7.2, the median per capita income of the lease-in group is 8,000 *yuan*, higher than the other groups. This echoes the findings of Zhang et al. (2004) that land rental markets have not only created a new source of income (land rentals) for the lease-out group, but also acted as a "compensatory mechanism" that improves the wellbeing of the lessee group—an otherwise disadvantaged group.

Table 7.2 Comparative Advantages of the Households in Qun'an (Certified)

		Lease-in	Lease-out	Autarkic
Farm	farm income	**52,443** (3,380)	17,945 (3,750)	4,420 **(4,740)**
	wage income	4,429 (5,000)	25,650 (13,500)	18,969 (12,000)
	total income	**59,537** (16,000)	46,848 (**24,258**)	24,938 (18,696)
	per capita income	**26,962 (8,000)**	12,784 (7,494)	5,351 (5,156)
	observations	7	24	16
Non-farm	farm income	--	0	--
	wage income	--	**27,916 (20,000)**	--
	total income	--	33,545 (22,520)	--
	per capita income	--	8,332 (6,133)	--
	observations	0	31	0

Source: Author's survey in 2011.

Note: The values are mean income of the households; the median values are in parentheses because the income variables are not normal distributed. The unit of income is Chinese *yuan*. Five households who leased in land also leased out their land.

Farming income accounted for 55% of the total income for households leasing in land and only 10% for the lease-out group. The proportion of the off-farm wage income was 30% for the lease-in group and 68% for the lease-out group. Relative to the autarkic group, involvement in the land transfer market had increased the income of the market participants. Compared to the autarkic group, the lease-in group had an increase in the proportion of farm income while the lease-out group raised its wages income. Thus, participation in the land rental market made possible through the RLRC has increased welfare.

The total subsidies actually received by households such as the CLPF and subsidies for purchasing superior seeds were 300 *yuan*/*mu*, 332 *yuan*/*mu*, and 411 *yuan*/*mu* for the lease-in, lease-out, and autarkic groups, respectively.[16]

The average area of land being leased in was 2.71 *mu* with an average rental of 515.7 *yuan*/*mu* per year, while the average area of land being leased out was 4 *mu* with an average rental of 1,003 *yuan*/*mu* per year. Leasing-in activities mostly happened between acquaintances in the same village, therefore the rental rate for leasing in was much lower than leasing out land to commercial plantations. This can also explain why leased-out area was larger than leased-in area: higher rental leads to larger supply of land to plantations.

Table 7.2 reports the income status for four groups of households who: leased in land and farmed; leased out land and also kept farming; leased out land but did not farm; and did not participate in leasing. Households who leased in to farm generated the highest average farm income. There were 3 out of 7 leased-in families who did not work in the off-farm sectors but concentrated on farming. Take one of them as an example: the initial land area allocated to them was 2 *mu*. They leased in another 10 *mu* of land to grow mushrooms and earned 300,000 *yuan* of farming income in 2011. If there had been no land transfers, this household might only earn 2,000 *yuan* from farming with the 2 *mu* of land endowment.

[16] The amount of CLPF the households received were different because, as Chapter 6 mentioned, the CLPF payment was 360 yuan per *mu* per year for basic farmland (to grow field crops such as grain, cotton, oil, and vegetables) and 270 yuan per *mu* per year for general farmland (used for cash crops like flowers, herbs, etc.). In addition, farmers could receive a direct subsidy for growing grain which was 60 – 90 yuan per mu. Therefore, farmers in the certified village could receive about 270 – 450 yuan/mu of subsidies from the government according to the type of farmland and the type of crops.

The lease-in group also presented a higher per capita income than the other groups. In contrast, the lease-out and non-farm group demonstrated their comparative advantages in off-farm labour markets. The mean wage income of this group was 27,916 *yuan*, higher than the other groups.

Although the sub-samples are relatively small, the lease-in families identified themselves as more productive farmers. Similarly, the lease-out family, especially those who had given up farming, identified themselves as more productive in off-farm employment.

Compared to the autarkic group, the development of the land transfer markets had helped improve the income of the lease-in group, which may otherwise be a disadvantaged group as explained above, and the lease-out groups through the reallocation of the resources (land, labour). Farmers are economic men. They know best where to devote their efforts to maximise their utility. Therefore, the reallocation process was the revealed preference of each household head.

The results of the estimation of Equation 7.1 are presented in Table 7.3. The estimator used is OLS regression.

For the lease-in model, the only variable that has significant effects on the area leased in is the proportion of farm income. Farmers who had a higher proportion of farm income tended to lease in more land. Through land transfer markets, those who have comparative advantages in farming had chances to expand their farm either to meet subsistence needs or to undertake commercial farming (e.g., the mushroom grower mentioned above).

Table 7.3 OLS Regression for Area of Land Being Transferred

	Area leased in	**Area leased out**
Head's age	0.005 (0.468)	**0.048 (2.547)***
Male headed	0.269 (0.583)	**-1.470 (-2.128)***
Head's education level	-0.116 (-0.595)	-0.369 (-1.262)
Per capita land endowment	0.554 (1.087)	**1.732 (2.186)***
No. migrant workers	0.035 (0.323)	**0.579 (3.531)*****
Proportion of farm income	**3.936 (4.113)*****	-1.010 (-0.671)
Proportion of wage income	0.605 (0.723)	0.984 (0.740)
Subsidy per mu of land	0.0002 (0.337)	**-0.002 (-2.061)***
Rent per mu of land	0.0008 (1.266)	**0.003 (5.806)*****
(Intercept)	-1.818 (-1.214)	-2.182 (-0.939)
R-squared	0.42	0.70
Ramsey RESET test (F value, check for endogeneity)	32.36	9.60

Source: Computed based on author's survey in 2011. t-values are in parenthesis.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

However, the positive sign does not necessarily imply the causation direction from farm income to area leased in. Farm income data collected in the 2011 fieldwork was the income generated during the past 12 months; therefore, higher farm income could be an outcome after leasing in land. This suggests that an economy of scale to land may exist: more land leased in, more income generated. To test it, a regression was run on per capita income in Table 7.4. In Chapter 6, based on the data from the

certified Qun'an and uncertified Xiayong villages, it was found that participating in leasing in land could contribute to higher per capita income. In Table 7.4 below, the positive sign of lease-in area on per capita income further indicates that, in the certified Qun'an village, an economy of scale to land exists in the households that leased in land: leasing in one more *mu* of land could lead to an increase of per capita income by 93.5%.

Table 7.4 The Impact of Transferred Land Area on Per Capita Income

	Ln(pci)	**t-value**
Head's age	0.004	0.54
Male headed	0.527	1.66
Head's education level	0.153	1.20
Per capita land endowment	0.487	1.42
No. migrant workers	**0.232*** **	3.61
Lease-in area	**0.935** **	3.04
Lease-out area	0.202	0.95
Subsidy per mu of land	**0.001***	2.22
(Intercept)	5.946	7.11
R-squared	0.30	
Ramsey RESET test (F value)	1.23	

Source: Computed based on author's survey in 2011. t-values are in parenthesis.

Significance code: 0.001***, 0.01**, 0.05 *, 0.1·

With regard to the lease-out model in Table 7.3, the positive and statistically significant coefficient on per capita land endowment supports Hypothesis 3 that

households with higher land endowment were inclined to lease out their land. Specifically, increasing 1 *mu* of land per family member would lead to a total of 1.7 *mu* of land being leased out in the family. Having a higher per capita land endowment indicates that household labourers may be in short supply. When the family do not have enough labourers to work on the land they hold, they would either hire labourers or lease out the land. In the case of Qun'an, the surveyed households leased-out land rather than hiring labourers. Through the land transfer markets, the allocation efficiency of land was improved. The other direction of Hypothesis 3, that households with lower land endowment tend to lease in land, was supported by the estimates on the lease-in model.

The second finding of the lease-out model is the positive coefficient on migrant workers. With one more off-farm worker in a family, the leased-out land area would increase by 0.6 *mu*. Hypothesis 2 was therefore strongly supported. When households have more members working outside the village and farmers are able to earn more in the off-farm sectors, they would look for opportunities to lease out their land.

The third finding of the lease-out model is that subsidy has a negative impact on leased out area. Qun'an farmers could receive subsidies such as the CLPF and subsidies to purchase higher-quality seeds. The CLPF was given to farmers who kept their land under agricultural use. Subsidy to purchase higher-quality seeds was given according to the actual land area, including the leased-in land. The subsidies provided the incentive to grow grain and as a result led to a lesser amount of land being leased out.

The results of Table 7.3 also show that families with older household heads leased out more land. Generally, older farmers are regarded as a group who cannot accept a new policy quickly and have a higher dependence on land than younger farmers (Chu and Li, 2013). They may not be willing to lease out land. However, in the case of Qun'an, with the development of land transfer markets, the parameter estimates imply that an increase in the age of household head by 10 years results in an increase of about 0.5 *mu* of land being leased out. Older farmers may find farm work more difficult than younger farmers thus are more inclined to lease out their land.

The gender of household head also appears to be a key driver of land market participation, which echoes the study of Deininger et al. (2012) in Ethiopia. Female-headed households leased out 1.5 *mu* more land than male-headed households. An explanation for this may be that farm work is strenuous and thus female farmers are at a disadvantage. Besides, males often migrate to urban areas looking for off-farm jobs, the work for female farmers who remain in the village is getting harder and more time consuming: they have extensive work loads with "dual responsibility" of farm production and household production (e.g., livestock) (Food and Agriculture Organization, 1998). Female-headed households, as a result, tend to lease out more land than male-headed households.

Higher rental per *mu* of land resulted in a larger amount of leased-out land, which is plausible. A higher price creates a larger land supply.

Issue of endogeneity

The OLS estimates in Table 7.3 may be subject to bias because the regression specification error test (RESET) rejected the null hypothesis that model has no omitted variables. The omitted variables could be correlated with one or more

explanatory variables or some of the explanatory variables may be endogenous. For example, household's asset and the distance of the plots to market (or to plantations) may affect farmer's decisions to lease in or lease out land. This is part of ongoing research. In future study, with a larger sample collected in a broader context, the potential endogeneity problem may be addressed by estimating an instrumental variable model. The RESET test in Table 7.4, however, reveals that the model performs well to explain the change of per capita income.

7.6 Conclusions

The certified Qun'an village provides an interesting case to study of the factors underscoring the transfer mechanisms of rural land. The three key findings from the analysis of survey data collected in the certified village are discussed below.

Firstly, individual farmers who have a revealed comparative advantage in farming are more inclined to lease in land through land transfer markets and thus improve their income level. This is done despite them facing strong competition from the plantations that offer higher rental prices and lease in more land. Secondly, the availability of off-farm employment opportunities is one of the main drivers of the leasing out of registered and certified land. Higher levels of migrant workers have indeed increased the supply of land to rental markets. Thirdly, households with a higher level of land-labour ratios tend to lease out more land.

All these indicate that land transfer markets have redistribution effects in allocating household resources more efficiently across potential users of the resource. In the presence of active land transfer markets, on one hand, households that are more productive in agriculture are able to obtain extra land to expand the farm size and in the process increase their incomes. On the other hand, households that are more

competent in off-farm labour markets are freed from their land and focus on off-farm jobs whilst earning rental income from leasing their land out to others. It suggests that, with formal land certificates, farmers do not need to worry that they will lose the rights to their farmland if they find off-farm employment or lease out land. The typical story that labour mobility is inhibited by insecure land tenure (Rozelle et al., 1999, Chin, 2005) has changed in the certified Qun'an village.

Despite the opportunities created by the land tenure reform to develop a well-functioning land rental market, this process has had problems. For instance, a number of the land transfers took place involuntarily. Some local governments set targets for implementing rural land transfer and thus forced farmers to transfer their land-use rights, amid the Central Government's latest drive to deepen rural reform (China Daily, 2014). Thus, the formation and development of land rental market could have been artificially accelerated. The implication for the local governments is that the prerogative to transfer rural land is that of the farmers rather than that of the cadres of the village committee. Farmers' interests should be fully protected in the process of rural land reform and the promoting of land transfer market.

Chapter 8 Overall Conclusions

8.1 Overview of the study

This thesis deals with the consequences of different arrangements of land tenure on agricultural productivity in rural China. In particular, I have examined the effects of an ongoing RLRC (known as land titling in other contexts) program designed to provide farmers with secure land rights to occupy, operate, usufruct, transfer, and mortgage land. Land is one of the most precious assets for Chinese farmers. However, rural land tenure in China was insecure, weighing down growth of income and productivity. Rural residents could not enjoy the same rights to their land as the urban residents. Moreover, arable land has been over-expropriated for commercial use and around one-fifth of arable land has been polluted. The weak property rights to land and land scarcity were at the root of land conflicts, the income gap between urban-rural residents, and food security.

In order to cope with the issues triggered by land tenure insecurity and land scarcity, a series of land reforms were carried out by the Chinese government. Rural land arrangements concerning land ownership rights, duration of land use rights contracts, and land transfer rights have changed correspondingly. Most recently, the RLRC program was piloted in many areas including Chengdu, which is one of the study sites of this thesis. The RCLC is conceived as a fundamental step to improve land tenure security, increase farmers' incentives to raise farm-level investment, and thereby lead to higher agricultural productivity. For the whole country, national food security, which has always been a priority, could be safeguarded; for the rural area, household income level would be improved.

This thesis, therefore, has attempted to examine the impacts of land tenure reforms on grain productivity, income activities, and land market participation of small landholders living in rural China. It tries to answer the question “what would happen to agricultural productivity if Chinese farmers enjoyed secure, long-term, and transferable land rights?” In order to acquire an answer to this question, four sub-questions were formed.

The first sub-question examines the impact of land tenure arrangements on grain productivity. By dividing land tenure rights into three dimensions: ownership rights, duration of use rights, and permission of transfer rights, it attempts to decipher the individual contribution to grain production in China.

The second sub-question, with the example of the RLRC program launched in Chengdu, is to test whether certified farmers with more tenure security via the RLRC program have invested more in purchased inputs and achieved higher agricultural productivity than the uncertified farmers.

The third sub-question is to adopt the analytical framework developed in the second endeavour to evaluate the welfare effect of the RLRC program. Household welfare is here represented by five income indicators: farm income from crops, wages income from off-farm employment, transfer income from governmental subsidies and rentals, total annual household income, and income per household member. It attempts to test whether secure, long-term, and transferable land rights lead to higher incomes.

The fourth sub-question is to focus on the certified Qun’an village in Chengdu. It takes Qun’an village as an example to assess whether the completion of the RLRC program helped to develop a better-functioning land rental market.

Research methodology mainly employed in this thesis is a purpose-designed and questionnaire-based survey, which serves to collect the original farm-level data from the rural households in the selected study sites. Published panel data have been used to study the impact of changes in land tenure arrangements to productivity over time and across provinces.

This chapter is structured as follows. Section 2 summaries the key findings of the thesis. Section 3 derives some policy implications from the findings. Section 4 discusses the limitations of the thesis and provides a framework for future research.

8.2 Main findings

8.2.1 The historical circulation of land tenure arrangements in China

In Chapter 2, the historical trajectory of land tenure in China has been reviewed. Rural land ownership in China evolved from clan public ownership during the primitive period, king's ownership in the slave society period, to private ownership throughout the imperial period, and then to collective ownership since 1956. For the past 2,000 years, land tenure in China has involved a struggle between the tendencies of governments to allocate land administratively and the tendencies of a commercial economy to make land available as a freely exchangeable commodity. The tension between equitable sharing of land and increasing output for the resource has played out throughout the recorded history of China. The main conclusion drawn from this chapter is that history seems to repeat itself in the circle of concentration and anti-concentration of individual title to land with peasant protests and land reforms in China.

8.2.2 Long-term and transferable land rights contribute substantially to grain productivity during 1949 – 2008

An important finding of Chapter 4 is that the duration of land use contracts and land transfer rights have more impact on grain productivity than land ownership rights, if land tenure is divided into these three specific rights. This was analysed using panel data drawn across 31 provinces extending over the period 1949 – 2008.

The results also suggest that the effects of land use rights and transfer rights are more important determinants of grain productivity in the 13 major grain-producing provinces than in the 7 major grain-marketing provinces.

8.2.3 "Land titling" in China: the links between the RLRC program, investment, productivity, household income, and land markets

Chapters 5, 6, and 7 are empirical analysis based on the fieldwork conducted in the certified Qun'an village and the uncertified Xiayong village in 2011. The econometric results of Chapter 5 suggest that the RLRC program has contributed to increased farm-related investment: rice seeds, herbicides, and machinery use; but decreased inputs of fertilisers and labour. The increasing opportunity of leasing out land thanks to land certification may discourage farmers from investing in soil conservation inputs such as fertilisers. The empirics suggest that increased land tenure security enhances rice productivity. This in itself is a strong result. The channel through which tenure security increases productivity, as in Feder's framework (see Figure 3.1), is through increased investment rather than via access to a credit channel. With more secure land tenure rights, the certified farmers have more incentive to invest in short-term inputs. The credit channel using land certificates, however, has not been activated among the surveyed households who had undergone RCLC "treatment".

Chapter 6 studies the impact of the RLRC program on household income. Although the RLRC makes farmers engage more in land transferring activities, especially leasing out land to plantations or more productive farmers, the average household's total income and per capita income on certified plots was no more than on the uncertified plots. This in itself may sound inimical to the thesis. that security to land tenure increases productivity, which may in turn lead to higher farm income. However, the above is rational from the point of view of the household head when certification has a substitution effect and an income effect on the household's choice between farming, taking waged employment, and enjoying leisure. Specifically, a household that saves on effort by leasing out their land whilst generating the same income has higher welfare. Besides, leasing in land for farming has a positive impact on the total income and per capita income of the households. This implies that farmers are using the farmland more efficiently, and that benefits of economies of scale were being realised.

Chapter 7 uses the certified Qun'an village as a case to study the participation in land transfer markets after the completion of RLRC program. It turns out that land transfer markets have redistribution effects in allocating household resources more efficiently. They also help to equilibrate the ratio between land and labour. In the presence of an active land transfer market, on the one hand, households that are more productive in agriculture are able to obtain extra land to expand the farm and make scale farming possible. On the other hand, households that are more competent in off-farm labour markets are freed from their land and focus on off-farm employment.

8.3 Policy implications

Summarised next are policy implications based on the empirical findings above in order to ensure grain security and increase farmer's income, which echoes the major policy priorities included in the No.1 Documents of the Chinese government (as listed in Appendix 5 with a timeline).

Firstly, the RLRC program could be expanded to the rest of rural China. Thus Chinese farmers could have new, undisputed, and formal written certificates to protect and strengthen their permanent use rights and transfer rights to the contracted land. Once their rights to land have been improved, they would have the incentives to invest in farmland, which according to parameter estimates reported in both Table 4.1 and Table 4.2, will lead to higher grain productivity.

Secondly, the protection of farmers' rights to land needs not only new land certificates, but also the amendment of corresponding legal clauses to keep pace with the reforms in train. The current law is vague about land management, for example:

> Article 10 The State may, in the public interest and in accordance with law, expropriate or requisition land for its use and make compensation for the land expropriated or requisitioned.
>
> ---- Constitution of PRC (People's Republic of China, 2004a)

> Article 2 The State may, in the interest of the public, lawfully expropriate or requisition land and give compensation accordingly.
>
> ---- Land Administration Law of PRC (People's Republic of China, 2004b)

> Article 42 For the purpose of public interest, the collectively-owned land … may be expropriated in line with the procedure and within the authority provided by laws.
>
> For expropriation of collectively-owned land, such fees shall be paid as compensations for the land expropriated…
>
> ---- Property Rights Law of PRC (People's Republic of China, 2007)

According to the above, the state can nationalise the collective-owned rural land and convert farmland into industrial and construction use, if it is for the purpose of “public interest”. However, none of the laws clarifies what “public interest” means.

The No.1 Central Documents, on the other hand, are only policy statements, not the declaration of a legal rule. Such policy statements are regarded in Chinese jurisprudence as exhortatory only and not as binding rules of conduct (Prosternan, 2001). As a result, in practice, many land expropriations in China are for private or other for-profit interests (Zhu and Prosterman, 2012). Furthermore, compensation for farmers is frequently way too low and unfair because it is determined by annual yield of the farmland. However, the local governments can often earn large windfalls in cash on auctioning the expropriated rural land to real-estate developers at considerably higher prices (Hui and Bao, 2013). Over the past decade rural land disputes have regularly surfaced as a result of this discrepancy.

The ambiguity of the clause results in a situation where farmers could not prevent their land from being expropriated and could not obtain reasonable compensation under the legal framework. Therefore, the scope of “public interest” needs to be clearly defined and the standard of “compensation” for land expropriation should be raised. Based on the support of a well-functioning land expropriation law, farmers could use their formal land certificates to affirm their rights to land under the law. The

strengthening of the legislative mechanisms could also weaken the powers of local governments who have used/abused their monopoly positions to mandatorily expropriate rural and agricultural land.

Thirdly, improvement in the efficiency of agricultural outlays by the local governments is important in raising grain productivity. Despite the rapid annual increase in expenditure on agriculture (including the increasing direct grain subsidies), the fiscal support for agriculture presents a counter-intuitive effect on grain productivity (see Chapter 4). It is more important to allocate the agricultural expenditure properly and monitor where the fund actually goes, rather than blindly increasing the fund.

Fourthly, for individual rural households a wage is the main source of income. Household income largely depends on the number of migrant workers. In light of this, the risks of waged employment have to be lowered to encourage more rural workers to move to the formal sector, thereby improving rural household incomes, and at the same time releasing more land for commercial (large-scale) agriculture.

The challenge for policymakers here is to attract investors and industries to their cities that provide more job opportunities with better income security, and thus absorb the surplus rural labour. Therefore, security to land tenure has to be complemented with security to wages income if farm consolidation is to take place on a larger scale.

Finally, the development of a well-functioning land market should be encouraged so that farmers can borrow from the formal sector using land certificates as collateral, invest in assets to increase the productivity of land, and consolidate their fragmented

plots to realise economies of scale. Each of the above will increase income and thus contribute to improved household welfare.

The development model of Qun'an demonstrates that local authorities can play a crucial role in attracting investors, in promoting rental market development, and in the ensuing policies that improve the welfare of the residents.

8.4 Limitations and future research

This thesis has tried to fill the gap for the evaluation of the impacts of a land-titling program on agricultural productivity in the context of rural China. But there are obviously several areas where further research is required.

Firstly, it should be noted that the fieldwork data is cross-sectional and only two villages have been surveyed, thus the findings could not be generalised to represent the whole of rural China. Further research should consider a longitudinal approach which employs a larger representative sample so that generalisations can be drawn on the impact of land tenure reforms to income and productivity growth in China as a whole. By collecting data on at least two years, a longitudinal design can allow some insights into the dynamics of the variables and thereby reveal the directions of causality between the RLRC program and agricultural productivity. As an example, were the "more productive" regions chosen for the RLRC?

Secondly, the sampling strategy is convenience sampling. The findings are thus not representative. Convenience sampling is a non-probability sampling, which means some potential interviewees may have a greater chance of being selected than others, while some may have no chance of being selected at all. For example, my selection of interviewees was assisted by the village brigade leaders. The leaders

are more likely to select villagers they are familiar with and will not complain about sensitive issues related to land. While I have employed propensity score matching (PSM) method and related sensitivity analysis to address the issue of selection bias and increase the internal validity, there is still need for future research based on a random sampling strategy.

Thirdly, the thesis mainly studies the impact of the RLRC program on farmers' short-term purchase investments, i.e., seed, fertilisers and weeding, so it is important for future research to consider the effects of the RLRC program on long-term land-related investments, such as irrigation, drainage, land terracing, land levelling, or tree planting. The issue of tenure security may only matter in farming systems where long-term production decisions are important (Holden and Yohannes, 2002).

Fourthly, this thesis does not discuss the effects of the RLRC program on farmers' access to credit, which is another important channel where land titling could impact agricultural productivity and rural household welfare. It is therefore important to conduct further investigation on the effects of formal credit that rural households can use to spur farm productivity and improve rural household welfare.

Appendices

Appendix 1 Timeline of Chinese History

Dynasty		Period	Land Ownership
Xia		2070 – 1600 B.C.	Public land ownership
Shang		1600 – 1046 B.C.	
Zhou	Western Zhou	1046 – 771 B.C.	The *jingtian* system
	Eastern Zhou	770 – 256 B.C.	
	Spring and Autumn Period	770 – 476 B.C.	
	Warring States Period	475 – 221 B.C.	
Qin Dynasty		221 – 206 B.C.	The *mingtian* system
Han Dynasty	Western Han	206 B.C. – 25 A.D.	
	Xin	8 – 23 A.D.	The *wangtian* system (9 – 12 A.D.)
	Eastern Han	25 – 220	The *tuntian* system （196 – 264）
Three Kingdoms	Wei	220 – 265	
	Shu Han	221 – 263	
	Wu	222 – 280	
Western Jin Dynasty		265 – 317	The *zhantian* system
Eastern Jin Dynasty		317 – 420	
Northern and Southern Dynasties		420 – 581	The *juntian* system (485 – 780)
Sui Dynasty		581 – 618	
Tang Dynasty		618 – 907	
Five Dynasties		907 – 960	
Song Dynasty	Northern Song	960 – 1127	Laissez-faire of landlord ownership
	Southern Song	1127 – 1279	
Liao Dynasty		907 – 1125	
Jin Dynasty		1115 – 1234	
Yuan Dynasty		1206 – 1368	
Ming Dynasty		1368 – 1644	
Qing Dynasty		1616 – 1911	
Republic of China		1912 – 1949	
People's Republic of China		1949 – now	HRS (1978 – now)

Source: Author's classification based on People's Daily Online, http://english.people.com.cn/aboutchina/history.html

Appendix 2: Questionnaire

1. Village details

Question	Response
1.1 Village (a) *Qun'an* village (Certified) = 1 (b) Xiayong village (Uncertified) = 0	
1.2 Household ID: 001,002,…,etc.	
1.3 GPS coordinates=longitude (deg, dec)	
1.4 GPS coordinates=latitude (deg, dec)	
1.5 GPS coordinates=elevation (m)	
1.6 Photos of the house – photo number	

2. Household details of the participant (head of the household, HH)

Question	Response
2.1 HH Age: Years	
2.2 Sex: Male=1, Female=0	
2.3 HH Education: (a) never been to school = 1 (b) not completed primary education = 2 (c) primary school = 3 (d) junior middle school = 4 (e) high school (technical or vocational) = 5 (f) college (junior college or higher vocational) = 6 (g)) university = 7	

2.4 Total number of people in the house: Number	
2.5 Total number of males in the house: Number	
2.6 Number of adults (aged between 15 – 65)	
2.7 HH experience: Years of farming	

3. Land status of the participant (head of the household, HH)

Question		**Response**
3.1 Total size of cultivated land area (in *mu*)		
3.2 Number of plots: Number		
3.3 Frequency of reallocation in the last 12 months: Number		
3.4 Land tenure status: (a) uncertified = 0 (b) certified = 1		
3.5 How long have your plots been registered and certified? (in months)		
3.6 Did you **rent in** any parcel in the last 12 months? 1=Yes, 0=No		
3.7 Did you **rent out** any parcel in the last 12 months? 1=Yes, 0=No		
3.8 If you have **rented in** any parcel,	a. Rent per *mu* per *year?* (in *yuan*)	
	b. Size of rented in area? (in *mu*)	
	c. From whom was it rented	

	in? 1=village collective organization; 2=relatives/friends; 3=others (please state)	
3.9 If you have **rented out** any parcel,	a. Rent per *mu* per *year?* (in *yuan*)	
	b. Size of rented in area? (in *mu*)	
	c. To whom was it rented out? 1=village collective organization; 2=relatives/friends; 3=companies, 4= others (please state)	

4. Rice production in the last 12 months

Question	**Response**
4.1 Total size of rice area (in *mu*)	
4.2 Number of rice plots: Number	
4.3 Soil quality (approximately) (a) superior = 1 (b) good = 2 (c) medium = 3 (d) inferior = 4	
4.4 Total number of harvests: Number	

4.5 Total yield of rice (in kg)	
4.6 Yield of other crops (please state)	

5. Rice-related inputs in last 12 months

Question	**Response**
5.1 Seed (in *yuan*)	
5.2 Fertilizer (in *yuan*)	
5.3 Herbicide (in *yuan*)	
5.4 Number of cattle: Number	
5.5 Cattle (days)	
5.6 Number of Labourers (farming persons in the past year)	
5.7 Number of hired labourers	
5.8 Labour use (days/person * no. of labourers)	
5.9 Number of agricultural tractors: Number	
5.10 Total power of machinery (kw)	
5.11 Irrigation cost (in *yuan*)	

6. Credit use in the last 12 months

Question	**Response**	
6.1 Did you use the Rural Land Contract Certificate as collateral? (1 – Yes, 0 – No) If Yes, go to 6.2, 6.3.		
6.2 Informal credit (e.g. relatives or	a. Number	

friends)	b. Size (in *yuan*)	
	c. Length (in months)	
	d. Interest rate (per year)	
	e. Use of the credit: (1 – plant, 2 – business, 3 – medical expenses, 4 – housing, 5 – others)	
6.3 Formal credit (e.g. banks)	a. Number	
	b. Size (in *yuan*)	
	c. Length (in months)	
	d. Interest rate (per year)	
	e. Use of the credit: (1 – plant, 2 – business, 3 – medical expenses, 4 – housing, 5 – others)	

7. Household income in the last 12 months

Question	**Response**
7.1 **Farm** income in the last 12 months (in *yuan*): (a) rice (b) vegetables (c) other crops (d) livestock (cattle, pigs, chickens)	

(e) other farm-related income	
7.2 **Off-farm** income (in *yuan*) (a) salary of employment in the companies (b) income from self-employment	
7.3 **Non-farm** income (in *yuan*) (a) Farmland protection fund (b) Income from transferring land to others (c) remittances (d) other non-farm income	
7.4 other incomes (please state)	

Appendix 3: UNSW Human Research Ethics Approval

UNSW@ADFA
CANBERRA • AUSTRALIA
The University of New South Wales at the Australian Defence Force Academy

UNSW@ADFA Human Research Ethics Advisory Panel

Monday, 26 September 2011

Miss Zhou Yuepeng
School of Business

Re: *Land tenure and its Impact on Agricultural productivity and Household income in China*

Reference Number: A-11-40

At its meeting of 3 August 2011 the UNSW Canberra Human Research Ethics Advisory Panel was satisfied that this project is of minimal ethical impact and meets the requirements as set out in the National Statement on Ethical Conduct in Human Research*. Having taken into account the advice of the Panel, the Deputy Vice-Chancellor (Research) has approved the project to proceed.

Your Head of School/Unit/Centre will be informed of this decision. This approval is valid for 12 months from the date of the meeting.

Yours sincerely

.....
Dr Stephen Coleman
Convenor
UNSW Canberra Human Research Ethics Advisory Panel

Cc:
Prof Satish Chand
Prof Michael Hess
School of Business

* http:/www.nhmrc.gov.au

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Web: http://research.unsw.adfa.edu.au/index.html

Appendix 4: Participation Information Statement and Consent Form

Approval No (A-11-40)

THE UNIVERSITY OF NEW SOUTH WALES

PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM

Land Tenure and Its Impact on Agricultural Productivity and Household Income

You are invited to participate in a study of the impact of land tenure on agricultural productivity and household income. This is a PhD project during my study in UNSW, Australia. I hope to learn the difference in productivity and income sources between certified farmers and uncertified farmers. You were selected as a possible participant in this study because a land certification program had been carried out in your village.

If you decide to participate, I will ask you to fill in a questionnaire. The questionnaire will cover information about: household characteristics, land tenure status, land-related investment, agricultural production, access to credit use and income sources in the past 12 months. The questionnaire is anonymous and will only number the households. No sensitive information will be involved with. The questionnaires are only for research use, no commercial purpose is involved with. The collected data will be destroyed after 7-year storage in the university. To ensure the authenticity and scientific, please do fill in the questionnaire according to your true situation.

You are totally voluntary to participate in this survey. There will be no any consequence if you choose not to take part in or quit anytime before the completion of questionnaire. The questionnaire may cost you 20 – 30 minutes to complete. We cannot and do not guarantee or promise that you will receive any benefits from this study.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission, except as required by law. If you give us your permission by signing this document, I plan to discuss the results in my PhD thesis. In any publication, information will be provided in such a way that you cannot be identified.

Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au). Any complaint you make will be investigated promptly and you will be informed out the outcome.

If you need feedback at the completion of study, a summary of the research findings will be sent to you.

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

If you have any questions, please feel free to ask us. If you have any additional questions later, I will be happy to answer them. Contact details are as follows:

Yuepeng Zhou

School of Business, UNSW Canberra, PO Box 7916, ACT 2610, Australia. Tel: +61 2 6268 8084

Appendix 4: Participation Information Statement and Consent Form (continued)

THE UNIVERSITY OF NEW SOUTH WALES

PARTICIPANT INFORMATION STATEMENT AND CONSENT FORM (continued)

Land Tenure and Its Impact on Agricultural Productivity and Household Income

You are making a decision whether or not to participate. Your signature indicates that, having read the information provided above, you have decided to participate.

.....	.....
Signature of Research Participant	Signature of Witness
.....	.....
(Please PRINT name)	(Please PRINT name)
.....	.....
Date	Nature of Witness

REVOCATION OF CONSENT

Land Tenure and Its Impact on Agricultural Productivity and Household Income

I hereby wish to **WITHDRAW** my consent to participate in the research proposal described above and understand that such withdrawal **WILL NOT** jeopardise any treatment or my relationship with The University of New South Wales, *(other participating organisation[s] or other professional[s])*.

.....	.....
Signature	Date

.....

Please PRINT Name

The section for Revocation of Consent should be forwarded to：

Yuepeng Zhou

School of Business, UNSW Canberra

PO Box 7916, ACT 2610, Australia

Tel: +61 2 6268 8084

Appendix 5 The No.1 Documents of the Chinese Central Government that Related to the Three Rural Issues

Time Issued	Theme of Documents	Policy Priorities Related to Grain Security
Feb. 8, 2004	Boosting Growth in Farmers' Income	Help raise farmer's income in major grain-producing areas and improve grain-producing capability; Implement high-quality grain industry project; Subsidise farmers who buy or renew large agricultural machinery and tools.
Jan. 30, 2005	Strengthening rural work and improving the overall production capacity of agriculture	Keep reducing the agricultural tax; Keep subsidising farmers; Help major grain-producing areas through fiscal transfers; Steadily increase the fiscal expense to support agriculture.
Feb. 21, 2006	Constructing a new socialist countryside	Resolutely implement the strictest farmland protection system; Maintain the reward policy to the major grain-producing areas.
Jan. 29, 2007	Developing modern agriculture and steadily promote the construction of a new socialist countryside	Direct subsidy to grain farmers should account for at least 50% of the grain risk funds in each province and autonomous region.
Jan. 30, 2008	Fortifying the foundation of agriculture	Guarantee grain production safety and a balance between supply and demand, and between various grain products; Implement a Rural Land Registration and Certification (RLRC) program; Establish a well-functioning land use rights transfer market.

Feb. 1, 2009	Achieving steady agricultural development and sustained income increases for farmers	The government urged authorities to take resolute measures to avoid declining grain production and to ensure the steady expansion of agriculture and rural stability.
Jan. 31, 2010	Speeding up coordinated development between urban and rural areas and further cementing foundation of agricultural and rural area development	Promote resource elements allocation to rural areas; Supporting policies should lean towards major grain-producing areas.
Jan. 29, 2011	Accelerating development of water conservation	Promote farmland water conservation.
Feb. 1, 2012	Accelerating scientific and technological innovation to strengthen supply of agricultural products	Boost investment and subsidies in the agricultural sector; Complete the RLRC program in most rural areas within 2012.
Jan. 31, 2013	Speeding up the modernisation of agriculture and further strengthening the vitality of rural growth	Continue to increase investment and subsidies in the agricultural sector; Finish the RLRC program within five years.
Jan. 19, 2014	Deepening rural reforms and speeding up the modernisation of agriculture	Resolutely implement the “red line” of the cultivated land;; Ensure the bottom line of grain area in the major grain-producing areas; Continue to conduct and subsidise the RLRC program.

Source: Author’s compilation based on the websites: http://news.xinhuanet.com/ziliao/2006-02/09/content_4156863.htm; and http://news.xinhuanet.com/english/china/2014-01/19/c_133057374.htm.

Appendix 6 Quantisation of Land Policy Variables from 1949 to 2011 in China

(Excluding missing data)

year	private	use	transfer
1952	1	99	0
1957	0	0	0
1962	0	0	0
1965	0	0	0
1970	0	0	0
1975	0	0	0
1978	0	0	0
1979	0	0	0
1980	0	0	0
1981	0	0	0
1982	0	0	0
1983	0	0	0
1984	0	15	0
1985	0	14	0
1986	0	13	0
1987	0	12	0
1988	0	11	0
1989	0	10	0
1990	0	9	0
1991	0	8	0
1992	0	7	0
1993	0	6	0
1994	0	5	0
1995	0	4	1
1996	0	3	1
1997	0	2	1
1998	0	1	1
1999	0	30	1
2000	0	29	1
2001	0	28	1
2002	0	27	1
2003	0	26	1
2004	0	25	1
2005	0	24	1
2006	0	23	1
2007	0	22	1
2008	0	99	1
2009	0	99	1
2010	0	99	1
2011	0	99	1

Sources: Sorted based on the laws or policies of PRC.

Appendix 7 Variable Description and Basic Description of Statistics

	Name and Abbr.	Unit	Definition	Mean	Std. Dev.	Min	Max	Obs.	
V1	Grain productivity (*Y*)	Kg/ha	Grain output per hectare of land	Overall	3586.3	1400.348	754.3	7169.5	N=1036
				Between		1019.824	2073.18	6591.003	n=31
				Within		1074.7	625.76	6440.50	T-bar=33.41
V2	Grain sown area (*sownarea*)	1000 ha	Total grain sown area	Overall	3789	2580.40	141	12276	N=1036
				Between		2625.77	189.75	9364.75	n=31
				Within		492.70	1486.13	6874.23	T-bar=33.41
V3	Labour input (*labour*)	persons/ha	Labour input in grain production	Overall	1.313	0.426	0.358	2.558	N=1036
				Between		0.405	0.488	2.216	n=31
				Within		0.215	0.597	2.110	T-bar=33.41
V4	Fertilizer input (*ferti*)	Kg/ha	Total input of fertilizers in grain production	Overall	246.792	225.099	0.057	1615.441	N=1036
				Between		220.993	92.540	1253.48	n=31
				Within		150.60	-195.766	1184.732	T-bar=33.41
V5	Irrigation rate (*irrigation*)	--	Rate of effective irrigation on grain	Overall	0.341	0.158	0.025	0.950	N=1036
				Between		0.159	0.156	0.896	n=31
				Within		0.062	0.043	0.625	T-bar=33.41
V6	Machinery use (*machinery*)	Kwh/ha	Total power of machinery use on grain	Overall	2.385	2.351	0.0001	14.859	N=1036
				Between		1.715	.351	8.153	n=31
				Within		1.741	-2.844	12.606	T-bar=33.41
V7	Private land ownership (*private*)	--	Binary variable, 1-land was privately owned, and 0 otherwise	Overall	0.025	0.156	0	1	N=1036
				Between		0.032	0	0.094	n=31
				Within		0.151	-0.069	1.005	T-bar=33.41

Appendix 7 Variable Description and Basic Description of Statistics (Continued)

	Name and Abbr.	Unit	Definition		Mean	Std. Dev.	Min	Max	Obs.
V8	Duration of land use rights (*use*)	--	99 years when land was privately owned or land use rights are "unchanged for a long time";; 15 years since 1984 and 1 year descending each year until 1998; 30 years and 1 year descending until 2007.	Overall	15.194	22.578	0	99	N=1036
				Between		4.528	9.638	30.363	n=31
				Within		22.295	-14.168	104.556	T-bar=33.41
V9	Land transfer rights (*transfer*)	--	1- land is allowed to be transferred and 0 otherwise.	Overall	0.433	0.495	0	1	N=1036
				Between		0.209	0.288	1	n=31
				Within		0.469	-0.499	1.144	T-bar=33.41
V10	Fiscal support for agriculture (*agri_expense*)	--	Proportion of fiscal support for agriculture in gross output value of agriculture	Overall	0.043	0.046	0.0007	0.710	N=1036
				Between		0.028	0.016	0.106	n=31
				Within		0.037	-0.036	0.651	T-bar=33.41
V11	Agriculture tax (*tax*)	--	0-agricultural tax was abolished and 1 otherwise.	Overall	0.862	0.344	0	1	N=1036
				Between		0.177	0	0.946	n=31
				Within		0.307	-0.083	1.317	T-bar=33.41

Note: There are three different statistics for each variable: overall, between, and within. Overall statistics are ordinary statistics that are based on the 1036 observations. "Between" statistics are calculated on the basis of summary statistics of the 31 provinces regardless of time period, while "within" statistics are by summary statistics of 33 years (average, unbalanced panel) regardless of province.

Appendix 8 The Estimated Results for Different Regions (FE Models)

Variables	1 Major grain-producing area	2 Major grain-marketing area
Grain-related inputs		
log(labor)	-0.067 (-1.254)	**-0.233 (-3.866)*** **
log(ferti)	**0.057 (4.339)*** **	**0.148 (5.438)*** **
log(irrigation)	**0.273 (10.030)*** **	**0.155 (1.999)***
log(machinery)	**0.170 (15.335)*** **	**0.069 (3.432)*** **
Land tenure dummies		
private ownership	0.091 (1.071)	0.076 (0.691)
duration of use rights	**0.001 (3.564)*** **	0.0005 (1.112)
transfer rights	**0.057 (2.508)***	-0.004 (-0.169)
Agricultural supporting policies		
agri_tax	-0.040 (-1.473)	-0.020 (-0.635)
log(agri_expense)	**-0.160 (-11.944)*** **	**-0.070 (-3.110)** **
R square	0.914	0.839
Observations	467	196

Source: Authors' calculation with R software. Data in parentheses are t-values.

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

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