

The Peasants' Cognition and The Level of Informal Constraints and The Rural Land Institutional Change in China

—Analysis and simulation based on dynamic evolutionary game model

Jiang Li^{1, a}, Zhang Lei^{2, b}, and Li Lin^{3, c}

¹Business School of Jiang Han University, Wuhan, China

² People's Bank of China Wuhan branchWuhan, China

³School of Economics and Management North University of China,Tai Yuan, China

^ajiangli.sarina123@163.com, ^b442425085@qq.com, ^c765205229@qq.com

Abstract. The peasants' cognition and informal constraints are important factors that affect the rural land institutional change in China. By constructing a dynamic evolutionary game model and conducting simulation analysis, this paper finds that the individual cognition of peasants affects the strategic choice of them, and then affects the direction of the rural land institutional change in China, which is the endogenous power of institutional change; Informal constraints are hierarchical and affect the speed of institutional change. The higher the level of informal constraints, the faster the speed of institutional change. Based on the above conclusions, this paper proposes to adhere to the road of gradual reform, carry out multi-party research activities, and improve peasants' cognition; Clarify the main status of f peasants in the reform and create an organizational form with them as the main core; Give rights to the rural grass-roots democratic autonomy, and form broad binding informal constraints.

Keywords: Peasants' cognition; Informal constraints; Rural land institutional change; Evolutionary game

1. Introduction

There are unique and extensive informal constraints in China's rural land system. Although the implementation of formal rules is mandatory, the role of peasants' cognition and informal constraints cannot be ignored. When peasants are affected by various informal constraints such as traditional "equalitarianism", "family ideology", "public-private concept", their attitudes towards the existing formal rural land system will be affected. Studying the changes of rural land system with peasants' cognition and informal constraints as the starting point has practical significance, which explains the fundamental reason why it is difficult to promote China's rural land reform, and deepens the implementation of the central policy, also resolves and avoid disputes and conflicts that may arise in the process of further reform.

In the study of rural land institutional change, peasants' cognition, as a recessive way of existence, is the premise for the formation of different levels of informal constraints on rural land, and plays an important role in China's rural land institutional change (Sun Dan et al., 2021). Ma Xianlei and Qu Futian (2005) found that peasants' cognition and willingness to rural land property rights are highly heterogeneous. Xu Meiyin and Qian Zhonghao (2008) used the topological model of rural land system to study and found that the improvement of the external environment and peasants' own quality can enhance peasants' awareness of the rural land system, reduce the institutional boundary and thus promote the changes of the rural land system [15]. Feng Lei et al. (2019) believed that the peasants' cognition in rural land ownership confirmation jointly determined the peasants' willingness to confirm their rights, which in turn affected their participation in the right confirmation and the change of rural land system. In addition, peasants' individual factors, basic family characteristics, external environment and rural land system are important factors that affect peasants' cognition (Chen Yongtao et al., 2017; Guo Zhen, 2020).

In explaining the regional differences of China's rural land system (Yao Yang, 2000), the establishment of HRS (Yang Decai, 2002), the innovation of various rural land systems (Chen Zhigang, Qu Futian, 2003), the rural land property rights system (Zhong Wenjing, et al., 2021), and other issues of rural land system change, discussing China's rural land system change from the perspective of informal constraints has proved its effectiveness [19-22]. As an explicit institutional form, informal constraints' change are influenced by implicit cognition, however, it also has levels inside. From the perspective of the binding force of the system on individuals and the binding range of the whole society, the binding force is from low to high, including personal habits, customs and conventions (Wesson, 2001; Sun Dan et al., 2021) [23,13]. In the study of rural land institutional change, we found that the study of peasants' habits and their role in rural land was less, but we focused more on "peasants' cognition", as mentioned in the previous literature, most studies understand peasants' understanding of certain land policies through micro research, and thus set variables for research. Therefore, we take the implicit variable of peasants' cognition, which is easy to be manifested, as the main research object, and think that it plays an important role in the change of rural land system.

In terms of research methods, evolutionary game theory has been widely applied to the analysis of institutional change by some economists such as Schotter (1981), Payton Yang (2004), North (1990), Bowles (2004) and Aoki (2001). They believe that institution is a means for human beings to solve coordination problems, and the formation of institution can be seen as a process of game: Short focuses on using evolutionary equilibrium of stable strategy (ESS) and copying dynamic models, emphasizing the initial state and evolution of the system itself; Patton Yang used the stochastic stability of evolutionary game (SSE) model to emphasize the learning and adaptive process in the process of institutional evolution, and Aoki, Bowles and others used evolutionary game theory to analyze institutional change [24-28]. Even though there is still a dispute in the economic circle about the application of game theory and evolutionary game tools to institutional change (Greif, 2004) [29], evolutionary economics organically combines the ideas of sociobiology with the analysis methods of game theory, and relies on mathematical tools such as stochastic processes to analogy social and economic activities to biological competition, modeling the adaptive characteristics of participants and the concept of bounded rationality. Thus, it has become a powerful tool for analyzing dynamic institutional change (Zhou Ye'an, Lai Bulian, 2006) [30]. Some scholars have also used evolutionary game theory to model and simulate changes in social norms to explain the impact of changes in social structure and external environment on social norms (De, Nau&Gelfand, 2017) [31].

To sum up, the existing research shows that peasants' individual cognition and informal constraints have played an important role in the process of rural land institutional change in China. When emphasizing the role of peasants' cognition in institutional change, most of the literature draws conclusions through empirical analysis based on field questionnaires. The research on informal constraints on rural land also focuses on case analysis, there is also little discussion on the level of informal constraints in China (Sun Dan et al., 2021), there is also little discussion on the level of informal constraints in China (Sun Dan et al., 2021), and at present, it is rare to establish a theoretical framework that unifies peasants' cognition and rural informal constraints, and then explain the mechanism of rural land system. Therefore, based on the method of evolutionary game, this paper brings the implicit individual cognition and levels of explicit informal constraints into a framework, and carries out simulation analysis in order to make marginal contribution to the theory of rural land system reform.

Hypothesis 1: The implicit peasants' cognition and the explicit informal constraints jointly affect the changes of the rural land system, in which the peasants' cognition is the root of the institutional change and determines the direction of the changes of the rural land system; The level of informal constraints affects the speed of rural land institutional change.

Hypothesis 2: The informal constraints in the rural land system itself have a certain level inside. According to its scope of action, binding force and cost, they can be formed into peasants' habits -

rural land customs - village rules and customs in turn. The higher the level, the greater possibility of becoming a formal rule, and the greater possibility of institutional changing.

2. Model setting, calculation and simulation

2.1 Model assumptions

The model assumes that in a simple rural society with N individuals, there is a traditional norm S that exists as a typical informal constraint. Through this kind of norm, we can distribute the resources with value V in the society, the higher the level of informal constraint S , the greater the cost of violating it. The specific assumptions are as follows:

1. In rural society, peasants have three choice strategies for customs S : one is peasants who follow customs, which is called custom followers Z for short; one is the peasant household that violates customs S , which is called "those who violate customs W " for short; The other is the moderation who neither follows nor violates, and holds an indifferent attitude A . The choice of each strategy depends on the peasants' respective cognition, and the existing customs are the explicit manifestations of the peasants' potential common cognition, if the proportion of W increases, it indicates that the previous implicit common cognition has changed, which in turn affects the continued existence of customs and causes institutional changes.

2. In the whole group, as time goes by, peasants form three types of groups $Z/W/A$ by choosing three strategies, their initial proportions are α / β and $1 - \alpha - \beta$ respectively, the value range is $[0,1]$. It should be noted that the proportion of violators is the explicit expression of peasants' implicit cognition: (1) When there is a violation of customs among peasants, that is, when β is not equal to 0, this shows that some peasants have changed their understanding of the custom, which has affected the direction of institutional change; β proportion shows the difference between the group and the general cognition, we can simulate four situations: $\beta = 1$, $\beta = 0.5$, $\beta > 0.5$ and $\beta < 0.5$, discuss the role of different proportion of violators in the overall group respectively, and the influence and role of different proportions on the direction of institutional change. (2) For the sake of completeness and comparison, in addition, when $\beta = 0$, that is, how does the institutional change when there are no violators, but only the moderation and custom followers.

3. In each communication process, peasants with different strategies are paired randomly, take A as an example, A may meet with A , Z or W , and meet with different types of peasants. Whether or not to allocate resources according to this standard will lead to different benefits for both sides.

4. Informal constraint S determines the cost C to some extent, if S is a convention S_1 , the cost of violating it is C_1 . If S is just a general convention S_2 , and the cost of violating S_2 is C_2 , then $C_1 > C_2$.

2.2 Model building

The construction of the model is mainly reflected in the interaction of individuals and the determination of payment, while the calculation of payment is reflected in the idea of modeling. In the process of interaction between two people, there are four situations, and individuals get the corresponding payment:

1. When Z and Z meet, their cognition is the same, the payment they get is the same, and the total resource value is shared equally;

2. When the person Z who follows the custom meets the moderation A , the moderation A is likely to follow the custom, and the payment he gets is similar to the above situation;

3. The cost of violating customs is C , and the possibility of customs being overturned depends on the proportion of violators β , the reason is that the more people violate, the more likely the custom is to be overturned: it can be explained from two aspects: one is that even if someone has enough right to violate the custom, it needs to be recognized by the majority in form, so he will try to get support from others; second, if most people do not agree, the new rules are difficult to implement in

the later implementation process, that is, they have not been substantially changed. Correspondingly, the possibility that the custom has not been overthrown is $1 - \beta$, therefore, when the person who violates the custom W meets the person who follows the custom Z, the expected payment for the person who violates the custom is $\beta v - (1 - \beta)c$; the expected payment for those who follow the custom is $(1 - \beta)v - \beta c$.

4. When the person who violates the custom W meets the man of the mean A, because the man of the mean A does not care about the distribution of the benefits, the person who violates the custom will possess all the benefits V, the mean person gets 0.

See Table 1 for specific payment matrix (participants' payments are arranged by line):

table 1. payment for different types of peasants

participants	Z	W	A
Z	$v/2$	$(1-\beta)v - \beta c$	$v/2$
W	$\beta v - (1-\beta)c$	$v/2$	v
A	$v/2$	0	$v/2$

2.3 Model calculation

Based on the above assumptions, we can get the expected payment levels of three types of peasants with different proportions in the group, as follows (1) - (3) and the average payment level (4):

$$E(\pi^Z) = \alpha \frac{v}{2} + \beta[(1 - \beta)v - \beta c] + (1 - \alpha - \beta) \frac{v}{2}$$

(1)

$$E(\pi^W) = \alpha[\beta v - (1 - \beta)c] + \beta \frac{v}{2} + (1 - \alpha - \beta)v$$

(2)

$$E(\pi^A) = \alpha \frac{v}{2} + (1 - \alpha - \beta) \frac{v}{2}$$

(3)

$$E(\bar{\pi}) = \alpha E(\pi^Z) + \beta E(\pi^W) + (1 - \alpha - \beta) E(\pi^A) = \frac{v}{2} - \alpha \beta c$$

..... (4)

According to the formula (1) - (4), the differential equation of time can be calculated for α and β respectively according to the copied dynamic equation:

$$\frac{d\alpha}{dt} = 0, \quad \frac{d\beta}{dt} = 0$$

$$\frac{d\alpha}{dt} = \alpha[E(\pi^Z) - E(\bar{\pi})] = \alpha\beta[(1 - \beta)v - \frac{v}{2} - \beta c + \alpha c] = 0$$

$$\frac{d\beta}{dt} = \beta[E(\pi^W) - E(\bar{\pi})]$$

$$= \beta[\beta(\alpha v + 2\alpha c - \frac{v}{2}) + \frac{v}{2} - \alpha v - \alpha c] = 0$$

From the above, the values of the parameters V and C will determine the solutions of A and B, from this, we can find the ESS equilibrium solution and evolution dynamic direction of the model.

2.4 Analog simulation

2.4.1 Consider the role of peasants' cognition in institutional change

Regardless of the level of informal constraints, we believe that this custom is an informal constraint universally recognized by peasants, and the cost of violating it is very high, let $V=2$, $C=3$, respectively consider $\beta=0$; 1 ; 0.5 ; $1/3 (<0.5)$ and $3/4 (>0.5)$ of the evolutionary game dynamics are as follows:

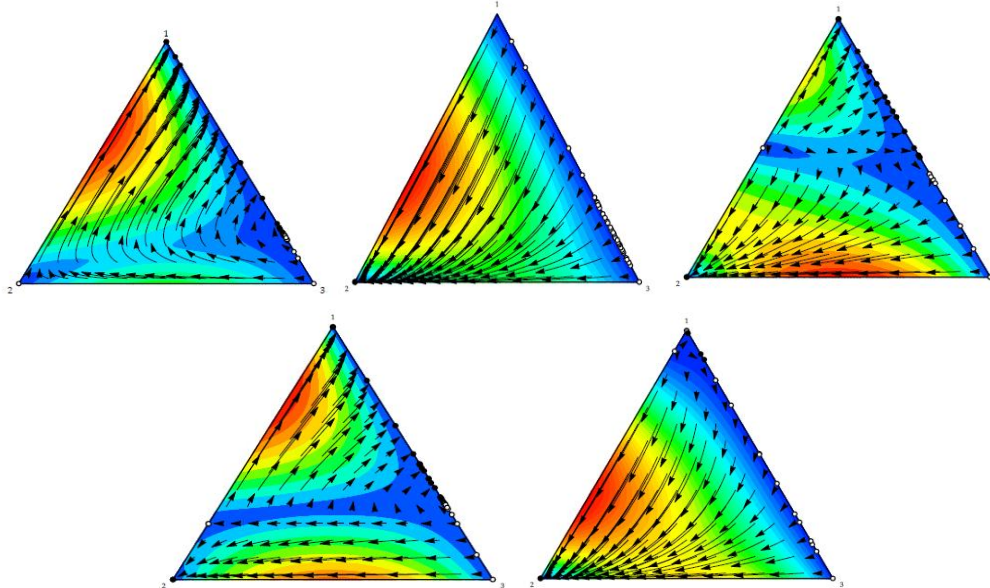


Figure 2 when $C=3$, the corresponding dynamic change phase diagram to the strategy of different β values selects

Note: from top to bottom and from left to right respectively means When $\beta=0$; $\beta=1$; $\beta=0.5$; $\beta=1/3 (<0.5)$ and $\beta=3/4 (>0.5)$, the transition process and state distribution of the three strategies, among them, 1, 2 and 3 respectively indicate that the three strategies follow custom, violate custom and mean. The simulation track starts from the initial conditions, and each solution path runs in a unit time, the color in the contour map indicates the dynamic movement speed: red is fast, blue is slow; black and white points correspond to stable and unstable equilibrium points in the dynamic process; simulate for 50 times, and the arrow direction indicates the motion track.

(1) When $\beta=0$, that is, in the initial stage, there is no person who violates the custom. In the evolution process of the three strategies, the final path is to follow the custom. The custom exists stably for a long time. Even as time goes on, some peasants want to violate the custom because of their own cognition, or have ignored the custom, and there is so-called moderation, especially some of the moderation, may choose to violate the custom, However, they will still choose to follow the customs for a long time, which will not change the steady-state results.

(2) When $\beta=1$, that is, in the initial stage, people who are against customs, in the evolution process of the three strategies, even if there are still some peasants who follow the customs or indifferent moderates, the customs will be overthrown in a long time.

(3) When $\beta=0.5$, that is, in the initial stage, if half of the peasants choose to violate the customs, two paths will eventually emerge: One is to follow the custom, the other is to violate the custom. It is worth noting that in the process of evolution, the speed of institutional change of violating customs is faster, people who choose the moderation strategy are more likely to evolve in the direction of violating customs in the long-term evolution.

(4) When $\beta=1/3 (<0.5)$, that is, at the initial stage, a small part of peasants choose strategies that violate customs. In this dynamic evolution process, there are also two paths: one is to follow customs, the other is to violate customs. Different from $\beta=0.5$, in this process, most of the moderate people will choose to violate the customs in the long-term evolution, but some peasants who

initially choose to violate the customs will eventually tend to follow the customs, and a small number of the moderate people will also choose to follow the customs after violating the customs.

(5) When $\beta = 3/4$ (>0.5), that is, in the initial stage, more than half of the peasants choose the strategy of breaking customs. In this dynamic evolution process, they eventually evolve in the direction of breaking customs. Similar to the situation (2), the speed of change is relatively different. In the initial stage, it is slower than (2), and in the middle stage, it is faster than (2). In (2), the change of peasants' choice from the mean state to breaking customs is slower, while in (5), it is a gradual process, Will gradually accelerate the change of ideas.

2.4.2 Consider the role of informal constraints on institutional change

Then consider the level of informal constraints, that is, whether the size of C will affect the direction and speed of change. Let $V=2$, but let $C=1$, that is, the cost of violating the custom is small. The level of informal constraints is relatively low, and consider the dynamic graph of evolutionary game obtained by $\beta = 0, 1, 0.5, 1/3$ (<0.5) and $3/4$ (>0.5) respectively (see Figure 2):

From the comparison between the phase diagrams of $C=3$ and $C=1$, the arrow directions of the phase diagrams corresponding to the five β values are almost similar, and the difference is mainly reflected in the color, that is, the speed of change:

(1) In the extreme case $\beta = 0$ and 1 , it can be seen that the difference between the two figures is not large, and the level of informal constraints has little influence on the direction and speed of change;

(2) When $\beta = 0.5, 1/3$ and $3/4$, $C=1$ changes more slowly than $C=3$, that is, when the level of informal constraints is low, the speed of institutional change will be slow, the moderate and the disobedient may hesitate to finally choose to follow the original customs, and the original customs will continue to exist, but the peasants may waver in this process; However, when the level of informal constraint is relatively high, once the decision to continue to follow the constraint is made, the decision will be made decisively, whether the original system is maintained or the system is violated, the speed is fast.

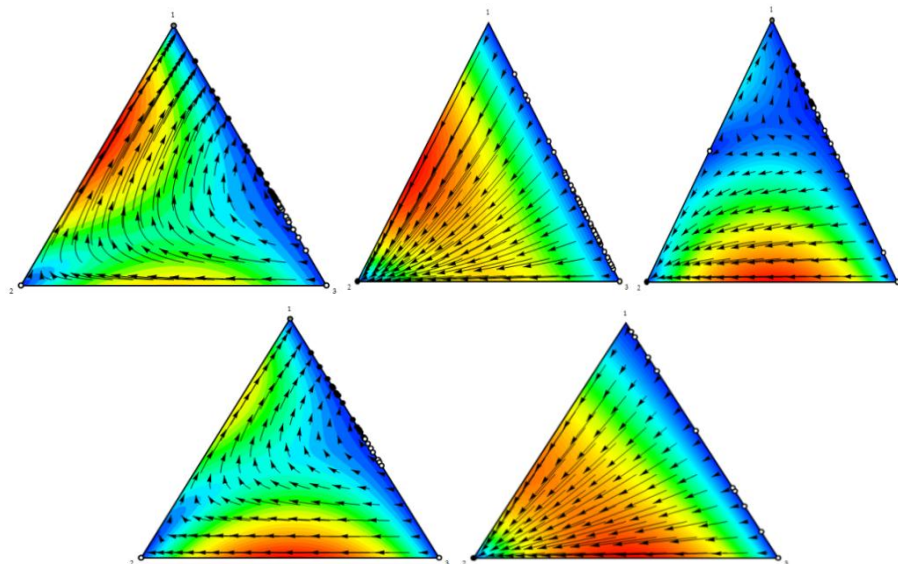


Figure 3 when $C=1$, the corresponding dynamic change phase diagram to the strategy of different A values selects

Note: Same as the figure 2 above

2.4.3 Analysis of results

Through the simulation analysis of the evolution game model of rural land system change, it is found that the process of rural land system change is always consistent with the cognition of the majority of peasants, and under the background of different informal constraint levels, the speed

and possibility of change are different: the higher the level of informal constraints, the greater the possibility of changing into formal rules, and result in a institutional change. When peasants' cognition is completely consistent with the original system, or when peasants' cognition is contrary to the original system, the level of informal constraints has little impact on the institutional change's speed; The level of informal constraints mainly affects the speed of institutional change. The lower the level of informal constraints in the rural land system, the lower the cost of violating the informal constraints. Under the condition that peasants' cognition remains unchanged, the original institutional constraints are more likely to be overturned and new systems are more likely to emerge. However, whether they choose to continue the old system or choose to violate the system, the speed of change is slower than that of high-level informal constraints.

2.5 Model conclusion

2.5.1 peasants' cognition influences the direction of rural land system change

From the reasoning and simulation of the evolutionary game model, we find that: (1) peasants' cognition affects the direction of the change of rural land system. When the group cognition of peasants is basically consistent and solidified into a system of common compliance, the rural land system will tend to be stable for a long time; On the contrary, peasants' cognition of the existing system is basically inconsistent, and the existing rural land system will be overthrown or exist in name only; (2) When a small part of the peasants have cognitive differences, most peasants who adhere to the original land system will still choose to follow the original system, and a small part of the moderation will also choose to follow the custom after violating the custom; (3) When there are most cognitive differences among peasants, the original land system will be abandoned and a new land system will emerge. In general, only the top-down rural land system that conforms to the peasants' cognition and is recognized and supported by peasants can be successfully implemented and play a significant role in the system performance. On the contrary, those rural land systems that contradict the peasants' interests and do not conform to the peasants' cognition are difficult to maintain, which may appear to exist in name only, or may be difficult to implement or even cause more social conflicts.

2.5.2 Informal constraints in rural land system are hierarchical and affect the speed of institutional change

The calculation and simulation results of the evolutionary game model show that: when peasants' cognition is basically consistent or inconsistent, the level of informal constraints basically does not affect the speed of institutional change; When the level of informal constraint is low, the speed of institutional change is slow, especially when it is decided that the informal constraint will continue to exist, some peasants who violate the constraint or do not care may hesitate to finally choose to follow the original custom; However, when the level of informal constraint is relatively high, once the decision to continue to follow the constraint is made, the decision will be made decisively to maintain the original system or once the decision to violate the custom is made, the speed will be faster. In the informal constraint stratification of rural land system, for example, from low to high, we can divide it into the values in rural society (such as family consciousness, land worship complex, egalitarianism ideology, etc.) - the customs and practices that have been formed in rural land (such as buying first by relatives and neighbors, looking for price for redemption, etc.) - the village rules and regulations in rural areas (including specific village rules and regulations, villagers' autonomy regulations, etc.) - the formal rural land system (such as the China Land Management Law, etc.), in the informal constraint stratification of rural land system, for example, from low to high, we can divide it into the values in rural society (such as family consciousness, land worship complex, egalitarianism ideology, etc.) —the customs and practices that have been formed in rural land (such as buying first by relatives and neighbors, looking for price for redemption, etc.) —the village rules and regulations in rural areas (including specific village rules and regulations, villagers' autonomy regulations, etc.) —the formal rural land system (such as the

China Land Management Law, etc.), among them, the higher level village rules and regulations have the greatest impact on the speed of institutional change. In terms of support and maintenance of the formal system, if the village rules and regulations correctly understand and stipulate the "top-down" formal rural land system, then the villagers will implement and maintain this institutional constraint, thus promoting the rural land system change.

3. Suggestion

Based on the above evolutionary game analysis and simulation analysis, peasants' cognition and informal constraints jointly affect the innovation of rural land system. Therefore, we propose the following three countermeasures:

3.1 Adhere to the road of gradual reform, carry out research activities involving multiple parties, and improve peasants' awareness.

Gradual rural land system reform can ensure the relative stability of the rural land system environment. At the same time, through continuous innovation and trial and error, the rural land system reform can meet the needs of peasants. In the pilot process, under the action of government policy's publicity and demonstration, peasants' cognition can be reshaped through the interaction between policymakers' cognitive goals and peasants' cognition, and the uncertainty and resistance that may be encountered in the promotion of future land policies can be reduced through peasants' information feedback. The peasants' information and management of land is sufficient relative to the policy makers. The peasants' cognition of the rural land system has largely affected the changes of the rural land system. The government and peasants continue to interact and gradually form the government's cognition and decision-making. It has been proved by experience that only the institutional arrangement that conforms to the subjective cognition of peasants can achieve higher economic performance, can realize the interaction of cognition in the process of subjective game, and the rural land institutional change can be carried out smoothly. For the current rural land system, when it is implemented in different regions, peasants may have different degrees of understanding due to their individual cognitive differences. Even when good policies are implemented at the local level, the understanding of peasants was biased, and the policy was even implemented against the original intention of the policy, resulting in the failure to implement some policies. Therefore, the central or local government can understand peasants' cognition and demand for relevant rural land policies through regular and continuous research activities involving multiple parties, and at the same time, popularize knowledge about land policies to peasants through active guidance, expansion of education and other ways to improve peasants' awareness. In this process, we should consider the stages of reform: in the short term, we should not change the current basic system of collective ownership of rural land and household contract responsibility system, constantly explore and improve the profound connotation and implementation mode from "two rights separation" to "three rights separation", and ensure that the rights and interests of peasants will not be damaged; In the medium and long term, based on the process of China's urbanization, the pilot experience of the "three reforms", and the overall development and changing environment of China's economy, establish a unified urban and rural construction land market, achieve the same price and right, achieve urban and rural land integration, achieve rural economic development and the goal of rural land system reform which is to improve the living standard of peasants.

3.2 Clarify the main position of peasants in the reform and create an organizational form with peasants as the main body.

In the process of rural land reform, peasants have always been the most important subject of reform participation. The main position is reflected in respecting peasants' demands, ensuring peasants' interests to the maximum extent, and responding to peasants' demands in a timely manner, for example, in the process of rural land transfer, we should respect the demands of peasants, any

organization or individual can't replace peasants' decisions, nor damage peasants' land rights and interests. We should enhance peasants' game ability and voice in land transfer negotiations. In rural production activities, "companies+peasants", "professional cooperatives", etc. are the main forms of organizations in which peasants participate. This model has realized large-scale operation and once brought relatively stable economic benefits to peasants, but to a large extent, peasants and villagers' organizations have lost their subjectivity step by step. It is easy to strengthen the position of a minority strong groups, ignoring the dominant position and voice of peasants that is a vulnerable group. In the process of rural land transfer and construction land entering the market, peasants and village collectives can set up stock cooperatives representing peasants' interests and financial, land bank and land special companies, build rural subjective organizations and realize reasonable distribution of internal interests.

3.3 Give play to the function of democratic autonomy at the grass-roots level in rural areas, and form informal constraints with broad binding force.

The traditional values and local customs in rural society are relatively stronger, but with the penetration of the market economy and the process of new urbanization, it is also facing the transformation from "acquaintance society" to "contract society". As a typical informal constraint, the village rules and regulations and the villagers' autonomy system are an integration mechanism integrating the local characteristics and modernity, in a broad sense, village rules and regulations (such as villagers' autonomy regulations) not only conform to the national formal rule framework, but also contain local informal constraints. The government should actively advocate the respect and maintenance of the customs and practices favorable to the change of the rural land system, give full play to the role of the village rules and regulations, innovate the village to strengthen the function of the village level autonomous organization, further standardize the ways and procedures of the villagers' autonomy for the participating peasants, such as establishing the villagers' discussion platform and the village affairs supervision committee, improving the "four discussions, two disclosures and two supervisions system", strengthening the democratic decision-making management in the village, and ensuring the legitimate land rights and interests of the villagers. At the same time, improve the importance of land management in villagers' autonomy, and increase the relevant content of land property rights, cultivated land, homestead and collective operating construction land.

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