How does land finance effect economic growth in China?

——Theoretical analysis and empirical analysis on panel data

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Land finance, as the local governments' policy to collect revenue in China, is considered to be related with the economic growth. In this paper, the economy is divided into two sections—traditional Malthus section and modern Solow section in this paper. The effect of land finance on economic growth in China is derived via mathematical method based on economic growth model. The result shows that land finance will transfer the labor from Malthus section to Solow section, which will induce the economic growth. The panel data analysis is used to test the above result. It finds that reducing the farm land and raising the land lease price promote the economic growth. The labor transfer from Malthus section to Solow section caused by land finance do more contribution to economic growth than reducing the farm land and raising the land lease price.

Keywords: land finance, economic growth, Malthus section, Solow section

1. Introduction

Since the housing reform in 1998 in China, land finance has been becoming an important problem which attracted all social circles' attention. There are three causes for the land finance. First, the "tax-sharing system" (*fenshuizhi*) is the most important institutional cause for the land finance (Gong, 2012), and the land finance is the result of the "tax-sharing system" reform (Du et al. 2009; Sun and Zhou, 2013). Second, based on the theory of "promotion championships", the promotion competition of local officials causes the land finance (Liu et al., 2012). The land leasing and land leasing revenue are related closely to the Chinese Provincial Communist Party Congress circle (Yu, 2015). Third, in the past 30 years, China is undergoing rapid industrialization which demands more land. Land finance is accompany with the industrialization (Jiang, 2014).

Besides the tax revenues, land leasing revenue accounts for a large proportion of local governments' revenue. This revenue is totally dominated by the local governments and covered the local deficit at a large extent. In 2014, the local governments' fund revenue was 4.99 trillion yuan, among which the land leasing revenue was 4.26 trillion yuan. The land leasing revenue increased by 134 billion yuan

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and the increasing rate was 3.2% compared to last year.[1] The proportion of land leasing revenue to local general public budget revenue was 56.15% in 2014.

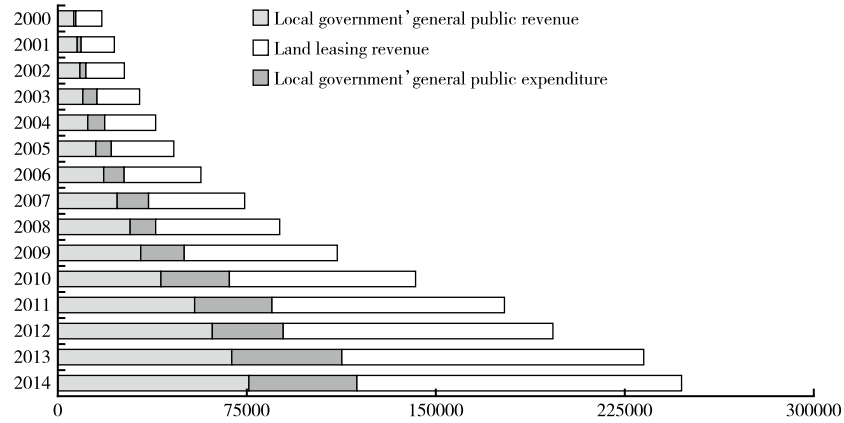

Figure1. Local governments' general public revenue, land leasing revenue and local governments' general public expenditure.

Source: *China Statistical Yearbook* and *China Yearbook of Land and Resources*.

Figure 1 illustrates the local governments' general public budget revenues, land finance revenues and general public expenditures from 2000 to 2014. During the past 15 years, the local general public expenditures grow much faster than the local general public revenues. The local governments' deficit gaps would be bigger without the land finance revenues.

Land finance does not only cover the local governments' deficit, but also contributes to Chinese industrialization and urbanization. For industrialization, as the owner of the land the local government offers land to the industrial companies gratuitously or at a price less than the market price, even at a fixed price when the company is listed. These policies are actually the subsidies for industrial production which reduce the cost of the companies (Research Group on China's Economic Growth (CASS), 2011). For urbanization, the local government expands the urban area through moving the town to the city or adjusting the administrative division (Jiang et al., 2007). From 2008 to 2013, the area of built districts increased from 36295.3 sq. km to 47855.3 sq. km, the average increasing rate was 6.37% per year. During those 5 years, the population density of urban area has increased from 2080 to 2362 per person per square kilometers.[2] Land finance seems to contribute the economic growth in China if we do not consider the food security and ecological environment.

Chinese economy keeps high growth during the past more than 30 years. As the Chinese government's economic behavior, does land finance promote the economic growth or restrain the economic growth? How does land finance affect the Chinese

[1] Source: Ministry of Finance of the People's Republic of China, http://gks.mof.gov.cn/zhengfuxinxi/tongjishuju/201501/t20150130_1186487.html.

[2] Source: *China Statistical Yearbook*.

economic growth? They are very interesting and attractive questions. The purpose of this paper is to set up a model of economic growth to answer the above questions. This paper is organized as follows. Section 2 will review the studies of land and economic growth. A model is presented in Section 3. In section 4, provincial-level panel data is used to test the model. The last section offers some concluding remarks.

2. Literature review

Adam Smith (1776) and David Ricardo (1871), as the most influential classical economists, thought that land was the essential productive factor which was the "mother of the wealth". They also emphasized that the fixed amount land restrained the economic growth because of the law of diminishing marginal return. After the neoclassical economics development, land had become less important as a factor of production in economic theories. Instead, capital and technology were the key factors of economic growth. Land could be replaced by capital and technology which could offset the restraint of land on economic growth (Cobb-Douglass, 1928; Harrod, 1948; Solow, 1974).

Under neoclassical economics, Nichols (1970), McCain (1970), Homburg (1991) and Rhee (1991) study balanced-growth path and dynamic inefficiency in economy with land. Compared to the stock land, the amount of flowing land was very little, and the added land hardly effected the economic growth (Harvey and Jowsey, 2004). Metzemakers and Louw (2005) say at the macro level, the available amount of industrial land could be a factor in national economic growth, just like growth of the labor force. Loupias and Wigniolle's (2013) study contributed to the unified growth theory emphasizing the role of land and technological progress in economic and population growth. They believe that in a long run perspective, land seems a very important variable in the growth process that deserves a particular study.

Recently, many researchers study the relationships between land and Chinese economic growth. Li et al. (2008) analyze that from 1999 to 2005, the excess expansion of China's construction land lead to an increase in the capital-output ration. Therefore, expanding construction land has made little contribution to economic growth. Deng et al. (2010) find that urban land expanded by 3 per cent when the economy, measured by gross domestic product, grows by 10 per cent. They also find that the expansion of the urban core is associated with changes in China's economic structure. Ding and Lichtenberg's (2011) research shows that land availability has a large proportional impact on economic growth than domestic and foreign investment, labor supply, and government spending. Wu et al. (2014) use "Centipede Game Model" to find that China's rapid progress in industrialization was related to the low industrial land prices. Feng et al. (2008) find the contribution of land to economic growth in China is significantly 11.01%. Xue and Chi's (2010) study shows the local government's land finance revenue positively affect the China's economic growth. Ye et al.'s (2011) research based on spatial panel data model, and they find from 1989 to 2009, land as the production factor contributed 19.31% to China's economic growth. Zou and Liu (2015) think land finance promoted the economic growth and speeded up

the progress of industrialization in short term. However, in the long run, land finance would restrain the economic growth because the land finance might disorder the allocation of resources and neglect the balance development of the second and third industries.

In one word, the previous researches focus on empirical analysis about the relationship between land, as the production factor, and economic growth in China. Seldom people study the mechanism of how land finance effected Chinese economic growth. The next section will analyze the mechanism via theoretical method.

3. Model

The Chinese economy is currently in a phase of rapid industrialization and urbanization, which means that it is in the transformation from Malthus Growth to Solow Growth (Ngai, 2004). In Malthus Growth, the production is related to land-intensive and the growth relies on agriculture. In Solow Growth, the production is related to capital-intensive and the growth relies on industry and commerce. In China, land finance policy develops with industrialization and urbanization. Conversely, the rapid progress of industrialization and urbanization need more lands which are requisitioned from rural area by the local governments. How does land finance effect the economic growth when China's economic growth is experiencing the transition from Malthus Growth to Solow Growth?

Hansen and Prescott (2002) develop a growth model that may explain the growth transaction from Malthus Growth to Solow Growth. China is experiencing the economic growth transaction from Malthus to Solow. Hansen and Prescott's model is the basic model in this paper and land finance policy is considered.

Consider a closed economy with over-lapping generations in the process of development. There are two final goods, agricultural goods and non-agricultural goods, which are produced using one of two technologies, traditional-Malthus (m) and modern-Solow (s). Capital, labor and land are input of production. According to Hansen and Prescott (2002), in Malthus sector, capital, labor and land are combined to produce output, however, in Solow sector, just capital and labor are used to production. The production functions of the two goods are as follows,

$$Y_m = AK_m^{\alpha} L_m^{\beta} N_m^{1-\alpha-\beta} \tag{1}$$

$$Y_s = BK_s^{\gamma} N_s^{1-\gamma} \tag{2}$$

In the above expressions, Y_j, K_j, L_j, and N_j are output, the input of capital, land and labor in sector j, $j \in (m, s)$. A and B refer to total factor productivity and are assumed to be exogenous.

The supply amount of land in this economy is fixed, L. Although land is not input in Solow sector, proportional land still be needed for housing, infrastructure, and business etc.. We can write $\frac{L_m}{L} = \varphi$, i.e $L_m = \varphi L$. Hence, function (1) can be rewritten as,

$$Y_m = AK_m^{\alpha} (\varphi L)^{\beta} N_m^{1-\alpha-\beta} \tag{3}$$

Labor, expressed as N, are distributed in the Malthus sector and Solow sector, and the constraints of labor are given by,

$$N = N_m + N_s \tag{4}$$

The labor share in the two different sectors can be written as,

$$n_m = \frac{N_m}{N} \tag{5}$$

$$n_s = \frac{N_s}{N} \tag{6}$$

Hence, we can get,

$$n_m + n_s = 1 \tag{7}$$

Similarly, the capital, K , in the economy also can be written as,

$$K = K_m + K_s \tag{8}$$

Consider (5), (6) and (7), we can write capital per capita as,

$$n_m k_m + n_s k_s = k \tag{9}$$

Where, k_m , k_s and k refer to the capital per capita in Malthus sector, Solow sector and whole economy.

Aggregate capital, K_t, is assumed to depreciate geometrically at a rate δ<1, and thus capital evolves according to the following law of motion,

$$K_{t+1} = (1 - \delta) K_t + I_t \tag{10}$$

where I_t is aggregate investment at period t. Hence,

$$I_t = K_{t+1} - (1 - \delta) K_t \tag{11}$$

For analytical convenience, we assume that there is only one competitive firm in each sector for the production functions exhibit constant returns to scale. Given a value for a capital rental rate (r), a wage rate (w), and a rental rate for land (q), the problems of representative firms in Malthus sector and Solow sector are as follows respectively,

$$\max \{ AK_m^{\alpha} (\varphi L)^{\beta} N_m^{1-\alpha-\beta} - rK_m - q(\varphi L) - wN_m \} \tag{12}$$

$$\max \{ BK_s^{\gamma} N_s^{1-\gamma} - rK_s - wN_s \} \tag{13}$$

Firm in each sector will maximize its profit. Since the resources are allocated efficiently across the two sectors, total output is determined by the following well-behave maximization problem,

$$\max\{[AK_m^{\alpha}(\varphi L)^{\beta}N_m^{1-\alpha-\beta} - rK_m - q(\varphi L) - wN_m] + [BK_s^{\gamma}N_s^{1-\gamma} - rK_s - wN_s]\} \tag{14}$$

When the economy is equilibrium, wage rate, rate of capital rent and rate of land rent are,

$$w = A(1-\alpha-\beta)K_m^{\alpha}(\varphi L)^{\beta}N_m^{-\alpha-\beta} = B(1-\gamma)K_s^{\gamma}N_s^{-\gamma} \tag{15}$$
$$r = A\alpha K_m^{\alpha-1}(\varphi L)^{\beta}N_m^{1-\alpha-\beta} = B\gamma K_s^{\gamma-1}N_s^{1-\gamma} \tag{16}$$
$$q = A\beta\varphi K_m^{\alpha}(\varphi L)^{\beta-1}N_m^{1-\alpha-\beta} \tag{17}$$

From the firm's optimality conditions, we can derive expressions for input intensities in each sector. In Malthus sector, we can derive,

$$\frac{w}{r} = \frac{1-\alpha-\beta}{\alpha} \cdot \frac{K_m}{N_m} \tag{18}$$
$$\frac{w}{q} = \frac{1-\alpha-\beta}{\beta} \cdot \frac{L}{N_m} \tag{19}$$

By substituting (5) into (18) and (19), we can rewrite,

$$K_m = \frac{\alpha w}{q(1-\alpha-\beta)} n_m N \tag{18a}$$

$$L = \frac{\beta w}{q(1-\alpha-\beta)} n_m N \tag{19a}$$

In Solow sector we can derive,

$$\frac{w}{r} = \frac{1-\gamma}{\gamma} \cdot \frac{K_s}{N_s} \tag{20}$$

By substituting (6) and (7) into (20), we can rewrite,

$$K_s = \frac{w\gamma}{r(1-\gamma)} n_s N = \frac{w\gamma}{r(1-\gamma)}(1-n_m)N \tag{20a}$$

As analysis in Section 1, local governments in China largely rely on land to collect local revenue in recent years. There are two channels for maximizing local revenue via land. First, the local governments requisition rural land for urban development and economic construction, which means to decrease φ. Second, as the land actual owner, the local governments try every available method to increase the urban land leasing price. We assume that there is no land in Solow Section at the beginning. All land of Solow Section is requisitioned by local governments from Malthus Section and the cost of requisition is 0. Let π refer the average price for one unit land, the problem of local governments is expressed as follows under the motivation of maximization the revenue from land,

$$\Pi = \pi(1-\varphi)L \tag{21}$$

where Π is the local revenue from land. In order to maximize Π, the local

governments will increase π as well as decrease φ.

Assume there are two generations in the economy, young household and old household. The young household born at time t consumes c_{1t} and the old household who were born at time t-1 consumes c_{2t} in period t. For the young household, his utility function in period t is,

$$U(c_{1t}, c_{2t+1}) = \log c_{1t} + \rho \log c_{2t+1} \tag{22}$$

Here, ρ is the discount factor that lies in (0,1).

The income of a young household born at time t is his wage, w_t. Out of his income he consumes c_{1t} and save the rest. His saving is used to invest either capital or land. All the proceeds will be used for c_{2t} when they are old. That is, the young households maximize their utility function (22) subject to the following budget constraints,

$$c_{1t} + k_{t+1} + q_t l_{t+1} = w_t \tag{23}$$
$$c_{2t+1} = r_{t+1} k_{t+1} + q_{t+1} l_{t+1} \tag{24}$$

In the above expressions, we use k and l donate the capital and land owned by per household. Hence, in the period t, the aggregate consumption C is,

$$C = c_{1t} N_t + c_{2t+1} N_{t-1} \tag{25}$$

To assume the labor increasing rate is g, the function (25) can be rewritten as,

$$C = c_{1t} N_t + c_{2t+1} \frac{N_t}{1+g} \tag{26}$$

The resource constraint for the economy requires that total output is used for consumption, investment and government procurement,

$$C + I + G = Y_m + Y_s \tag{27}$$

In the closed economy, we assume that: i. There is no tax revenue for the governments, and all the governments' revenues are from land leasing; ii. There is no surplus or deficit for the local governments and the local governments do not transfer their revenue to the households. All the local governments' revenues are used to government procurement, i.e. Π=G.

Based on the above assumption, function (27) can be rewritten as,

$$C + I + \Pi = Y_m + Y_s \tag{28}$$

Using expressions (1), (2), (7), (11), (18a), (19a), (20a), (21), (25), and (28), we can get the share of labor employed in the Malthus sector,

$$n_s = \frac{c_{1t} + \frac{c_{2t}}{1+g} + (g+\delta)\frac{\gamma w}{r(1-\gamma)} - B\left(\frac{\gamma w}{r(1-\gamma)}\right)^{\gamma}}{A\left(\frac{\alpha w}{r(1-\alpha-\beta)}\right)^{\alpha}\left(\frac{\beta\varphi w}{q(1-\alpha-\beta)}\right)^{\beta} - B\left(\frac{\gamma w}{r(1-\gamma)}\right)^{\gamma} - \pi(1-\varphi)\frac{\beta w}{q(1-\alpha-\beta)} - (g+\delta)\frac{\alpha(1-\gamma)w + \gamma(1-\alpha-\beta)w}{r(1-\alpha-\beta)(1-\gamma)}} \tag{29}$$

We get another equation of n_s. According to function (29), if we hold other variables constant, the local governments' actions of pursuing to maximize land revenue, to increase land leasing price and to extend urban land, i.e. to increase π and decrease φ, will increase n_s which means the ratio of labor in Solow Section will increase. Since the amount of labor in the economy is fixed, the increasing n_s means the labors transfer from Malthus Section to Solow Section. To judge by common sense, the productive efficiency in Solow Section is more than Malthus Section and the labors' transfer will promote the economic growth. Figure 2 graphs the changes of labor allocation between the two sections with the economic growth after the application of land finance policy in China.

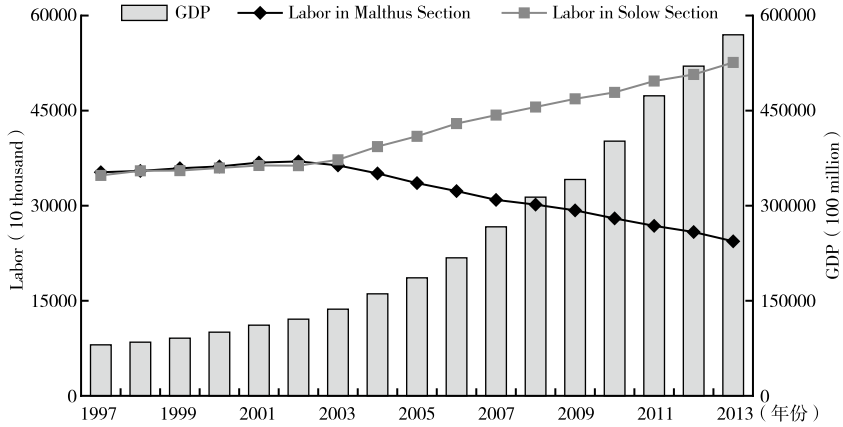

Figure 2. The changes of labor between Malthus Section and Solow Section
Source: *China Statistic Yearbook*.

In 1999, the State of the Council modified the Land Administrative Law which was issued in 1986. The expropriation of the land shall be approved by the State Council or the people's governments of provinces. The principle of land requisition changed from "agreement" to "announcement". The governments started to charge the using fees on the new-added construction land and the revenues would be used to adjust the land benefits between the central government and the local governments. The modification of the Land Administrative Law means the application of land finance policy. After the modification, the governments can requisition the rural land as they need according to the Land Administrative Law. Figure 2 plots that before the modification of the Land Administrative Law, the allocation proportion of labor between Malthus Section and Solow Section is almost equal. However, after 2002, the labor in Malthus Section declines dramatically, in contrast, the labor in Solow Section increases significantly. The gap of the labor allocation between the two sections is becoming bigger.

The land finance policy does not only decreas the land area in Malthus Section but also transfers the labor from traditional Malthus Section to modern Solow Section. If other production factors are fixed, the above two results caused by the land finance policy will promote the economic growth. Besides, the governments have more revenues because of leasing the land which can be used to provide more public goods and services and will help the economic growth.

In a word, to requisition the rural land and increase the land leasing price will reallocate the labor between Malthus Section and Solow Section. Concretely, if the total amount of capital, labor and land are constant, the land finance policy not only decreases the land area in Malthus Section but also transfers the labor from Malthus Section to Solow Section which will boost the economic development in China.

4. Empirical model and results

This section specifies an empirical model to test the above mathematical model and estimate the relationship between land finance policy and economic growth using the provincial panel data from 2004 to 2013. According to the feature of Malthus Section and Solow section, we define the primary industry as Malthus Section and the secondary and tertiary industry as Solow Section.

4.1. Data

We use panel data of 30 Chinese provinces during the period 2004-2013. Tibet is exclusive. The data comes from China Statistic Yearbook, each province's statistic yearbook, China Yearbook of Land and Resources and China Communiqué of Land and Resources. The data for Malthus Section comes from the primary industry and the data for Solow Section comes from the sum of the secondary and tertiary industry.

4.2. Model specification

In this paper, we focus on the effect of land finance policy, i.e. rural land requisition and high land leasing price, and labor transfer caused by land finance policy on economic growth in China. Rural land, land leasing price and labor transfer must be considered in the model. The empirical approach is to run panel data regressions of the form, and the estimation equation is:

$$Y_{it} = C_i + \alpha K_{mit} + \beta RL_{mit} + \gamma N_{mit} + \phi K_{sit} + \eta N_{sit} + \delta RMS + \lambda R_{it} + \zeta_t + \xi_i + \mu_{it}$$

Where Y_{it} denotes years of per capita GDP completed by year t in province i, C is constant, K_m is the input of capital in Malthus Section, RL_m is the average real value of rural land, N_m is the labor in Malthus Section, K_s is the input of capital in Solow Section, N_s is the labor in Solow Section, RMS measures the labor transfer from Malthus Section to Solow Section, R is the land leasing revenue, ζ_t is the time effect,

ξ_i is the individual effect, μ_{it} is the random error. Mixed-effect model, random effect model and fixed effect model will be used to test the estimation equation. Descriptive statistics of the sample used in the analysis are given in Table 1.

Table 1
Descriptive statistics of the data used in the model of per capita GDP in 30 Chinese provinces

Variable	Unit	Number of observations	Mean	Standard deviation	Minimum	Maximum
Y	Yuan/person	300	25001.35	17124.07	4215	89326
K_m	100 million yuan	300	70.9184	64.11076	5.28	318.08
RL_m	100 million yuan/acer	300	0.0000817	0.0000648	1.39E-06	0.0002936
N_m	10 thousand	300	1006.471	723.1707	37.09	3246
K_m	100 million yuan	300	2585.425	2087.943	183.58	9399.91
RMS	10 thousand	300	887.792	620.8291	85.2	3153
RMS	%	300	0.3627	0.1776	0.0043	0.8034
R	100 million yuan	300	637.5179	826.5836	1.64	6114.96

4.3 Econometric results

We use Stata 14 to do the regression test. The estimated parameters of all three models are given in Table 2. Column (1) reports the result of mixed-effect model. Column (2) reports the result of random effect model and Column (3) reports the result of fixed effect model. According to the Hausman test, p value is 0 which rejects the null hypothesis. The fixed effect model's result in Column (3) is accepted. According to Column (3) in Table 2, the variables related to land finance, RL_m, R and *RMS* are all significant. The results suggest that: (1) To requisition the rural land can promote the economic growth. In our regression model, we use the average real value of rural land to reflect the effect of rural land to the economic growth. One percent increase in average real value of rural land increase per capita GDP by 1.095%. As mentioned before, rural land is the denominator of the average real value of rural land (RL_m). To requisition the rural land means to decrease RL_m's denominator which will increase RL_m and promote the economic growth. (2) Land leasing revenue can raise the economic growth. One percent increase in land leasing revenue increase per capita GDP by 0.056%. (3) The labor transfer from Malthus Section to Solow Section caused by land finance policy can promote the economic growth. One percent increase in *RMS* increase per capita GDP by 0.021%.

In order to test the model's robustness, we use average land leasing price to replace land leasing revenue and lag the capital input variables and land leasing price variable one period. The results of mixed-effect model, random effect model and fixed effect model are given in Column (4), (5) and (6) in Table 2. We examine this possibility using a Hausman test. The fixed effect model, Column (6), is accepted and the effects

are robust. Land finance policy can promote the economic growth and the labor transfer caused by land finance policy can also increase the economic growth in China.

Table 2
Estimated coefficients of regression models of economic growth in China

	(1) Pols	(2) Re	(3) Fe	(4) Pols	(5) Re	(6) Fe
K_m	0.137**	0.493***	0.900***	0.177***	0.716***	0.858*
	(0.0501)	(0.092)	(0.292)	(0.054)	(0.117)	(0.326)
RL_m	-0.494	0.225***	1.095***	0.004	0.443***	1.295***
	(0.042)	(0.071)	(0.158)	(0.043)	(0.139)	(0.206)
N_m	-0.481***	-0.707***	-0.584***	-0.458***	-0.795***	-0.560***
	(0.039)	(0.071)	(0.117)	(0.052)	(0.100)	(0.128)
K_s	0.125*	0.075*	0.017	0.225	0.011	-0.004
	(0.063)	(0.039)	(0.017)	(0.143)	(0.086)	(0.013)
N_s	0.120	0.175*	0.181**	0.206	0.290*	0.193***
	(0.089)	(0.096)	(0.068)	(0.052)	(0.160)	(0.065)
RMS	0.064	0.059*	0.021*	0.094*	0.077**	0.032*
	(0.039)	(0.031)	(0.028)	(0.051)	(0.060)	(0.029)
R	0.263***	0.209***	0.056**	0.179***	0.126***	0.023*
	(0.027)	(0.026)	(0.022)	(0.043)	(0.036)	(0.013)
C	8.890***	11.998***	19.412***	9.926***	15.234***	21.917***
	(0.775)	(0.879)	(2.480)	(0.803)	(1.781)	(3.245)

Pols denotes mixed-effect model, Re denotes random effect model, Fe denotes fixed effect model.
*** denotes significantly different from zero at a 1 percent significance level, ** denotes significantly different from zero at a 5 percent significance level, * denotes significantly different from zero at a 10 percent significance level.
Cluster robust standard errors in parentheses.

5. Conclusion

In this paper, the economy is divided into two sections, Malthus Section and Solow Section. According to the theoretical analysis and empirical analysis based on classical model, we get the conclusion that the land finance policy can promote the Chinese economic growth. The labor transfer from Malthus section to Solow section caused by land finance do more contribution to economic growth than reducing the farm land and raising the land lease price.

In China, the labor transfer presents the transfer from rural area to urban area. It is difficult for the labors to get used to modern productive section. The local governments have to help the transferred labor master the new skills to be used to the modern productive section. Besides, the local governments have to set up the social welfare system for the transferred labors.

To increase the land leasing revenue means the local governments can get more finance revenue which can be used to provide public goods and services and infrastructure construction. This explains why increasing the land leasing revenue can promote the economic growth.

In this paper, we just consider the economic effect caused by land finance policy. Actually, a series of social problems may happen during the progress of land requisition, such as how to guarantee the farmers' land property rights and how to preserve the food safety and ecological condition. These are crucial problems during the progress of urbanization and industrialization. If we cannot deal with the problems well, they will strangle the economic growth. The local governments have to take preventive action to avoid the possible problems.

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