

Can the Reform of Rural Collective Property Rights System Improve Agricultural Total Factor Productivity?

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Abstract. Based on the theory of property rights and division of labor, this paper constructs the mechanism of rural collective property rights system reform to promote agricultural total factor productivity (TFP). And using PSM-DID analysis of the impact of the reform on agricultural TFP. The results show that the reform has improved the agricultural TFP. This study is beneficial to objectively evaluate the effect of rural collective property right system reform, and is of great significance to explore the focus and key path of the new round of reform under the background of common prosperity.

1. Introduction

The reform of rural collective property rights system is a comprehensive, long-term and overall reform in rural areas, which provides basic institutional support for the revitalization of rural industries and is an important basic support for promoting high-quality agricultural development and realizing agricultural and rural modernization. The reform has initially realized "changing resources into assets", "changing funds into shares" and "changing farmers into shareholders", which fundamentally solved the basic conditions for revitalizing rural resources and realizing the market-oriented allocation of rural resources. However, does the reform promote the allocation efficiency of agricultural factors and realize the growth of agricultural total factor productivity (TFP)? Studying this issue from the theoretical and empirical levels will help to objectively evaluate the effect of the reform, and is of great significance to explore the key points and key paths of the new round of reform under the background of common prosperity.

The reform of rural property rights system and agricultural TFP have always been an important topic of academic concern. Currently, the academic research on the reform mainly focuses on the following aspects. First, starting from the reform itself, it summarizes the specific practices, achievements, problems, experiences and suggestions of the reform, and to some extent reveals the evolution logic of the reform and China's unique reform methods [1]. Secondly, starting from the theory of property rights, cooperative system, incomplete contract and incentive theory, the papers discusses the theoretical logic of reform, and explains the mechanism of reform in stimulating the vitality of rural resource elements,

improving the economic efficiency of market-oriented allocation of rural resources, expanding rural collective economic organizations, safeguarding farmers' property rights and interests and alleviating rural relative poverty [2].

The reform has clarified the reform direction of comprehensively improving the efficiency of market-oriented allocation of rural factors, especially improving the TFP of agriculture and realizing the high-quality development of agriculture. However, the current research rarely involves whether and how the reform can promote the progress and efficiency of agricultural technology. Therefore, this paper focuses on the reform of rural collective property rights system, and based on the theory of property rights and division of labor, constructs the mechanism of the reform to promote agricultural total factor productivity. By using PSM-DID, this paper empirically analyzes the influence of the reform on agricultural TFP, and discusses its mechanism. Compared with the previous related literature, the marginal contribution of the text lies in: combining the reform of rural collective property rights system with agricultural TFP, this paper analyzes the theoretical logic of the influence of the reform on agricultural TFP; using PSM-DID, this paper examines the influence mechanism of rural collective property right system reform on agricultural total factor productivity. The following parts of this paper are arranged as follows: the second part discusses the theoretical logic and research hypothesis, the third part introduces the data source and research design, the fourth part discusses the empirical results, and the fifth part expounds the main conclusions and policy suggestions.

2. Theoretical analysis

Institution restricts people's behavior and affects the

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efficiency of resource allocation [3]. With other input factors unchanged, the more efficient and stimulating institutional arrangements formed by institutional evolution can guide the rational flow of production factors, optimize the allocation of resources, improve the output efficiency of various factors, and realize the high-quality development of agricultural economy [4]. The following will make a concrete analysis of the influence mechanism of the rural collective property right system reform in China to improve the agricultural TFP through different paths (Fig. 1).

2.1 Clarity of property rights

Clear property rights are the premise of effective market. On the one hand, the reform further clarified the relationship of farmland property rights among collectives, farmers and operators, improved the security of land rights and enhanced the intensity of farmland investment; on the other hand, strengthening the intermediary effect of rural collective economic organizations and reducing the land transaction cost will help stimulate the vitality of rural land, labor, capital and other factors, optimize the allocation of agricultural production factors, realize Pareto improvement, and thus improve the technical efficiency of agricultural production.

First of all, the reform is conducive to revitalizing rural land resources. The reform strengthens the collective ownership of rural land, further implements the system of "separation of three powers" of agricultural land, strengthens the stability of land property rights, reduces the cost of protecting agricultural land property rights, promotes the increase of long-term investment in agricultural land and improves the output efficiency of agricultural land [5,6].

Secondly, the reform is conducive to promoting the two-way flow of urban and rural labor force. The reform is conducive to improving institutional incentives, making the potential agricultural surplus labor explicit, promoting the redistribution of production factors such as labor and improving the efficiency of resource allocation.

Finally, the reform is conducive to revitalizing rural financial resources. The reform makes the property right protection system more perfect and the mortgage function of rural assets more perfect, which is conducive to encouraging financial institutions to increase the credit supply to farmers and promote the improvement of farmers' credit demand, thus stimulating the vitality of rural capital factor markets.

2.2 Specialization and scale

The reform has further subdivided all kinds of property rights in rural areas, promoted agricultural division of labor, promoted rural land circulation, promoted the development of agricultural production services, formed agricultural economies of scale, and thus improved the technical efficiency of agricultural production.

The reform has promoted the flow of rural land and is conducive to the formation of land scale economy. The reform is conducive to promoting the better flow and

allocation of collective land, transferring the land that needs to be reconfigured to qualified and willing farmers for management, accelerating the cultivation of new business entities, improving the organization and scale of agricultural production and management, and thus improving agricultural production efficiency.

The reform has promoted the development of agricultural productive service organizations and is conducive to the formation of service economies of scale. After the reform, many villages set up farmers' professional cooperatives to transform external market services into internal organizational services, providing farmers with diversified services in production, processing, management and credit financing, which is conducive to giving full play to the role of collective economic organizations, reducing production costs and saving transaction costs, realizing economies of scale and improving agricultural production efficiency.

2.3 New production factors

The key to the transformation from traditional agriculture to modern agriculture is to improve the marginal rate of return of introducing new production technology and new production factors into agriculture. The reform provides conditions for the development of agricultural economic organizations, and promotes the efficient flow and recombination of agricultural production factors, modern technical equipment and management talents.

Through the separation of rural collective ownership, management right and income right, the reform has promoted the cultivation of new business entities such as rural joint-stock economic cooperation organizations and cooperatives led by party branches, innovated the interest linkage mechanism between new business entities and small farmers.

The reform promotes the introduction of modern enterprise system, operation mechanisms and other new production factors into new business entities such as rural joint-stock economic cooperatives, which is conducive to innovating organizational methods and management models, improving the management level of agricultural production and operation.

According to the above analysis, we put forward hypothesis H1: The reform of rural collective property rights system improves the agricultural TFP of farmers.

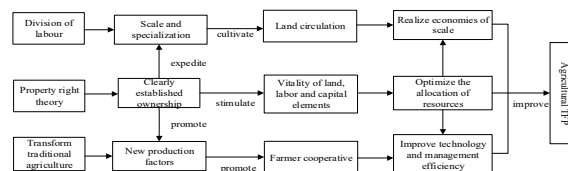


Fig.1. Path analysis of rural collective property right system reform to improve agricultural TFP

3. Data source and research design

3.1. Data source

From a national perspective, the pilot reform in S province

started earlier, the types of collective economic development are relatively complete, and the reform has made remarkable achievements. Among them, A and B counties have the same pilot time and the same reform progress, but the rural development model is different. The rural area of A county is mainly a model of integrated development of industry and agriculture. Since 2013, it has actively promoted the reform work; The rural area of County B is a typical development model of agricultural industrialization, and it is one of the reform pilot units selected by the state. Therefore, the relevant data of the reform in counties A and B of S province are widely representative.

3.2. Model setting

The purpose of this paper is to investigate the influence of the reform on agricultural TFP. The benchmark regression model is as follows:

$$TFP_{it} = \alpha_0 + \beta_0 D_{it} + \gamma_0 X_{it} + \lambda_t + \mu_i + \delta_{it} \quad (1)$$

In model (1), i and t respectively represent the corresponding farmers and years, TFP_{it} is the interpreted variable. α_0 and δ_{it} are intercept terms and random error terms, D stands for virtual variable. X_{it} represents other control variables that may affect agricultural total factor productivity. λ_t and μ_i are the fixed time effect and the individual fixed effect of farmers, respectively. β_0 and γ_0 are the coefficients to be estimated. The sign and size of coefficient β_0 is the key to measure the effectiveness of the reform.

In the pilot counties and cities, the reform work is also gradually promoted, and the reform can be regarded as a quasi-natural experiment. However, the villages that started the reform earlier are carefully selected, and there may be self-selection bias. Therefore, we use PSM-DID to analyze the net effect of the reform. This method can not only effectively reduce the influence of self-selection bias on the accuracy of parameter estimation, but also reduce the influence of unobservable variables such as individual differences and time trends on the evaluation of reform effectiveness. The specific model is set as follows:

$$TFP_{it} = \alpha_1 + \beta_1 Reform_{it} + \gamma_1 X_{it} + \lambda_t + \mu_i + \delta_{it} \quad (2)$$

3.3. Variable selection and explanation

According to the research needs, this paper uses the data from 2016-2018 survey interviews for variable processing and sample screening to measure the changing pattern of agricultural TFP, and finally obtains three-phase balanced panel data consisting of 2364 samples from 788 households.

Considering the availability of survey data, we use the growth accounting method to measure the agricultural TFP of farmers. In a short period of time, farmers' ability to adjust input factors such as land and capital is weak, and the adjustment speed is relatively slow. Therefore, it is appropriate to set C-D production function as agricultural production function to measure agricultural TFP from the micro-household level, and the existing literature also supports this treatment [7]. Based on the research of scholars such as Chari, this paper calculates the

agricultural TFP of farmers on the basis of C-D production function.

$$Y_{it} = TFP_{it} K_{it}^\alpha T_{it}^\beta L_{it}^\gamma \quad (3)$$

$$\log TFP_{it} = Y_{it} - \hat{\alpha} \log K_{it} - \hat{\beta} \log T_{it} - \hat{\gamma} \log L_{it} \quad (4)$$

i and t represent the corresponding farmers and years respectively, and Y_{it} represents the total agricultural output value of farmer i in t year. K is the agricultural capital input. T is land input. L is labor input. Based on formula (3), the elasticity of each input factor is estimated, and then the agricultural TFP of farmers is calculated by formula (4).

This paper regards the implementation of the reform as a policy shock and measures the policy treatment effect of the reform on the agricultural TFP. Whether the village where farmers live has completed the reform is based on the dichotomy variable in the survey data, that is, "whether the rural collective property right system reform has been completed".

In order to alleviate the error of missing variables, this paper selects a series of observable variables from the level of farmers and villages to control them. Including the average age of family labor force, the average education level of family members, family size, main social status, the proportion of non-agricultural labor income, the working time of migrant workers and health level; It also includes the type of village to which the farmers belong, the annual income of the village collective.

Table 1 Variables and date

Variable	Reform farmers		Non-reformed farmers	
	Mean	Std. Dev	Mean	Std. Dev
Operating income	9.362	1.353	8.515	1.523
Labor time	5.298	0.971	5.192	0.863
Scale of operation	1.872	8.813	1.411	7.791
Operating expense	8.262	1.526	7.305	1.363
TFP	4.36	0.187	4.19	0.327
Reform	1.000	0.000	0.000	0.000
Average age	55.71 2	13.72 9	50.62 5	14.010
Average education level	3.049	6.805	2.924	7.232
Family size	3.556	1.522	3.701	1.611
Main social identity	4.385	0.490	4.510	0.421
Farmer cooperative	0.667	0.471	0.462	0.499
Non-agricultural	0.398	0.427	0.501	0.439
Migrant workers	1.946	6.353	1.606	7.174
Farmers' health level	2.727	0.485	2.390	0.499
Type of village	1.166	2.075	0.575	2.521
Collective income	15.64 1	6.837	11.33 2	6.175

4. Empirical results and analysis

4.1. PSM result and model result

It can be seen from Table 2 that the absolute values of the standard deviations of all matched variables are less than 6% after matching, which shows that the matched variables and matching methods selected in this paper are reasonable. At the same time, the matched t statistics are not significant, that is, the original hypothesis that there is a significant difference between the experimental group and the control group is rejected, and PSM is effective. The samples obtained after matching the tendency scores ensure the randomness of sample processing and the reliability of DID estimation results.

Table 2 PSM validity test results

Variable	Processing group	Control group	Std. Dev	P> t
Operating income	9.205	8.412	9.8	<0.001
	9.027	8.793	1.2	0.887
Operating expense	8.104	7.113	10.6	<0.001
	7.935	7.611	0.7	0.950
Average age	53.688	50.132	15.3	<0.001
	54.712	49.625	4.2	0.634
Average education level	3.025	2.874	8.5	<0.001
	3.026	2.895	2.8	0.784
Family size	3.569	3.785	16.4	<0.002
	3.540	3.648	-1.5	0.844
Non-agricultural	0.427	0.530	11.7	<0.001
	0.406	0.481	-2.3	0.811

In this paper, Stata16 is used to estimate the benchmark regression model and PSM-DID, and Table 3 shows the estimation results. The first two columns are based on the estimation results of model (1), and the first column does not add any control variables. The results show that the agricultural TFP of farmers has increased by 11.6% after the reform. The second column controls the control variables at the level of farmers and villages. Although the coefficient value of reform variables has decreased, it is still significant at the statistical level of 5%. The third column reports the estimated results of model (2), showing that the agricultural TFP of farmers has increased by 10.1% after the reform, which is less than the estimated results of model (1), and the significance has weakened, indicating that the reform will be affected by many factors. The results of models (1) and (2) show that the reform can improve farmers' agricultural TFP, and the research hypothesis H1 is verified.

In terms of control variables, Average education level, Collective income and Family size have a significant positive impact on agricultural TFP. The higher the education level of farmers, the easier it is to accept cutting-edge knowledge and promote the popularization and use of new technologies and elements; The development of rural collective economy is conducive to promoting the development of agricultural productive service organizations, promoting professional division of labor; The increase of family population and the improvement of

health level mean the improvement of the quantity and quality of agricultural labor force, which is conducive to improving the production efficiency of farmers; Villages close to cities have more convenient transportation and perfect market environment, which is more conducive to improving agricultural TFP. However, Average age, Non-agricultural and Migrant workers have a significant negative impact on farmers' agricultural TFP, which is significant at the statistical level of 10%, 5% and 10% respectively. Under normal circumstances, with the increase of labor age, its innovation ability will be weakened, and when it is too old, it will restrict the promotion of TFP; The longer farmers go out to work and the higher the proportion of non-agricultural labor income, the lower the investment in agriculture, which leads to the decrease of land utilization rate, thus inhibiting farmers' agricultural TFP.

Table 3 Regression result

Variable	Regression result		
	(1)	(1)	(2)
	TFP	TFP	TFP
<i>Reform_{it}</i>	0.116** (0.052)	0.109** (0.054)	0.101* (0.052)
Average age		-0.075* (0.042)	-0.068* (0.039)
Average education level		0.113** (0.048)	0.115** (0.049)
Family size		0.098* (0.055)	0.101* (0.059)
Main social identity		0.099 (0.087)	0.092 (0.082)
Non-agricultural		-0.118** (0.055)	-0.109** (0.052)
Migrant workers		-0.115** (0.053)	-0.104* (0.063)
Farmers' health level		0.102* (0.054)	0.099* (0.059)
Type of village		0.125* (0.073)	0.113* (0.067)
Collective income		0.116** (0.046)	0.112** (0.048)
Number of observes	2364	2364	2271
Adjusted R ²	0.011	0.023	0.019

Note: *, ** and *** represent the significance levels of 1%, 5% and 10% respectively; Robust standard error in brackets.

4.2. Robustness test

In order to ensure the robustness and reliability of the above results, this paper tests the robustness on the basis of model (2), and the estimated results are shown in Table 4. First, change the explained variables. The comprehensive efficiency of agricultural production is a comprehensive evaluation of farmers' resource allocation ability, resource use efficiency and other aspects, and it is an important reference for studying agricultural TFP. Therefore, the BCC model is used to measure farmers' comprehensive efficiency of agricultural production, and it is replaced by the explained variable to make PSM-DID estimation again. The results show that the coefficient

value of the reform variable has increased from 10.1% to 11.4%, and it is still significant at the statistical level of 10%, indicating that the estimation result of model (2) is more robust.

Secondly, the robustness is tested by changing the matching method. In order to avoid the influence of matching methods on the selection of control group and the regression results, this paper adopts nearest neighbor matching and kernel matching to adjust the samples and re-do the DID. The results show that no matter which matching method is adopted, the coefficient values of reform variables are all around 10%, and they are all significant at the statistical level of 10%, thus confirming the robustness of PSM-DID estimation results.

Table 4 Robustness test result

Variable	BCC	Nearest neighbor matching	Kernel matching
$Reform_{it}$	0.114*(0.065)	0.097*(0.057)	0.098*(0.056)
Number of observes	2271	2214	2283
Adjusted R ²	0.026	0.015	0.009

Note: Same as above.

5. Conclusion

Based on the survey data of farmers in S province, this paper empirically analyzes the influence of rural collective property right system reform on agricultural TFP in China by using PSM-DID method. The results show that: First, the reform can effectively improve the agricultural TFP of farmers, and mainly through the path of farmers joining new business entities such as cooperatives. Second, the impact of the reform on agricultural TFP is positively related to the scale of land management, but the leading role of large-scale farmers and agricultural productive service organizations on small farmers is difficult to highlight. Third, the scale of farmers is too small, the age is too large, the rural land market is immature and some supporting systems are lacking, which limits the role of reform.

Although the phased tasks of reform have been basically completed, various problems faced in the process of reform have not been completely solved, such as imperfect procedures and weak farmers' awareness of property rights, which will undoubtedly increase the difficulties in deepening the reform in the future. Based on the above conclusions, the following policy suggestions are put forward: First, optimize the implementation environment of the reform. Combined with the pilot experience, we should improve the construction of supporting systems from the aspects of agricultural policy, land policy, finance and taxation, and optimize the implementation environment of policies in order to better play the role of reform. Second, strengthen rural human capital investment. We will improve the policy of supporting employment and entrepreneurship in returning home, enhance the attractiveness of rural areas to talents, and promote the rejuvenation of agricultural groups. Use

practical agricultural talents with knowledge and technology to promote the popularization and use of advanced technology, improve the level of agricultural management and build modern agriculture. Third, improve the construction of socialized service system. Give full play to the role of collective economy, accelerate the construction of rural land market, and promote the development of agricultural productive service organizations. According to local conditions, we will promote the moderate scale management of rural land and ensure the leading role of large-scale farmers in small farmers.

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