Original Paper

Research on the Interaction Mechanism between Farmland Circulation and Non-Agricultural Industry from the Perspective of Equilibrium

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Abstract

The "three rights division" is a major innovation in China's land system. Under the framework of "three rights division", there are corresponding policy constraints on the circulation of management rights of different types of land. This paper constructs a dynamic equilibrium model of farmland management right transfer from the macro level, and studies the economic connection between farmland circulation and non-agricultural sectors. The results show that there is an obvious economic interaction mechanism between the circulation of agricultural land and the development of regional non-agricultural industries, and circulation is a channel to communicate the flow of factors between the agricultural sector and the non-agricultural sector, and its flow trend is significantly affected by policies. There is a certain threshold for the start of agricultural land circulation, and the critical condition is that the industrial capital stock of the non-agricultural sector reaches a certain level. Therefore, to effectively promote the circulation of agricultural land, we cannot completely rely on the market, and the government's action is crucial. Based on the analysis, this paper puts forward corresponding policy suggestions on guiding the circulation of farmland and better playing the role of circulation in promoting industrial development.

Keywords

three rights division, agricultural land circulation, industrial development

1. Introduction

China's current land system can be traced back to the implementation of the household joint production contract responsibility system in 1978, that is, "package production to households". In a specific historical period, "package production to households" solved the problem of enthusiasm in agricultural production, and promoted the increase of agricultural production and farmers' income. With the continuous changes in the economic structure and the continuous deepening of reform, peasants' enthusiasm for production and operation of their own contracted land has decreased significantly. Taking into account the economic benefits of agricultural production, farmers' will, coordinated development and other factors, the Party Central Committee decided to implement the policy of "three rights division" in land. As an important part of China's agricultural supply-side structural reform, the purpose of "three rights division" is to further transform the mode of agricultural development in China, form a pattern of separation of ownership, contracting rights and management rights, and circulation of management rights, and realize the intensive and large-scale development of China's agriculture.

At present, the work of confirming the right to contract management of rural land has been implemented, and the relevant supporting system of "three rights division" has also been implemented. In the context of rapid urbanization in China, it is generally expected that the "three rights division" can be successful, revitalize existing land and promote the growth of farmers' income and the development of agricultural modernization. The study of Mao Peihua and Xu Ji (2015) found that land transfer can increase the household income of any sample of farmers and those who have already transferred farmers by 19% and 33%, respectively. Zhang Guolin and He Li (2021) found that the circulation of land management rights is an important mechanism to promote the growth of farmers' property income. Cao Zijian et al. (2022) show that the reform of the farmland property rights system represented by the "three rights division" significantly improves the efficiency of agricultural modernization development by accelerating the mediating effect of farmland circulation.

In the practice of guiding the "three rights division", the transfer of agricultural land management rights is an important content. In recent years, a major feature of the circulation of agricultural land in China is that the regional differences are significant, and the turnover rate in some areas is not as expected. Taking the cultivated land that occupies the main position in the agricultural land area as an example, according to the statistics of the Policy Reform Department of the Ministry of Agriculture and Rural Affairs, in 2020, China's household contracted cultivated land area was 1561.6624 million mu, and the circulation area was 532.1892 million mu, with a turnover rate of 34%. Among them, the turnover rate in the western region is 24%, the turnover rate in the northeast region is 46%, the central region and the eastern region are 36% and 43% respectively, and the turnover rate in the eastern and northeastern regions is significantly higher than that in the central and western regions. The analysis of this

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phenomenon often involves the endowment factors of agricultural land, such as topography, climate, hydrological conditions, etc., but the intuitive endowment factors can only partially explain the difference in regional turnover rate, and the explanation without economic and social factors is too thin to be completely convincing. For the analysis of other reasons for regional turnover rate differences, there are many literature worthy of reference. Guo Bin et al. (2013) argue that farmers decide whether to circulate by comparing the likelihood and size of investment in the sustainable use of the outflow land. Zhang Lan et al. (2016) believe that transaction costs, expected income, and land endowment are important factors affecting the circulation of agricultural land. Hu Zhen and Zhu Xiaoqingji (2017) discuss whether the "three rights division" is a natural need of rural social development and whether it is the same as the right arrangement under China's traditional perpetual tenant system, from the perspective of agricultural social needs and agricultural system, which has certain reference significance for further explaining the reasons for the significant differences in agricultural land circulation in different regions. Zhong Guohui (2019) believes that farmers tend to transfer land between neighbors, but the circulation area between neighbors is very limited, so the phenomenon of idle agricultural land and management rights not coexisting often occurs. Guo Xiuli (2021) conducted a field survey on the circulation of cultivated land in Liangzhou District, Wuwei City, Gansu Province, and analyzed the main drivers of local farmers' transfer, including migrant workers in urban areas, non-agricultural operations, aging agricultural labor, circulation of village committee organizations, scattered cultivated land, and remoteness from residences. Liu Hua et al. (2022) studied the relationship between the implementation of land circulation performance guarantee insurance and land circulation. The results show that land circulation performance guarantee insurance reduces the risk of land circulation to a certain extent and improves the enthusiasm for circulation. However, the frequent occurrence of disputes over the transfer of land operation rights has adversely affected the development of the rural land circulation market, resulting in a gap between the actual circulation effect and expectations. Du Jiao (2022) believes that the phenomenon of alienation of the "three rights division" in some regions has occurred in the process of practice, which is specifically manifested in the absolute responsibility of the rights of ownership and contracting rights subjects and the weakening of the rights of the subjects of management rights, and the imbalance of subject rights has failed to give full play to the ideal efficiency of "three rights division". Zhu Xinhua et al. (2021) believe that in the practice of "three rights division" in some regions, due to institutional and market factors such as unclear competence and imperfect income distribution mechanism, the mismatch of ownership and qualification rights has arisen, which is not conducive to the role of "three rights division". Although Zhu's research object is mainly limited to the circulation of homesteads, his research methods are also of great significance to the problem of agricultural land circulation. Some scholars have also done research from other perspectives, contributing to further elucidating the causes.

Summarizing the literature, the existing research on all aspects of farmland circulation presents the characteristics of diversification, interdisciplinarity and case-oriented, and most of the analysis starts

from the field of sociology, and the analysis in the field of economics is less than that in the field of sociology, that is, there is a lack of in-depth analysis of the economic mechanism and the main economic motivation behind the circulation of farmland. In terms of methods, field investigation and case analysis are mostly used, while normative research based on classical economic paradigm is almost blank and needs to be further improved. In the context of China's socialist market economy, economic factors have a huge impact on the circulation of agricultural land, and the impact may not be less than endowment, social and other factors. In view of this, the purpose of this paper is to use normative economic analysis methods to explore the core economic factors affecting the circulation of farmland. Considering that the circulation of farmland inevitably involves the non-agricultural sector, this paper will also try to clarify the interaction mechanism between the transfer of farmland and the non-agricultural sector, and put forward corresponding policy suggestions for better playing the role of the government, hoping to make theoretical and original contributions to promoting rural revitalization with Chinese-style modernization.

2. Assumptions

2.1 Assumptions and Premises

The analysis of the intrinsic economic mechanism of agricultural land circulation can be carried out from both macro and micro levels. The micro-level research on farmland circulation mainly involves the economic interests, legal rights and interests of the transfer subjects, rural traditional social structure and cultural customs, and farmers' psychology, and individual heterogeneity factors play an important role in it. Due to the high complexity of individual heterogeneity factors, microscopic studies on agricultural land circulation inevitably have certain subjectivity in conclusions. Based on the above reasons, it is difficult to abstract the core factors that determine the circulation of farmland in the economic aspect, and it is difficult to deepen the research. At the macro level, classical macroeconomic theory provides a suitable analytical tool for the study of this paper - the neoclassical growth model. The introduction of this model can effectively abandon the individual heterogeneity factors of circulation subjects, abstract the common economic factors in circulation decision-making to the greatest extent and analyze them in depth. Therefore, this paper will analyze the economic equilibrium of the subject from the macro level, and have the basic assumptions (1) that the factors of individual heterogeneity are excluded, that the circulation subjects are completely homogeneous, and that the macro output of each sector is a simple linear sum of the output of homogeneous individuals; (2) ignoring population growth; (3) do not distinguish between population and labor force, and set the two equivalence; (4) Regardless of monetary factors, income and output levels are measured in kind.

In addition, the circulation of farmland management rights involves entities including the outflow party of the management right (or the supply side, generally farmers), the inflow party of the management right (or the demand side, including economic organizations and individuals such as enterprises, cooperatives, and wealthy farmers), and the government (including the government, collectives, land

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circulation service centers and other organizations and institutions).

2.2 Macro Production Function

The transfer of farmland management rights involves traditional agricultural sectors, modern agricultural sectors and non-agricultural sectors, and the production functions of the three sectors are all characterized in the form of Cobb-Douglas.

Traditional agricultural sector. Traditional agricultural production is characterized by investing only labor and land production factors, and not capital factors such as machinery. Suppose that in traditional agriculture with surplus labor, each homogeneous farmer is contracted to operate one unit area of agricultural land. Under this hypothetical condition, when farmers choose to transfer and engage in non-agricultural work, the area of farmland operated by farmers and the number of farmers in the traditional agricultural production function will change proportionally. This condition also means that the peasant's investment in his own land is equivalent to the transfer to the enterprise, in which case the peasant is equivalent to working for his own enterprise and paying for himself, and the R_s ("rent" of the agricultural land circulation)is also paid to himself. Under traditional agricultural production, farmers derive from production experience that the expected output per unit of land is related to A(socio-technical level), and the output per unit area is bA. Constant b is the extent to which the local farmer has applied the technology. If $\overline{N}$ and N are the original farmland area and circulation area of the traditional agricultural sector, respectively, the macro production function of the traditional agricultural sector is $Y_r = bA(\overline{N} - N)$.

Modern agricultural sector. As the main body of demand, enterprises specialize in "renting" agricultural land and investing capital in modern agricultural production. The key difference between modern agricultural production and traditional agricultural production is that capital is invested as a factor of production, which increases unit output while reducing production risks. The enterprise obtains the farmer's farmland management right with "rent" R_d, and N is the area of farmland operated by the enterprise. Assuming that the enterprise invests fixed capital θ per unit area of agricultural land for modernization, the total capital invested is $K_f = \theta N$. In view of the small amount of labor required for large-scale mechanized production, the labor required by enterprises is ignored and only capital and agricultural land are invested in production. In summary, the macro

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production function of the modern agricultural sector is $Y_f = A K_f^\beta N^{1-\beta} = A\theta^\beta N$, and the output

per unit area is $A\theta^\beta$.

Non-agricultural sector. Let the capital stock of the non-agricultural sector is K_c, and the function of

total employment is $L(K_c)$. That is, the number of jobs in the non-agricultural sector is an increase

function of the capital stock K_c. L can have different forms of functions, and L is a linear function

of K_c when the industrial structure does not change. When the industrial structure changes, the

number of jobs grows slower than the growth rate of capital and the gap widens, and L is a function of

the marginal decline of K_c. The government can influence the functional form of L by implementing

effective employment safeguard measures. Although the average social technical level is relatively
stable in a certain period of time, due to the promotion and application of technology in local areas and
individual departments, the proficiency level of workers and the gradual improvement of managers'
management experience, there will still be phenomena similar to changes in industrial structure, so that
the growth rate of employment is not as fast as the growth rate of capital. Therefore, this article first

discusses L's case of marginal decline in K_c, which means that the government does nothing to do

and does not take strong employment protection measures, and then discusses other situations. Since
the above assumes that each homogeneous farmer owns one unit area of farmland, the turnover area of
farmland is equal to the number of farmers who have been transferred, and the total population of the

non-agricultural sector is $L_0 + N$ and L_0 is the initial population of the non-agricultural sector.

There is unemployment in the non-agricultural sector, employment rate $p = L/(L_0 + N)$. Due to

the rigid constraints of the system, the initial non-agricultural population L_0 (such as the urban native

household registration population) without land contracting rights cannot be transferred to the

agricultural population. Hence $N \geq 0$ .In summary, the macro production function of the

non-agricultural sector is $Y_c = A K_c^\alpha L^{1-\alpha}$.

In summary, the macro production function of the three sectors is

$$\begin{cases} Y_r = bA(\overline{N} - N) \\ \quad Y_f = A\theta^\beta N \\ Y_c = AK_c^\alpha L^{1-\alpha} \end{cases}$$

It is noted that under the condition of satisfying the basic assumptions, it is not only the circulation area of agricultural land, but also equivalent to the area of agricultural land "rented" by enterprises, and it is also equivalent to the labor supply flowing into the non-agricultural sector, becoming an intermediary to communicate the production function of the three sectors.

2.3 Subject Decision-Making

The circulation subjects have their own interests, and the circulation can only occur when the interests of the subjects are coordinated with each other. The following article first analyzes the interests of farmers and enterprises in the process of circulation, and constructs the decision-making equation of the corresponding entity accordingly, and then analyzes the situation when the government of the third-party entity intervenes.

Farmers and total supply. The characteristics of farmers' production decisions in the traditional agricultural economy are reflected in their concave preference function, and "save every inch of land, leave it to future generations to cultivate" reflects the farmers' risk aversion preference. This preference inherently drives farmers to focus on risk factors in their daily production and gradually develop broad and deep-seated conservatism in production decisions. For farmers with concave preferences, the comparison between agricultural production risk and employment failure risk can greatly affect farmers' choice. The expected income of farmers after conversion is $p\omega$, and ω is the average salary in the non-farm sector. Since p and the number of jobs in the non-agricultural sector L are positively correlated, if the total number of jobs L in the non-agricultural sector is large enough, farmers with risk-averse preferences expect that the average unemployment risk in the non-agricultural sector is less than the traditional agricultural risk of "resigned to fate", and farmers will consider transferring agricultural land management rights to avoid agricultural production risks. Transferring the right to operate agricultural land is different from withdrawing from rural land. The central authorities have clearly stressed that the withdrawal from rural land must not be used as a condition for peasants to settle in cities, and that after settling in cities, peasants will continue to enjoy the "three rights" of collective land without compensation for a certain period of time, and peasants who have been transferred to other jobs will naturally not lose their collective membership. In the event of an economic shock, the risk of employment in the non-agricultural sector increases sharply and $E(p\omega)$ falls sharply, and farmers can demand the return of their right to operate their arable land, thus avoiding

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income fluctuations caused by the economic downturn. In addition, the "rent" paid by enterprises to farmers is also an important part of farmers' utility. In the face of an economic crisis, employment risks are extremely high, and enterprises can achieve the stability of circulation by increasing the "rent" of circulation - high "rent" returns offset the negative impact of unemployment risk on re-employed farmers, prompting some farmers to choose not to return their farmland management rights.Based on the above analysis, it can be seen that the total supply of farmland circulation determined by farmers is satisfied at macro equilibrium

$$R_s + cp\omega = bA + m \tag{1}$$

The above equation is the equation for the total supply of agricultural land. Among them, the coefficient c indicates the degree of farmers' aversion to the risk of reemployment or the degree of dependence on land, and for the risk-averse farmers, $c < 1$ must be valid, indicating that the farmer has the inertia of production, and the expected income from reemployment with the risk of unemployment has a risk premium $(1 - c)p\omega$ compared with the habitual farming income.

Non-farm sector employment rate $p = L/(L_0 + N)$. Real average wage $\omega = dY_c/dL = (1 - \alpha)AK_c^{\alpha}L^{-\alpha}$ (enterprises only consider changes in the number of social employees when determining wages, but do not consider changes in social capital, that is, enterprises are recipients of capital, which are regarded as constants in the process of determining the right).

Where m represents the actual cost of changing jobs for farmers, including training costs, transportation costs, and rents in different places, is set as a constant. As can be seen from the equilibrium equation, the motivation of peasant circulation consists of two parts: "rent" R_s and expected wage $cp\omega$. In reality, there must be $bA + m - cp\omega \geq 0$, $bA + m$ is the sum of the opportunity cost and the actual cost of the farmer's transfer, and the difference between this value and the expected wage income must be greater than zero, otherwise even if the "rent" of farmland is zero, the farmer will choose to circulate, which is inconsistent with reality, ignore this situation.

Business and total demand. For enterprises, the sole purpose of "renting" farmland for production is to generate profits. There is obviously an opportunity cost to enterprises "renting" farmer's land and putting equipment into production—the average profit obtained when the same amount of money is invested in other investment projects, and only when the opportunity cost is lower than the profit of

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"renting" farmland, the enterprise has the incentive to "rent". In the short term, because the socio-technical level and the basic economic environment generally do not change significantly, when the investment of various economic units in the non-agricultural sector increases significantly, the marginal rate of return on investment in the non-agricultural sector will continue to decline due to the decline in the marginal efficiency of capital. In reality, the total amount and growth rate of industrial investment in the non-agricultural sector are often higher than those in agriculture, and the marginal rate of return of agriculture will rise relatively higher, and some economic entities will choose to turn their investment attention to agricultural land for modern agricultural production. Therefore, the possibility of "renting" agricultural land by economic agents is naturally bred in the social economy.

The total demand of enterprises to operate farmland is met $A\theta^\beta = (R_d + \theta)(1 + r)$ at macro equilibrium. When enterprises "rent" one unit of farmland with capital R_d and invest capital θ, the income $A\theta^\beta$ per unit area of farmland obtained is equal to the average income obtained when the same funds are invested in non-agricultural industries. The average yield is measured by the investment rate r, $r = dY_c/dK_c = \alpha A K_c^{\alpha-1} L^{1-\alpha}$ (Enterprises only consider the size of social capital in investment decisions, so in the process of determining interest rates, that is, in the process of deriving the non-agricultural capital stock of the production function, the employment level should be regarded as a constant). Sort out and get the total demand equation

$$R_d = \frac{A\bar{\theta}^\beta}{1 + \alpha A K_c^{\alpha-1} L^{1-\alpha}} - \theta \ , \ R_d \geq 0 \tag{2}$$

Since in the process of determining the interest rate of non-agricultural investment, the total employment L is regarded as a constant, so the "rent" R_d has nothing to do with the turnover volume of agricultural land N, N does not enter the total demand, the flexibility of the retained bid of the enterprise to the change of the turnover area is zero, and the non-agricultural capital K_c positively determines the reserved price of the enterprise "renting" the farmland, reflecting the strong bargaining power of the enterprise relative to the farmers. In the "rent" game, farmers are in a weak position. The limit $A\theta^\beta - \theta$ of the reserve price R_d is exactly equal to the difference between the output per unit of agricultural land and the capital input of the enterprise. In general, there is $A\theta^\beta - \theta < bA + m$.

The reason is that when the "rent" is greater than the sum of the opportunity cost and the actual cost of the farmer's transfer, the rational farmer must agree to transfer the farmland, so the company does not need to raise the reserved bid higher than the $bA + m$. In addition, if $A\theta^\beta - \theta > bA + m$, that is, the farmland operated by the enterprise at a "rent" not higher than $bA + m$ can always obtain a positive profit, the company's demand for farmland will tend to infinity, which is far from reality, so

$A\theta^\beta - \theta < bA + m$.

3. Agricultural Land Circulation and Non-Agricultural Industry Development under Market Mechanism

3.1 Static Equalization

Combining the equations of aggregate supply and aggregate demand makes SS a function of the equilibrium circulation area N of the farmland management right with respect to the capital stock K of the non-agricultural sector, provided that farmers and enterprises agree on the turnover price

$$N(K_c) = \frac{c(1 - \alpha)(1 + r)AK_c^\alpha L^{1-\alpha}}{(1 + r)(\theta + bA + m) - A\theta^\beta} - L_0 \quad , N \geq 0 \tag{3}$$

Among them, there are $r = \alpha AK_c^{\alpha-1}L^{1-\alpha}$. As shown in Figure 1, N is a function of the increase in the capital stock of the non-agricultural sector, and its form is affected by the form of the function L. Due to institutional constraints, the total area of circulation cannot be less than zero, so there is a specific critical condition for non-agricultural capital (set to K^*) to enable the transfer of agricultural land management rights, and the size of K^* is significantly affected by the initial population L_0 of the non-agricultural sector. When the capital stock of the non-agricultural sector reaches a certain level, the phenomenon of large-scale transfer of agricultural land and conversion of farmland by farmers will occur.
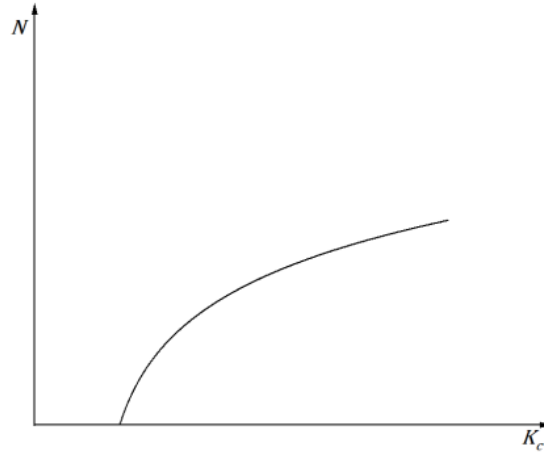
Figure 1. Turnover Area and Non-Agricultural Capital under equilibrium

3.1 Dynamic Models

The output of the enterprises is fully invested in the non-agricultural sector, except for consumption $(1-s)Y_f$, depreciation δK_f, new investment for changes in agricultural land area $\theta \dot{N}$ and payment of "rent" RN. Therefore, the new investment $\dot{K}_c$ in the non-agricultural sector is equal to $sY_c - \delta K_c$ plus the $s(Y_f - \theta \dot{N} - RN) - \delta K_f$ of the company's investment in the non-agricultural sector and the part of the sRN of the "rent" earned by the rehabilitated farmers deducted from consumption, and the differential equation for K_c for the new investment in the non-agricultural sector $\dot{K}_c$ including the total turnover area N is sorted out by using $\dot{N} = \gamma \cdot \dot{K}_c$

$$\dot{K}_c = \frac{sAK_c^\alpha L^{1-\alpha} - \delta K_c + (sA\theta^\beta - \delta\theta)N}{1 + s\theta \cdot \gamma} \tag{4}$$

The function $\gamma(K_c)$ in the above equation is the slope of the function $N(K_c)$. Obviously, γ is not continuous. We can also know the differential equation for K_c for the area of farmland added by the company

$$\dot{N} = \gamma \cdot \frac{sAK_c^\alpha L^{1-\alpha} - \delta K_c + (sA\theta^\beta - \delta\theta)N}{1 + s\theta \cdot \gamma} \tag{5}$$

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So far, this paper establishes the supply and demand model of the circulation of farmland management rights without government intervention in the form of formulas (4) and (5), and the core endogenous variable is the capital stock K_c of the non-agricultural sector, and the circulation area N is determined by K_c in the market environment, showing that there is an intrinsic relationship between the circulation of agricultural land and the development of the non-agricultural sector. Tentatively assume that the government "Wuwei" is the formula L as a function of diminishing marginal K_c. It can be seen from equation (4) that the convergence value of non-agricultural capital and the size of the critical condition K^* determine the equilibrium point in the model. When the convergence value is greater than the critical condition, the circulation of agricultural land will inevitably occur. On the contrary, the capital that converges below the critical condition is not enough to promote the circulation of farmland, farmers and enterprises cannot agree on the transfer price, and the government "rules without action", and the market mechanism makes the "three rights division" of agricultural land almost ineffective, as shown in Figure 2.
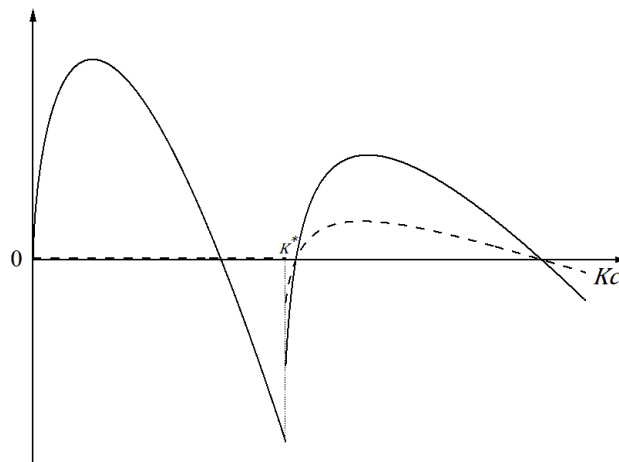

Figure 2. Phase Diagram When Critical Conditions Are not Met

The solid line in the figure represents the amount of new investment in the non-farm sector, and the dotted line represents the size of the new arable land area added by the enterprise

4. Agricultural Land Circulation and Non-Agricultural Industry Development with Government Intervention

The government has both long-term and short-term policy objectives. Promote the coordinated development of agriculture and non-agriculture in the long run, and maximize the social output under the circulation of farmland. The imbalance between urban and rural areas and between agriculture and

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non-agricultural development is an important part of the main contradiction in our society. The polarization of different industries will drag down the growth of total output in the long run, and total output is an important indicator of the degree of social development, and it is also an economic indicator that the government will focus on in the long run. Since the size of the agricultural land circulation area is an important indicator to measure agricultural development, the realization of coordinated development of agriculture and non-agriculture must also be based on the conditions of agricultural land circulation, that is, on the short-term goals of the government. In the short term, guide the circulation of farmland, increase the total grain output, and promote rural revitalization. Food security will play an important ballast role in China's sustainable economic and social development for a long time in the future, and maximizing total food output is an important goal of the government for a certain period of time. Due to the high yield of modern agricultural production, maximizing food output is deeply linked to guiding the circulation of farmland, and the government guiding the circulation of farmland in the short term, encouraging social capital to participate in the construction of high-standard farmland, and increasing total grain output are necessary conditions to ensure food security.

Although the government still has policy goals such as promoting the well-being of rural micro-individuals and improving rural ecology, the above two policy goals are more fundamental. The key to exploring what policies governments adopt to achieve long-term and short-term policy objectives, and how to balance long-term and short-term objectives, is how to influence policy variables.

The variables fixed as constants in the model include the initial non-agricultural population L_0, the capital input θ per unit area of farmland, and the elastic coefficients α and β in the macro functions of each sector, which are less likely to be changed by the government and are not the objects of direct attention of the government, so they will not be discussed in depth. Technology level A has its own evolutionary process, although the government can promote the development of technology through relevant policies, but its speed is relatively slow, so the impact on A has a long-term nature.

At the same time, since the depreciation rate δ and technical level are somewhat related, δ is not easy to change in the short term. In addition, the policy variable that governments need to change over a longer period of time is the level of human capital, which is reflected in the model as the coefficient of farmers' application of technology. Governments can also embody human capital policies by introducing education level $e > 1$ into the macro-production function of the non-farm sector, with the

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new production function being $Y_c = AK_c^\alpha (eL)^{1-\alpha}$. The policy variables that the government can

clearly influence in the short term are saving capacity s and the very unique employment function L,

and the impact of policy on L is reflected in the change of its function form rather than the adjustment

of the value itself.

In the long run, in the process of pursuing coordinated development of agriculture and non-agricultural development and maximizing total output, the most important measures are to accelerate technological

development, influence policy variables A and δ, and promote human capital improvement. In the

short term, guiding land transfer becomes a top priority, and the core variables that policies must focus

on are s and L, which not only affect the circulation effect, but also significantly change the total

social output, so this is the focus of the following analysis.

4.1 Underlying Policy Variables

Technology. The deepening of the model is similar by the changes of the technical level A and

depreciation rate δ, which reflect the overall productivity level, and the optimization of both increases

the size of new investment in the non-agricultural sector horizontally, improves the level of convergence, creates a basis for non-agricultural capital to reach the critical condition of agricultural land circulation, and realizes the increase of final capital stock in the long run. Therefore, the policy of

raising technology A and reducing the depreciation rate δ can indeed achieve the coordinated

development of agriculture and non-agriculture and increase total output. It should be noted that raising

A is essentially through the channel of increasing the relative average wage of the non-agricultural

sector to attract farmers to the non-agricultural sector, and eventually form capital supply, if the

increase of A is not sustainable, if there is a technical bottleneck that is difficult to solve in a certain

period of time, it will not change the trend of the eventual decline in the growth rate of non-agricultural investment.

Human capital. The technical training of traditional farmers can increase the size of the application

coefficient b, but the improvement of b reduces the circulation area under macro equilibrium, so the

technical training of traditional agricultural production is not necessarily appropriate. Although the

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agricultural output under traditional farming has improved, due to the small-scale and fragmented self-owned contracted land, coupled with the extremely limited capital input of individual farmers, the output is still far lower than the large-scale intensive modern agricultural output, the sustainable protection of this backward industrial model will cause waste of input in the long run, so the training of farmers' technology should focus on the training of non-agricultural skills, reduce the worry of farmers who are unemployed when changing jobs, and enhance farmers' confidence in circulation. Another manifestation of the human capital variable in the model is the introduction of the human capital

element e into the non-farm sector production function, so that $Y_c = AK_c^{\alpha}(eL)^{1-\alpha}$, the analysis of

which is similar to the previous part, will not be repeated.

4.2 Core Policy Variables

The savings capacity of farmers. For China, the areas where industrial development lags behind are often areas with a large proportion of agricultural population. Although the investment space of the non-agricultural industry is relatively large and the return on investment is relatively high, such investment projects often do not receive corresponding financial support. From a macroeconomic point of view, investment equals saving, and insufficient investment reflects the lack of saving capacity. From this point of view, under the dual structure of urban and rural areas, areas where the development of the non-agricultural sector lags behind, there are generally two major problems in terms of saving capacity at the macro level, namely, insufficient level of farmers' savings and insufficient ability to convert farmers' savings into investment, which seriously affects the circulation of agricultural land. Policy formulation also needs to start from here. In addition, the effective circulation of farmland is also counterproductive to improving the level of farmers' savings and their ability to convert them into investment. The specific analysis is as follows:

First, the level of savings of peasants is low. Farmers, due to their conservative nature, tend to have a high willingness to save, but the willingness to save is not equal to the actual level of savings. Due to various reasons, the income level of China's peasants has been maintained at a relatively low level for a long time, and the income of some peasants in areas that have just been lifted out of poverty can only reach the level of food and clothing. Forced by life, compared with the majority of the non-agricultural population, most peasants have to spend a large part of their income on basic living expenses such as housing, medical care, children's education and marriage, and the average savings level of most peasants is far lower than the average savings level of the non-agricultural population, especially the urban population. It can be seen that the insufficient level of savings is largely due to the low level of income. The proportion of low-income farmers in backward areas is large, and the average savings level will be relatively low; Second, peasants' ability to convert savings into investment is insufficient. The large number of peasant population means that farmers' savings generally account for a large part of the total savings of the region, and guiding the savings of farmers, who account for the bulk of the total savings, into investment is crucial for regional industrial development. The problem is that

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China's peasants have a strong conservative tendency in their economic decision-making due to the influence of ideology, culture, and local feelings. First, the decision to invest has a high risk cost for farmers compared to saving. Therefore, in the absence of stable and high-return investment channels, farmers will choose to save rather than invest most of the time. This conservatism makes it difficult to channel farmers' savings directly into investment in the short term. Second, out of the need to resist external risks, and the need to convert harvested agricultural products into money requires a certain cost, a large part of the "savings" remaining after deducting consumption from farmers' farming output are often held not in monetary form but in physical form, and this part of the so-called "savings" cannot be effectively converted into investment. From the perspective of saving equal to investment, it means that it is more difficult to obtain financial support from farmers for industrial development in backward areas, and farmers' savings account for a large part of the total regional savings, which has a great impact on industrial capital accumulation.

For backward areas, the double deficiency of farmers' savings level and the ability to convert farmers' savings into investment is reflected in the model as small savings capacity, and from the perspective of promoting circulation, low levels of saving capacity will have serious consequences. It can be seen from equation (4) that the size of non-farm capital convergence is related to the saving capacity s.

When s is less than a specific saving capacity s^*, the function crosses the horizontal axis from the horizontal vertical and vertical at less than the critical condition, and the non-agricultural capital below the critical condition is not enough to promote the circulation of agricultural land, and the "three rights division" is invalid, as shown in Figure 2. Since the development process of industry in the market environment is continuous, it is impossible for the industrial capital stock of the non-agricultural sector to accumulate by leap when the government does not intervene, and the function cannot converge to the equilibrium point greater than the critical condition in Figure 2.

The effect of increasing the saving capacity in promoting the circulation of agricultural land is obvious.

If $s > s^*$, the function remains positive for some time after crossing the critical condition, the non-farm capital will still increase, and the capital level greater than the critical condition will cause the turnover to occur. The function will drop jumping at the critical point, and the circulation of farmland will crowd out some investment in non-agricultural industries at the same time. But in the long run, the stock of capital eventually accumulated in the non-farm sector has also increased, as shown in Figure 3.

$(sA\theta^\beta - \delta\theta)N$ in the numerator played a key role here, promoting a temporary recovery in the growth rate of non-farm capital. On the other hand, although the denominator $1 + s\theta \cdot \gamma$ has a certain degree of crowding out the growth of capital stock at the beginning of agricultural land

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circulation, when the capital stock K_c is large, because the numerator in formula (4) is negative, the

savings rate s becomes larger and the denominator is larger, and the strong saving capacity plays a

role in slowing down the decline of capital accumulation $\dot{K_c}$ at this time. Affected by the law of

marginal decline, the growth rate of capital stock inevitably shows a downward trend in the long run, and the continuous occurrence of circulation can still guide some farmers' savings into investment and form capital stock, becoming a stabilizer for capital accumulation and industrial development in the non-agricultural sector in the long run.

The above conclusion can be understood as follows: the circulation of farmland has promoted the development of regional industries through two channels: improving the level of storage and converting savings into investment capacity. First, the lack of savings level is essentially due to the lack of income level, and compared with traditional farming income, the circulation of agricultural land has the characteristics of low risk because the circulation price is determined by the contract, and its payment is protected by the system and law, and compared with general deposit investment, the return on circulation is much higher. The combination of the two means that farmers have obtained a unique and considerable income channel protected by the system and law due to their status as "agricultural population"; Second, the transfer of agricultural land has a unique advantage in promoting the conversion of savings into investment. Farmers who transfer their own land to others can only earn income by collecting the transfer price and engaging in non-agricultural production due to the temporary transfer of agricultural production materials. Turnover prices and non-farm income are generally held by farmers in the form of cash or bank demand deposits, which can be more effective into investment than traditional farming income.

Based on the above analysis, it can be considered that the circulation of farmland has become an effective channel to communicate the development of agriculture and non-agriculture, and plays a complementary role in the development of the non-agricultural sector. The improvement of saving capacity has led to the further development of the non-agricultural sector through the mechanism of agricultural land transfer, that is, the increase in the final capital stock through intermediaries that raise farmers' incomes and "monetize" the form of savings. The increase in capital comes from two aspects: First, the factors of agricultural labor are invested in the non-agricultural sector, and eventually converted into capital supply. Second, due to the increase in income and changes in the living environment after farmers change jobs, the final demand for non-agricultural products has risen. In it, the government is doing more "ex-front" work to create start-up conditions for circulation, and the market mechanism is still very important, thus achieving the goal of guiding the circulation of agricultural land in the short term, and taking into account the long-term goal of coordinating agricultural and non-agricultural development. However, the limitations of this policy are also obvious,

the most important factor affecting the ability to save is the income level, for the government, it is not easy to raise the income level of residents in the short term, so the strength and effect of the policy will not be very significant. If savings are unilaterally increased without raising income levels, although it can promote the circulation of agricultural land and industrial development, it will also crowd out consumption to a certain extent, affecting the happiness of micro individuals.

The government's employment guarantee in the process of changing farmers' jobs. Changes in saving capacity have a great impact on the deepening of the model, but from the perspective of path, the impact is more focused on promoting the development of non-agricultural industries. From the main point of view, although it is the savings capacity of farmers that is improved, it is the enterprise that plays the main role, and the willingness of farmers to circulate has not been directly improved, so although the change of peasants' saving capacity has a direct impact on industrial development, the impact on the circulation of agricultural land is less obvious. For the determination of the turnover area, the more immediate problem arises on the supply side. When farmers transfer their agricultural land management rights, they must consider the employment problem after changing jobs, and the government's policy grasp at this time is to change the function form of employment function L.

Under the condition that the savings capacity of farmers remains unchanged, the government decides to implement a series of employment guarantee measures to keep the growth rate of employment and capital in the non-agricultural sector matched, in case one leg is short and one leg is long, because the government cannot let L increase marginally on K_c, which means the degradation of the industrial structure, you can set L to be a linear function of K_c, $L = \mu K_c$. μ represents the strength of the policy. Bringing into the (3) equation to sort out $N = \tau K_c - L_0$, $N \geq 0$, that is, the circulation area N is a linear function of the non-agricultural capital stock K_c, and τ is positively correlated with the policy strength μ. Critical condition $K^* = L_0/\tau$, the greater the policy strength, the smaller the critical condition, the more relaxed the conditions required for circulation. Bring $N = \tau K_c - L_0$ into Equation (4) is known

$$\dot{K_c} = \begin{cases} (sA\mu^{1-\alpha} - \delta)K_c \ , \ K_c < K^* \\ (sA\mu^{1-\alpha} - \delta + \varphi)K_c - \sigma L_0 \ , \ K_c \geq K^* \end{cases}$$

It is easy to prove that $\tau, \varphi, \sigma > 0$. The above function is a piecewise linear function. Since savings are generally greater than depreciation, when the policy strength reaches a certain level, the slope of

$$s\mu^{1-\alpha}A - \delta > 0 \text{ and } sA\theta^\beta - \delta\theta > 0,$$ function is positive for a long time. Because the size of critical capital is negatively correlated with policy strength, increasing policy intensity can reduce critical capital and promote the circulation of agricultural land under more relaxed conditions.

Notice that the slope of the function increases after crossing the critical condition. The increase in the growth rate of new investment follows the following reasons: the government's employment guarantee has greatly affected farmers' willingness to make decisions, causing the continuous circulation of agricultural land, and the industrial development of the non-agricultural sector has been significantly affected by the agricultural sector. In the short term, its new investment has been squeezed out at one time, due to the low proportion of agriculture in the national economic structure, this short-term squeeze will not be particularly obvious, non-agricultural investment can still maintain positive growth, so the effect of employment security on guiding circulation in the short term is very significant. In the long run, employment security will also lead to a sustained increase in the growth rate of new investment in non-agricultural industries, changing the original local industrial development path. Given the differences in development conditions in different places, whether such changes are consistent with the country's orientation for local development needs to be screened as appropriate.

Due to the sustained increase in new investment in the non-farm sector, there must be a positive correlation between long-term total output and policy strength given T at a specific point in time. But unlike savings, job protection measures are not low-cost, they require large amounts of fiscal resources. Safeguard jobs are created by the strong promotion of the government, these jobs do not fully match market demand, so their benefits are limited, and the government's fiscal constraints make policy efficiency extremely critical at this time. Set the government utility as $U = Y - q(\mu) \cdot \lambda$, where Y is the total output of the three departments, q is the number of guaranteed jobs created by the government and q is positively correlated with μ. λ is the creation cost of a single security job, and $q\lambda$ is the total financial input measured in kind. Under these conditions, maximizing government utility equals maximizing net social output. On the basis of guiding the circulation of farmland and maximizing utility, the following equation system can be constructed in order to derive the optimal policy strength μ_e of the government that takes into account both output and input

$$\begin{cases} U_\mu = 0 \\ K_c(T) = \dfrac{L_0}{\tau} + Be^{BT} - Be^{Bt^*} \\ N(T) = \tau K_c(T) - L_0 \end{cases}$$

And

$$B = sA\mu^{1-\alpha} - \delta + \varphi$$

$$t^* = ln(K^* - K_0 + B - \varphi) - 2ln(B - \varphi)$$

In the above system of equations, the capital stock at $t = 0$ is K_0 that has not reached the critical

condition, t^* is the time required to reach the critical condition. T is a future year or acceptance year,

$T > t^*$. And the capital stock $K_c(T)$ in Tth year is solved by the differential equation. It can be

proved that in the Tth year, there will be an inverted U-shaped relationship between policy strength

and government utility, that is, social net output, and there is a marginal diminishing effect of policy

effect, and the first-order conditions of the government utility function can solve the optimal policy

strength μ_e to maximize government utility, that is, maximize social net output in Tth year. Reducing

the deviation from the optimal policy strength tests the government's macro-control ability. Too low a

policy will not be able to complete the goal of guiding the circulation of farmland as soon as possible,

and too high a policy will crowd out market capacity, forming an inefficient equilibrium - the net

output remains at a low level of policy equilibrium, although the goal of guiding the circulation of

cultivated land has been achieved at this time, but will make the net output of society decline, at this

time the policy is inefficient.

5. Recommendations for Policy

5.1 Coordinate the Role of the Market and the Government, and Improve Agricultural Infrastructure

To promote the circulation of agricultural land, the ability to save is crucial, and the lack of saving

capacity is essentially a lack of income level. It is necessary to pay attention to ensuring the livelihood

of poor peasants and promote the tilt of financial funds to rural areas. It is necessary to improve the

construction of rural water conservancy, electric power, roads and other infrastructure, and make up for

the shortcomings of rural infrastructure. Science and technology is the primary productive force of

agricultural production, and it is necessary to strengthen the support of agricultural science and

technology, increase scientific and technological research and application, and improve the level of farmland productivity. County and township governments should persistently grasp the "three rural areas" as the most important task and do everything possible to promote the increase of agricultural output and peasants' income. It is necessary to take the promotion of increasing peasants' incomes as the main starting point for promoting agricultural and rural development and the comprehensive revitalization of rural areas, concentrate efforts on solving problems such as low efficiency in agricultural production and operation and unfair distribution of agricultural products, and promote the priority development of agriculture and rural areas. It is necessary to avoid falling into the misunderstanding of blindly "withdrawing counties and setting up districts", coordinate regional agricultural and non-agricultural development according to local conditions, and promote the coordinated development of three industries.

5.2 Subsidize the Main Body of Agricultural Land Circulation and Increase the Income of Farmers' Circulation

The target of subsidies are farmers and enterprises, and the effect of subsidizing farmers is better than subsidizing enterprises. For circulation enterprises, the government's granting of circulation subsidies is equivalent to increasing the retained bid of enterprises to "rent" agricultural land, but because there is a limit to the retained bid of enterprises, and the "rented" area is less sensitive to "rent" changes, the effect of subsidizing enterprises is poor. For farmers, the government's turnover subsidy has a dual effect: first, it reduces the minimum "rent" acceptance of farmers' transfer of agricultural land; Second, subsidy income from the government is almost non-existent compared to farming income, which is equivalent to reducing farmers' decision-making risk. The two effects have increased the willingness of farmers to circulate from both direct and indirect aspects. Therefore, subsidizing farmers is better than subsidizing enterprises.

5.3 Do a Good Job of Guaranteeing Non-Agricultural Employment and Carry out Skills Training for Job Transfers

Promote the employment of migrant workers and farmers who have changed jobs and urban areas, promote the use of migrant workers and farmers who have changed jobs and urban areas as the main body of cash-for-work, do a good job in unemployment protection, and at the same time carry out relevant skills training to enhance farmers' confidence in employment. Employment or unemployment plays a decisive role in whether farmers transfer their arable land. Agricultural land is transferred, farmers as the supply side determine the circulation area, and enterprises decide to circulate "rent". If there is no or only a very low risk of unemployment for demobilized farmers, the threshold for circulation will be greatly reduced regardless of wage income, and the short-term policy effect is very significant, but in the long run, it is necessary to adopt appropriate policy strength according to the different development conditions and development positioning of various places.

5.4 Improve Supporting Systems to Safeguard the Lawful Rights and Interests of Entities

The absence of systems and laws has shifted the economic risks of circulation subjects, especially

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farmers, from the aspect of production to the implementation of guarantee contracts, and the risks are highly concentrated on the farmers' side, which cannot be effectively dispersed among various subjects, especially between farmers and enterprises, which greatly affects the willingness of economic entities to circulate. Therefore, the system and law guarantee the full payment of the transfer price and the right to transfer and return the right to operate farmland are the basic requirements for ensuring the circulation of cultivated land. Therefore, it is necessary to improve the legal and institutional system related to the circulation of agricultural land, promote systems such as land performance guarantee insurance and liquidated damages for circulation, and revise and improve the "Rural Land Contracting Law of the People's Republic of China" and other relevant laws according to the situation. At the same time, the government should improve the establishment of service institutions such as land circulation service centers and perform the duties of service-oriented governments.

5.5 Deepen Rural Financial Reform and Support the Transformation of Rural Farmland

Increase financial support for agricultural and rural projects, encourage willing farmers to upgrade and transform their own farmland and "rent" farmland on a large scale, and provide necessary credit support for farmers to invest in the construction of high-standard farmland and large-scale farming operations. Although financial factors have not directly entered the model, because farmers' investment upgrading has realized the integration of the two main bodies of supply side and demand side, the size of financial support will also indirectly affect the effect of farmland circulation from both supply and demand aspects. Therefore, increasing credit support for rural finance, especially agricultural modernization, and promoting the deepening of rural finance is conducive to promoting the circulation of farmland.

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