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博士論文

Essays on Rural–Urban Disparity in China:
Interaction, Migration, and Financial Development



現代経済政策専攻

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王 学龍

Abstract

Substantial rural–urban disparity is a potential threat to the sustainable development of the Chinese economy. This dissertation studies China’s rural–urban disparity from three different perspectives: rural–urban interactions, migration, and financial development.

The study analyzes rural–urban interactions based on panel causality tests and China’s provincial panel data, finding strong effects of urban growth on the rural sector and weak effects of rural growth on the urban sector. One reason for the rural sector’s weak effects is low rural income. Historically, the low income of Chinese farmers corresponded to low demand for manufactured goods and services. Thus, increases in rural income were mainly transformed into demand for agricultural products instead of strongly affecting urban growth.

The study also reviews the effects of land and land institutions on rural–urban migration in China. A simple model is established to discuss a farmer’s choice among migration, local wage work, and pure farm work. It is found that the probability of migration is high when landholdings are medium-sized. If the landholding is small, a farmer tends to choose local wage work instead of migration, and if it is large, he/she is likely to choose pure farm work. The theoretical conclusions are supported by the data of the Chinese Household Income Project (CHIP). The empirical results indicate that China’s collective land ownership stimulates migration.

This dissertation further evaluates the effects of financial development on rural–urban inequality using provincial panel data on China’s 31 provinces. It is found that credit services would deteriorate income distribution if they were only available to rich people. When the coverage of credit services is wide, financial development helps reduce income inequality. In addition, financial development plays different roles at varied stages of economic growth. At the starting stage, when physical capital is the engine of growth, financial development reduces income inequality. At the mature stage, when the return to human capital is much higher, financial development may increase income inequality.

Keywords: Inequality, Rural-Urban Interaction, Migration, Financial Development

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Announcement

I certify that the dissertation I have submitted for examination for the Ph.D. degree of Hokkaido University has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

I certify that the dissertation is my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

The copyright of this thesis rests with the author. Quotation from it is permitted, provided that full acknowledgement is made. I warrant that this authorization does not infringe the rights of any third party.

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Chapter 1

Introduction

1.1 Motivation

Declarations are usually contrary to the real world. We often mention the immortal declaration “all men are created equal,” because we live in a world where all men are born unequal, at least in most developing countries. Inequality is a socioeconomic problem in many developing countries, and we can observe two substantially different societies within one developing country: the rural society and the urban one.

As the largest developing country, China is characterized by a typical dual economy and has one of the most serious rural–urban disparities in the world. The country has gained rapid economic growth in the urban sector. The rural areas, however, are struggling with poverty. Thus, China has seen a stunning increase in rural–urban inequality. According to official data, the real income of urban residents is three times as high as that of rural residents. Rural–urban inequality clearly contributes to the high Gini index in China.

Serious rural poverty, that is, both absolute and relative poverty, may cause social problems. As expressed by the saying “hunger is often the mother of crime,” poverty is the root of various social evils. Accompanying the increasing rural–urban inequality are growing social conflicts, increasing crime rates, and serious unemployment problems. Furthermore, the sense of security has been decreasing rapidly among urban residents in China.

Rural development is important for social progress and stability. Although we can find many discussions on the development process for rural areas and methods to reduce rural–urban inequality, further discussion is required on this complex problem. This dissertation therefore discusses three topics on rural–urban inequality for China.

1.2 Structure

The dissertation first briefly introduces China’s economic background in Chapter 2. This chapter includes information on the country’s economic growth and the rural–urban income inequality, financial gap, and migration and its land institutions.

Next, the study discusses three loosely connected topics on rural–urban inequality in China, including rural-urban interactions, migration, and financial development. Chapter 3 aims to clarify the relationship between rural and urban growth. A number of policymakers believe that urban growth is critical for economic development and that rural poverty can be alleviated through urban growth; in

addition, they believe that rural growth is not important. In the period between the 1950s and 1970s, many developing countries tried to boost their economies by implementing urban-biased policies, which often failed to promote urban growth and caused lasting poverty in rural areas. We must clarify the relationship between rural and urban growth to implement correct development policies. Therefore, we first explore the mutual effects between rural and urban economies using provincial panel data on China.

After identifying the relationship between rural and urban development, Chapter 4 studies rural–urban migration, which is the main channel reducing rural–urban inequality. Economists have long been aware of the importance of rural–urban migration. A large body of literature discusses the determinants and consequences of rural–urban migration. However, few studies specifically focus on the effects of land on rural–urban migration. Because China is undergoing some fundamental reforms in land institutions, it is necessary to evaluate the effects of land and land institutions on migration. Therefore, Chapter 4 analyzes the effects of land on employment decisions in temporary migration.

Chapter 5 focuses on the effects of financial development on rural–urban inequality. To date, the relationship between finance and income inequality has been studied from different perspectives. Some theories indicate a positive relationship between financial development and inequality, and others indicate a negative one. We can also find theories indicating a nonlinear relationship between financial development and income inequality. There is no consensus in the theoretical discussions, and therefore, it is necessary to identify this relation empirically. Chapter 5 uses Chinese data to empirically study the relationship between financial development and rural-urban inequality.

Chapter 6 concludes the main findings of these studies. In addition, the chapter discusses some policy implications and limitations of the study.

1.3 Findings

Chapter 3 examines the rural–urban interactions using provincial panel data on China. Panel causality tests show strong effects of urban development on the rural sector, but only weak effects in the opposite direction. Low rural income may be a cause of the rural sector’s weak effects. Because Chinese rural residents were too poor to afford sufficient manufactured goods and services, an increase in the rural income was mainly transformed into demand for agricultural products without stimulating urban growth. The empirical results also imply that the positive effects of rural development on the urban sector will increase in strength as the income of Chinese farmers increases.

Chapter 4 analyses the effects of land on rural–urban migration in China. It is found that farmers with small or large landholdings tend to do non-farm work within their counties, whereas those with medium-sized landholdings tend to migrate outside the counties. These arguments are supported by the data of the Chinese Household Income Project (CHIP). The empirical results show that collective land ownership, which distributes land equally, stimulates migration.

Chapter 5 assesses the effects of financial development on rural–urban inequality using panel data on China’s 31 provinces. The study finds that credit services deteriorate income distribution if they are only available to rich people. Financial development helps reduce income inequality, when the credit coverage widens. In addition, finance plays different roles at varied stages of economic development. At the starting stage of economic growth, when physical capital is the engine of economic development, financial development can reduce income inequality. In a mature economy, where the return to human capital is much higher, financial development may increase income inequality.

Chapter 2

A Brief Introduction to Chinese Economy and Rural-Urban Disparity

2.1 Economic Development in China

China is a developing country with a population of 1.3 billion. China has 23 provinces, four direct-controlled municipalities, five autonomous regions, and two mostly self-governing special administrative regions (Hong Kong and Macau), with land area being approximately 9.6 million square kilometers.

China is also a transition economy. During the period from 1949 to 1978, the country was a typical planning economy. Although the capital accumulation in this period was obviously large, political movements resulted in serious economic fluctuations and harmed economic development. Therefore China began the economic reform. China's reform is different from other transformations (Hoff and Stiglitz, 2004). Although China's economic reform proceeded without democratization, and only followed an incremental and experimental approach to reform, the reform has resulted in high and stable growth rate for more than 30 years (Hasan et al., 2009, Prasad and Rajan, 2006).

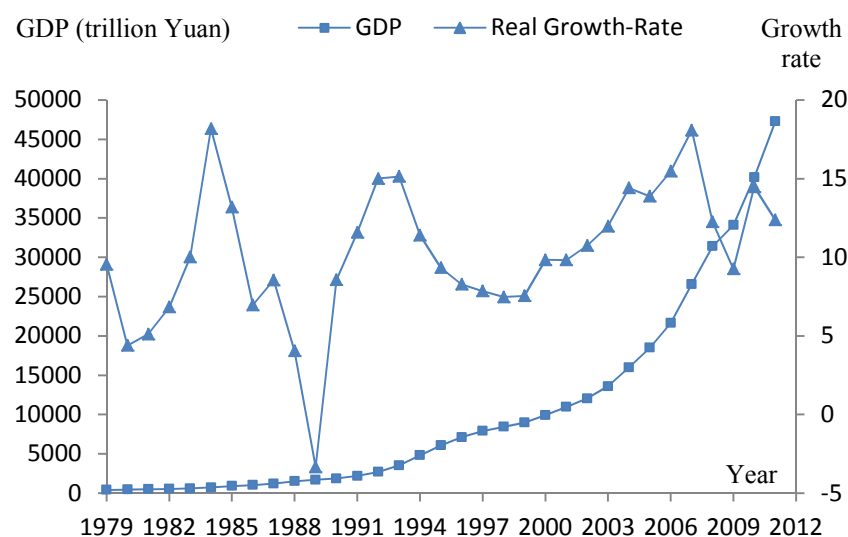


Figure 2.1 China's Economic Growth after the 1978 Reform

Note: The unit is 100 million Yuan. Yuan is China's currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars).

After the *Reform and Opening Up* in 1978, China experienced rapid economic growth. Figure 2.1 presents the trend of GDP after the reform. According to the data of National Bureau of Statistics of China (NBSC), the average growth rate of real GDP was over 9% during the period from 1980 to 2010¹. In 2011, the nominal GDP is 47.29 trillion Yuan (NBSC, 2012). A lot of economists attribute the reason for the economic growth to the institutional reform, which allowed people to get their contributions to the economy in the market so that people have strong incentive to work hard (Lin et al., 2003; Qian, 2002; Qian, 2000; Woo, 1999). Other economists analyze China's economic growth within an aggregate production function framework (Wang and Yao, 2003; Wu, 2003; Young, 2000). However, we cannot completely deny the value created in the planning period. In the planning period, although consumption goods were limited, the capital accumulation was astonishing because leaders were urged to mobilize idle labor for capital construction work (Chen and Galenson, 1970).

However, a number of people hesitate to believe the rapid growth of Chinese economy. Some scholars argue that local governments in China tend to manipulate provincial GDP data, because they are more likely to be promoted if their province comes up with higher growth rate². It is possible that the data of NBSC are not accurate (Hoshino, 2011). Therefore we need to evaluate Chinese economy from different perspectives, such as the structure of industries.

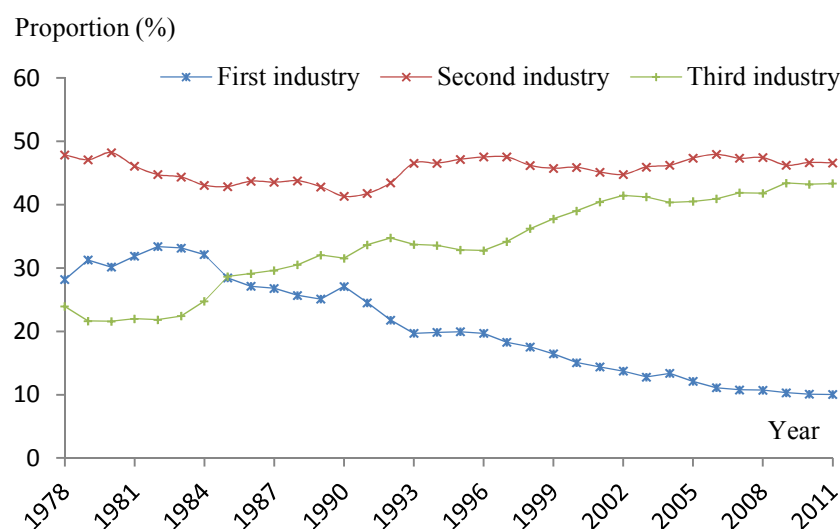


Figure 2.2 Industrial Structure of China

Note: 1. Data source: The Statistics Yearbook of China 2012. 2. The vertical axis measures the proportions of an industry in national GDP.

¹ Please visit the website of NBSC for the data, <http://www.stats.gov.cn/tjsj/ndsj/>.

² In some provinces, when government officers have a conference, the seats of the officers are ranked by the GDP growth rates of their counties. Under such conditions, local governments have high motivations to make false data.

Figure 2.2 presents the proportions of the first, second and third industries in China. From the figure we can see that the proportion of the first industry decreased during the period from 1978 to 2011. In 1982, the proportion of the first industry was 33%. This proportion decreased to 10% by 2010. During this period, the third industry developed rapidly. The proportion of the third industry increased from 22% in 1982 to 43% in 2011. The proportion of the second industry was relatively stable during this period at the level around 46%. To sum up, from the perspective of economic structure, China has transformed from a typical low-income country into a middle-income country.

2.2 Rural-Urban Income Inequality

As China's economy has been growing rapidly since 1978, the rural-urban disparity has become a serious concern in the society. A widely used measurement of rural-urban inequality is the income ratio (Knight and Song, 1999; Li and Yue, 2004). We need to note that the calculation of the income of urban residents is different from that of the farmers in China³. The measurement of urban income is per-capita disposable income⁴. The measurement of rural income is not disposable income but net income⁵. Net income is mainly used as input for reinvestment in production, consumption expenditure, savings and non-compulsory expenses of other forms. "Per capita net income of farmers" is the level of net income averaged by population, reflecting the average income level of rural households in a given area (NBSC, 2011).

Figure 2.3 describes the trend of urban-rural income ratios. As well as the simple income ratio, we also present the ratio of real incomes, because the prices of consumption goods are different in rural and urban areas. From Figure 2.3, we can see that the gap between the nominal and the real income ratios is not large, and the trends are similar. The real income ratio gradually increases to 3.12 in 2009. It means the real income of urban residents is more than three times that of rural residents. Although we can see a decreasing trend since 2009, income inequality is still a serious problem.

³ To see more concrete information about the definition of income and the measurement, please visit the website of NBSC. <http://www.stats.gov.cn/tjsj/ndsj/2009/indexeh.htm>.

⁴ Disposable income = total household income - income tax - personal contribution to social security - subsidy for keeping diaries for a sampled household.

⁵ Net income = total income - taxes and fees paid - household operation expenses - taxes and fees depreciation of fixed assets for production - gifts to non-rural relatives.

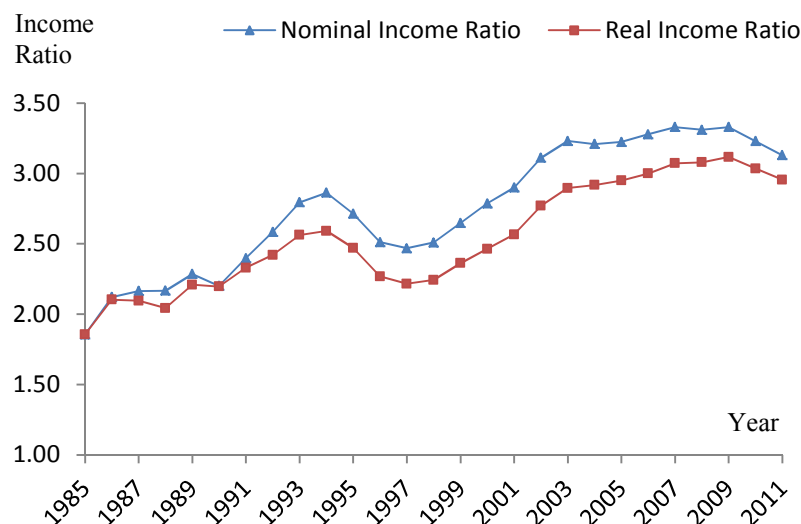


Figure 2.3 China's Urban-Rural Income Ratio

Source: China Statistics Yearbook 2012, Report on China's Agriculture Development 2007 (in Chinese: 《中国农业发展报告》)

Some economic researchers argue that the measurement described above does not consider the invisible welfare in cities, such as more convenient transportation, better education quality and medical service, the social security system and information system (Chen and Ravallion, 2004; Khan and Riskin, 1998; Adelman and Sunding, 1987). Li and Luo (2007) re-estimate the rural-urban income ratio taking urban welfare into consideration and find that the income of urban residents is 5 times higher than that of rural residents.

Contrary to the observation of the above economists, Cai and Wang (2008) provide persuasive evidence showing that China's rural-urban inequality is not as high as illustrated by the official data. They introduce an important variable in the calculation of rural-urban inequality: the income from temporary migration. They take the income of temporary migrants into consideration when decomposing the national inequality into inequality within rural areas, inequality within urban areas and inequality between rural and urban areas. They find that the rural-urban inequality became less serious if the income from temporary migration is added in the calculation. They also find that rural-urban inequality contributes approximately 20 percent of the national inequality⁶. Their findings are consistent with Sicular et al. (2007), who use the household survey data from 1995 to 2002 to estimate the size of China's rural-urban income gap and the gap's contribution to overall inequality in China.

⁶ Because temporary migration is very important for the analysis of rural-urban disparity, it is necessary to study what factors influence the temporary migration behavior of farmers.

Some economists have devoted their efforts to explaining the rural-urban income gap (Katou and Uehara, 2004; Lin, 2004). They introduce various variables explaining household income inequality, such as demographic characteristics, education, household assets and political status and connections (Morduch and Sicular, 2000; Lam, 2003)⁷. As well as the individual-level perspective, some economists explain Chinese rural-urban disparity from macro perspectives. Cai and Yang (2000) study China's rural-urban income gap from the perspective of institutions. They find that political inequality is the reason of economic inequality. The conclusion is consistent with the theoretical framework developed by Acemoglu et al. (2005), who argue that political power can influence economic institutions and consequently influence economic growth. Lu and Chen (2004) regard urban-biased economic policies as the most important reason for the increasing rural-urban inequality. Other scholars analyze this problem from the perspective of labor migration (Park and Wang, 2010). They find that labor migration restriction and urban-biased fiscal expenditure can increase rural-urban inequality seriously. Recently, the influences of finance has attracted the attention of many economists, such as Tao et al. (2005) and Luo and Gao (2012). According to their research, financial services are important for farmers to overcome capital constraint and to increase income. However, China's present land institutions deprive farmers of land transfer rights and consequently make them unable to use land as collateral.

We can see that a large number of studies notice the importance of political inequality. Before 2009, the *Electoral Law of the People's Republic of China* states that four rural residents have the vote right equal to one urban resident. The consequences of the political inequality are serious. Farmers have no methods to express their interests and various unequal economic institutions appeared. For example, the Household Registration System (HRS for short, Hukou System in Chinese) that aims to restrict farmers' migration. The HRS makes farmers unable to enjoy equal education, medical care and other public services⁸. Political inequality may be the foundation of economic inequality. In order to realize economic equality between rural and urban areas, the first important thing may be realizing political equality among rural and urban residents.

⁷ Demographic characteristics includes, for example, the household size, the proportion of dependents versus working-age household members, the ethnic composition of household members, and the age of household members (Sicular et al., 2007).

⁸ For instance, rural residents and urban residents have different social security system. The social security services for urban residents are much better than those for rural residents. The services are distributed according the HRS status.

2.3 Rural-Urban Financial Gap

Besides the rural-urban disparity in public services, we can observe an astonishing inequality in financial services (Wen et al., 2005). Financial services are important for rural households to capture better job opportunities, manage risks and establish small business. Financial market and institutions could help people overcome information asymmetries and capital constraint. When financial institutions function well, “they provide opportunities for all market participants to take advantage of the best investments by channeling funds to their most productive uses, hence boosting growth, improving income distribution, and reducing poverty” (Beck et al., 2009). Obviously financial institutions and financial services are important for the development of both rural and urban economies.

“Financial service” in this study refers to loans, deposit service, insurance and other kinds of financial products. With those financial services, people can overcome capital constraint and manage risk to some extent. Those financial services are especially needed by those who live below the poverty line (Dercon, 2005). Unfortunately, most financial products are not designed for the poor, and most poor people do not have access to financial services. This situation is common in China, especially in the rural areas.

Table 2.1 China's Social Scale of Financing in 2013 (Unit: billion Yuan)

Total Social Financing	31007.7	100%
Loans in RMB	15763.2	51%
Loans in Foreign Currency	8203.6	26%
Entrust Loans	916.4	3%
Trust Loans	1284.1	4%
Bank Acceptance Bill	1284.7	4%
Corporate Bond	1049.9	3%
Equity Financing (Non-financial Business)	2255.1	7%

Notes: RMB is the Chinese currency, Renminbi, the unit of which is Yuan. 1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars. Data source is the website of the People's Bank of China (China's central bank), <http://www.pbc.gov.cn/publish/html/kuangjia.htm?id=2012s18.htm>

Loan (credit) plays the most important role in the financial sector of China (Yao, 2006). We can see from Table 2.1 that about 51% of the social financing was in the form of loans in RMB, and 26% are in the form of loans in foreign currency⁹. The

⁹ Social Scale of Financing refers to the total amount of capital that the real economy gets from financial systems in a certain period (month, quarter or year). Financial system includes those institutions such as banks, securities, insurance companies. From the perspective of financial market, financial system consists of credit market, bond market, stock market, insurance market and

total proportion of loans is 77%. In 2002, the proportion of credit in the total social financing was much higher, more than 90 percent¹⁰.

According to the data of *Report of Rural Finance in China 2010* (shown in Table 2.2), only 7.49% institution loans were provided to the rural sector. In the national level, only 28.85% loans were supplied to the rural sector in 2010. It means the rural finance is mainly supported by the government, and few farmers have access to loan services.

Table 2.2 Loans for Rural Sector in 2010 (Unit: 100 million Yuan)

	All Loans Stock	Rural Loans					
		Rural Loans Stock	Increase relative to last year	Ratios to All Loans Stock			
				Loans for Rural Sector	Loans for Villages	Loans for Agriculture	Loans for Rural Residents
National		117657.54	28.85	23.11	19.25	4.53	5.11
Financial Institutions	20744.63	516.40	7.49	2.49	0.45	0.10	0.00

Source: Report of Rural Finance in China 2010 (in Chinese: 中国农村金融服务报告). Yuan is China's currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars).

The large gap between urban and rural finance may be an important reason for rural-urban inequality (Ma, 2009; Wen et al., 2005). There is a sea of literature on the relationship between income inequality and financial development (Perez-Moreno, 2010; Beck et al, 2007). However, we cannot see any consensus in the impacts of financial development on rural-urban inequality. Motivated by the theoretical conflicts, Chapter 5 re-evaluates the influences of financial development on rural-urban inequality with the data of China.

2.4 Rural-Urban Migration in China

2.4.1 China's Rural-Urban Migration and Hukou System

Rural-urban migration is one of the most important phenomena in the process of development. Economists have for a long time been aware of the importance of migration. We can find various theories on migration in developing countries, such as Lewis (1954), Ranis and Fei (1961), Jorgenson (1961), Harris and Todaro (1970) and

intermediary service market and so on.

¹⁰ Although the importance of loans has declined drastically, it still plays the most significant role in China's financial system. The shadow bank increased rapidly and is playing important role in financing activities of small and middle-sized enterprises (Li, 2006).

Stark (1991). Rural-urban migration is induced by a lot of reasons, such as income gap, social network, and information flow (Zhang and Song, 2003).

China's economic development is characterized with large-scale rural-urban migration. The size of this migrant population was around 2 million in the mid-1980s and reached to about 94 million in 2002 (Zhao, 2005; Ping and Pieke, 2003). According to the data in Yan (2010), the numbers of temporary migrants were respectively 144 million in 2000 and 147 million in 2005. The number of migrants reached to 130 million, accounting for 24% rural labor, in 2008 (Cai, 2010). All data show astonishing number of rural-urban migrants.

The urbanization process is reflected by Figure 2.4. In 1978, the proportion of urban residents was only 17.92%. This proportion reached 51.27% in 2011. The increase in urbanization rate implies huge-scale migration, because China's population is 1.3 billion. In recent years, the urbanization rate usually increased by around 1 percent point every year. It means almost 6 million farmers leave the rural villages to urban areas.

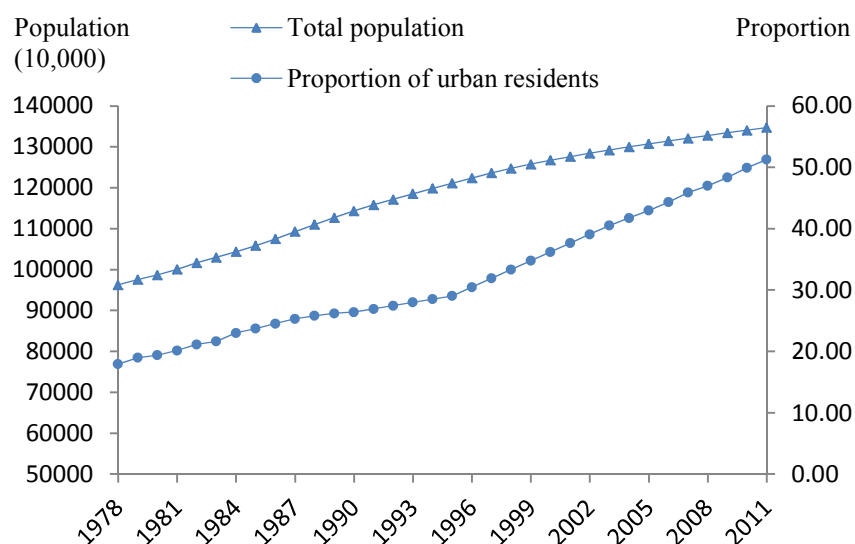


Figure 2.4 China's Population and Urbanization Rate

Data: China Statistics Yearbook 2012, National Bureau of Statistics of China. The unit of population is 10 thousand.

Creating enough job opportunities has always been one of the biggest challenges for Chinese government. This problem is more serious if we look at the structure of present migrant workers. There are almost 150 million migrant workers in urban China, among which 80% are young people born after 1980 in Chinese villages (Chan, 2010). According to a survey conducted by *Research Center for Chinese Youth*, 90% of those young migrant workers are not willing to return to their villages. They have large cultural gap with the farmers who have always been staying in rural areas. In

addition, those young migrants are not as endurable as their parents. They do not want to work more than twelve hours every day with little consumption. They do not want to save most of their cash and use that money to build houses in their villages. They want to seek identities equal to normal urban residents (Chan, 2010; Connelly et al., 2011). Providing enough job opportunities for the young migrant workers is not easy for the Chinese government.

A simple solution to the shortage of job opportunities seems to be restraining rural-urban migration. Before 2000, Chinese government implemented migration restrictions using Household Registration System (HRS, Hukou System in Chinese), which aimed to restrain the rural-urban migration (Chan and Buckingham, 2008). HRS refers to the “class system” of residency permits that dates back to 1958, where household registration is required by law in China (Liu, 2005, Whalley and Zhang, 2007)¹¹. A worker seeking to move from the rural areas to cities to take up non-agricultural work has to apply for the permission to stay in a city through the relevant bureaucracies. It is found that the Hukou System contributes obviously to the rural-urban inequality in China (Whalley and Zhang, 2007; Du et al., 2005; Chan, 2009; Sicular et al., 2007; Afridi et al., 2012).

There have been some changes in the Hukou System. Before 1990s, Chinese farmers are not allowed to stay in cities without official permit. Farmers were generally not allowed to do business in cities. However, as economy developed, more job opportunities appeared. Consequently, a large demand for rural-urban migrants appeared. The Chinese government therefore gradually relaxed the migration restrictions. Now Chinese farmers are allowed to do business in urban areas freely. In recent years, most local governments have relaxed the Hukou System and allow farmers to migrate (temporary migration) into urban area more freely¹² (Zhu, 2007).

As for permanent migration, farmers have to change their status in the *Hukou System*. At present, the cost of permanent migration is high, because the change of *Hukou* status means farmers have to give up their land rights (Chan, 2009; Zhang and Song, 2003). And some cities, for example Shijiazhuang, have canceled major *Hukou* restrictions to allow farmers to settle down easily. Contrary to our expectation, farmers cope with the institutional changes with cool attitudes. And there is no “great tide of migration”. The story indicates that *Hukou* System is not sufficient to explain the rural-urban migration in China, and there must be some other important variables influencing China’s rural-urban migration.

¹¹ A household registration record officially identifies a person as a resident of an area and includes identity information such as name, parents, spouse, and date of birth.

¹² After the Chinese economic reforms, it became possible for some to unofficially migrate and get a job without a valid permit. Economic reforms also created pressures to encourage migration from the rural area to cities.

Considering this situation, it is necessary to study other factors influencing the migration behavior of farmers. Land and land institutions may be important factors influencing rural-urban migration, because land and land institutions influence agricultural revenue and the opportunity cost of migration. In VanWey (2005), migration is regarded as a function of land. Brueckner (1990) and Brueckner and Zenou (1999) also prove the important influence of land on rural-urban migration. However, there are a lot of contradictory findings in the existing empirical literature. This dissertation will explore the influences of land and land institutions on migration.

2.4.2 Temporary Migration and Permanent Migration

Although there are plenty of empirical researches examining the determinants of rural-urban migration, contradictory findings are common (Chen et al., 2004; Park and Wang, 2010; Lall et al., 2006). One reason for the contradictory findings may be that researchers do not mean the same thing when they refer to “migration”. Although the researchers use the same word “migration”, their research objectives may be different. Therefore we need to clarify the concept of migration before the analysis. Generally we divide migration into two categories: permanent migration and temporary migration¹³. In this study, permanent migration means that a farmer leaves the rural area and moves into a city for working and living permanently. Temporary migration means that a farmer leaves her village and goes to other places to find a job for a period, but she does not stay there permanently. Temporary migration is a kind of mobility where the economic activity of a person is moved but not the usual residence (Bilsborrow et al., 1987). Essentially, it is a move made for a short period of time with the intention of returning to the place of usual residence (Keshri and Bhagat, 2011).

Conclusions on temporary migration may also have implications on permanent migration, because temporary migration is likely to be a prelude of permanent migration. In other words, temporary migration is a transitional step before a permanent change of residence (Pham and Hill, 2008). When a temporary migrant gets accustomed to the city life and does not want to go back to the rural area, temporary migration becomes permanent migration. The difference and relation between permanent migration and temporary migration has interesting implications on migration, which will be seen in Chapter 4.

¹³ This distinction is important. Some researches obtain strange conclusions because they do not distinguish permanent migration and temporary migration (Mullan and Grosjean, 2011).

2.5 Land Institutions

2.5.1 The Evolution of China's Land Institutions

Land is one of the important assets of farmers. Land and land institutions therefore have significant influences on farmers' behaviors (Brueckner and Zenou, 1999). As a transforming economy, China has unique and complicated land institutions. Because of the experience of centrally planned economy, the evolution of land institutions in China is different from other market economies.

Land was privately owned in China before 1949. After the Land Reform during the period 1949-1953, most land was redistributed from landlords to farmers, which resulted in a more equal land distribution. During the period 1949-1953, farmers had complete land rights, meaning they had ownership, right-to-use, and right-to-transfer on their land (Liu and Cheng, 2007).

After 1953, Chinese government began to promote Cooperation Organizations, in which farmers did not have land use-right. By the end of 1956, 1 million Cooperative Organizations were established, covering 106 million households (90% of the number of rural households). In such organizations, farmers still owned their land. They were actually stockholders that were able to get dividends from their Cooperative Organizations. The amount of dividends was determined by the quality and quantity of their land. The usage of land was decided by the organization committee instead of each individual farmer. Farmers were allowed to exit the organizations with their land (Liu and Cheng, 2007; Gao, 2007).

In 1958, the People's Commune Movement changed the land institutions fundamentally. In that movement, Advanced Cooperative Organizations were promoted and farmers' land rights were completely deprived. All land rights belonged to the organization instead of farmers. As well as land, farmers had to hand over their production tools to their organizations. This movement was a disaster to agricultural production of China (Liu and Cheng, 2007; Gao, 2007).

In 1978, a fundamental institutional reform started from Xiaogang, a poor village in Anhui province. In order to solve the problem of food shortage, farmers in Xiaogang designed the "Household Responsibility System" (Li and Wen, 2009). In particular, they divided village land into small parts, and each household was responsible to a certain part. As a result of the institutional innovation, agricultural production increased dramatically and the food shortage problem was solved. Deng Xiaoping and some other advanced officials accepted this institutional innovation. In 1993 the National People's Congress passed an act to legalize this innovation. And the framework of the present land institutions was established. Now village communities own the village land, and farmers have the rights to rent collective land

for a certain period. The rented land is referred to as “contracted land”. Figure 2.5 summarizes the evolution of China’s land institutions briefly.

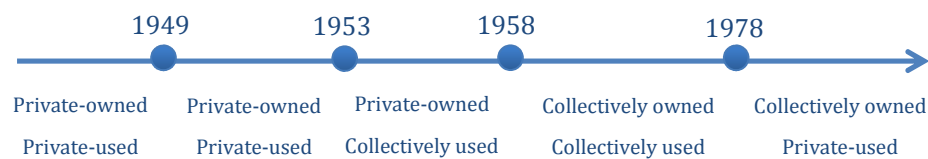


Figure 2.5 The Evolution of China’s Land Institutions

2.5.2 Present Land Institutions

2.5.2.1 Land Ownership

There are two forms of land ownership in China: state-owned and collectively-owned¹⁴(Zhu, 2005). All of the city land is state-owned and is under the effective control of the government. Most land in suburban and rural areas is collectively-owned. Decisions regarding the distribution and use of collective land are made by the village committees (*cunmin weiyuanhui*). Farmers only have the right to rent collective land for, at most, 30 years. This land is named as “contracted land.” However, collective land ownership is not a clearly defined property right, and has caused a lot of socio-economic problems (Ho, 2005b).

2.5.2.2 Land Use Rights

Land can be used for construction or agriculture. All the land in city is used for construction. Villages can only use part of the agricultural land for construction, including for farmers’ houses, roads and factories (Zhu, 2005; Hsing, 2010).

The regulations on agricultural land are very strict. Farmers are not allowed to build houses and factories on farmland. If the agricultural land needs to be used for construction, approval is required from at least two-thirds of village committee members. The village committee has tremendous power and influence in regards to the use of collective land (Liu and Cheng, 2007). However, generally, a committee only consists of 3 to 7 people.

If urban residents want to buy construction land in rural areas, they can only buy state-owned construction land. Therefore, the government is the only provider of construction land.

¹⁴ Property may be privately, collectively or state-owned; in the present paper, we use land holding to represent the amount of land owned by a person.

2.5.2.3 Land Transfer Rights

In cities, urban residents are able to enjoy land-use rights for over 70 years. They can sell and mortgage their houses. However, in rural areas, farmers are not allowed to sell their land and houses, in accordance with the present *Land Management Law* of China (Deininger and Jin, 2009; Deininger and Jin, 2005). Generally, they can only rent their land to other users within the same village. Arable land transfer is rare in China¹⁵. One reason for the lack of land market is the collective land ownership. Under collective land ownership, land can only be sold to village members. Moreover, collective land ownership blocks the external land demand. In addition, land supply is rare and not stable within villages. The limited demand and rare supply lead to inactive land markets. Inactive land markets imply that opportunity cost of farm land is low and all land should be used in the agricultural production.

Some provinces are trying to set up markets for land leasing and transfer right, to allow farmers to exchange their land rights; however, there are no successful and widely applicable experiences as yet (Ho, 2005a). Allowing the transfer of land-use rights might be a step toward privatization. However, there is no clear policy direction for future property right reform.

Appendix 2.1: NBSC's Definition of Urban and Rural Population

According to NBSC, population of urban households refers to members of households living and sharing together in the urban areas. All the income and expenditure of all the members of such households are included in the calculation of urban household income.

NBSC's concept of Rural Households refers to usual resident households in rural areas. Usual resident households in rural areas are households residing on a long term basis (for more than one year) in the areas under the administration of township governments (not including county towns), and in the areas under the administration of villages in county towns. Households residing in the current addresses for over one year with their household registration in other places are still considered as resident households of the locality. For households with their household registration in one place but all members of the households having moved away to make a living in another place for over one year, they will not be included in the rural households of the area where they are registered, irrespective of whether they still keep their contracted land (NBSC, 2012).

¹⁵ In fact, most developing countries do not have active land markets (Bardhan and Udry, 1999).

Chapter 3

Rural-Urban Interactions in China: A Panel

Causality Test

A number of economists agree on the positive impacts of urban growth on rural economy, but have different opinions on the impacts of rural growth on urban economy. This paper examines the rural-urban interactions with China's provincial panel data. Panel causality tests show strong influences of urban growth on rural sector, while indicate weak causality in the opposite direction. One reason for rural sector's weak influences is the low rural income. Because China's rural residents were too poor to afford many manufactured goods and services, the increase in rural income mainly transformed into the demand for agricultural products, without strongly stimulating urban growth. Empirical results also imply that the positive influences of rural development on urban sector will become increasingly strong as Chinese farmers become richer.

3.1 Introduction

Poverty is a predominantly rural phenomenon (Dercon, 2009). Around 76% of the poor people in the world live in rural areas, while the proportion of rural population is only 58% (Ravallion and Chen, 2007). Ravallion and Chen (2007) also find that 80% of aggregate poverty declines are resulted from rural poverty declines. However, it does not prove that rural development is the engine of poverty reduction. Urban development, which drives amount of rural labors out of agriculture, may be more important than rural growth. Whether rural sector or urban sector is the foundation of economic development is a well-rehearsed but still relevant question.

We cannot observe a consensus on this question from existing literature. Some consider the urban sector as the engine of growth. Timmer (2007) argue that agricultural growth is the key engine of economic growth. Sachs (2005) even suggests a “green revolution” in Africa as the essential strategy to realize development. The Staple Theory of Growth argues that improving agricultural productivity is a necessary condition of successful development strategies (Watkins, 1963)¹⁶. However,

¹⁶ We can also observe some evidence for the importance of rural development from history. In the period between 1950s and 1970s, many developing countries tried to boost economies by implementing urban-biased policies. Those policies, however, often failed to promote urban growth and caused lasting poverty in rural areas (Lanjouw and Lanjouw, 1995).

others economists think that rural growth is the foundation of economic development and that rural growth could stimulate growth in urban sector. The potential of agricultural development is largely handicapped by land. By contrast, manufacturing industry uses only a little land and obtains huge potential by capital accumulation (Eswaran and Kotwal, 2006). If a low land-to-labor ratio in agriculture is an important reason for poverty, a simple solution to reduce poverty is to develop industry and urban sector. Moreover, the Law of Comparative Advantage predicts a negative link between agricultural productivity and industrialization, because rural growth will increase labor cost in the urban sector (Field, 1978).

Dercon (2009) provides a survey on the relation between rural growth and urban growth. The survey finds that rural growth is the foundation for a closed economy. Regarding an open economy, the staple of rural growth is removed by international trade and industrial sector should be the engine of development. However, the survey does not consider the work of Matsuyama (1992), which proves negative influences of agricultural development in an open economy. Adding the theory of Matsuyama (1992) in the analytical framework, we cannot make sure the influences of rural development on urban growth. This is a task left for empirical study. Therefore, this study empirically explores the mutual influences between rural and urban economies. We study under the background of China because China is a typical dual economy, and the largest developing economy in the world. We are especially interested in the impacts of rural growth on urban sector.

We explore the rural-urban interactions with the provincial panel data of China. Because China is a typical dual economy, the conclusions may be useful for other developing countries. Through panel causality tests, we find asymmetric influences between China's rural and urban sectors. In particular, China's urban development exhibited strong and positive influences on rural development. However, we cannot observe significant influences from the opposite direction. Empirical evidence attributes the reason to the low income of rural residents. Because rural residents were too poor to afford large amount of manufactured goods, the increase in rural income mainly transformed into the demand for agricultural products. The income increase therefore did not have strong influences on urban sector. The results also imply that the influences of rural development will be increasingly strong as farmers become richer.

The contribution of this study is twofold. First, we provide an empirical test on rural-urban interactions. 15 years ago, Tacoli (1998) complained "most development theory and practice have focused on either 'urban' or 'rural' issues with little consideration of the interrelations between the two". Unfortunately, we still cannot find a lot of empirical analyses on rural-urban interactions 15 years later. This study tries to make a contribution on this topic. The second contribution is to integrate

spatial model into the framework of causality test, which enables us to deal with spatial dependence or cross-sectional dependence. Traditional panel causality tests only consider the dimension of time, ignoring the dimension of space. They test causality by checking whether the “time lag” of x helps to predict y . Under the background of spatial dependence, we introduce “spatial lag” as well as “time lag” in the causality test.

The remainder of this chapter is organized as follows: Section 3.2 provides two hypotheses on the rural-urban interactions in China; Section 3.3 describes the data; Section 3.4 presents the methodologies. Section 3.5 and Section 3.6 show the empirical results. Section 3.7 concludes.

3.2 Rural-Urban Interactions in Developing Countries

3.2.1 Theoretical Discussions

The mutual influences between rural and urban development depend on whether an economy is open or closed (Dercon, 2009). In order to understand this argument, we need to notice two facts. (1) The potential of agricultural development is largely handicapped by land. By contrast, industry uses a little land and obtains huge potential by capital accumulation (Eswaran and Kotwal, 2006). (2) The rural-urban interactions are mainly through demand linkages. The growth of urban economy implies higher demand for agricultural goods (grains, milk, meat, eggs and so on) and more importantly the increased demand for rural labor (Chowdhury et al., 2005). Both the demand for agricultural goods and rural labor may lead to economic growth in rural areas. In addition, rural growth can result in both increased demand for farm inputs (like fertilizers and farm equipment) and increased demand for manufactured goods and services. The increased demand can boost the economic growth in the urban area (Diao et al., 2007).

In a closed economy, rural development has positive influences on urban growth (Matsuyama, 1992). Urban development, however, may not have obviously positive influences on rural growth (Eswaran and Kotwal, 2002). We can understand this with the analytical framework of Eswaran and Kotwal (1993, 2002). The model of Eswaran and Kotwal has two sectors: industry and agriculture. In the rural economy, landowners and workers produce food. In the industrial sector, workers produce shirt. The preference of all economic agents is lexicographic, meaning that they first meet their need of food before buying any shirt. In a closed economy, the productivity growth in the industrial sector will only benefit the rich people without stimulating the rural development. Although the increase in industrial productivity results in lower shirt price, the poor people will not buy any shirt since they do not have enough food. No one has incentive to move out of agriculture, because total food supply would

decrease and food demand would increase. Consequently, rural poverty is unchanged. By contrast, the increase in agricultural productivity will benefit both sectors. The result of higher agricultural productivity is more food supply and higher demand on shirts, as well as more labor supply to the industrial sector. In the equilibrium of higher agricultural productivity, real wages of both sectors will increase. These implications for a closed economy are consistent with the arguments of the Staple Theory of Growth¹⁷. Although agricultural development is the foundation of growth in general, industrial growth is still the necessary way to become rich (Dercon, 2009). The reason is that the potential for productivity increase is limited in the agricultural sector, but unlimited in the industrial sector.

The rural-urban interactions are different under the context of an open economy. In an open economy, the demand and supply constraints are not important anymore for traded goods since they can be imported (Dercon, 2009). Because food can be imported, agricultural development is not essential for general growth and poverty reduction. In an open economy, industrial productivity increase could also stimulate rural growth. Higher industrial productivity implies lower average cost of shirts while the world price of shirts is constant. Firms then employ more labor. Some rural labors will migrate from agricultural production to industrial sector. Although food production will decrease, more food can be imported from the world market. In the equilibrium, real wages in both rural and urban sectors will increase (Eswaran, 2002). The impacts of agricultural productivity increase are similar. To sum up, development in any sector could stimulate the development in another sector, under the background of an open economy. Since urban sector has larger potential than rural sector, the right development strategy for an open economy is to focus on the urban sector (Dercon, 2009).

As for the influence of rural development on urban growth, we can observe some disputations. For example, the Law of Comparative Advantage predicts a negative link between agricultural productivity and industrialization. Manufacturing sector compete with agricultural sector for labor, higher agricultural productivity therefore implies higher labor cost for urban sector. The increased labor cost will reduce the competitive power of the manufacturing industry. Matsuyama (1992) also shows that agricultural productivity growth has negative influences on urban sector in an open economy. In his model, rural growth has two effects on urban sector. The first is the increasing demand for manufactured products, and the second is increasing the wage in manufacturing industry. In a closed economy, the demand-increasing effect is

¹⁷ The Staple Theory of Growth argues that improving agricultural productivity is a necessary condition of successful development strategy (Eswaran and Kotwal, 2002). Improving agricultural productivity has at least four benefits on urban sector: (1) providing more raw materials for urban sector; (2) releasing labor for urban sector; (3) creating more demand on manufactured products; (4) increasing domestic savings to finance industrialization.

dominant and consequently rural growth promotes urban development. In an open economy, however, the cost-increasing effect is dominant and consequently rural growth harms the urban economy.

Eswaran and Kotwal (2002), however, argue that rural growth may have positive influences on urban sector even in an open economy. The reason is that rural income growth leads to higher demand and supply of services, and consequently reduces the average cost of services¹⁸. Because services are inputs in manufacturing sector, the reduced service cost implies a higher competitive power of the urban sector.

To summarize the theoretical discussions on rural-urban interactions, we arrive at two consensuses. (1) In a closed economy, rural development is the foundation of general growth and has positive impacts on urban development. However, industrial development may not have positive impact on rural development. (2) In an open economy, urban development has positive influences on rural development.

As well as the two consensuses, we can still observe disputation regarding the influences of rural development in an open economy. Rural growth has two effects on urban sector. (1) The negative effect is that rural growth increases the labor cost of urban sector. In an open economy, the increased labor cost harms the competitive power of manufacturing industry. (2) The positive effect is that rural growth leads to higher demand on manufactured goods and services. The overall effect of rural growth depends on which effect is dominant. As for a very poor economy, where people's demand on food is dominant¹⁹, income growth of rural residents mainly transforms into the demand for food and other agricultural products²⁰. And the cost-increasing effect is therefore superior to the demand-increasing effect. As a result, rural growth may not have positive influences on urban growth. As for a relatively rich economy, where the Engel's coefficient of rural residents is low, the influences of rural growth depend on whether rural income growth can effectively drive the growth of service sector. If the theory of Eswaran and Kotwal (2002) is right, a richer rural sector corresponds to stronger influences on urban growth.

3.2.2 Rural and Urban Economies in China

The empirical studies on rural-urban interactions are sparse (Dercon, 2009). Li (2012) identifies different rural-urban interaction patterns and proposes specific ways of achieving rural-urban integration regarding those different patterns. Olsson (2012)

¹⁸ In the Eswaran and Kotwal model, the service sector is assumed to have a fixed cost which implies scale economy. The services are used by both consumers and manufacturers.

¹⁹ In other words, Engle's coefficient is very high.

²⁰ The agricultural economist Robert Thompson finds that between per capita incomes of 2 dollars and 10 dollars per day people eat more animal protein, fruits vegetables and edible oils; as a consequence, the raw agricultural commodity demand grow rapidly; but after 10 dollars per day, people buy more processing, services, packaging, variety and luxury form, so that the pressure for raw agriculture demand is relaxed to some extent (Johnson, 2009).

studies spatial interaction between rural and urban areas by exploring how the long-distance mobility behavior of households and individuals has changed over a period of intensified rural-urban interaction in a rural Philippine area. However, they do not provide direct empirical evidence on the mutual influences between rural and urban development. This paper therefore tests existing theories using the data of China.

China was a typical closed economy before 1978, and became an open economy after implementing the policies of Reform and Openness. After the economic reform, the urban sector experienced rapid growth. A number of economists attribute the reasons for the urban growth to international trade, without stressing the importance of rural economy (Lin, 2003). The positive influences of urban development is understandable since we have seen a consensus on the positive impact of industrial development in an open economy.

The interesting question is whether rural development also has significant and positive influences on the urban development of China. According to the theoretical discussions, the impacts of rural development in an open economy depends on whether cost-increasing effect or demand-increasing effect is dominant. If an open economy is very poor, namely the Engel's coefficient of rural residents is low, the cost-increasing effect is dominant, and the impacts of rural development is at best insignificant. This is just the case of China. See Table 3.1 for the data of per-capita income and Engel's coefficient of urban and rural households in China (Table 3.1).

From Table 3.1, we can see that the Engel's coefficient decreased for urban households rapidly. However, the income of urban household increased even more rapidly, which implies that the total demand for food and clothes (closely related to agricultural goods) still increased obviously. This trend indicates that urban development could strongly stimulate rural development. Regarding the rural residents, although their incomes grew rapidly, they were still very poor with Engel's coefficients over 43 by 2009 ²¹. As a result, their demand for manufactured goods might be limited. The evidence indicates weak influences of rural sector. Therefore, we have the following hypotheses to be tested in this study.

H₁: China's rural development did not stimulate urban growth obviously, but the urban growth had strong positive influences rural development.

As well as the mutual influences between rural and urban development, this study also tests the theory of Eswaran and Kotwal (2002). In particular, we test

²¹ The Food and Agriculture Organization divide the different levels of the living standard according to the Engel's coefficient. The classification is as follows: above 60% is poverty, 50%-60% is barely enough food and clothing; 40%-50% is initial prosperity; below 40% is rich. According to this standard, Chinese farmers are poor, or at least not rich.

whether a richer rural sector will have stronger influences on urban growth. This is the second hypotheses to be tested in this study.

H₂: A richer rural sector has stronger influences on urban growth.

Table 3.1 Per-capita Income and Engel's Coefficient of Urban and Rural Households

Year	Disposable Income of Urban Residents (Yuan)	Net Income of Rural Residents (Yuan)	Engel's Coefficient of Urban Households (%)	Engel's Coefficient of Rural Households (%)
1990-1994	2262.2	864.4	52.2	58.4
1995-1999	5112.2	1993.2	46.6	55.2
2000-2004	7747.4	2530.6	38.0	47.2
2005-2009	13799.0	4179.2	36.8	43.4

Notes: The table is calculated according to the data provided by National Bureau of Statistics of China (NBSC). At the beginning period of economic development, when Chinese rural households were very poor, farmers' demand for agricultural goods grew rapidly while the demand for manufactured goods only increased at a relatively slow speed. When people become rich, their demand for agricultural goods would be gradually saturated while the demand for manufactured goods would increase. As rural residents become richer, their expenditure on manufactured goods may increase. Yuan is China's currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars).

3.3 The Data

Motivated by the theoretical analysis, we test the interactions between China's rural and urban economies. We employ provincial panel data in this study, because panel data allow us to have a greater availability of degrees of freedom so as to increase estimation efficiency (Elhorst, 2010)²². Although the data reflects provincial development, they can be employed to test the hypotheses mentioned above. If we understand each province as an extremely open economy, the provincial data are valid for testing hypotheses proposed for an open economy²³.

We use per-capita income to reflect the economic development and to test the rural-urban interactions. The reason why we use income instead of consumption data is that income is a better indicator for measuring poverty in the short-run. Risk-averse households prefer less variable consumption, which makes consumption much smoother than income (Dercon, 2002). For example, if the current income increase is not sustainable, households will not increase their consumption obviously. Therefore

²² Panel data are generally more informative than cross-section data and time series data, and they contain more variation and less collinearity among the variables. Therefore panel data offer us extended modeling possibilities as compared to the single equation cross-sectional setting.

²³ The major difference between inter-provincial economies and inter-national economies may be labor migration. However, labor migration does not essentially influence the local rural-urban linkages.

consumption change may reflect the long-term welfare change instead of short-term. Because we do not have data covering very long time-span, income is a better choice for this study. The data are available from the National Bureau of Statistics of China (NBSC).

We should note that the statistical approach of calculating urban income is different from that of calculating the rural one. The urban income is the average disposable income of urban residents, while the rural income is the average per-capita net income of rural residents. The difference between the two concepts is that rural residents have to use part of their “net income” to buy seeds, machines, fertilizers and other agricultural inputs. If a farmer’s net income is 500 USD, and she has to use 20 percent of his net income to invest in agricultural production, it means the farmer’s disposable income is actually 400 USD. However, the difference between statistical approaches is not a vital problem for this study. If only the statistical approaches are stable, we can use the data because we care the changes of rural and urban incomes instead of the absolute value. The causality relationship between variable y and x can also be tested with the data of y and cx , where c is a constant.

Table 3.2 Summary Statistics of the Data

Variable	Obs.	Mean	Std. Dev.	Min	Max
Urban Income (UI)	930	6209	6053	402	36230
Rural Income (RI)	930	2305	2315	174	16054
Population	930	3858	2520	189	10505
Urbanization Rate	930	34.76	17.07	4.53	89.30
Nominal Interest Rate	930	8.20	2.11	5.76	13.10
Inflation Rate	930	6.04	6.83	-3.20	29.40
International Trade	930	173.70	533.24	0.00	5400

Note: The data are available in the China Statistics Yearbook. The units of per-capita income are Yuan. Yuan is China’s currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars). The unit of population is 10,000. The unit of international trade is 100 million USD. UI represents the average disposable income of urban residents. RI denotes the average per-capital net income of rural residents.

Control variables include population, urbanization rate, real interest rate and international trade. In the following estimations, we use the logarithm of all variables except real interest rate. The real interest rate is calculated as the nominal interest rate subtracting inflation rate. International trade is measured by the sum of import and export in U.S. dollars. Descriptive statistics of the data are shown in Table 3.2.

3.4 Methodologies

3.4.1 Panel Unit Root Test

Before analyzing the causality between rural and urban development, we need to test stationarity of the variables. If the variables are not stationary, we need to be cautious on the pseudo-regression problem. In the existing literature, the most popular ones are LLC test developed by Levin et al. (2002) and the IPS test by Im et al. (2003). IPS test is a more general panel unit root test and described as “heterogeneous panel unit root test” (Al-Iriani, 2006)²⁴. This study uses both LLC test and IPS test.

The results show that rural income, urban income, population, urbanization rate and international trade are all first-order stationary. In other words, the five variables are stationary after first-order difference. Real interest rate is stationary. If the variables are first-order stationary, they may have linear combinations that are stationary without differencing. In other words, they are cointegrated (Granger, 1981). Cointegration test is employed to test whether a long-run relationship exists among the variables.

3.4.2 Panel Cointegration Test

The traditional cointegration test is developed by Engle and Granger (1987). The basic insight of traditional cointegration test is the Granger representation theorem, which says that if the variables are cointegrated, then we can find a valid error correction representation of the data, and vice versa²⁵. The method of Granger (1987) has mainly three problems (Brooks, 2008). One problem is that Engle-Granger cointegration test may suffer from simultaneous equations bias if there is bi-direction causality between two variables²⁶. This problem is addressed by Johansen (1988). Johansen’s method is popular and useful in testing cointegration for individuals, but not directly applicable to panel data.

A special panel cointegration test is proposed by Pedroni (2004). Because of the use of panel data, we can overcome the small-sample problems. However, a large number of studies fail to reject the null hypothesis with Pedroni’s approach, even

²⁴ Although both principles of LLC and IPS tests are augmented Dickey-Fuller test (ADF), they have different assumptions on the homogeneity of panel members. LLC assumes homogeneity in the autoregressive coefficients for all panel members, while IPS test allows the coefficients of panel members to be different.

²⁵ Engle and Granger (1987) suggest a two-step procedure for the cointegration test. The first step is to estimate the long-run equilibrium equation, and the second step is to estimate an error correction model using the residuals from the first step.

²⁶ Another two problems are as follows. (1) The augmented Dickey-Fuller unit root test has low power in finite samples. ADF type tests tend to accept the null hypothesis of stationarity. (2) It is impossible to make any inferences on the actual cointegration regression. To deal with this problem, Engle and Yoo (1987) add a third step to correct the cointegration vector and standard errors. Although the Engle-Yoo three-step method makes inferences possible, it suffers from all remaining problems of the Engle-Granger test and is rarely used in the empirical applications (Brooks, 2008).

when cointegration is strongly suggested by theory (Westerlund, 2007). Westerlund (2007) attributes this phenomenon to the fact that residual-based tests require the long-run cointegration vector for the variables in their levels being equal to the short-run adjustment process for the variables in their differences. The failure of such a “common factor restriction” can result in a significant loss of power for residual-based cointegration tests (Kremers et al., 1992). Therefore Westerlund (2007) develops a new error correction-based cointegration tests for panel data. The Westerlund tests have good small-sample properties with small size distortions. In addition, the new tests have stronger power relative to other popular residual-based panel cointegration tests.

This study employs the Westerlund approach to test the existence of long-run relationship between rural and urban development. The results are placed in Appendix A3.1, which provides strong evidence for the existence of long-run relation. The cointegration test, however, only proves correlation instead of causality. We therefore implement several methods testing the causality between rural and urban development.

3.4.3 Testing Rural-Urban Interactions

3.4.3.1 Holtz-Eakin Panel Causality Test

Theories indicate potential mutual influences between rural and urban sectors. Urban development can stimulate rural growth, because the increase in urban income results in higher demand for agricultural products and labor. On the other hand, rural income increase may lead to higher demand for manufactured goods and services, and the increased demand will transform into the income of urban residents. If the rural-urban interactions function well, we can observe a “virtuous circle” between rural and urban growth²⁷ (Braun, 2007). In practice, however, we do not often observe such a “virtuous circle”. This section examines the existence of rural-urban interaction, namely we test the bi-causality between rural and urban development.

Most causality tests are based on the idea of classical Granger causality test. The underlying idea of Granger’s test is that, if a certain variable x causes other variable y , then the past information of x should help to explain and predict y . Put differently, the lagged values of x in a regression of y on its own lagged values and other explanatory variables should significantly improve the forecasting power of the model. If the past values of y help explain x , then y is supposed to be a causal factor of x . Following such an idea, we can apply it to the case of panel data. The traditional Granger test

²⁷ The virtuous circle means that rural development can stimulate urban development and urban development can reversely stimulate rural development.

requires time series data with large T . However, sufficiently long time series data are often unavailable. As a result, panel data have become more and more popular in testing causality. Panel models allow for the analytical incorporation of significantly more observations and degrees of freedom. Therefore panel Granger tests are significantly more efficient than conventional Granger tests (Hurlin and Venet, 2001).

Based on the insights of Granger causality test, a popular panel causality test is developed by Holtzeakin et al. (1988) and Holtzeakin et al. (1989), which has been widely employed in empirical applications. Based on the framework of Holtz-Eakin test, we design the following equations so as to test the causality between rural and urban development.

$$UI_{it} = a_0 + \sum_{k=1}^p \beta_k UI_{it-k} + \sum_{k=1}^p \gamma_k RI_{it-k} + \mathbf{X}_{it}\boldsymbol{\beta} + f_i + u_{it} \quad (3.1)$$

$$RI_{it} = b_0 + \sum_{k=1}^p \delta_k RI_{it-k} + \sum_{k=1}^p \eta_k UI_{it-k} + \mathbf{X}_{it}\boldsymbol{\gamma} + g_i + v_{it} \quad (3.2)$$

where UI denotes the log-level of urban per-capita income and RI represents the log-level of the rural per-capita income, t represents time period ($t = 1, 2, \dots, T$), i is the individual of the panel ($i = 1, 2, \dots, N$), f_i and g_i are fixed effects, k is the lag order with p being its maximum number lags, and p is assumed to be common. u_{it} and v_{it} are random terms. a_0 and b_0 are constants. The autoregressive parameters β_k and δ_k ($k \in [1, m]$) and the coefficients γ_k and η_k ($k \in [1, m]$) are assumed to be equal across panel members.

In order to eliminate the unobserved fixed effects, we need to difference equations (3.1) and (3.2). Therefore we obtain equations (3.3) and (3.4).

$$\Delta UI_{it} = \sum_{k=1}^p \beta_k \Delta UI_{it-k} + \sum_{k=1}^p \gamma_k \Delta RI_{it-k} + \Delta \mathbf{X}_{it}\boldsymbol{\beta} + \Delta u_{it} \quad (3.3)$$

$$\Delta RI_{it} = \sum_{k=1}^p \delta_k \Delta RI_{it-k} + \sum_{k=1}^p \eta_k \Delta UI_{it-k} + \Delta \mathbf{X}_{it}\boldsymbol{\gamma} + \Delta v_{it} \quad (3.4)$$

Obviously, the differenced error terms are correlated with the first-order differenced lagged endogenous variables. In order to deal with this problem, a usual method is the instrumental variable estimation. Under the assumption that u_{it} and v_{it} are independent, higher-order lagged values of UI_{it} and RI_{it} can be used as instruments. A widely used estimator is the generalized method of moments (GMM) estimator applied to dynamic panel (Arellano and Bond, 1991).

We should note that GMM is a common solution to the panel with small T and large N . If T is large, dynamic panel bias becomes not important, and the more straightforward fixed-effects estimator should be employed (Roodman, 2006). In addition, Roodman points out that the number of instruments in difference and system GMM tends to explode with T . As a result, the cluster-robust standard errors and the Arellano–Bond autocorrelation test may be unreliable if N is small. Regarding the

panel data employed in this study, the data contain 30 years and 31 panel members. The data are characterized with large T and relatively small N. Therefore the traditional fixed-effects estimator better fits this study.

In order to examine causality, the joint hypotheses $\gamma_k = 0$ for $\forall k \in [1, m]$ and $\eta_k = 0$ for $\forall k \in [1, m]$ are tested. In particular, we first estimate equations (3.1) and (3.2), and then test the null hypothesis that the coefficients of lags of *RI* (γ_k , $k \in [1, m]$) and lags of *UI* (η_k , $k \in [1, m]$) are all 0. The test statistics follow a chi-squared distribution. Rejection of the null for the Wald test indicates the existence of causality.

3.4.3.2 Causality Test Based on Spatial Model

One shortcoming of the traditional panel causality test is the ignorance of cross-sectional dependence. Actually when we use panel data, cross-sectional dependence is a common phenomenon. It is not reasonable to assume independence among panel members in the present study. The urban development in one province not only attracts more rural labor in the same province, but also attracts labor from other provinces. In addition, the increase of rural income in one province leads to not only higher demand for goods produced in the local province, but also higher demand for goods produced in other provinces. The increased rural income will stimulate investment and growth in both local and other provinces. In order to test the existence of cross-sectional dependence we employ the method developed by Pesaran (2004). The results, presented in Appendix A3.2, provide strong evidence for cross-sectional dependence in the panel data.

There are mainly two sources of cross-sectional dependence, with the first one being common factors influencing all panel members and the second one being spatial effects. The problem caused by common factors can be solved by introducing time dummies if we assume that all panel members have homogenous reactions on the common factors. If we assume heterogeneity in the common factor effects, dummy variables are not proper because the number of dummies will be too large. Some special estimators, such as Pesaran's (2006) Common Correlated Effect (CCE) estimator, may be employed. If the cross-sectional dependence results from spatial effects, it is better to employ spatial model to deal with the problem²⁸. Otherwise the omitted spatial effect would be projected to the influences of other variables and bias the estimated coefficients. The bias may cause reference error.

²⁸ Spatial effects pertain to spatial dependence or spatial autocorrelation. For details please see Anselin, Luc, 1988, *Spatial econometrics: methods and models*: Springer.

Spatial model can be applied to causality test. Traditional panel causality tests only consider the dimension of time, ignoring the dimension of space. They test causality by checking whether the “time lag” of x can help to predict y . Under the background of spatial dependence, we can introduce “spatial lag” as well as “time lag” in the causality test. In spatial econometrics, spatial lag is defined as the average characteristic of spatial neighbors (Anselin, 1988). Mathematically, the spatial lag of y_i is $\sum_{j=1}^N w_{ij}y_j$, where i is a panel member, j is the neighbor of i , and y is a variable, w_{ij} is corresponding weight. The reason for introducing spatial lag in this study is that the economic development in one panel member is likely to have influences on its neighbors. In addition, ignoring spatial effects may distort causality test, because the traditional estimation strategies will project the omitted spatial effects to the observed explanatory variables and make the estimated coefficients biased. We therefore need to introduce spatial lag in the causality test.

Table 3.3 Introducing Spatial Lag into Causality Test

The dependent variable (y_t)		Time dimension	
		Current characteristics	Time lag
Space dimension	Own characteristics	x_t	y_{t-1} x_{t-1}
	Spatial lag	Wy_t Wx_t	Wy_{t-1} Wx_{t-1}

Notes: In this table we only discuss first-order lags.

Table 3.3 lists all useful information for predicting y in two dimensions: time and space. The definitions on variables are as follows. $y_t = (y_{1t}, y_{2t}, \dots, y_{Nt})'$ is a vector of dependent variable with N being the number of individuals in the panel data, vector $y_{t-1} = (y_{1t-1}, y_{2t-1}, \dots, y_{Nt-1})'$ is the lag of y_t . $x_t = (x_{1t}, x_{2t}, \dots, x_{Nt})'$ is a vector of explanatory variables, with x_{t-1} being the lag of x_t . W is the spatial matrix for the autoregressive component and at the same time for the spatially lagged independent variables. The W matrix used in this study is a row-normalized adjacency matrix. The adjacency matrix is defined following the method of “Rook contiguity” introduced in LeSage (1999). It is a $N \times N$ matrix with each factor (w_{ij}) measuring whether two provinces (i and j) are neighbors. If i and j are neighbors, $w_{ij} = 1$; otherwise, $w_{ij} = 0$. Note that $w_{ii} = 0$ for $i = 1, 2, \dots, N$. This method is simple but reasonable.

Weinhold and Reis (2001) use $\mathbf{W}\mathbf{y}_{t-1}$ and $\mathbf{W}\mathbf{x}_{t-1}$ in the causality test with short T panel data²⁹. We follow their idea but replace $\mathbf{W}\mathbf{y}_{t-1}$ by $\mathbf{W}\mathbf{y}_t$ so as to integrate the causality test into a well-developed spatial Durbin model. Because our interested variable is $\mathbf{x}$, and $\mathbf{W}\mathbf{y}_t$ is highly correlated with $\mathbf{W}\mathbf{y}_{t-1}$, this adjustment does not have fundamental influences on the estimation of $\mathbf{x}$. In particular, we design the following spatial econometric model to test causality.

$$\mathbf{y}_t = (\mathbf{y}_{t-1}\alpha^T + \mathbf{x}_{t-1}\beta^T) + (\mathbf{W}\mathbf{y}_t\alpha^S + \mathbf{W}\mathbf{x}_{t-1}\beta^{ST}) + (\mathbf{Z}_{t-1} + \mathbf{W}\mathbf{Z}_{t-1}\theta) + \mathbf{a} + \gamma_t + \varepsilon_t$$

$$\varepsilon_t \sim N(\mathbf{0}, \Omega) \quad (3.5)$$

where $\mathbf{a}$ is a $n \times 1$ vector of individual fixed or random effects with $\mathbf{a} = (a_1, a_2, \dots, a_N)$. γ_t is a $n \times 1$ vector of time specific effects with $\gamma_t = (\gamma_t, \gamma_t, \dots, \gamma_t)$. $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{Nt})'$ is a vector of normally distributed error terms. $\mathbf{Z}_{t-1}$ is a matrix of control variables including population, urbanization rate, real interest rate and international trade. α^T , β^T , α^S and β^{ST} are parameters. The term in the first bracket captures time lag information, while the term in the second bracket captures spatial lag information. The model described in equation (3.5) is essentially a dynamic panel model with spatial effects. Maximum Likelihood Estimation is applied to estimate this model (Elhorst, 2010; Federico et al., 2013). As explained before, the panel data employed in this study have large T and relatively small N. We therefore do not apply the approach of Arellano and Bond (1991) to deal with the dynamic panel, but use the Fixed Effect estimator in the estimation. After the estimation we test whether coefficients β^T and β^{ST} are all 0. If this null hypothesis is rejected, we conclude a causal relationship from x to y . This framework is applied to test the existence of bi-causality between rural and urban development.

3.4.4 Testing Dynamic Influences of Rural Sector

Weak influences of rural development on urban growth may be due to the low income of rural residents. China's rural areas were so poor that farmers could not afford various manufactured products. Consequently the income growth of rural residents might not provide much effective demand for urban sector (manufactured goods). We therefore test whether the influences of rural development increase as rural income grows.

We design the following regression model, where ΔUI_{it} is the urban income increase in period t , ΔRI_{it-1} is the rural income increase in the last period ($t-1$). The key variable is $\Delta RI_{it-1} \times RI_{it-1}$, which is the interaction term between the growth and the level of rural income. If the impacts of rural development increase with rural

²⁹ We do not directly employ the method of Weinhold and Reis (2001) because this method is mainly designed to deal with short-T panel data. We follow the idea of Weinhold and Reis (2001) only in using spatial information in the causality test.

income growth, this interaction term should have a significantly positive coefficient. $\mathbf{Z}_{it}$ is a vector of control variables including population, urbanization rate, real interest rate and international trade.

$$\Delta UI_{it} = \beta_0 + \beta_1 \Delta UI_{it-1} + \beta_2 \Delta RI_{it-1} + \beta_3 (\Delta RI_{it-1} \times RI_{it-1}) + \mathbf{Z}_{it} \boldsymbol{\gamma} + \varepsilon_{it} \quad (3.6)$$

As well as Fixed Effect and difference GMM estimators, we also use system GMM contributed by Arellano and Bover (1995) and Blundell and Bonds (1998). Difference GMM estimator suffers from small sample bias when the number of time periods is small and the dependent variable is highly persistent (Heid et al., 2012). By contrast, system GMM estimator performs better with highly persistent data under mild assumptions. Although the estimator is good in term of asymptotic efficiency, it may suffer from finite sample bias and may increase the likelihood of false positive results. The reason is that the number of instruments increases exponentially with the number of time periods (Roodman, 2006). Therefore we use only two lags in system GMM estimation.

3.5 Results on Rural-Urban Interactions

3.5.1 Causality Test Results Based on Holtz-Eakin Method

The causality test results based on Fixed Effect estimator are presented in Table 3.4. Results of specifications (1) and (2) indicate that rural development only has minor influences on urban development. The coefficient of lagged rural income in specification (1) is 0.02, indicating that a one-percent increase in rural income only stimulates urban income to increase by 0.02 percent. The coefficients of lagged rural income are all insignificant in specification (2). The Wald tests conclude that the information of rural income can significantly help us to predict urban income. Although Wald tests prove the existence of causality from rural to urban development, the influences of rural development are not large in magnitude.

From specifications (3) and (4), we find that urban development has strong influences on rural income. The coefficient of lagged urban income is 0.28 in specification (3), indicating that a one-percent increase in urban income will corresponds to 0.28 percent increase in rural income. This influence is 14 times ($=0.28/0.02$) that of the rural income. Wald tests prove the influences of urban development to be significant at the level of 0.01, no matter lag length is one or two.

Table 3.4 Causality Test Results Based on Fixed Effect Estimator

Independent Variables	Dependent Variable			
	(1)	(2)	(3)	(4)
	Urban Income	Urban Income	Rural Income	Rural Income
	Lag =1	Lag = 2	Lag = 1	Lag = 2
Urban Income (t-1)	0.8977*** (0.0146)	0.9676*** (0.0347)	0.2835*** (0.0369)	0.2643*** (0.0870)
Rural Income (t-1)	0.0216** (0.0109)	0.0151 (0.0134)	0.5329*** (0.0278)	0.3947*** (0.0336)
Urban Income (t-2)		-0.0928*** (0.0346)		-0.0486 (0.0867)
Rural Income (t-2)		0.0155 (0.0130)		0.2096*** (0.0325)
Population (t-1)	-0.0558** (0.0225)	-0.0928*** (0.0346)	-0.1492*** (0.0571)	-0.1260** (0.0578)
Urbanization Rate (t-1)	-0.0147** (0.0061)	-0.0405* (0.0231)	-0.0132 (0.0154)	0.0003 (0.0160)
Real Interest Rate (t-1)	-0.0017*** (0.0006)	-0.0181*** (0.0064)	-0.0015 (0.0015)	-0.0019 (0.0015)
International Trade (t-1)	-0.0046 (0.0030)	-0.0014** (0.0006)	-0.0019 (0.0075)	0.0001 (0.0078)
Year Dummies	Yes	Yes	Yes	Yes
Bhargava Test	1.80	1.98	2.25	1.99
Wald Causality Test	3.90**	2.91**	58.85* **	16.44***
R ²	0.997	0.997	0.992	0.993
Observations	899	868	899	868

Notes: *, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Robust standard errors are in parentheses. Bhargava test is an adjusted DW serial correlation test developed by Bhargava et al. (1982), and calculated as $\frac{\sum_{i=1}^N \sum_{j=1}^T (e_{it} - e_{it-1})^2}{\sum_{i=1}^N \sum_{j=1}^T e_{it}^2}$. If the value is close to 2, the null of serial correlation is rejected. No serial correlation implies a proper lag length.

3.5.2 Causality Test Results Based on Spatial Model

The causality test results based on spatial model are shown in Table 3.5. The results are consistent with that based on FE estimation in showing asymmetric influences between rural and urban development. According to the results of specification (1), coefficients of lagged rural income are neither significant in individual effects nor in spatial effects. By contrast, specification (2) shows that urban development has

significant influences on rural income of the same province (individual effects), and has significant influences on rural income of the neighbor provinces (spatial effects). Wald test results reject the existence of causality from rural to urban income, while provide strong evidence for the causality in the opposite direction.

Table 3.5 Causality Test Results Based on Spatial Model

Independents	Urban income (1)	Independents	Rural income (2)
<i>Individual effects:</i>		<i>Individual effects:</i>	
Urban Income (t-1)	0.8732*** (0.0159)	Urban Income (t-1)	0.2312*** (0.0413)
Rural Income (t-1)	0.0109 (0.0110)	Rural Income (t-1)	0.4905*** (0.0281)
Population (t-1)	-0.0301 (0.0233)	Population (t-1)	-0.1514** (0.0599)
Urbanization Rate (t-1)	-0.0151** (0.0067)	Urbanization Rate (t-1)	-0.0121 (0.0172)
Real Interest (t-1)	-0.0014** (0.0007)	Real Interest (t-1)	-0.0015 (0.0017)
International Trade (t-1)	-0.0045 (0.0031)	International Trade (t-1)	0.0006 (0.0080)
<i>Spatial effects:</i>		<i>Spatial effects:</i>	
Urban Income (t)	0.1194*** (0.0248)	Rural Income (t)	0.1286*** (0.0416)
Rural Income (t-1)	-0.0208 (0.0190)	Urban Income (t-1)	0.0685 (0.0664)
Population (t-1)	-0.0307 (0.0559)	Population (t-1)	0.0405 (0.1428)
Urbanization Rate (t-1)	-0.0148 (0.0122)	Urbanization Rate (t-1)	0.0174 (0.0313)
Real Interest Rate (t-1)	-0.0009 (0.0012)	Real Interest Rate (t-1)	0.0001 (0.0030)
International Trade (t-1)	-0.0030 (0.0062)	International Trade (t-1)	-0.0044 (0.0160)
Wald Causality Test	0.91	Wald Causality Test	21.39 ***
<i>N</i>	899	<i>N</i>	899
<i>R</i> ²	0.995	<i>R</i> ²	0.954

Notes: *, ** and ***denotes the significance at the 10, 5 and 1percent level respectively and standard errors are in parentheses. Individual effects means the influences of one province's own characteristics (*x*) on its own performance (*y*). Spatial effects mean the influences of neighbor province's characteristics on a province's own performance.

3.6 Results on Dynamic Influences of Rural Sector

The estimation results, shown in Table 3.6, show strong evidence for the hypothesis that the influences of rural sector increase as rural income grows. The coefficients of the interaction term are both statistically and economically significant. Combining the coefficients of rural income growth and the interaction term in specification (1), we find that rural development will have importantly positive influences on urban sector if rural income is higher than 2500 Yuan ($=0.16/0.06$). GMM estimation results in specification (2) show that if rural income is larger than 2800 Yuan ($=0.17/0.06$), rural development will exhibit strong influences on urban areas. The most optimistic conclusion is derived from system GMM estimation, which implies that 2000 Yuan ($=0.13/0.06$) is enough to guarantee the positive influences of rural development. Because the coefficients of the interaction term are all significantly large in economic magnitude, we can conclude that rural development will have important and positive impacts on China's urban growth.

Table 3.6 Influences of Rural Development Increase with Rural Income Growth

Independents	Dependent Variable: Urban Income Growth (t)		
	FE	GMM	System GMM
Urban Income Growth (t-1)	0.3667*** (0.0363)	0.2893*** (0.0631)	0.5252*** (0.0403)
Rural Income Growth (t-1)	-0.1622*** (0.0514)	-0.1773** (0.0797)	-0.1363** (0.0587)
RI (t-1) $\times$ RI Growth (t-1)	0.0621*** (0.0081)	0.0615*** (0.0136)	0.0613*** (0.0082)
Population (t-1)	-0.2110 (0.1581)	-0.3821 (0.3686)	0.0095 (0.0094)
Urbanization Rate (t-1)	0.0105 (0.0434)	0.0924 (0.1091)	0.0588** (0.0229)
Real Interest Rate (t-1)	-0.0007 (0.0038)	-0.0029 (0.0094)	0.0051 (0.0048)
International Trade (t-1)	0.0262 (0.0201)	0.0721 (0.0507)	0.0106 (0.0067)
Year Dummy	Yes	Yes	Yes
Number of Observations	868	837	868

Notes: Unit of income: 1000 Chinese Yuan. We transform the unit so as to make the table clear. RI represents rural income.

The empirical results provide strong evidence for the hypothesis that rural residents will have stronger influences on urban growth as farmers' incomes increase. The conclusions imply that China's future policies should focus on how to develop the rural market as farmers become richer. In addition, urban biased policies will have more negative influences on growth because it restrains income growth of rural residents and consequently restrains demand for urban goods. Therefore those policies should be removed.

3.7 Conclusions

This paper explores the interaction between rural economy and urban economy with the provincial panel data of China. The data cover 31 provinces and 30 years from 1982 to 2011. Panel Granger causality tests are employed so as to analyze the causal relationship between rural and urban economies. We also employ the Spatial Durbin Model (SDM) to test the rural-urban interactions. We find asymmetric influences between China's rural and urban sectors. China's urban development exhibited strong and positive influences on rural development, but similar strong influences cannot be observed from the opposite direction. Empirical evidence attributes the reason to the low income of rural residents. In the open Chinese economy, the rural development can exhibit strong influences on urban development only when rural residents are rich enough to afford a large amount of manufactured goods and services. When rural residents were very poor, rural income increase mainly transformed into the demand for agricultural goods without significantly stimulating urban growth. When farmers become rich enough, rural development is possible to show positive influences on urban sector. Empirical results imply that the influences of rural development on urban sector will become stronger as rural income increases.

Appendix A3.1 Westerlund Panel Cointegration Test

The panel cointegration tests are developed by Westerlund (2007), which contain four statistics. The core idea of the cointegration test is to check whether error correction process exists for individual panel members or for the whole panel. The error correction model is specified as equation (A3.1), where all variables in levels are assumed to be first-order stationary.

$$\Delta y_{it} = c_i + \sum_{j=1}^p a_{ip} \Delta y_{it-p} + \sum_{j=1}^p b_{ip} \Delta x_{it-p} + a_i (y_{it-1} - b_i x_{it-1}) + u_{it} \quad (\text{A3.1})$$

In this error correction model, a_i is the parameter of interest, which estimate the speed of error-correction towards the long run equilibrium. Based on a_i , Westerlund (2007) develops four statistics to test cointegration, namely G_t , G_a , P_t , P_a . The null hypothesis for G_t and G_a is $a_i = 0$ for all i . The alternative hypothesis is $a_i < 0$ for at least one i . G_t and G_a start from weighted average of the individual t-ratio and a_i . If the null hypothesis is rejected, the test indicates the existence of cointegration for at least one panel member. P_t and P_a pool information of all panel members to test the cointegration of the whole panel. The null hypothesis for the G_t and G_a is $a_i = 0$ for all i . The alternative hypothesis is $a_i < 0$ for all i . If the null hypothesis is rejected, we can conclude the existence of cointegration in the whole panel.

The test results of the Westerlund tests are presented in Table A3.1, which show strong evidence for cointegration in the variables of rural income, urban income, population, urbanization rate and real interest rate.

Table A3.1 Cointegration Test Results

Statistic	Value	Z-value	P-value
G_t	-3.516	-7.874	0.00
G_a	-18.794	-5.553	0.00
P_t	-18.265	-7.437	0.00
P_a	-18.019	-8.251	0.00

The null hypothesis is: no cointegration. The test examines whether there is cointegration between urban income and rural income. Variables are log-levels.

Appendix A3.2 Cross-sectional Dependence Test

The test in this section checks the existence of cross-section dependence (CD) based on the method developed by Pesaran (2004). The test does not need a priori specification of spatial matrix. The Pesaran CD-test uses the correlation-coefficients between the time series for each panel member (ρ_{ij}). The Pesaran CD statistic is described as the following, where T_{ij} is the number of observations for which the correlation coefficient was computed. Under the null hypothesis of cross-section independence the CD statistics is normally distributed for $T_{ij} > 3$ and N sufficiently large. The Pesaran (2004) test is robust to nonstationary, heterogeneity. It could perform well even in small samples.

$$CD = \sqrt{\frac{2}{N(N-1)}} (\sum_{i=1}^{N-1} \sum_{j=i+1}^N T_{ij} \rho_{ij}) \quad (A3.2)$$

The test results are shown in Table A3.2, from which we can see strong evidence for cross-section dependence both for all variables. This implies that Spatial Durbin Model (SDM), which is a general form spatial model, may be better to fit the data.

Table A3.2 Cross-section Dependence Test

Variable	CD-test	p-value	Correlation
Urban income	119.78	0.00	0.93
Rural income	119.07	0.00	0.91
Growth rate of urban income	87.58	0.00	0.73
Growth rate of rural income	65.55	0.00	0.55
Population	107.87	0.00	0.90
Urbanization rate	104.98	0.00	0.87
CPI	98.26	0.00	0.82
Interest rate	120.06	0.00	1.00

Chapter 4

Migration, Local Wage Work and Land Holding: Estimating the Influences of Land on Farmer's Employment Choice

China is undergoing some fundamental reforms in land institutions. This study analyses the influences of land and land institutions on rural-urban migration in China. We establish a simple model to discuss the influences of land on farmer's choice among migration, local wage work and pure farm work. We find that the probability of migration is high when land holding is at the intermediate level. If land holding is small, farmers tend to choose local wage work. If land holding is pretty large, farmers are more likely to choose pure farm work. The theoretical conclusions are supported by the data of Chinese Household Income Project (CHIP). The empirical results indicate that China's collective land ownership stimulates migration.

4.1 Introduction

As the largest developing country in the world, China is a typical dual economy characterized by massive rural-urban migration. Since 1978, the largest scale of rural-urban migration in the world has happened in China, which has resulted in a rapid process of urbanization (Zhang and Song, 2003). The proportion of urban residents rose from 18% in 1978 to 50% in 2011, according to the data of National Bureau of Statistics of China (NBSC)³⁰. The large number of migrants poses a potential threat to Chinese economy. Migrants may cause serious social instability if they suffer seriously from unemployment. It is therefore necessary to study the determinants of migration so as to avoid unnecessary policy shocks on migrants.

Existing literature focuses on a wide range of topics related to migration, such as Hukou system, education, and so on (Cai and Wang, 2008). Different from a lot of existing literature, the present study focuses on the influences of land on migration. This research topic is important because China is undergoing some fundamental reforms in land institutions (Deininger and Jin, 2009; Mullan et al., 2011). Moreover, land and land institutions have important impacts on farmers' decision-making

³⁰ In addition, approximately 145 million migrant workers lived in urban areas by the end of 2009 (NBSC, 2012).

because they influence the revenue and cost of migration (Brueckner and Zenou, 1999; Brueckner, 1990)³¹.

Existing studies on the relationship between migration and land holding find contradictory results. Some scholars argue that the shortage of land is a reason for migration, because the labor productivity in agricultural production is low when labor-land ratio is too high (Zhao, 2003; Hare, 2002; Zhu, 2002). The “push effect” in migration has been discussed by a large number of studies. This effect predicts a negative relationship between migration probability and land holding (Potts, 2006; Barbieri 2006). However, Rozelle et al. (1999) show evidence for a positive relation between migrant number in a rural household and land holding. Their explanation is that households with more land are likely to be more capital-constrained in crop production, given imperfections in land and capital markets in China. Some other researchers, such as Gray (2009), also find positive relation between migration and land holding. They argue that the relationship is positive because more land implies more capital necessary to finance migration. The contradictory empirical studies indicate the necessity to use a more general analytical framework so that we can consider the “push effect” and capital constraint simultaneously.

The present study contributes to the existing literature by building a simple but reasonably comprehensive framework that integrates “push effect” and capital constraint into migration analysis. Besides, the present study brings local wage work into the analytical framework. Local wage work is an important alternative choice of migration (Shi et al., 2007; Huffman, 2007; Mohapatra et al., 2006). Introducing such an important choice brings us advantage over the generally employed choice set of migration or not (Chen et al., 2004). The more realistic model enables us to obtain more reasonable results that are important to labor development literature and Chinese decision makers.

The present study establishes a theoretical model to analyze the influences of land on farmers’ choices among migration, local wage work and pure farm work. The model shows that farmers with small or moderately large land holding tend to do local wage work, while farmers with intermediate land holding tend to migrate. The theoretical conclusions are supported by the data of Chinese Household Income Project (CHIP). The empirical results indicate that collective land ownership stimulates migration. However, the institutional cost of permanent migration, giving up land rights, is too high under collective land ownership. This fact implies that collective land ownership will face more challenge in the process of urbanization.

³¹ The reason that we only examine the influences of land on temporary migration is China’s collective land ownership. Most Chinese rural-urban migrants are not willing to permanently migrate into cities, because permanent migration would result in the loss of land rights. Therefore temporary migration, instead of permanent migration, is popular in China.

The remainder of the paper is organized as follows. Section 4.2 presents a theoretical model analyzing the influences of land on temporary migration. Section 4.3 presents the data employed in this study. Section 4.4 shows the methodologies and Section 4.5 presents the empirical results. Section 4.6 discusses policy implications and Section 4.7 summarizes the conclusions.

4.2 Theoretical Model

4.2.1 The Settings

We use an income maximization framework to analyze the optimal labor allocation of a representative farmer. The farmer allocates labor in three activities, including agricultural work, local wage work and migration. Migration means the farmer moves to farther places to do some wage work. Migration is different from local wage work because migration has higher wage and higher cost. In the context of Chinese economy, local wage work means doing wage work in the village or within the county³². Migration means moving outside the county to do better paid jobs. Farmers could choose farm work at the same time of choosing non-agricultural work, because crops planting has seasonal characteristics³³.

The labor endowment of a representative farmer is 1. The amount of labor invested in local nonfarm activities is denoted as l_n , invested in migration is l_m , and invested in agricultural production is l_f . The labor endowment constraint is therefore $l_f + l_n + l_m = 1$. The income of a representative farmer, denoted as Π , is the total income from all activities.

The agricultural product market is competitive. Therefore the price of agricultural products P is constant for a farmer. Agricultural production is assumed as a function of farm labor and land input, written as equation (4.1).

$$y = f(l_f, R) \quad (4.1)$$

where R is the amount of land input³⁴. R is an exogenous variable, because land transfer is rare in China. We assume the following conditions for the agricultural production function: $f(l_f, 0) = f(0, R) = 0$, $f_{l_f} = \frac{\partial f(l_f, R)}{\partial l_f} > 0$, $f_R = \frac{\partial f(l_f, R)}{\partial R} > 0$, $\lim_{l_f \rightarrow 0} \frac{\partial f(l_f, R)}{\partial l_f} > +\infty$, $\lim_{R \rightarrow 0} \frac{\partial f(l_f, R)}{\partial R} > +\infty$, $\frac{\partial^2 f(l_f, R)}{\partial l_f \partial l_f} < 0$, $\frac{\partial^2 f(l_f, R)}{\partial R \partial R} < 0$. The income from agricultural production is $Pf(l_f, R)$.

³² Note that the distance between county and villages are generally close and the transfer cost is low.

³³ Zhao (2001) finds that most migrants return to their village two or three times to plant or harvest crops.

³⁴ We do not place capital investment explicitly in the production function because it is not the focus in this study.

The wage of local nonfarm activities is w_n . Since the transfer cost of local wage work is generally low, the cost is set to be 0 in this study³⁵. The income from local nonfarm activity is therefore $w_n l_n$.

When we calculate the income of migration, it is necessary to consider both higher wage and higher cost. The wage of a unit migration labor is w_m . Migration cost consists of two components, including the one-time cost and variable cost. The one-time cost, denoted as T_0 , includes transportation cost (bus ticket, train ticket), initial accommodation fee and certain institutional cost. The institutional cost may be related to China's Household Registration System (Hukou System). When Chinese government restricted migration, the institutional cost was so high that migration was never a practical choice for farmers. The variable cost includes food expenditure and daily accommodation expenses. The variable cost is proportional to the amount of work time of a migrant and is set as tl_m , where t is a constant parameter. Therefore the total cost of migration is $T(l_m) = I(l_m)T_0 + tl_m$, where $I(l_m)$ is an indicator function. The value of $I(l_m)$ is 0 if $l_m = 0$, 1 if $l_m > 0$, namely $I(l_m) = \begin{cases} 0 & \text{if } l_m = 0 \\ 1 & \text{if } l_m > 0 \end{cases}$. We assume migration cost is not too high and $w_m - (t + T_0) > 0$. This condition means migration is profitable if a farmer invests all her labor in migration. If migration cost is too high or migration wage is too low that the condition is violated, migration is not possible in any situation.

We also assume $w_n < w_m - t - T_0$; otherwise, migration is never better than local wage work. This argument is established by the following analysis. Define a vector of two functions $(l_f^M, l_m^M) = \text{Argmax}_{l_f, l_m} Pf(l_f, R) + (w_m - t)l_m - T_0$, and denote Π^M as the corresponding optimal income of the farmer. We further define a vector of two functions $(l_f^N, l_n^N) = \text{Argmax}_{l_f, l_n} Pf(l_f, R) + w_n l_n$ and denote the corresponding optimal income as Π^N . If $w_n \geq w_m - t - T_0$, we have the following relation: $\Pi^M = Pf(l_f^M, R) + (w_m - t)l_m^M - T_0 = Pf(l_f^M, R) + (w_m - t - T_0)l_m^M + (l_m^M - 1)T_0 < Pf(l_f^M, R) + w_n l_m^M \leq Pf(l_f^N, R) + w_n l_n^N = \Pi^N$. Obviously local wage work is always a better choice than migration.

A farmer needs to cover the initial one-time cost if she wants to migrate. A farmer needs some initial capital to cover the migration cost. In other words, migrant needs to overcome capital constraint. The capital ability of the farmer is $B(R)$, and $B(R) = B_0 + g(R)$. B_0 is the capital ability independent of land holding and related to other factors, such as social network. $g(R)$ is the capital ability related to land

³⁵ A positive cost of local wage work, however, does not change the main conclusions of the model.

holding with $g_R(R) > 0$. If the farmer has the right to use land as collateral, $g(R)$ may have strong relationship with land holding. However, Chinese farmers are not allowed to use land as collateral, indicating a weaker relation between land holding and Chinese farmers' capital ability. The capital constraint condition is $I(l_m)T_0 \leq B(R)$.

Based on the above description, the income maximization problem is therefore as follows.

$$\text{Max}_{l_f, l_n, l_m} \Pi = Pf(l_f, R) + w_n l_n + w_m l_m - T(l_m) \quad (4.2)$$

$$\text{s.t. } l_f + l_n + l_m = 1$$

$$I(l_m)T_0 \leq B(R)$$

$$l_f \geq 0; l_n \geq 0; l_m \geq 0$$

4.2.2 The Results

Based on the settings, a representative farmer will not choose migration and local wage work at the same time. In other words, l_m and l_n cannot simultaneously be positive³⁶. Because we assume $\lim_{l_f \rightarrow 0} \frac{\partial f(l_f, R)}{\partial l_f} > +\infty$ for agricultural production function, farm labor will always be positive, unless land holding (R) is 0. Since migration and local wage work cannot exist simultaneously, we mainly have three employment types: pure farm work, local wage work and migration.

Table 4.1 Three Employment Types

	Farm labor (l_f)	Local wage work labor (l_n)	Migration labor (l_m)
Pure farm work	+	0	0
Local wage work	+/0	+	0
Migration	+/0	0	+

Note: “+/0” means farm work could be positive or 0. Actually farm labor is 0 only when land holding is 0.

³⁶ The following analysis is suggested by Prof. Ohyama. Suppose l_n^* and l_m^* as the optimal allocation of labor. Consider an alternative allocation $l_n^{**} = l_n^* - \varepsilon$ and $l_m^{**} = l_m^* + \varepsilon$, where ε is a sufficiently small positive real number. By this construction, we have $l_f^* + l_n^{**} + l_m^{**} = l_f^* + l_n^* + l_m^* = 1$ with $l_n^{**} \geq 0$ and $l_m^{**} \geq 0$. In other words, l_n^{**} and l_m^{**} are in the constraint set. Note that $\pi^{**} = pf(l_f^*, R) + w_n l_n^{**} + (w_m - t)l_m^{**} - T_0 = pf(l_f^*, R) + w_n(l_n^* - \varepsilon) + (w_m - t)(l_m^* + \varepsilon) - T_0 = pf(l_f^*, R) + w_n l_n^* + (w_m - t)l_m^* + \varepsilon((w_m - t) - w_n) - T_0 > pf(l_f^*, R) + w_n l_n^* + (w_m - t)l_m^* - T_0$. The last inequality follows from the assumption that $w_n < w_m - t$. More importantly, the last inequality contradicts that l_n^* and l_m^* are an optimum solution.

We can compare two income-maximization framework to conclude which employment type is better: (1) $\text{Max}_{l_f, l_m} \Pi = Pf(1 - l_m, R) + (w_m - t)l_m - T_0$ subject to capital constraint $T_0 \leq B(R)$ and (2) $\text{Max}_{l_f, l_m} \Pi = Pf(1 - l_n, R) + w_n l_n$. Denote $\Pi^n(R)$ and $\Pi^m(R)$ respectively as the optimal income of doing local wage work and migration. Namely, $\Pi^n(R) = \sup_{l_f, l_n} Pf(l_f, R) + w_n l_n$, and $\Pi^m(R) = \sup_{l_f, l_m} Pf(l_f, R) + (w_m - t)l_m - T_0$. We need to compare the value of $\Pi^n(R)$ and $\Pi^m(R)$ to see whether migration is better than local wage work.

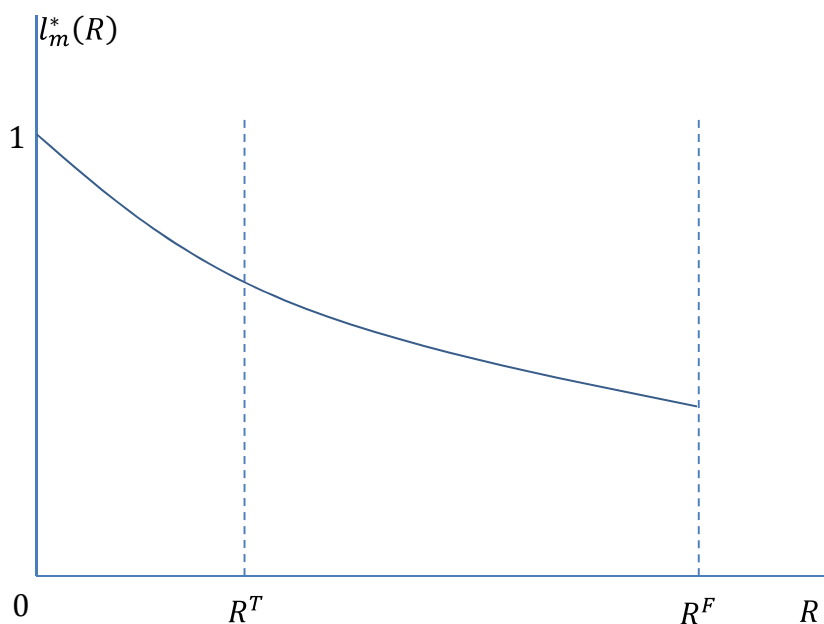


Figure 4.1 Optimal Migration Labor and Land Holding

Note: R^T is determined independent from R^F . Therefore we cannot know the relative position of R^T and R^F . When migration cost T_0 is too large, it possible that $R^T \geq R^F$ and migration is never an optimal choice for farmers. Figure 4.1 only shows a possible case. In the context of Chinese economy, capital constraint in migration is not serious and consequently R^T is negligibly small. We therefore set $R^T = 0$ in the following analysis.

Proposition 1 discusses the relationship between nonfarm labor and land. Proposition1 finds that a farmer is able to overcome capital constraint in migration, only when land holding is larger than a benchmark (R^T). If a farmer's capital ability independent of land holding (B_0) is larger than the initial one-time cost necessary in migration, capital constraint is not a serious problem in migration. Since the value of R^T is determined by some exogenous variables, such as B_0 , it can be determined independently. The discussion after Proposition 1 therefore ignores the problem of

capital constraint. This problem will be considered at the end of this section, where we composite all analysis results in this section.

Proposition 1 also shows that migration is better than pure farm work if land holding is smaller than another benchmark (R^F). This is because of the initial one-time cost necessary for migration. If the amount of non-agricultural labor is very small, the income from migration could not cover migration cost.

The second argument in Proposition 1 shows a negative relationship between the optimal amount of local wage labor and land holding in the second income-maximization framework. In addition, we can find a threshold below which local wage work is better than pure farm work.

Proposition 1: The amount of labor invested in local wage work or migration has negative relationship with land holding. In particular, we have the following two arguments. (1) Consider the income-maximization framework of migration, that is $Max_{l_f, l_m} \Pi = Pf(1 - l_m, R) + (w_m - t)l_m - T_0$ subject to the capital constraint $T_0 \leq B(R)$. The optimal amount of migration labor has a negative relation with land holding, namely $\frac{dl_m^*(R)}{dR} < 0$ if $l_m^* > 0$. And we can find two thresholds, R^T and R^F , with $l_m^* = 0$ if $R < R^T$, and migration income is less than pure farm work if $R > R^F$. (2) Consider the income-maximization framework for local wage work, that is $Max_{l_f, l_n} \Pi = Pf(1 - l_n, R) + w_n l_n$. The optimal labor of local wage work has a negative relation with land holding, namely $\frac{\partial l_n^*(R)}{\partial R} < 0$ if $l_n^* > 0$. And we can find a threshold, R^M , over which pure farm work is better than local wage work.

Proof: The proposition is established by the following two components.

(1) The first argument is obtained by solving the maximization problem described in 4.3. If $l_m > 0$, the income maximization problem becomes the following version.

$$\begin{aligned} Max_{l_m} \Pi &= Pf(1 - l_m, R) + (w_m - t)l_m - T_0 \\ s. t. \quad &T_0 \leq B(R) \end{aligned} \tag{4.3}$$

(i) Internal solution. The first order condition is $\frac{\partial \Pi}{\partial l_m} = -Pf_{l_f}(1 - l_m, R) + (w_m - t) = 0$. By this first order condition we can get the amount of optimal migrant labor l_m^* , so that $Pf_{l_f}(1 - l_m^*, R) = w_m - t$. Obviously we have the relation

$$\frac{\partial l_m^*(R)}{\partial R} = \frac{f_{l_f R}(1 - l_m^*, R)}{f_{l_f l_f}(1 - l_m^*, R)} < 0.$$

(ii) Define R^T . Write the cutoff R^T satisfying that $T_0 = B_0 + g(R^T)$. If $T_0 - B_0 < g(0)$, then we have $T_0 < B_0 + g(R)$ for any R . In this case, capital cost constraint is redundant. Put it differently, $R^T = 0$. Assume that $T_0 - B_0 > g(0)$. If we assume that $g(R)$ is a continuous function and if there is an R such that $T_0 - B_0 < g(R)$, then the intermediate value theorem guarantee the existence of R^T . Since we assume that $g_R(R) > 0$ for any R , there is a unique value of R^T specified by $R^T = g^{-1}(T_0 - B_0)$, where g^{-1} is the inverse of g . Since $g_R(R) > 0$ for any R , g^{-1} is an increasing function of T_0 . We can also conclude that $T_0 \geq B_0 + g(R)$ if $R \leq R^T$. This implies that $l_m^* = 0$ if $R \leq R^T$.

(iii) Define R^F .

First define $\pi'_M = \sup_{l_m} Pf(1 - l_m, R) + (w_m - t)l_m - T_0$, and $\pi_A = Pf(1, R)$. When $\pi'_M < \pi_A$, pure farm work is better than migration. When $\pi'_M > \pi_A$, migration is better than pure farm work.

π'_M is not a continuous function over land holding R . To illustrate this argument, define R^* as the amount of land holding satisfying $Pf_{l_f}(1, R^*) = w_m - t$. Because $f_{l_f}(1, R)$ is an increasing function over R , there is a unique R^* .

When $R \geq R^*$, the optimal value of $\pi'_M = Pf(1, R) - T_0$. Obviously $\pi'_M < \pi_A$ if $R \geq R^*$. It implies that migration is never better than pure farm work if land holding is larger than R^* .

When $R < R^*$, $\pi'_M = Pf(1 - l_m^*, R) + (w_m - t)l_m^* - T_0$ is continuous over R , where l_m^* maximizes π'_M . In this situation, we can find a cutoff R^F that tells when migration is better than pure farm work.

$$\pi'_M = \begin{cases} Pf(1, R) - T_0 & \text{if } R \geq R^* \\ Pf(1 - l_m^*, R) + (w_m - t)l_m^* - T_0 & \text{if } R < R^* \end{cases} \quad (4.4)$$

The existence of R^F is proved by the intermediate value theorem. At the point $R = R^*$, $\pi'_M - \pi_A < 0$. At the point $R = 0$, $\pi_A = Pf(1, 0) = 0$, and $\pi'_M = (w_m - t) - T_0 > 0$. Therefore $\pi'_M - \pi_A > 0$, if $R = 0$. By the intermediate value theorem, we can find a value R^F satisfying $\pi'_M - \pi_A = 0$, with $R^F \in (0, R^*)$.

The uniqueness of R^F is proved by the following analysis. Because l_m^* maximizes $\pi'_M = Pf(1 - l_m, R) + (w_m - t)l_m - T_0$, by envelope theorem, we have $\frac{\partial \pi'_M}{\partial R} = Pf_R(1 - l_m^*, R)$. Since $1 - l_m^* < 1$, $Pf_R(1 - l_m^*, R) < Pf_R(1, R)$, we have the following relation.

$$\frac{\partial(\pi'_M - \pi_A)}{\partial R} = Pf_R(1 - l_m^*, R) - Pf_R(1, R) < 0 \quad (4.5)$$

Because $\frac{\partial(\pi'_M - \pi_A)}{\partial R} < 0$, the uniqueness of R^F is guaranteed. Therefore we have $\pi'_M < \pi_A$ if $R > R^F$. It means pure farm work is better than migration when land holding is larger than R^F .

(2) The second argument is obtained through the following analysis.

The income maximization problem for local wage work is described as follows.

$$\begin{aligned} \text{Max}_{l_f, l_n} \quad & \Pi = Pf(1 - l_n, R) + w_n l_n \\ \text{s. t.} \quad & l_n \geq 0 \end{aligned} \quad (4.6)$$

The first order condition for internal solution is $\frac{\partial \Pi}{\partial l_n} = -Pf_{l_f}(1 - l_n, R) + w_n = 0$. With this condition we can easily solve $l_n^* = l_n^*(R)$ which satisfies $f_{l_f}(1 - l_n^*, R) = w_n$. It is easy to show $\frac{\partial l_n^*(R)}{\partial R} = \frac{f_{l_f R}(1 - l_n^*, R)}{f_{l_f l_f}(1 - l_n^*, R)} < 0$.

The corner solution is solved by this condition $Pf_{l_f}(1, R) \geq w_n$. Therefore we can find a threshold R^M over which pure farm work is better than local wage work.

■

We cannot determine the relationship between R^F and R^M , because R^F is determined by some variables that do not influence R^M . However, the relative position between R^F and R^M has important implications on the optimal labor allocation. This will be shown in Proposition 2.

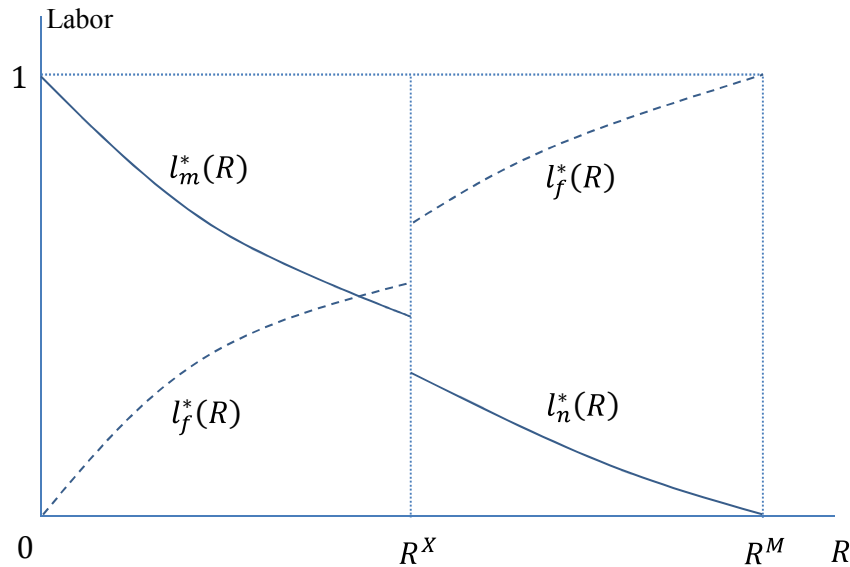


Figure 4.2 Optimal Labor Allocation and Land Holding

Note: Figure 4.2 shows a special case that is generally observed in the real world, where $R^F < R^M$. At the point of $R = R^M$, $Pf_{l_f}(1 - l_m, R) = w_m - t$ if migration is the choice; and

$Pf'_1(1 - l_n, R) = w_n$ if local wage work is the choice. Because $w_n < w_m - t$, we can get $l_m^*(R^M) > l_n^*(R^M)$.

Proposition 2 analyzes the choice between local wage work and migration. Under the assumption of no capital constraint ($R^F = 0$), when the wage of local wage work (w_n) is too low and $R^F > R^M$, local wage work is never better than migration. When w_n is moderately high but still with $w_n < w_m - t - T_0$ so that $R^F < R^M$, we can observe a situation described by Figure 4.2. Specifically, we can find two cutoff values R^X and R^M , with $R^X < R^M$. The representative farmer chooses migration if $R < R^X$ chooses local wage work if $R^X < R < R^M$, and chooses pure farm work if $R > R^M$.

Proposition 2: Under the condition $w_m - t - T_0 > w_n$, if $R^M \leq R^F$, local wage work is never an income maximization choice; if $R^M > R^F$, we can find a threshold R^X with $R^X < R^F$ so that local wage work is the best choice when $R^X < R < R^M$, and migration is the best choice when $R < R^X$.

Proof: $\Pi^n(R)$ and $\Pi^m(R)$ are the maximized income of doing local wage work and migration. Specifically, $\Pi^n(R) = \sup_{l_f, l_n} Pf(l_f, R) + w_n l_n$, and $\Pi^m(R) = \sup_{l_f, l_m} Pf(l_f, R) + (w_m - t)l_m - T_0$. It is easy to show $\Pi^n = Pf(1, R)$ if $R = R^M$. And $\Pi^m = Pf(1, R)$ if $R = R^F$.

By envelope theorem, $\frac{\partial \Pi^m(R)}{\partial R} = f_R(l_f^m, R) > 0$, where l_f^m is the optimal farm labor amount under the maximization problem of migration. And $\frac{\partial \Pi^n(R)}{\partial R} = f_R(l_f^n, R) > 0$, where l_f^n is the optimal farm labor amount under the maximization problem of local wage work.

If $R^M = R^F$, $\Pi^m(R^M) = f(1, R^M) = \Pi^n(R^M)$.

If $R^M < R^F$, it is easy to show $\Pi^m(R) > \Pi^n(R)$ for $R \in (R^M, R^F)$, and we can see $\Pi^m(R^M) > f(1, R^M) = \Pi^n(R^M)$. For any $R < R^M$, we have $f_{l_f^n}(l_f^n, R) = w_n$ and $f_{l_f^m}(l_f^m, R) = w_m - t$. Since $w_m - t > w_n$ and $f_{l_f l_f}(l_f, R) < 0$, we have $l_f^m < l_f^n$. Because $f_{R l_f}(l_f, R) > 0$, by envelop theorem, we have $\frac{\partial \Pi^n(R)}{\partial R} = f_R(l_f^n, R) > f_R(l_f^m, R) = \frac{\partial \Pi^m(R)}{\partial R}$. Therefore we can see $\frac{\partial (\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$. With $\Pi^n(R^M) -$

$\Pi^m(R^M) \leq 0$, $\Pi^n(0) - \Pi^m(0) < 0$ and $\frac{\partial(\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$, it is easy to prove $\Pi^n(R) < \Pi^m(R)$ for all $R < R^M$ if $R^M \leq R^F$.

If $R^M > R^F$, obviously we have $\Pi^n(R) > \Pi^m(R)$ for $R \in [R^F, R^M)$, because the optimal income of local wage work is larger than the income of pure farm work. In the interval $R \in [0, R^F]$, $\Pi^n(R)$ and $\Pi^m(R)$ are continuous functions over land holding R . Because $w_n < w_m - (t + T_0)$, we have $\Pi^n(0) - \Pi^m(0) < 0$. At the point $R = R^F$, $\Pi^n(R^F) - \Pi^m(R^F) > 0$. Since $\Pi^n(R) - \Pi^m(R)$ is a continuous function, we can find a solution for $\Pi^n(R) - \Pi^m(R) = 0$ in the interval $R \in [0, R^F]$. Denote the solution as R^X . The following steps show that R^X is a unique solution. For $R \in (0, R^F)$, we have $f_{l_f^n}(l_f^n, R) = w_n$ and $f_{l_f^m}(l_f^m, R) = w_m - t$. Because $w_m - t > w_n$ and $f_{l_f l_f}(l_f, R) < 0$, we have $l_f^m < l_f^n$. Because $f_{R l_f}(l_f, R) > 0$, we have $\frac{\partial \Pi^n(R)}{\partial R} = f_R(l_f^n, R) > f_R(l_f^m, R) = \frac{\partial \Pi^m(R)}{\partial R}$. Therefore we can see $\frac{\partial(\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$. Therefore R^X is a unique solution. Since $\frac{\partial(\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$, it is easy to show that $\Pi^n(R) > \Pi^m(R)$ if $R \in (R^X, R^M)$, and $\Pi^n(R) < \Pi^m(R)$ if $R \in [0, R^X)$. ■

Regarding Chinese economy, both migration and local wage work are common. In addition, a large proportion of farmers with relatively large land holding choose local wage work. Combining the two facts, we therefore believe that Chinese farmers' employment choices can be represented by the situation $R^M > R^F$.

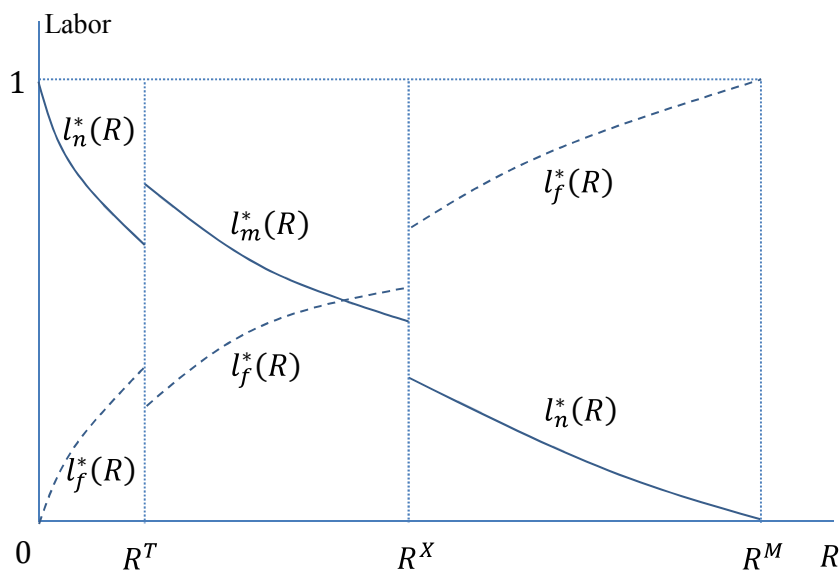


Figure 4.3 The Employment Choice under Capital Constraint

The above analysis does not consider capital constraint. For most Chinese migrants capital constraint is less than a concern (Zhao, 2001). Although some farmers lack enough savings to overcome capital constraint, their relatives and friends often provide sufficient help. However, we do observe some poor farmers that cannot afford the cost of migration. Introducing capital constraint into the analysis we can get Figure 4.3 that represents farmers' employment choices in China³⁷. The empirical analysis is mainly based on Figure 4.3.

In particular, we mainly have two tests in the empirical analysis: (1) testing the negative relationship between migration probability and land holding; (2) testing the negative relationship between the relative probabilities of migration and local wage work comparing with pure farm work. The empirical estimations are based on the fact that a larger predicted amount of migration labor (l_m^*) is correlated with higher probability of migration, and the fact that the predicted amount of local wage work labor (l_n^*) is correlated with higher probability of local wage work. More detailed empirical discussions on the thresholds analyzed in Proposition 2 will be carried out in the policy evaluation analysis.

4.3 Data

4.3.1 Data and Variables

The data of Chinese Household Income Project (CHIP) are employed. CHIP project was conducted by Li (2002). CHIP 2002 was designed to measure and estimate the distribution of personal income and related economic factors in both rural and urban areas of China. Rural and urban data were collected through a series of questionnaire-based interviews at the end of 2002. The 2002 rural survey data cover 9200 households in 22 provinces in China. The 2002 survey has ten separate datasets, in which the fifth, sixth and seventh datasets are used in the present study³⁸.

We define different employment types based on the data of farmers' secondary jobs. A question on workplace was designed in the survey: "where is the workplace of your secondary job?"³⁹ The respondents chose from the following five options: (A) Within the village; (B) Outside the village but within the township; (C) Outside the township but within the county; (D) Outside the county but within the province; (E) Outside the province. A farmer is considered to do local wage work if he/she had a secondary job within the county. Migration means a farmer worked outside the county. If she did not have any secondary job and only did farm work, the employment status is defined as pure farm work.

³⁷ We assume that capital constraint is not too serious, namely $R^T < R^X$. Otherwise migration is never a practical choice for any farmer.

³⁸ See the website of the project for more information. <http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/21741>.

³⁹ Primary job is farming. This question is on temporary migrators.

The key explanatory variable is land holding. This variable is measured by the amount of a farmer's "contracted land" at the end of 2002. Contracted land is a special concept in China. According to Land Management Law of China, rural land is collectively owned, which means village land is owned by all village members as a whole. In practice, village land is under the control of village committee (Cunmin Wei-yuanhui in Chinese). Each rural household has to sign a contract with the village committee to rent land for a certain period. The rented land is "contracted land". Before 1997, village land in China was frequently redistributed. Such an institutional arrangement caused land overuse. Therefore Chinese government decided to extend the rent period. Now the rent period can last for 30 years⁴⁰.

Control variables are selected to cover farmers' individual, household and village level characteristics, consisted of *schooling*, *age*, *marriage*, *minority*, *geographic condition* and *average per capita income of villages*. *age* is the age of a farmer⁴¹. *schooling* measures the schooling years of the respondent. *marriage* describes the marital status of a farmer, which equals to 1 if she is married. *minority* is a dummy that equals to 1 if the respondent has minority status. *Geographical condition* is also a dummy, the value of which is 1 if the village lies in plain or basin. Labor number represents the number of labors of the rural household. Table 4.2 shows summary statistics of the variables.

Table 4.2 Summary Statistics

Variables	Pure Farm Work	Local Wage Work	Migration
Average Contracted Land Holding	3.32	2.84	2.44
Average Age	39.87	39.65	28.40
Average Schooling Years	6.57	7.77	8.04
Percentage Married	0.83	0.86	0.49
Percentage Minority	0.18	0.09	0.10
Average Labor Number	3.12	2.63	3.34
Average Geographic Condition	0.47	0.52	0.35
Average Village Per Capita Income	2.20	2.98	2.18

The unit of land holding is *mu*, which is a Chinese measurement unit. 1 *mu* equals about 0.16 acre. The unit of Average Village Per Capita Income is 1000 Yuan. Yuan is China's currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars).

4.3.2 Descriptive Analysis

We describe the distribution of different employment choices in Figure 4.4. Each point in the figure represents the proportion of corresponding employment choice among farmers, whose land holding lies in the interval that surrounds this point. Note that every interval of land holding is 0.5 *mu*. In addition, the variances of each

⁴⁰ A lot of research has found that the extension of use right could obviously increase agricultural productivity (Li, Rozelle and Brandt, 1998).

⁴¹ Labors are defined as males with age between 16 and 65.

proportion become larger when land holding is larger than 13 mus, because the number of farmers owning large land holding becomes smaller.

The employment choice distribution in Figure 4.4 is basically consistent with the predicted trend shown in Figure 4.3. We cannot get clear observation when land holding is larger than 13 mus, because the variances become too large. When land holding is smaller than 13 mus, we can get the following observations. The proportion pure farm work mainly exhibits an increasing trend, with a moderate decrease for intermediate land holding. The proportion of migration increases in the interval of (0, 1). It steadily decreases as land become larger. The proportion of farmers choosing local wage work is pretty high when land holding is smaller than 0.5 mu. It decreases as land holding increases and reaches the bottom point when land holding is 7.5 mus. Then the proportion of local wage work increases as land increases.

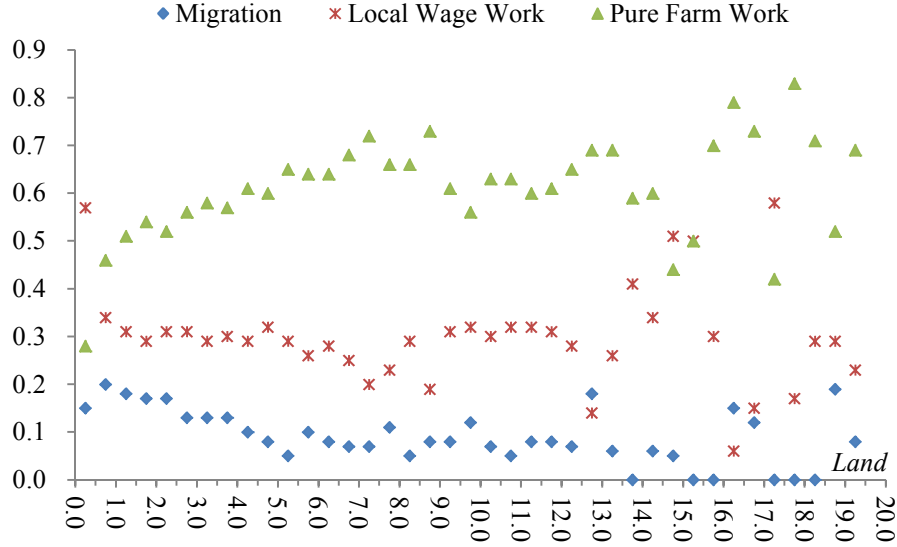


Figure 4.4 The Distribution of Different Employment Types

Note: The figure is calculated based on the data of CHIP2002. Horizontal axis measures per capita land holding. Vertical axis measures the proportion of different employment types.

4.4 Methodology

4.4.1 Testing the Probability of Migration with Binary Choice Models

4.4.1.1 The Basic Model

Under the assumption of capital constraint, $w_n < w_m - t - T_0$ and $R^M \geq R^F$, we can observe a scheme of employment choice described by Figure 4.3. A testable prediction is a negative relation between the probability of migration and land holding. We therefore design the following model to make a preliminary test.

$$y_i^* = \alpha + \beta_1 \text{land}_i + \gamma X_i + \varepsilon_i \quad (4.7)$$

where i represents the farmer i , y_i^* is a latent variable deciding whether or not to migrate (net relative income in this study). The farmer migrate if $y_i^* > 0$, does not migrate otherwise. $land_i$ means the amount of land holding, $\mathbf{X}_i$ is a vector of control variables. $\boldsymbol{\gamma}$ is the coefficient vector corresponding to $\mathbf{X}_i$. If ε_i follows Logistic distribution, we can estimate the model by Logit model. If ε_i follows normal distribution, the model can be estimated by Probit model.

We also introduce the square term of land holding to relax the linear constraint. The model with the square term is shown in (4.8).

$$y_i^* = \alpha + \beta_1 land_i + \beta_2 land_i^2 + \boldsymbol{\gamma} \mathbf{X}_i + \varepsilon_i \quad (4.8)$$

We cannot predict the sign of β_2 because it may be positive or negative. If capital constraint does not have important influences, the main shape of migration probability is the left part of a U-curve. Under this situation, β_2 should be positive. If capital constraint is serious, for a large proportion of farmers, we may see an inverted U-shaped relation between migration probability and land holding. It is because migration probability is low when $R \leq R^T$ and $R \geq R^X$, but high when $R^T < R < R^X$. An inverted U-shaped relation corresponds to a negative β_2 .

We need to be cautious to interpret the square term in a nonlinear model (Ai and Norton, 2003). Consider the following equation $E(y) = F(\beta_1 x + \beta_2 x^2 + \boldsymbol{\delta} \mathbf{Z}) = F(\cdot)$, where y is the dependent variable in a probability model (or latent variable model), x is the interested variable, $\mathbf{Z}$ is a vector of control variables, and $F(\cdot)$ is the cumulative distribution function. We can derive the following relation $\frac{\partial E(y)}{\partial x^2} = \beta_2 F'(\cdot) + (\beta_1 + \beta_2 x)^2 F''(\cdot)$. Regarding the Logit regression, we have the following equation $F(X) = \frac{1}{1+e^{-X}}$, where $X = \beta_1 x + \beta_2 x^2 + \boldsymbol{\delta} \mathbf{Z}$. Therefore $F'(X) = \frac{e^{-X}}{(1+e^{-X})^2}$ and $F''(X) = \frac{e^{-X}(e^{-X}-1)}{(1+e^{-X})^3}$. It is obvious that $F'(X) > 0$ for all X . We have $F''(X) < 0$ for $X > 0$ and $F''(X) > 0$ for $X < 0$. The influence of land holding is nonlinear. It could be positive or negative.

4.4.1.2 Endogeneity

Land holding may be endogenous. Theoretically, contracted land holding should be fixed from 1997 and constant over a period of 30 years. In reality, however, some households permanently migrate to urban areas. Their land might be redistributed to other village members. A rural household with stronger motivation to migrate into a city is less likely to rent land. Those unwilling to migrate may have stronger preference for land, because land is the most important means of agricultural production. Such a reverse causality from migration probability to land holding may

cause endogeneity. Another reason for endogeneity is that migration and land holding might be simultaneously influenced by a third variable, such as natural disaster.

A conventional instrument is the past land holding. This method is not applicable in this study. Although CHIP is a panel survey and provided household land data in 1995, only 30% of the households in CHIP 2002 were interviewed in CHIP 1995 survey. In addition, an institutional change happened in 1997. The land distribution in 1995 was quite different from that in 2002. As a result, the land holding in 1995 is not a good instrument.

Therefore we use another set of instruments, that is, the average household land holding in 1998, land productivity, homestead area and reserved land area. 1998 is the first year implementing the 1997 land contract policy. Although we do not know land holding of each household at the end of 1998, we know the total land holding and the number of households of a village. We can calculate the average household land holding in 1998. Land productivity is employed to capture the effects of land fertility. Homestead area and reserved land are constant over time because houses and reserved land was not redistributed. To test whether endogeneity is a serious problem for the variable of land holding, we employ the method explained by Wooldridge (2002). The results indicate important influences resulted from endogeneity. We therefore need to correct the estimation.

We run two-stage estimation with the instruments described above. In particular, we run an OLS regression in the first stage, with land holding in 2002 as the dependent variable while the instruments and other exogenous variables as independents. The predicted land holding is used in the second stage that is Logit or Probit regression. Because the second stage uses an estimate from the first stage, as opposed to the true value of land holding in 2002, the asymptotic sampling variance of the second-stage estimator needs to consider this extra source of variation. According to Petrin and Train (2010), we mainly have two methods to calculate the corrected variance. The first one is to bootstrap the two-stage maximum likelihood estimation, and the second one is to use the two-stage estimators developed by Murphy and Topel (1985). This study corrects the variance through bootstrap.

4.4.2 Test based on Multinomial Choice Models

The theoretical analysis predicts that the probabilities of migration and local wage work mainly decreases with land holding, while the probability of farm work increases with land holding. Consequently the model predicts that the relative probability of migration comparing with farm work has a negative relation with land holding. Similarly, it also predicts that the relative probability of local wage work decreases with land holding. The predictions can be tested by multinomial choice models.

Denote the employment choice of the farmer as y_i^M .

$$y_i^M = \begin{cases} 0, & \text{pure farm work} \\ 1, & \text{local wage work} \\ 2, & \text{migration} \end{cases} \quad (4.9)$$

Denote Π_{ij} as the optimal income if farmer i chooses choice j , as described by equation (4.10), where i represents the household i , $land_i$ means the amount of land holding, $\mathbf{X}_i$ is a vector of control variables capturing the characteristics of household i . $\boldsymbol{\gamma}$ is the vector of coefficients of $\mathbf{X}_i$.

$$\Pi_{ij} = \alpha + \beta_j land_i + \boldsymbol{\gamma}_j \mathbf{X}_i + \varepsilon_j \quad (4.10)$$

The most popular method dealing with such a discrete choice problem is the Multinomial Logit Model. Hausman test and Small-Hsiao test provide evidence for the IIA assumption (see Appendix A4.2)⁴². We use Multinomial Logit as the main approach, and still run other estimations in case that IIA assumption is invalid.

Then we can get a set of functions, which reflects the fact that the relative probability of any two choices is not influenced by a third choice.

$$\begin{aligned} \Pr(y_i^M = j) &= \Pr(\Pi_{ij} - \Pi_{ik} > 0, \forall k = 1, 2) \\ &= \Pr((\beta_j land_i + \boldsymbol{\gamma}_j \mathbf{X}_i + \varepsilon_j) - (\beta_k land_i + \boldsymbol{\gamma}_k \mathbf{X}_i + \varepsilon_k) > 0, \forall k = 1, 2) \\ &= \Pr((\beta_j - \beta_k) land_i + (\boldsymbol{\gamma}_j - \boldsymbol{\gamma}_k) \mathbf{X}_i + (\varepsilon_j - \varepsilon_k) > 0, \forall k = 0, 1, 2; k \neq j) \end{aligned} \quad (4.11)$$

Assume that the random terms follow extreme-value distribution. The difference of two independent identically distributed (i.i.d) extreme-value-distributed variables follows the logistic distribution. Namely, if ε_k follows extreme value distribution $EV(a, b)$, $\forall k = 0, 1, 2$, then $\varepsilon_k - \varepsilon_p$ follows a Logistic distribution, $Logistic(0, b)$, $\forall k, p = 0, 1, 2$ and $k \neq p$. Then we can estimate the parameters by Multinomial Logit model. And setting pure farm work as the base outcome, the coefficients of $land_i$ should be negative.

We consider two problems in the robustness check. (1) First, the IIA assumption may be invalid. Cheng and Long (2007) find that IIA tests often reject the assumption when the alternatives are distinct and often fail to reject the assumption when the alternatives are close substitutes. And they conclude that IIA tests based on the estimation of a restricted choice set are unsatisfactory for applied work. When the assumption is not satisfied, an alternative method is the Multinomial Probit Model. (2) The second problem is the endogeneity of land holding explained above. Regarding

⁴² Multinomial Logit Model relies on the assumption of Independence of Irrelevant Alternatives (IIA). The IIA assumption means that adding or deleting alternative outcome categories does not affect the relative probability among the remaining outcomes.

the IV Multinomial Logit regression, we employ the same instruments introduced in the last section.

4.5 Empirical Results

4.5.1 Results on Migration Probability

4.5.1.1 Results of Basic Binary Choice Models

The negative relationship between migration probability and land holding is proved by the estimation results of regressions (1) and (3). Both regressions show significantly negative coefficient of land holding.

Table 4.3 Results of Binary Choice Model

	(1) Logit	(2) Logit	(3) Probit	(4) Probit
Land Holding	-0.0664*** (0.0081)	-0.0930*** (0.0109)	-0.0342*** (0.0041)	-0.0509*** (0.0058)
Squared Land Holding		0.0015*** (0.0003)		0.0008*** (0.0002)
Age	0.0947*** (0.0174)	0.0952*** (0.0174)	0.0289*** (0.0091)	0.0294*** (0.0091)
Squared Age	-0.0022*** (0.0002)	-0.0022*** (0.0002)	-0.0008*** (0.0001)	-0.0008*** (0.0001)
Schooling (years)	0.0567*** (0.0093)	0.0562*** (0.0093)	0.0325*** (0.0050)	0.0322*** (0.0050)
Marriage (married=1)	-0.9010*** (0.0678)	-0.9031*** (0.0678)	-0.5066*** (0.0388)	-0.5089*** (0.0389)
Minority (minority=1)	-0.8850*** (0.0718)	-0.8805*** (0.0719)	-0.4769*** (0.0384)	-0.4724*** (0.0385)
Labor Number	0.1044*** (0.0194)	0.0997*** (0.0194)	0.0472*** (0.0108)	0.0437*** (0.0108)
Geography (suburb=1)	-0.5255*** (0.0451)	-0.5244*** (0.0451)	-0.2763*** (0.0246)	-0.2752*** (0.0246)
Village Per Capita Income	-0.1703*** (0.0182)	-0.1758*** (0.0183)	-0.0906*** (0.0096)	-0.0944*** (0.0097)
Number of Observations	21433	21433	21433	21433

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses.

The coefficients of squared land holding are significantly positive. However, the magnitudes are pretty small, indicating a mainly negative relationship between migration probability and land holding. According to the analysis in Section 4.1.1, $\frac{\partial E(y)}{\partial x^2} > 0$ if $\beta_1 + \beta_2 x < 0$. As for this study, we can conclude a U shaped relation between migration probability and land holding, if the magnitude of the negative

coefficient of land holding is sufficiently larger than the positive coefficient of squared land holding. The estimation results of specification (2) indicate that we can observe a U shaped relation between migration probability and land holding, if land holding is larger than 62 mus ($=0.093/0.0015$). Regression (4) shows that the benchmark is 63.6 mus. Therefore we can conclude a negative relation between migration probability and land holding. Actually, the positive coefficients of squared land holding indicate that capital constraint may not be a serious problem for most farmers.

Most control variables have significant influences on migration. The results show that middle-aged labors are more likely to migrate than old and young labors. Education could obviously increase the probability of migration. Marriage and minority status have negative impacts on migration. The results are understandable because married people are not willing to leave their partners alone, and minority areas are usually poor and have limited information necessary for migration. The labor number of a rural household has positive relation with migration probability. There are at least two reasons for this relation. (1) More labors imply more capital support that facilitates migration; (2) more labor number means a larger social network that could help potential migrants to get job information and reduce migration cost. Better geography condition and richer village economy also have negative influences on migration.

4.5.1.2 Results of Instrumental Estimation on Binary Choice Models

After controlling endogeneity, the coefficients of squared land holding become insignificant. It provides stronger evidence for the negative relationship between migration probability and land holding. The magnitudes of coefficients of land holding in IV estimations are much larger than those shown in Table 4.4. In addition, the insignificant coefficients indicate that capital constraint may not be a serious problem for most farmers because the negative coefficient of land holding is not biased by the squared terms.

The results on control variables are consistent with the results shown in Table 4.3. Middle-aged farmers are more likely to migrate. Married and minority farmers are less likely to migrate. The number of household labors has a negative relationship with the probability of migration. And farmers living in better geographical areas are less likely to migrate.

Table 4.4 IV Estimation Results of Binary Choice Model

	(1)	(2)	(3)	(4)
	IV Logit	IV Logit	IV Probit	IV Probit
Land Holding	-0.1672*** (0.0149)	-0.1790*** (0.0369)	-0.0896*** (0.0081)	-0.0882*** (0.0204)
Squared Land Holding		0.0005 (0.0016)		-0.0001 (0.0008)
Age	0.1141*** (0.0223)	0.1145*** (0.0222)	0.0372*** (0.0107)	0.0371*** (0.0107)
Squared Age	-0.0025*** (0.0003)	-0.0025*** (0.0003)	-0.0010*** (0.0001)	-0.0010*** (0.0001)
Schooling (years)	0.0508*** (0.0101)	0.0507*** (0.0085)	0.0304*** (0.0058)	0.0304*** (0.0058)
Marriage (married=1)	-0.9206*** (0.0747)	-0.9228*** (0.0826)	-0.5263*** (0.0451)	-0.5261*** (0.0452)
Minority (minority=1)	-0.7394*** (0.0845)	-0.7315*** (0.1044)	-0.3989*** (0.0456)	-0.4000*** (0.0472)
Labor Number	0.0399* (0.0239)	0.0371 (0.0230)	0.0147 (0.0132)	0.0153 (0.0140)
Geography (suburb=1)	-0.5409*** (0.0604)	-0.5389*** (0.0569)	-0.2718*** (0.0301)	-0.2719*** (0.0303)
Village Per Capita Income	-0.1708*** (0.0211)	-0.1739*** (0.0184)	-0.0934*** (0.0107)	-0.0929*** (0.0117)
Number of Observations	15460	15460	15460	15460

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses. The coefficients of control variables are consistent with the results described in Table 4.3.

4.5.2 Results of Multinomial Choice Models

4.5.2.1 Results on Ordinary Multinomial Choice Models

The results of Multinomial Logit regression and Multinomial Probit regression are presented in Table 4.5. The coefficients of land holding are significantly negative according to both estimations, indicating that more land holding reduces the relative probabilities of migration and local wage work.

Most control variables show significant influences on migration probabilities. The influence of age is statistically significant, and the economic magnitude is also significant. Schooling-year has positive impacts on both local wage work and migration. Married status reduces the relative probabilities of both migration and local wage work. Minority status corresponds to lower probabilities of migration. Geographic condition does not show important influence on migration. Average per capita income of village has negative effect on migration. The reason for this result

may be that a better developed rural economy could provide more job opportunities within villages and reduces migration.

Table 4.5 Results of Ordinary Multinomial Choice Models

	(1) Multinomial Logit		(2) Multinomial Probit	
	Local Wage Work	Migration	Local Wage Work	Migration
Land Holding	-0.0418*** (0.0046)	-0.0797*** (0.0083)	-0.0339*** (0.0036)	-0.0571*** (0.0054)
Age	0.0690*** (0.0117)	0.1222*** (0.0178)	0.0583*** (0.0094)	0.0581*** (0.0124)
Squared Age	-0.0008*** (0.0001)	-0.0025*** (0.0002)	-0.0007*** (0.0001)	-0.0013*** (0.0002)
Schooling (years)	0.1530*** (0.0067)	0.1112*** (0.0098)	0.1246*** (0.0054)	0.0919*** (0.0070)
Marriage (married=1)	-0.0791 (0.0655)	-0.9265*** (0.0714)	-0.0947* (0.0515)	-0.6831*** (0.0546)
Minority (minority=1)	-0.2911*** (0.0520)	-0.9309*** (0.0727)	-0.2416*** (0.0413)	-0.6758*** (0.0521)
Labor Number	-0.3764*** (0.0167)	-0.0114 (0.0201)	-0.2898*** (0.0130)	-0.0466*** (0.0149)
Geography (suburb=1)	-0.1405*** (0.0337)	-0.5797*** (0.0467)	-0.1239*** (0.0275)	-0.4066*** (0.0339)
Village Per Capita Income	0.2781*** (0.0120)	-0.0425** (0.0196)	0.2297*** (0.0098)	-0.0044 (0.0137)
Number of Observations	21433		21433	

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses. (1) is estimated by Multinomial Logit regression, (2) is estimated by Multinomial Probit regression.

4.5.2.2 Results on IV Multinomial Choice Models

Table 4.6 presents the estimation results of IV Multinomial Logit estimations. The variances in Table 4.6 are calculated through bootstrap. The coefficients of land holding are statistically significant for local wage work and migration in both estimations. The results provide further evidence for the theoretical predictions that relative probabilities of both local wage work and migration have negative relation with land holding. The IV estimation results are consistent with the ordinary Multinomial Logit estimations.

Table 4.6 IV Estimation Results of Multinomial Choice Models

	(1)		(2)	
	IV Multinomial Logit		IV Multinomial Probit	
	Local Wage Work	Migration	Local Wage Work	Migration
Land Holding	-0.0950*** (0.0107)	-0.1979*** (0.0158)	-0.0752*** (0.0090)	-0.1482*** (0.0110)
Age	0.0941*** (0.0131)	0.1495*** (0.0202)	0.0782*** (0.0109)	0.0751*** (0.0152)
Squared Age	-0.0011*** (0.0002)	-0.0029*** (0.0003)	-0.0009*** (0.0001)	-0.0016*** (0.0002)
Schooling (years)	0.1487*** (0.0088)	0.1043*** (0.0106)	0.1200*** (0.0063)	0.0881*** (0.0076)
Marriage (married=1)	-0.1918*** (0.0732)	-0.9864*** (0.0826)	-0.1866*** (0.0625)	-0.7429*** (0.0554)
Minority (minority=1)	-0.1981*** (0.0610)	-0.7584*** (0.0873)	-0.1803*** (0.0504)	-0.5446*** (0.0650)
Labor Number	-0.4098*** (0.0207)	-0.0877*** (0.0243)	-0.3141*** (0.0187)	-0.1004*** (0.0213)
Geography (suburb=1)	-0.1941*** (0.0443)	-0.6082*** (0.0635)	-0.1694*** (0.0317)	-0.4181*** (0.0396)
Village Per Capita Income	0.2561*** (0.0153)	-0.0497** (0.0242)	0.2110*** (0.0121)	-0.0173 (0.0155)
Number of Observations	15460		15460	

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses. (1) is estimated by Multinomial Logit regression, (2) is estimated by Multinomial Probit regression.

4.6 Evaluating the Influences of Collective Land Ownership

Comparing with private land ownership, collective land ownership is characterized by an equal land distribution. Therefore, we can conclude that collective land ownership stimulates migration if the mean of per capita land holding lies in the interval (R^T, R^X) . In order to evaluate the influences of collective land ownership, we therefore need to estimate the values of R^T and R^X . Section 6.1 develops a framework to achieve this object.

4.6.1 The Value of R^T

Capital constraint is likely to be faced by some poor farmers. In this section, we find the threshold R^T , over which farmers are likely to be able to overcome capital constraint. The theoretical analysis predicts that migration probability has a negative relationship with land holding when $R > R^T$. We find the rough value of R^T by descriptive analysis. We present the distribution of migrant proportion over land holding in Figure 4.5. Each star in the figure represents the proportion of migration

among farmers, whose land holding lies in the interval that surrounds this point. Note that every interval of land holding is 0.25 mu. The number above the star in the figure shows the proportion of migration in a certain interval.

It is easy to observe a positive relationship between migration proportion and land holding when land is smaller than 0.75 mu. This positive relation provides evidence for the function of land as capital that facilitates migration. Many farmers cover migration cost by savings (Armstrong and Lewis, 2009). Land can improve farmers' income and enable them to save enough money to overcome capital constraint. Farmers can also borrow from relatives and friends to finance migration. Under this situation, more land increases the probability that a potential migrant can get financial support from her relatives and friends, because the land use-right can be regarded as an insurance that the potential migrant will pay back⁴³. No matter in which way, the land improves farmers' ability to overcome capital constraint.

According to Figure 4.5, if land is larger than 0.75 mu, the relation between migration proportion and land holding becomes negative. This indicates that 0.75 can be regarded as a rough estimate of R^T .

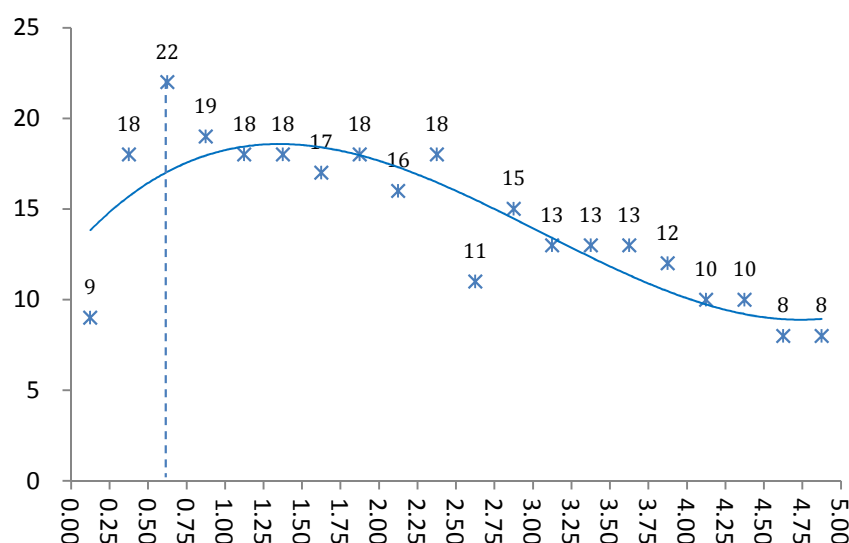


Figure 4.5 The Distribution of Migrant Proportion over Land Holding

4.6.2 The Value of R^X

4.6.2.1 The Methodology of Estimating R^F , R^M and R^X

In order to clear the influences of capital constraint, we drop the 10% poorest farmers and use the data of relatively rich farmers in the following empirical analysis⁴⁴. Then each remaining farmer has three choices: pure farm work, local wage work and migration. Denote the employment choice as y .

⁴³ If the potential migrant does not pay back borrowed money, the lender may claim for the land use-right.

⁴⁴ The 10% is arbitrarily decided. In order to test robustness, we also use different sub-samples in the estimation.

$$y_i = \begin{cases} 0, & \text{pure agricultural work} \\ 1, & \text{local wage work} \\ 2, & \text{migration} \end{cases} \quad (4.14)$$

A farmer decides the employment type according to the income of different choices. Π_{ij} is the optimal income if farmer i chooses $y_i = j$, $j = 0, 1, 2$. We assume that the optimal income of each choice is influenced by some random factors (ε). The farmer chooses the employment type that maximizes her income. In order to better understand the estimation process, we first discuss the estimation without considering control variables. The controls will be introduced later. According to the theoretical analysis, the incomes of three employment types are respectively as follows.

$$\Pi_{i0} = Pf(1, R_i) + \varepsilon_0 \quad (4.15)$$

$$\Pi_{i1} = Pf(l_f^N, R_i) + w_n(1 - l_f^N) + \varepsilon_1$$

$$\Pi_{i2} = Pf(l_f^M, R_i) + (w_m - t)(1 - l_f^M) - T_0 + \varepsilon_2$$

l_f^N and l_f^M denote the optimal labor allocation, the definitions of which are consistent with those defined in the settings. Then we can get a set of functions described by (4.16), reflecting the fact that the relative probability of any two choices is not influenced by a third choice.

$$\Pr(y_i = 0) = \Pr(\Pi_{i0} > \Pi_{i1}, \Pi_{i0} > \Pi_{i2}) \quad (4.16)$$

$$\Pr(y_i = 1) = \Pr(\Pi_{i1} > \Pi_{i0}, \Pi_{i1} > \Pi_{i2})$$

$$\Pr(y_i = 2) = \Pr(\Pi_{i2} > \Pi_{i0}, \Pi_{i2} > \Pi_{i1})$$

Assume that the random terms are independent and identically follow extreme-value distribution, we can obtain the following probabilities, where $M = \exp(\Pi_{i0} - \varepsilon_0) + \exp(\Pi_{i1} - \varepsilon_1) + \exp(\Pi_{i2} - \varepsilon_2)$.

$$\Pr(y_i = 0) = M^{-1} \exp(Pf(1, R_i)) \quad (4.17)$$

$$\Pr(y_i = 1) = M^{-1} \exp(Pf(l_f^N, R_i) + w_n(1 - l_f^N))$$

$$\Pr(y_i = 2) = M^{-1} \exp(Pf(l_f^M, R_i) + (w_m - t)(1 - l_f^M) - T_0)$$

Setting pure agricultural work as the reference group, then the logs of relative probabilities are as follows. Then we are able to estimate the model by constraint Multinomial Logit regression.

$$\ln \left(\frac{\Pr(y_i=1)}{\Pr(y_i=0)} \right) = Pf(l_f^N, R_i) + w_n(1 - l_f^N) - Pf(1, R_i) \quad (4.18)$$

$$\ln\left(\frac{\Pr(y_i=2)}{\Pr(y_i=0)}\right) = Pf(l_f^M, R_i) + (w_m - t)(1 - l_f^M) - T_0 - Pf(1, R_i)$$

Notice that $Pf(l_f^N, R_i) + w_n(1 - l_f^N) - Pf(1, R_i)$ is the difference between the income of pure farm work and local wage work. It is a decreasing function of R_i , and the value equals to 0 when $R_i > R^M$. $Pf(l_f^M, R) + (w_m - t)(1 - l_f^M) - T_0 - Pf(1, R_i)$ measures the income gap between migration and pure farm work. It is also a decreasing function of land holding, with the value being 0 if $R_i > R^F$.

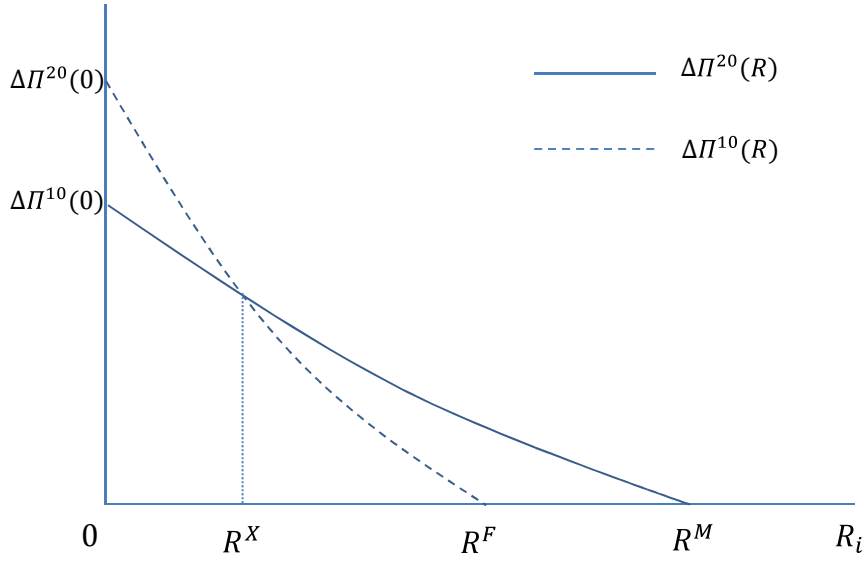


Figure 4.6 Income Gaps and Land Holding

Note: $\Delta\Pi^{20}(R) = Pf(l_f^M, R) + (w_m - t)(1 - l_f^M) - T_0 - Pf(1, R)$, and $\Delta\Pi^{10}(R) = Pf(l_f^N, R) + w_n(1 - l_f^N) - Pf(1, R)$. By definitions and taking $R = 0$, we know $\Delta\Pi^{20}(0) = w_m - t - T_0$ and $\Delta\Pi^{10}(0) = w_n$.

In order to derive practical estimation, we use a linear function $C_n + \beta_n R_i$ to approximate $Pf(l_f^N, R_i) + w_n(1 - l_f^N) - Pf(1, R_i)$ when $R_i < R^M$, where C_n is a constant and β_n is the slope of the corresponding line. We use another linear function $C_m + \beta_m R_i$ to approximate the income difference $Pf(l_f^M, R) + (w_m - t)(1 - l_f^M) - T_0 - Pf(1, R_i)$ when $R_i < R^F$. C_m and β_m are respectively a constant and the slope. The two linear functions can be fitted by regression. With the linear approximation, the econometric model becomes that shown in 4.19.

Because the difference between the incomes of pure farm work and local wage work is a decreasing function of R_i , we expect β_n to be negative. Similarly we also

expect β_m to be negative. By the analysis with envelope theorem in Proposition 2, $\frac{\partial(\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$, we also predict $|\beta_m| > |\beta_n|$.

$$\ln \left(\frac{\Pr(y_i=1)}{\Pr(y_i=0)} \right) = \alpha_1 + \beta_n D_n \text{land}_i \quad (4.19)$$

$$\ln \left(\frac{\Pr(y_i=2)}{\Pr(y_i=0)} \right) = \alpha_2 + \beta_m D_m \text{land}_i$$

where D_m and D_n are two dummy variables. $D_m = 1$ if $R < R^F$ and $D_m = 0$ otherwise; $D_n = 1$ if $R < R^M$ and $D_n = 0$ otherwise. α_1 and α_2 are constants.

Note that the values of R^F and R^M are unknown beforehand. It is necessary to estimate the R^F and R^M as parameters. We obtain the estimated value of R^F and R^M by searching. In particular, we set a proper interval for R^F , with $R^F \in (0, 30]$ ⁴⁵. Then we set $R^M \in (R^F, 30]$. For each value combination of R^F and R^M we are able to estimate the model described in (4.19) by constraint Multinomial Logit regression. The optimal combination of R^F and R^M , which is able to maximize the log likelihood, is then chosen as the estimated value, namely $\hat{R}^F$ and $\hat{R}^M$.

In order to do significance test, we use bootstrap technique to re-estimate the process described above and obtain the mean and variance of $\hat{R}^F$ and $\hat{R}^M$.

Introducing control variables in equations shown in (4.19), we can obtain the econometric model shown in (4.20) by similar process described above, where γ_0 , γ_1 and γ_2 are coefficient vectors of the control variables corresponding to the three equations in (4.15).

$$\ln \left(\frac{\Pr(y_i=1)}{\Pr(y_i=0)} \right) = \alpha_1 + \beta_n D_n \text{land}_i + (\gamma_1 - \gamma_0) X_i \quad (4.20)$$

$$\ln \left(\frac{\Pr(y_i=2)}{\Pr(y_i=0)} \right) = \alpha_2 + \beta_m D_m \text{land}_i + (\gamma_2 - \gamma_0) X_i$$

Assuming that the random terms follow normal distribution, we can estimate the econometric model with Multinomial Probit regression. Multinomial Probit regression does not rely on the IIA assumption. We therefore use Multinomial Probit estimation as a robustness check⁴⁶.

⁴⁵ 30 is larger than the 99% percentile value of land holding.

⁴⁶ Cheng and Long (2007) find that IIA tests often reject the assumption when the alternatives are distinct and often fail to reject the assumption when the alternatives are close substitutes. And they conclude that IIA tests based on the estimation of a restricted choice set are unsatisfactory for applied work. When the assumption is not satisfied, an alternative method is the Multinomial Probit Model.

Because $\Pi_{i1} - \Pi_{i0}$ is approximated by the expression $C_n + \beta_n R_i$ and $\Pi_{i2} - \Pi_{i0}$ is approximated by $C_m + \beta_m R_i$, we can calculate R^X by the estimated values of $\hat{\beta}_n$, $\hat{\beta}_m$, $\hat{R}^F$ and $\hat{R}^M$. The calculation is as follows.

Since $C_n + \hat{\beta}_n \hat{R}^M = 0$, we know that $C_n = -\hat{\beta}_n \hat{R}^M$. Therefore $\Pi_{i1} - \Pi_{i0} \approx -\hat{\beta}_n \hat{R}^M + \hat{\beta}_n R_i$. By $C_m + \hat{\beta}_m \hat{R}^F = 0$, we can get $C_m = -\hat{\beta}_m \hat{R}^F$. Therefore $\Pi_{i2} - \Pi_{i0} \approx -\hat{\beta}_m \hat{R}^F + \hat{\beta}_m R_i$.

Since R^X implies $\Pi_{i1} = \Pi_{i2}$, we can get the estimated value of R^X by solving the following equation: $-\hat{\beta}_n \hat{R}^M + \hat{\beta}_n \hat{R}^X = -\hat{\beta}_m \hat{R}^F + \hat{\beta}_m \hat{R}^X$, where $\hat{R}^X$ is the estimated value of R^X . Therefore, $\hat{R}^X$ is calculated based on equation (4.21).

$$\hat{R}^X = \frac{\hat{\beta}_n \hat{R}^M - \hat{\beta}_m \hat{R}^F}{\hat{\beta}_n - \hat{\beta}_m} \quad (4.21)$$

With the value of $\hat{R}^T$ and $\hat{R}^X$, we can evaluate the influences of collective land ownership. In particular, we can conclude whether collective land ownership stimulates migration or local wage work. If the mean of per capita land holding lies in the interval $(\hat{R}^T, \hat{R}^X)$, it indicates that collective land ownership stimulates migration.

4.6.2.2 Estimation Results of R^F , R^M and R^X

The coefficients of interaction terms between land holding and dummies are significantly negative. This provides some evidence for the decreasing relative probability described in Figure 4.3. The magnitude of $\hat{\beta}_m$ is obviously larger than that of $\hat{\beta}_n$, which is exactly as predicted by the theoretical model (see $\frac{\partial(\Pi^n(R) - \Pi^m(R))}{\partial R} > 0$ in Proposition 2).

$\hat{R}^F$ is estimated as 22.6 by Multinomial Logit regression. This is larger than 99% percentile of per capita land holding. It means migration is better than pure farm work for most Chinese farmers, because they only have limited land. The estimated $\hat{R}^F$ based on Multinomial Probit regression is similar to that of Multinomial Logit regression, indicating robustness.

$\hat{R}^X$ is respectively 16.9 and 16.5 based on Multinomial Logit and Multinomial Probit regression. Either value is obviously larger than $\hat{R}^T$ and the mean of per capita land holding (3.6 mus). It indicates that the collective land ownership in China, which distributes land evenly, stimulates migration.

Table 4.7 Results of R^F , R^M and R^X Estimation

	(1) Multinomial Logit		(2) Multinomial Probit	
	Local Wage Work	Migration	Local Wage Work	Migration
$\hat{R}^F$	22.6*** (11.145)	22.6*** (11.145)	22.6** (12.142)	22.6** (12.142)
$\hat{R}^M$	26.1*** (9.0940)	26.1*** (9.0940)	25.6*** (9.041)	25.6*** (9.041)
$\hat{R}^X$	16.9 (14.816)	16.9 (14.816)	16.5 (14.872)	16.5 (14.872)
$\hat{\beta}_m: D_m land_i$		-0.1018*** (0.0095)		-0.0791** (0.0073)
$\hat{\beta}_n: D_n land_i$	-0.0571*** (0.0058)		-0.0504*** (0.0051)	
Age	0.0570*** (0.0125)	0.1230*** (0.0189)	0.0456*** (0.0111)	0.0369*** (0.0146)
Squared Age	-0.0007*** (0.0001)	-0.0025*** (0.0003)	-0.0006*** (0.0001)	-0.0011*** (0.0002)
Schooling (years)	0.1513*** (0.0071)	0.1061*** (0.0103)	0.1251*** (0.0063)	0.0882*** (0.0082)
Marriage (married=1)	-0.0653 (0.0702)	-0.9699*** (0.0757)	-0.0782 (0.0608)	-0.6939*** (0.0643)
Minority (minority=1)	-0.3585*** (0.0563)	-0.9732*** (0.0769)	-0.3249*** (0.0502)	-0.8067*** (0.0643)
Labor Number	-0.3874*** (0.0176)	-0.0219 (0.0211)	-0.3007*** (0.0149)	-0.0608*** (0.0172)
Geography (suburb=1)	-0.1445*** (0.0353)	-0.5779*** (0.0484)	-0.1196*** (0.0314)	-0.4258*** (0.0386)
Village Per Capita Income	0.2660*** (0.0124)	-0.0655*** (0.0203)	0.2172*** (0.0108)	-0.0156*** (0.0149)
Number of Observations	21433		21433	

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses. (1) is estimated by Multinomial Logit regression, (2) is estimated by Multinomial Probit regression.

4.6.3 Policy Implications

Collective land ownership stimulates migration, because the mean of per capita land holding is 3.6 mus and this value lies in the interval $(\hat{R}^T, \hat{R}^X)$. The result is consistent with Yao (2001) in concluding that more egalitarian land distribution promotes temporary migration.

Although collective land ownership stimulates temporary migration, it does not imply a positive influence on permanent migration. This is because the cost of permanent migration is pretty high under collective land ownership. A farmer has to

give up her land rights if she permanently moves into a city. As well as this direct cost, we should note that collectively owned land functions as a kind of social insurance for the rural residents in developing countries⁴⁷. Losing land ownership means losing an important insurance. A third problem concerns capital constraint. Comparing with private-owned land ownership, collectively owned land ownership does not allow a farmer to sell or mortgage her land to get capital for permanent migration.

The contradict influences of collective land ownership on temporary and permanent migration indicate large pressure on land institution reform. When economic development makes the urban income increasingly higher, more farmers are willing to permanently migrate into cities. However, they are unwilling to give up their land rights because of the increasing value of rural land. As a result, more and more farmers will oppose collective land ownership. Collective land ownership may have to change to meet the demand of migrants.

4.7 Conclusions

We establish a simple household model to analyze the influence of land on temporary migration. We find that the probability of migration is high when land holding is at the intermediate level. If the land holding is small, farmers tend to choose local wage work instead of migration. When a farmer has pretty large land holding, she is more likely to choose pure farm work. The theoretical conclusions are supported by the data of Chinese Household Income Project (CHIP).

The results indicate that collective land ownership, which is characterized by an even-distribution of land, especially stimulates migration. The reason is that more farmers have intermediate land holdings under collective land ownership, and such farmers have two characteristics: (1) the marginal productivity of their farm labor is low so that they are willing to migrate, and (2) they do not face capital constraint in migration so that they can migrate.

Although collective land ownership stimulates temporary migration, it restrains permanent migration. Collective land ownership is characterized by high institutional cost of permanent migration that is abandoning all land rights. This paradox implies that collective land ownership will face more and more challenge from potential permanent migrants in the process of urbanization.

⁴⁷ Potts and Mutambirwa (1990) find that migrated farmers try to keep in touch with the rural area when they study the migration in Zimbabwe. Their explanation is that farmers are not willing to permanently migrate into urban areas because of the poor social security system and the insurance function of collectively owned land.

Appendix A4.1 Test of Endogeneity

According to Woodridge (2002), to test whether it is necessary to use an instrumental variable amounts to test whether a set of estimates obtained by least squares is consistent or not. An augmented regression test can be formed by two steps. The first step is to regress the endogenous variable over all exogenous variables and obtain the residuals. The second step is to include the residuals in a regression of the original model. The original model may be a Probit model for discrete dependent variable model, or OLS regression. If the coefficient of the residual of endogenous variable is significantly different from zero, then the original regression is not consistent (Rivers and Vuong, 1988).

Table A4.1 Endogeneity Test

	(1)	(2)	(3)
	Land Holding 2002	Logit Model	Probit Model
Residual from 1 st Stage		0.1607*** (0.0169)	0.0881*** (0.0091)
Land Holding in 2002		-0.1684*** (0.0151)	-0.0925*** (0.0080)
Land Holding in 1998	0.0871*** (0.0048)		
Productivity	-0.0003*** (0.0001)		
Homestead	1.0498*** (0.0800)		
Reserved Land	-0.0443*** (0.0080)	0.0125*** (0.0047)	0.0264*** (0.0046)
Age	0.0580*** (0.0160)	0.1145*** (0.0199)	0.0374*** (0.0105)
Squared Age	-0.0008*** (0.0002)	-0.0025*** (0.0003)	-0.0010*** (0.0001)
Schooling (years)	-0.0279*** (0.0093)	0.0507*** (0.0105)	0.0305*** (0.0058)
Marriage (married=1)	-0.1282 (0.0866)	-0.9221*** (0.0762)	-0.5279*** (0.0444)
Minority (minority=1)	0.3179*** (0.0732)	-0.7381*** (0.0824)	-0.3983*** (0.0450)
Labor Number	-0.7657*** (0.0213)	0.0405* (0.0234)	0.0129 (0.0131)
Geography (suburb=1)	-0.7175*** (0.0512)	-0.5407*** (0.0542)	-0.2766*** (0.0297)
Village Average Per Capita Income	-0.0583*** (0.0164)	-0.1713*** (0.0195)	-0.0941*** (0.0106)
R-squared	0.459		
Number of Observations	15460	15460	15460

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Standard errors are in parentheses. Instruments are land holding in 1998, land productivity, homestead area and reserved land holding.

The test results are shown in Table A4.1. From the statistics of first stage regression, we can see that all instruments are valid instruments for total land holding, although they are weak to some extent. In addition, the regression results of (2) and (3) show that coefficients of residuals are significant, indicating that endogeneity has important influences. Therefore we need to use instruments to correct the bias resulted from endogeneity.

Appendix A4.2 Test of IIA Assumption

Hausman and McFadden (1984) proposed an approach testing the IIA assumption, the idea of which is that if choices are truly independent, the odds ratios will not change if the model is estimated on a sub-set of alternatives. This method of IIA test was improved by Small and Hsiao (1985). We use both tests in this study.

Regarding the results of Hausman test of IIA assumption, the Chi-square test provides evidence for the null hypothesis. But the probability omitting migration becomes very small, which is evidence against IIA assumption. With regard to Small-Hsiao test, the assumption is supported by the tests omitting either employment type. To sum up, the tests provide some evidence for IIA assumption.

Table A4.2 IIA Assumption Test

Method	Omitted	Chi-square	Degree of Freedom	P>chi2	Evidence
Hausman Test	1	9.618	9	0.382	For IIA Assumption
	2	127.031	9	0.000	Against IIA Assumption
Small-Hsiao Test	1	7.402	10	0.687	For IIA Assumption
	2	10.496	10	0.398	For IIA Assumption

Chapter 5

Financial Development and Rural-Urban Inequality: Evidence from China

This chapter assesses the impacts of financial development on rural-urban inequality with the panel data of China's 31 provinces. We find that credit service deteriorates income distribution if it is only available to the rich people. When the credit coverage becomes wide, finance helps to reduce income inequality. In addition, finance plays different roles at different stages of economic development. At the starting stage of economic growth, where physical capital is the engine of economic development, financial development reduces income inequality. In a mature economy, where the return to human capital is much higher, financial development may increase income inequality.

5.1 Introduction

China has experienced an obvious increase of income inequality since the Reform and Openness, with the Gini Index having reached 0.458 in 2010. A number of economists have devoted their efforts to finding the reasons of the unequal income distribution. Some have turned their attention to the influence of financial development. Up to now, the relationship between finance and income inequality has been studied from different perspectives, and theories can be classified as the following three classes.

A popular view is that financial development may primarily benefit the rich and deteriorate income inequality. Since the poor do not have enough collateral, it is difficult for them to get loans and other financial services due to adverse selection and moral hazard problems. Consequently financial institutions mainly channel money to the rich and the well-connected (Rajan and Zingales, 2003). Therefore income gap is enlarged by financial development.

Other theories suggest that financial development promotes economic growth and decrease inequality. From the household perspective, financial development may improve the human capital accumulation of the poor. If financial help is unavailable when the poor households suffer from negative income shocks, they may take their kids out of school (Banerjee and Newman, 1993; Jacoby and Skoufias, 1997; Baland and Robinson, 1998). Therefore the development of financial market and wider access

to credit will help those poor households to deal with adverse shocks and to smooth consumption, so as to accumulate human capital. Demircuc-Kunt and Levine (2009) argue that a less developed financial market increases the degree to which the level of assets (physical capital) influences the investment opportunities and returns. If an individual's investment opportunities are constrained by parental wealth, lower levels of financial market can foster persistent inequality. Another perspective concerns firms and employment. Financial development may improve market competition and reduce discrimination and consequently benefits the poor (Black and Strahan, 2002; Kerr and Nanda, 2007; Levine, Levkov and Rubinstein, 2008). What is more important is that financial market development can disproportionately benefit the small and medium enterprises (SMEs) that employ much more labor force than those large companies. The growth of SMEs may result in growing demand for less skilled workers. As a result, the job opportunities and wages of those workers will increase (Banerjee and Newman, 1993; Beck et al, 2008).

Some economists, like Greenwood and Jovanovic (1989), Agihon and Bolton (1997), Matsuyama (2000) and Galor and Moav (2004), suggest that different impacts may dominate at different stages of economic development. And the influence of financial development on inequality may be nonlinear. Since China's rural residents are generally poor, the development of rural credit might enable them to consume more and save less. As a result, the rural investment and economic development is restrained and the rural-urban gap might be enlarged. Some investigations show that most of the micro-finance credit in the rural areas is used for household consumption instead of investment in agricultural tools, fertilizers or seeds. Those facts are in favor of the theory of Galor and Moav (2004).

While the existing studies provide evidence that finance has important relation with income distribution, they hold different views on whether financial development increases or decreases income inequality. It is straightforward to proceed further and investigate empirically how financial development could influence income distribution. Existing literature does not solve this problem in a satisfying way. A lot of researches test one or two theories at one time (Beck et al., 2004; Zhang et al., 2004; Yao, 2005; Clarke et al., 2006). However, financial development can influence income inequality through various channels, as indicated by many existing theories. Therefore it is necessary to test different theories simultaneously.

This paper tests different theories on the relation between financial development and income inequality with the data of China. It is found that credit service would deteriorate income distribution if it is only available to the rich people. When the credit coverage becomes wide, finance helps to reduce income inequality. In addition, finance plays different roles at different stages of economic development. At the starting stage of economic growth, where physical capital is the engine of economic

development, financial development reduces income inequality. In a mature economy, where the return to human capital is much higher, financial development may increase income inequality. As for the present Chinese economy, the development of financial development may help reduce rural-urban inequality.

The remainder of the paper is organized as follows. Section 5.2 describes the data and empirical methodology. The methodology in this paper takes into account of three classes of theories discussed above. Section 5.3 presents the estimation results and Section 5.4 summarize the conclusions.

5.2 Data and Methodology

5.2.1 The Data

We construct a panel of China's 31 provinces to study the impacts of finance on rural-urban inequality. The data are collected from the Statistic Yearbook of each province. Since China's National Accounting System was established in 1978, the data quality of the beginning years might not be high enough and there are a lot of missing values in the data from 1978 to 1980. Therefore we use the data from 1981 to 2008. In 1984 the National Bureau of Statistics of China (NBSC) established Urban Survey Teams and Rural Survey Teams in every province and county of China so as to provide better data. In order to test the robustness of the results we will estimate with the data from 1985 to 2008 and compare with the regression results of the data from 1981 to 2008.

The dependent variable GAP is defined as the ratio of the average income of urban residents to the average income of rural residents. Note that the statistical approach of the urban resident income is different from that of the rural resident income. The urban resident income is the *disposable income* of an urban resident. Disposable income = gross income - taxes - expenditure for social security - necessities. The rural resident income is the *net income* of a rural resident, a part of which must be invested in agriculture production. Consequently GAP_{it} underestimates the rural-urban inequality. However, it is not an important problem for our research, because we focus on the dynamics of the rural-urban inequality. As long as the statistical approaches keep stable, we can get credible conclusions.

The key explanatory variable is financial development. Financial development is the growth of financial services. "Financial service" in this study refers to loans, deposit service, insurance and other kinds of financial products. With those financial services, people can overcome capital constraint and manage risk to some extent. Measuring financial development is important for us to evaluate the progress and functions of financial sector. However, it is difficult to measure financial development, because the complicated meaning and wide coverage of finance. Some researchers use

M2 as a share of GDP. But M2 does not reflect a key function of financial intermediaries that is the channeling of society's savings to investment. Other researchers, like Levin (1993), use the ratio of commercial bank assets to commercial bank plus central bank assets. This indicator ignores the fact that commercial banks are not the only financial institutions intermediating society's resources. We follow Beck, Demirguc-Kunt and Levine (2007) to use the ratio of loans to GDP in the present study. Although this indicator cannot perfectly capture the full dimensions of financial development, it is better than many other widely used measures. In order to do robustness check, we use another indicator that is the ratio of the sum of loans and deposits to GDP, which is used by Xu (2010). It describes the total amount of financial resources relative to the economic aggregate. Although the economic sense is not as good as that of the main indicator, we can use it to test the robustness of the results.

$$FD1 = \frac{Loans}{GDP} \quad (5.1)$$

$$FD2 = \frac{Loans+Deposits}{GDP} \quad (5.2)$$

The variable of *GOV* is employed as a control variable, which measures the extent of local government intervention in the economy. It is defined as the ratio of fiscal revenue to GDP or the ratio of fiscal expenditure to GDP. If China's local governments function well in transfer payment, the variable of *GOV* should have a negative impact on rural-urban inequality. In reality, however, local governments in China pay most of their attention to the construction of infrastructural facilities and are not interested in transfer payment. In addition, the local governments often channel rural resources, such as land, forests and mineral resources, to urban sectors with paying pretty low prices to farmers. Moreover, with regard to the corruption problem in China, rural-urban inequality may be enlarged by more government intervention.

$$GOV1 = \frac{Fiscal\ Revenue}{GDP} \quad (5.3)$$

$$GOV2 = \frac{Fiscal\ Expenditure}{GDP} \quad (5.4)$$

DEV is another control variable that reflects the employment structure and grasps the labor migration effects. It is defined as the proportion of labor force employed by the secondary sector and the tertiary sector. Actually the proper indicator should be urbanization rate, which is the ratio of urban population to total population. In China, however, the urbanization rate is an ambiguous concept because of the Household Registration System (*Hukou System*). Sometimes a farmer is defined as an urban resident because she lives in a suburb, which belongs to the urban area

according to the *Hukou System*. *DEV* is a better indicator than urbanization rate in this research because it is defined according to real economic activities.

The summary statistics of the variables are presented in Table 5.1. The panel data cover 31 provinces and 28 years. Most data are collected from the *China Statistics Yearbook* of different years.

Table 5.1 Summary Statistics

Variable	Observation	Mean	Standard Deviation	Minimum Value	Maximum Value
<i>GAP</i>	859	2.55	0.87	0.97	14.92
<i>FD1</i>	868	0.89	0.29	0.20	2.25
<i>FD2</i>	868	1.86	0.74	0.71	5.94
<i>PCGDP</i>	868	0.69	0.93	0.02	7.31
<i>GOV1</i>	864	0.09	0.05	-0.08	0.54
<i>GOV2</i>	864	0.15	0.10	0.05	0.96
<i>DEV</i>	858	0.46	0.18	0.16	0.95

Note: The unit of *PCGDP* is 10000Yuan (about 1587 U.S. dollars). Yuan is China's currency unit (1 US dollar= 6.3 Yuan, 100 Yuan=15.86 U.S. dollars).

5.2.2 The Methodology

5.2.2.1 The Econometric Model

In this study, we design an econometric model to simultaneously test three classes of theories on the relation between inequality and financial development. We specify the model as in equation (5.5).

$$\begin{aligned}
 GAP_{it} = & \gamma GAP_{it-1} + \beta_1 FD_{it} + \beta_2 FD_{it}^2 + \beta_3 PCGDP_{it} + \beta_4 PCGDP_{it}^2 + \beta_5 PCGDP_{it} * FD_{it} \\
 & + \beta_6 PCGDP_{it}^2 * FD_{it} + \beta_7 GOV_{it} + \beta_8 DEV_{it} + u_{it} \\
 u_{it} = & d_i + \varepsilon_{it}
 \end{aligned} \tag{5.5}$$

As the dependent variable, GAP_{it} measures the extent of the rural-urban inequality. The lagged dependent variable is introduced so as to capture the unobservable effect with time serial correlation (Beck & Katz, 1995, 1996). u_{it} is the disturbance, which contains two components. The first component d_i is the unobservable idiosyncratic characteristics or fixed effects. The second component ε_{it} is a random term with zero-mean and normal distribution.

FD_{it} represents the level of financial development defined as *FD1* or *FD2*. FD_{it}^2 is the square term of FD_{it} . As indicated by the existing literature, if financial services are only available to the rich people, financial institutions may channel resources from the poor to the rich and consequently increase income inequality. If financial services could cover most of the residents, this problem is not serious. Therefore the impacts of finance on inequality may present a reverse-U type dynamics, which means when the value of FD is small, the influence of finance on inequality is

positive but the influence will change to be negative when the value of FD increases. Concretely speaking, β_1 should be positive and β_2 should be negative.

$PCGDP_{it}$ represents per-capita GDP. $PCGDP_{it}^2$ is the square of it, which is designed to test whether rural-urban inequality presents a reverse-U type dynamics as the per-capita GDP increases. The reverse-U hypothesis, developed by Kuznets (1955) says that there is a natural cycle of income inequality driven by market forces which at first increases inequality, and then decreases it after a certain average income is attained.

It is necessary to give more explanation on the interaction terms of $PCGDP_{it} * FD_{it}$ and $PCGDP_{it}^2 * FD_{it}$. They are designed to test the shift of financial impact as the economy develops. We expect the coefficient of $PCGDP_{it} * FD_{it}$ (β_5) to be negative and the coefficient of $PCGDP_{it}^2 * FD_{it}$ (β_6) to be positive. In other words, as the economy grows, the marginal impact of financial development on inequality may be negative at the starting period of economic growth; however it may turn to be positive in the mature stage of economic growth. According to Galor and Moav (2004), human capital accumulation will at last replace physical capital accumulation as a prime engine of growth along the process of development. At the starting stage of development, physical capital is more important than human capital and its return is much higher than that of human capital. Therefore the people who can get credit and accumulate physical capital would enjoy a good income. In this case, if credit service could cover more people, income inequality might be reduced. At the developed stage of an economy, the return of human capital is much higher than that of physical capital. Some people could not earn a lot of money even they had access to credit, because they do not have enough natural endowments or other kinds of human capital. Credit only helps those who are endowed with higher ability. The implication is that more credit will not increase the income of the people with low ability, but only improve the income of those of talent. Now we may conclude that at the beginning stage of economic growth, financial development could decrease income inequality, but at the mature stage of an economy, when human capital is more important than physical capital, financial development may increase income inequality.

5.2.2.2 Estimation Methods

Before estimating the model, unit root test and cointegration test are implemented. With Levin-Lin-Chu unit root test for panel data we find that all of the variables are first order stationary. In addition, the panel data cointegration test, developed by Persyn and Westerlund (2008), proves the long-term stable relationship between rural-urban inequality and financial development, per-capita GDP, government intervention and the employment structure.

The introduction of the lagged dependent variable, as a control, helps us to capture the unobservable effect. However, it may bias the estimated coefficients of other variables (Achen, 2000). The lagged dependent variable is often correlated with the fixed effect d_i , leading to endogenous problem. There are two approaches to deal with the fixed effect: the first one is using dummies to capture the fixed effect, and the second is eliminating the fixed effect by differencing. The first approach is named as Least Square Dummy Variables (LSDV). Kiviet (1995) argues that applying LSDV and then correcting the variance is the best method to deal with dynamic panel models. However, his argument only holds when two conditions are satisfied. The first condition is a large sample, and the second condition is balanced panel data (Roodman, 2006). As for the data employed in this study, both conditions are satisfied. Therefore LSDV estimator is proper for the present analysis.

The second approach to eliminate the fixed effect is differencing. However, differencing will result in another endogenous problem. It is because $\Delta GAP_{it-1} = GAP_{it-1} - GAP_{it-2}$ will be correlated with $\Delta \varepsilon_{it-1} = \varepsilon_{it-1} - \varepsilon_{it-2}$. In order to deal with this problem, a simple method employed by Anderson and Hsiao (1982) is to use the second-order lagged dependent variable as an instrument and implement Two-Stage-Least-Square (2SLS) estimation. However, when GAP_{it-1} tends to a random walk process, GAP_{it-2} is not a good instrument for ΔGAP_{it-1} (Roodman, 2006). The Difference-GMM developed by Arellano & Bond (1991) and System-GMM developed by Arellano & Bover (1995) and Blundell and Bond (1998) are better methods to deal with the endogeneity resulted from differencing. Difference-GMM only uses levels of lagged dependent variable as instruments. System-GMM uses both levels and differences of lagged dependent variable as instruments, and can have better performance on persistent data. Therefore, we use System-GMM to estimate the econometric model.

As well as the endogeneity related to the lagged dependent variable, other explanatory variables may also suffer from endogeneity. For example, we need to concern the possible causal links from rural-urban inequality to financial development. According to Beck et al. (2007), reductions in income inequality may stimulate political pressures to create more efficient financial systems that fund projects based on market criteria instead of political connections. This is what happened in China. In order to deal with the endogenous problem resulted from the reverse causality, we use instrumental variable estimation. The ratio of fixed capital investment to GDP and the ratio of national deposits to GDP are employed as instruments. Fixed capital investment is dependent on the loans from commercial banks and other financial institutions, and it is able to influence economic growth, the income of rural residents and urban residents. And it is not obviously influenced by rural-urban income distribution. The reason why we choose deposit as an instrument for financial

development is that deposit is the base of loans and seems not to be significantly influenced by rural-urban inequality.

A third problem is the reverse causality from rural-urban inequality to per-capita GDP. Because of the serious rural poverty, China has to depend on export to develop the economy. Such an open economy is fragile to international economic crisis. Since sub-prime crisis of 2008, numerous factories in China collapsed. Chinese government began to stress the importance of the rural economy and the necessity of a balanced economic development. If China's rural area had been developed better, the domestic demand would have helped China's economy to grow better. Therefore, rural poverty may have negative impacts on economic development. We use the lagged value of per-capita GDP as an instrument in order to deal with this endogenous problem.

Because of the endogeneity related to the lagged dependent variable, financial development and per-capita GDP, we set them as endogenous variables when implementing system GMM estimations. In addition, we also use lagged independent variables in regressions so as to reduce reverse causality problem.

Since the panel data cover all of the 31 continent provinces of China, Fixed Effect model should be a proper choice. It enables us to control for unobserved province-specific effects. Pooled OLS method and Random Effect model are also employed so as to test the robustness. We also use substitutive indicators, such as *FD1* and *FD2*, *GOV1* and *GOV2* to test the robustness.

5.3 Empirical Results

The basic regression results are shown in Table 5.2. We can observe that financial development has significant influence on China's rural-urban inequality. And the economic effects are substantial. A reverse-U shaped dynamics of the impacts of finance is proved by the positive coefficients of *FD* and the negative coefficients of *FD-Squared*. The coefficients of *FD* are around three times of the coefficients of *FD-Squared* when we use the ratio of loans to GDP (*FD1*) to measure financial development ⁴⁸. It means that, when credit is more than three times of GDP, it will certainly decrease the rural-urban inequality. Since China's credit is 1.01 times of GDP in 2008, we have to consider the interaction terms in order to check the overall effects of finance. When the ratio of the sum of loans and deposits to GDP (*FD2*) is used to measure financial development, the signs of coefficients and significance do not change. However, the magnitudes of *FD-Squared* become smaller.

The results of the interaction terms are in accord with our expectations with negative coefficients of *PCGDP*FD* and positive coefficients of *PCGDP-Squared*FD*. It proves that, at the development stage dominated by physical capital, a wider

⁴⁸ Hausman tests reject the hypothesis that difference in FE and RE coefficients is not systematic, indicating that FE coefficients are more credible.

coverage of credit service is helpful to restrain income inequality. When human capital becomes the engine of economic growth, credit may deteriorate income distribution. The results of specification (1) imply that when per-capita GDP is more than 50000 Yuan ($=10000 \times 0.2519 / 0.0504$, about 8265 U.S. dollars) credit is more likely to increase China's rural-urban income inequality⁴⁹.

With consideration to all of the above factors, we can check the overall effects of finance. Take the case of China in 2008, *FDI* is 1.01, *PCGDP* equals 2.4 (according to the Statistic Yearbook of China), then based on the results of specification (1) the marginal effect of finance on rural-urban inequality is 0.269. It means that finance is now increasing the rural-urban inequality. However, it is insufficient to judge whether China should reduce the credit scale. Before saying anything about China's present financial policies, a structural analysis is necessary. According to *FD* and *FD-Squared* more credit may enable the rich to control more resources. But *PCGDP*FD* and *PCGDP-Squared*FD* indicate that if more loans are available, more people could become rich and consequently reduce the income inequality. The key is the coefficient of *FD-Squared*. The negative coefficient means that, if more credit could be provided, finance would do less harm to income distribution. To sum up, in order to reduce the rural-urban inequality, more credit should be supplied.

Government intervention has positive relation with rural-urban inequality, which confirms the hypothesis that government distribution is less fair than market distribution. The negative coefficients of *DEV* suggest that the growth of the secondary and the tertiary sector could help reduce rural-urban inequality.

The results dealing with reverse causality are presented in Table 5.3. Specifications (1)-(8) use lagged independent variables in regressions. Obviously, the signs are consistent with those shown in Table 5.2. However, the signs of *PCGDP*FD* and *PCGDP-Squared*FD* are not significant. Because simply regressing on lagged independent variables does not correct the endogeneity of the lagged dependent variable, the results of System GMM estimations are more credible. According to (9)-(12), the results from GMM estimations are consistent with those shown in Table 5.2. The impacts of financial development on rural-urban inequality are proved to take a reverse-U type dynamics, and the hypothesis of Kuznets (1955) seems to be valid. With regard to the interaction terms, the coefficients of *PCGDP-Squared*FD* are still positive, the coefficients of *PCGDP*FD* are consistently negative. In addition, the estimation results using the data from 1984 to 2008 are also consistent with the conclusions described above (not reported here to save space).

⁴⁹ Current RMB-USD exchange rate is 1USD = 6.0478 RMB.

Table 5.2 The Rural-Urban Income Inequality and Financial Development: General Estimation

<i>Independents</i>	<i>Dependent Variable: Gap</i>											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Lag-Inequality</i>	0.5849*** (0.1357)	0.5863*** (0.1357)	0.5906*** (0.1432)	0.5905*** (0.1439)	0.4423** (0.1865)	0.4541** (0.1837)	0.4366** (0.1896)	0.4549** (0.1871)	0.7901*** (0.0858)	0.7742*** (0.0873)	0.7735*** (0.0957)	0.7724*** (0.0957)
<i>FD</i>	0.5787*** (0.1334)	0.5757*** (0.1342)	0.1904*** (0.0564)	0.1826*** (0.0530)	0.1971** (0.0791)	0.1909** (0.0814)	0.0795** (0.0346)	0.0528** (0.0243)	0.4393*** (0.1374)	0.4642*** (0.1437)	0.1728*** (0.0603)	0.1690*** (0.0590)
<i>FD-Squared</i>	-0.1572*** (0.0519)	-0.1533*** (0.0525)	-0.0145 (0.0133)	-0.0133 (0.0123)	-0.0621* (0.0360)	-0.0530 (0.0346)	-0.0053 (0.0066)	-0.0001 (0.0054)	-0.1416*** (0.0549)	-0.1509*** (0.0569)	-0.0233** (0.0097)	-0.0225** (0.0093)
<i>PCGDP*FD</i>	-0.1374** (0.0608)	-0.1390** (0.0601)	-0.0318 (0.0277)	-0.0324 (0.0266)	-0.0020 (0.0348)	-0.0162 (0.0322)	-0.0026 (0.0151)	-0.0088 (0.0148)	-0.0945* (0.0523)	-0.1034* (0.0552)	-0.0160 (0.0208)	-0.0173 (0.0204)
<i>PCGDP-Squared*FD</i>	0.0307** (0.0147)	0.0304** (0.0147)	0.0056 (0.0042)	0.0056 (0.0040)	0.0009 (0.0072)	0.0023 (0.0066)	-0.0001 (0.0021)	0.0004 (0.0020)	0.0234** (0.0119)	0.0252** (0.0125)	0.0046 (0.0035)	0.0048 (0.0035)
<i>PCGDP</i>	0.2519** (0.0977)	0.2497** (0.0992)	0.1180 (0.0826)	0.1160 (0.0812)	0.0386 (0.0423)	0.0413 (0.0415)	0.0321 (0.0387)	0.0259 (0.0411)	0.1882** (0.0891)	0.2017** (0.0935)	0.0981 (0.0685)	0.1012 (0.0692)
<i>PCGDP-Squared</i>	-0.0504** (0.0226)	-0.0496** (0.0230)	-0.0205 (0.0143)	-0.0199 (0.0140)	-0.0042 (0.0102)	-0.0042 (0.0093)	-0.0013 (0.0065)	0.0002 (0.0064)	-0.0397** (0.0192)	-0.0426** (0.0200)	-0.0211 (0.0130)	-0.0215 (0.0133)
<i>GOV</i>	0.0101 (0.0992)	0.0948 (0.1245)	0.1149 (0.1388)	0.0075 (0.1197)	0.3496 (0.2126)	0.1898 (0.1570)	0.4193* (0.2294)	0.1390 (0.1466)	-0.0337 (0.0952)	0.1250*** (0.0425)	-0.0037 (0.1039)	0.0275 (0.0337)
<i>DEV</i>	-0.0544 (0.0919)	-0.0557 (0.0924)	-0.0070 (0.0961)	-0.0004 (0.0907)	-0.3368*** (0.1138)	-0.3124*** (0.1022)	-0.3425*** (0.1220)	-0.3034*** (0.1033)	-0.3684*** (0.1377)	-0.3647*** (0.1358)	-0.3686** (0.1513)	-0.3620** (0.1523)
<i>Method</i>	FE	FE	FE	FE	LSDV	LSDV	LSDV	LSDV	RE	RE	RE	RE
<i>R-square</i>	0.783	0.783	0.779	0.779	0.841	0.840	0.842	0.840	0.764	0.766	0.761	0.761
<i>N</i>	818	818	818	818	818	818	818	818	818	818	818	818

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Heteroskedasticity robust t-statistics are in parentheses. Specifications (1), (2), (5), (6), (9) and (10) use the definition of *FDI* to represent financial development, the other specifications use *FD2*, a less satisfying indicator, to test the robustness of the model. Specifications (1)-(4) use Fixed Effect model with heteroskedasticity-consistent t-statistics. Specifications (5)-(8) are estimated using Pooled OLS with heteroskedasticity-consistent t-statistics, and specifications (9)-(12) are estimated with Random Effect model. The indicator of *GOV1* is used in specifications of odd number and *GOV2* is used in even number specifications.

Table 5.3 The Rural-Urban Income Inequality and Financial Development: Lagged Independents

Independents	Dependent Variable: Gap											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Lag-Inequality</i>	0.5620*** (0.1444)	0.5631*** (0.1441)	0.5796*** (0.1539)	0.5801*** (0.1547)	0.4417** (0.1880)	0.4536** (0.1850)	0.4361** (0.1928)	0.4550** (0.1893)	0.5563*** (0.0254)	0.5629*** (0.0197)	0.5439*** (0.0219)	0.5464*** (0.0219)
<i>FD</i>	0.5941*** (0.1500)	0.5938*** (0.1496)	0.1958*** (0.0543)	0.1883*** (0.0516)	0.1905* (0.0969)	0.1877* (0.1022)	0.0650 (0.0424)	0.0354 (0.0314)	0.6392*** (0.1191)	0.6434*** (0.0983)	0.2043*** (0.0335)	0.2008*** (0.0334)
<i>FD-Squared</i>	-0.1713*** (0.0547)	-0.1677*** (0.0551)	-0.0159 (0.0115)	-0.0145 (0.0103)	-0.0665* (0.0370)	-0.0606 (0.0377)	-0.0046 (0.0071)	0.0010 (0.0069)	-0.1738*** (0.0609)	-0.1686*** (0.0452)	-0.0149** (0.0062)	-0.0137** (0.0061)
<i>PCGDP*FD</i>	-0.0989 (0.0633)	-0.1007 (0.0630)	-0.0266 (0.0318)	-0.0278 (0.0312)	0.0085 (0.0268)	-0.0011 (0.0279)	0.0011 (0.0157)	-0.0047 (0.0176)	-0.1473** (0.0654)	-0.1577*** (0.0556)	-0.0332*** (0.0107)	-0.0361*** (0.0103)
<i>PCGDP-Squared*FD</i>	0.0245 (0.0147)	0.0241 (0.0146)	0.0052 (0.0049)	0.0052 (0.0048)	-0.0002 (0.0062)	0.0002 (0.0059)	-0.0006 (0.0022)	-0.0003 (0.0022)	0.0310* (0.0162)	0.0332** (0.0132)	0.0050*** (0.0016)	0.0053*** (0.0013)
<i>PCGDP</i>	0.1858** (0.0879)	0.1819* (0.0892)	0.0876 (0.0775)	0.0868 (0.0771)	0.0281 (0.0371)	0.0233 (0.0358)	0.0213 (0.0404)	0.0117 (0.0422)	0.2657*** (0.0697)	0.2706*** (0.0595)	0.1082*** (0.0371)	0.1163*** (0.0332)
<i>PCGDP-Squared</i>	-0.0345* (0.0180)	-0.0334* (0.0182)	-0.0150 (0.0118)	-0.0146 (0.0117)	-0.0029 (0.0079)	-0.0015 (0.0071)	-0.0001 (0.0058)	0.0021 (0.0057)	-0.0509** (0.0196)	-0.0531*** (0.0160)	-0.0151* (0.0077)	-0.0165** (0.0064)
<i>GOV</i>	0.0178 (0.0934)	0.1324 (0.1203)	0.0936 (0.1408)	0.0202 (0.1172)	0.3507 (0.2112)	0.1938 (0.1570)	0.4140 (0.2469)	0.1637 (0.1497)	-0.0336 (0.1087)	0.1683 (0.1021)	-0.0357 (0.0854)	-0.0005 (0.0542)
<i>DEV</i>	-0.0134 (0.0877)	-0.0154 (0.0895)	0.0155 (0.0895)	0.0204 (0.0854)	-0.3232*** (0.4417**)	-0.2961*** (0.4536**)	-0.3280** (0.4361**)	-0.2898*** (0.4550**)	-0.1194 (0.0763)	-0.1149 (0.0906)	0.0256 (0.0672)	0.0364 (0.0598)
<i>Method</i>	FE	FE	FE	FE	LSDV	LSDV	LSDV	LSDV	GMM	GMM	GMM	GMM
<i>R-square</i>	0.784	0.784	0.778	0.778	0.841	0.840	0.841	0.839	-	-	-	-
<i>N</i>	818	818	818	818	818	818	818	818	818	818	818	818

*, ** and ***denotes the significance at the 10, 5 and 1percent level respectively. Heteroskedasticity robust t-statistics are in parentheses. Specifications (1), (2), (5), (6), (9) and (10) use the definition of *FDI* to represent financial development, the other specifications use *FD2*, a less satisfying indicator, to test the robustness of the model. Specifications (1)-(4) use Fixed Effect model with heteroskedasticity-consistent t-statistics. Specifications (5)-(8) are estimated using LSDV, and specifications (9)-(12) are estimated by System GMM. Specifications (9)-(12) are valid in overidentification tests and autocorrelation tests. The indicator of *GOV1* is used in specifications of odd number and *GOV2* is used in even number specifications.

5.4 Promoting Rural Finance

5.4.1 The Development of China's Rural Finance: since 1979

In the empirical analysis, we show that financial development in China may reduce the rural-urban inequality. Promoting the development of rural finance will increase the rural income and reduce inequality. The following contents give a brief introduction to the development of China's rural finance since 1979.

Jin (2008) finds that the development of China's rural finance since 1979 can be divided into three stages. The first stage is from 1979 to 1993. Before 1979, there was only one monopolistic financial institution, People's Bank of China (PBC). After the 1979 reform, new Agriculture Bank of China (ABC) and Rural Credit Cooperatives (RCC) were established. ABC soon took the place of PBC and became the central player in the rural finance market. Another important reform at this stage was the deregulation on postal savings. The reforms in the financial sector appeared after China's setting up the direction towards a market economy in 1978. The marketization reform in China started from the rural areas, and a number of township enterprises appeared after 1979. As a result, ABC and RCC were established to meet the financial demand of township enterprises.

The second stage is from 1993 to 2003, the most important reform in which is the establishment of the Agriculture Development Bank (ADB). ADB is a policy bank, mainly responsible for the government purchase of agricultural and sideline products. The main task of rural finance reforms in this period was to define the border of different financial institutions clearly. Before 1993, ABC took some policy tasks although it is a commercial bank. The mix of market business and policy tasks increased the difficulty of supervising ABC. As a result, ABC accumulated too many non-performing assets. The separation of market business and policy tasks obviously improved the efficiency of commercial banks, and strengthened the supervision of Chinese government.

(3) The third stage started from 2003. The main purpose in this stage was to establish a financial system including various financial institutions with different functions. Since 2003, a lot of micro-financial institutions (MFI) were established in the rural areas. Numerous rural branches of the main commercial banks were closed during the period from 1993 to 2003. The main reason was the thin profit margin of their rural businesses. Therefore, Chinese government began to encourage the establishment of MFIs. Some provinces even reduced the sales tax of MFIs by 50 percent.

5.4.2 MFIs and Farmers

Although Chinese government implemented some policies to promote the development of rural MFIs after 2003, it is found that MFIs did not supply sufficient loans to farmers and agriculture. Liao (2010) did a survey on MFIs in Sichuan province. He finds that most MFIs had good performance in financial sustainability. However, these MFIs mainly provided their loans to the local nonagricultural businesses, instead of farmers and agriculture. Wang and Feng (2011) did a survey on MFIs in Shandong province. They find that most small-credit companies, with operating experience more than one year, had high profit margins. Similar to the situation in Sichuan, most companies only provided limited loans to farmers and agriculture.

The performance of Chinese MFIs is consistent with other literature, which finds that return rate of loans in the poor areas is relatively high. Although average income of less developed areas are relatively low, people living there may be willing to pay a higher price for necessary financial services. For example, the interest rates of microfinance, which aims to help small businesses in rural areas, are often very high. A well-documented microfinance program is one conducted by a microfinance institution named Bharatha Swamukti Samsthe (BBS) in rural southern Karnataka, the annual interest of which is approximately 28% (Banerjee et al., 2012). In addition, low income does not necessarily imply fewer opportunities. As described by Banerjee and Duflo (2011), the poor are natural-born entrepreneurs and “we can reduce poverty by giving them the right environment and a little bit of help getting started”⁵⁰. This also indicates potential high return rate of small credit.

However, we still wonder the reasons why MFIs are not willing to provide loans to farmers and agriculture. According to the literature, there are at least two reasons, concerning mortgage and risk (Jin, 2008).

(1) The lack of mortgage. Chinese farmers do not have right to use their land as collateral, because the land is collectively owned. In practice, collective ownership actually means farmers only have use-right to their land. The ambiguous property right of collective ownership makes it difficult for each individual farmer to borrow money from financial institutions by mortgaging land.

(2) The high risk of traditional agriculture. Traditional agriculture suffers from both natural risk and market risk. Natural risk is resulted from draught, excessive rainfall, hail and so on. Market risk mainly refers to the fluctuation of prices. The price fluctuation is more serious in China than that in Japan and other developed countries. The more serious price fluctuation in China may be resulted from the following reasons. (a) First, the level of specialization among Chinese farmers is very

⁵⁰ A microfinance program conducted in Bangladesh shows that even the poorest the poor have the ability to run a small business successfully if they can obtain necessary help. In addition, the rates of return on money invested in those business are generally high (Banerjee and Duflo, 2011).

low. Most farmers change their crops year by year. They make planting decisions according to the prices of the previous year. That is, they behave in the way described by the cobweb model. The low level of specialization and the frequent changes of planting crops make the supply of agriculture goods pretty unstable. (b) Second, China's market size of agriculture products is very large. A moderate change in consumers' preferences or the farmers' expectations will result in serious imbalance between supply and demand of agriculture goods.

Therefore, in order to promote the development of rural finance and provide more loans to the poor farmers, it is necessary to reform the present land institution so that the farmers are able to use land as collateral. Now we can observe some evidence for reforms in land institutions. The first evidence is the registration of rural homesteads started from 2005. And most provinces have finished this project. This is an important step towards a clearly defined property right system. In addition, Chinese government has begun to register all rural lands since 2011, including rural homesteads, cultivated lands and construction lands⁵¹. Moreover, some provinces have recognized farmers' transfer rights of lands and are establishing official land markets.

In order to reduce the risk faced by farmers, it is necessary to improve the market infrastructures of agricultural goods. For example, electronic trade platform or future market may provide more information to farmers, and reduce the price fluctuations. In addition, new cooperative organizations should be promoted to improve the specialization level of Chinese farmers.

5.5 Concluding Remarks

The existing literature shows that financial development has close relationship to income distribution. Three classes of theories on the impacts of financial development are reviewed. There is no consensus on whether financial development deteriorates or improves income distribution. In this paper we assess the impacts of financial development on income inequality with the panel data of China's 31 provinces.

We find that if credit service is only available to a few rich people, finance deteriorates income distribution. As the coverage of credit service becomes wider, finance may decrease income inequality. In addition, finance plays different roles at different stages of economic development. At the starting stage of economic growth, when physical capital is the engine of economic development, financial development is helpful to reduce the income inequality. If an economy has developed into the mature stage, where human capital is much more important than physical capital, financial development may only benefit the talented. The reason is that physical capital can flow from one place to another place, owned by one person or another;

⁵¹ "On accelerating the right of rural collective land registration certification work" (Guo Tu Zi Fa [2011] No. 60), 《关于加快推进农村集体土地确权登记发证工作的通知》(国土资发〔2011〕60号)

however, human capital has close relation with natural endowments and cannot flow from one person to another. Therefore if the economy is not developed and physical capital has a high return, almost anyone is able to use more physical capital to earn more money if she has access to credit. In a mature economy, where the return to human capital is pretty high, only the people with great human capital are able to improve their income obviously. Credit is not important to those with low human capital. As a result, financial development may harm income distribution in a highly developed economy. This paper also confirms the hypothesis of income inequality dynamics developed by Kuznets (1955).

Based on the analysis of the estimation results, we find that China's finance deteriorated the rural-urban income inequality. However, a wider access of credit and a higher level of financial development may improve the income distribution. If more credit could be provided so as to realize a wider coverage of financial services, finance may at last help to reduce China's rural-urban inequality.

Chapter 6

Conclusions

6.1 Main Conclusions and Policy Implications

6.1.1 Rural-Urban Interactions

Regarding the mutual influences between rural and urban economic growth, we find asymmetric influences between China's rural and urban sectors. China's urban development exhibited strong and positive influences on rural development. However, similar strong influences cannot be observed from the opposite direction. Empirical evidence attributes the reason to the low income of rural residents. In the open Chinese economy, the rural development can exhibit strong influences on urban development only when rural residents are rich enough to afford many manufactured goods and services. If rural residents are very poor, rural income increase mainly transforms into the demand for agricultural goods. When farmers become rich enough, rural development is possible to have strong and positive influences on the urban sector. In addition, empirical results imply that the influences of rural development on urban sector will become stronger as rural income increases.

We have a lot reasons to believe that the low rural income and serious rural-urban inequality in China are not a natural market result, but the result of many unfair institutions. A lot of economists have devoted their efforts to explaining the rural-urban income gap. Cai and Yang (2000) study China's rural-urban income gap from the perspective of institutions. They find that political inequality is the reason of economic inequality. The conclusion is consistent with the theoretical framework developed by Acemoglu et al.(2005), which argues political power can influence economic institutions and consequently influence economic growth. Some researchers regard urban-biased economic policies as the most important cause of the increasing rural-urban inequality. Recent researches on financial development find that financial services are important for farmers to deal with the problem of capital constraint in job hunting. However, China's present land institutions deprive farmers' rights on land and consequently make them suffer from capital constraint.

If institutions are the fundamental reasons for rural poverty, removing the anti-rural policies may stimulate rural growth and consequently promote urban growth. Chinese farmers, however, do not have strong political power to change those policies. Before 2009, the Electoral Law of the People's Republic of China states that four rural resident can enjoy the same vote right as one urban resident. The negative

impacts of the political inequality are serious. Farmers have limited ways to express their interests. And as a result, numerous unequal economic institutions appeared, for example, the Household Registration System (Hukou System) that aims to restrict rural-urban migration. Political inequality may be the fundamental reason for rural poverty and economic inequality. Realizing political equality may be a way to reduce rural poverty and to improve rural-urban interactions.

The results on rural-urban interactions may also be applicable to other developing countries. In particular, the staple of rural development has been replaced in the context of globalization. If only the manufacture sector has competitive power in the global market, the country does not need to allocate too many resources to the rural sector. Therefore, the necessary condition for economic take-off in the modern world is to develop certain competitive power in manufacturing industry, instead of developing agriculture.

Contrary to the finding in this study, Eswaran and Kotwal (2006) argue for the importance of rural growth for an open economy. They argue that although the manufactured goods are produced for foreign demand, agriculture development is still important because developing countries have to use agricultural products to exchange technologies with developed countries. This may not be a reasonable logic under the background of globalization. Since multinational companies tend to combine technologies with the low-cost labor in developing countries to produce manufactured goods, developing countries do not need to exchange technologies with developed countries. They can improve technologies through FDI and Learning by Doing.

6.1.2 Land Institution and Rural-Urban Migration

The second essay establishes a simple household model to analyze the influence of land holding on temporary migration. It is found that the probability of migration is high when land holding is at the intermediate level. If the land holding is small, farmers tend to choose local wage work instead of migration. When a farmer has pretty large land holding, she is more likely to choose pure farm work. The results indicate that collective land ownership, which is characterized by an even-distribution of land, especially stimulates migration.

In addition, the study helps us to identify who are the most in need in rural areas: it is those who have little land and who do not have enough capital to migrate. Cai and Wang (2008) point out that migration income is important for increasing rural income and reduce rural-urban inequality. Therefore, effective policy is necessary to help those who are unable to migrate freely. Migration cost and the lack of necessary capital are obstacles for temporary migration. The cost consists of not only transportation costs, but also information costs, accommodation costs and psychological costs. To help the farmers with little land and capital, the Chinese

government could provide more job information, migration subsidies and the necessary employment training for those who want to migrate, and ensure the effectiveness of policy implementation.

The empirical finding that collective land ownership stimulates migration is likely to be specific in China. It is because China is a geographically huge economy. Because of the large geographical scale and corresponding long distance of migration, migration cost is a serious problem for some potential migrants in China. The existence of migration cost is the key for the positive impacts of collective land ownership on migration. It is because the even land-distribution provides some farmers with capital necessary to finance migration. If migration cost is negligible, collective land ownership is less likely to have important influences on migration. Since migration cost in some small countries is relatively low, the impacts of collective land ownership on migration may be weak in those countries.

6.1.3 Financial Development and Inequality

The essay regarding the influences of financial development on rural-urban inequality finds that if credit service is only available to a few rich people, finance would deteriorate income distribution. As the coverage of credit service becomes wider, finance may decrease income inequality. In addition, financial development plays different roles at different stages of economic growth. At the starting stage of economic growth, where physical capital is the engine of economic development, financial development is helpful to reduce the income inequality. However, if an economy has developed into the mature stage, where human capital is much more important than physical capital, financial development may only benefit the talented. This paper also confirms the hypothesis of income inequality dynamics developed by Kuznets (1955).

Based on the analysis of the estimation results we argue that, although at present China's finance is deteriorating the rural-urban income inequality, a wider access of credit and a higher level of financial development would be helpful. If more credit could be provided so as to realize a wider coverage of financial services, finance may at last help to reduce China's rural-urban inequality. In order to promote the development of rural finance and provide more loans to the poor farmers, it is necessary to reform the present land institution so that the farmers are able to use land as collateral. And, in order to reduce the risk faced by farmers, it is necessary to improve the market infrastructures of agricultural goods.

6.2 Limitations of the Study

One limitation of the study is the ignorance of rural organizations. Rural development is a complicated problem that needs thorough analysis from various perspectives and using different methods. The existing literature has extensively studied influences of policies and migration on rural development and rural-urban inequality. However, we still do not have enough attention to rural organizations. We can observe a lot of stories on how rural organizations helped Chinese farmers increase their income. Exploring the functions of rural organizations may be the direction of the future research.

In addition, social network is also important for improving the welfare of farmers. The importance of rural organizations and networks has been recognized by many scholars and policy makers. This dissertation mainly uses macro data and traditional household survey data, which do not give enough attention to social networks. The future study shall use more social network data obtained from field study. Such data allow us to get deeper understanding on the rural society and rural development.

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