Green Finance and Agricultural Green Transformation——Taking the Green Finance Reform and Innovation Pilot Zone as an Example

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Abstract: With the help of the "quasi-natural experiment" of setting up a green financial reform and innovation pilot zone, this paper uses the double difference method to test the impact of the green financial reform and innovation pilot zone policy on agricultural green development and regional differences, and further explores its mechanism. The research shows that the establishment of the green financial reform and innovation experimental zone has effectively promoted the green development of agriculture in the region, mainly through adjusting the agricultural structure and increasing mechanization investment. This paper provides important policy inspiration for improving the green financial policy system, deepening green financial innovation, and promoting the green and high-quality development of agriculture.

Keywords: Green Finance; Agricultural Green Development; Double Difference Method; Green Finance Reform and Innovation Pilot Area

1. Introduction

In recent years, with the rapid development of my country's economy, more and more serious environmental problems have gradually attracted people's attention. Therefore, how to realize the ecological and sustainable development of agriculture has gradually become the goal pursued by people.

In 2017, in order to further promote the development of green finance, my country established green financial reform and innovation pilot zones in five provinces and eight places across the country. This paper focuses on the experimental area, and uses the difference-in-differences method (DID) to evaluate the impact of the establishment of the green financial innovation experimental area on the green development of agriculture, so as to provide a theoretical basis for my country's green finance to promote the green and high-quality development of agriculture.

2. Literature review

Domestic research on this subject can be traced back to 2016. He Guangwen et al. (2016) proposed to build a complete rural green financial service system, and systematically expounded the feasibility of green finance to help agricultural development. Wang Zili et al. (2021) pointed out that the role of green finance should start from two aspects: infrastructure and market development. Si Lijuan et al. (2022) started from the relevant policies of the pilot zone, and clarified the important role played by green finance in the optimization of industrial structure, which has certain inspiration and guidance for this paper.

The relevant research on the construction of the agricultural green development index is quite mature in China. Wei Qi et al. (2018) constructed an evaluation system of agricultural green development indicators from the four dimensions of resources, environment, ecology, and quality, and discussed the domestic agricultural green development from two aspects of time and region.

3. Variable selection and model construction

3.1 Model construction - double difference model

This article takes the policy of the green financial reform and innovation pilot zone as a "quasi-natural experiment". According to

the practice of Li Gucheng (2022) , the specific settings of the model are as follows:

$$GAit=\partial 0+\partial 1Region\times \text{Time}+\partial xcontrolit+\mu i+\gamma t+\varepsilon it \quad (1)$$

In the formula, GA_{it} is the explained variable to measure the level of regional agricultural green development. i and t represent the i-th year and the t-th period respectively. Region is a region dummy variable, and the time dummy variable Time is used to divide the time before and after the policy of the green financial reform and innovation pilot zone is promulgated, and the interaction item (Region×Time) is the core explanatory variable. μi represents the time fixed effect, and $\gamma t_{\text{represents the}}$ city fixed effect. $control_{it}$ represents other control variables that affect agricultural green development; ε_{it} is a random disturbance item.

3.2 Variable selection

3.2.1 Interpreted variable: regional agricultural green development level

This paper refers to the ideas of scholars such as Zhang Naiming (2018) and Gong Qianwen (2020) to build an evaluation index system for regional agricultural green development.

Table 1 Descriptive Statistics-1

Level 1 indicators	Secondary indicators	serial number	Level 3 indicators	unit of measurement	maximum value	minimum value	Weights
Regional Agricultural Green Development Level	Save resources	1	Agricultural output value per unit cultivated land area	ten thousand yuan/ha	14.24	1.22	0.167
		2	Water consumption per unit output value	Cubic meter/10,000 yuan	210.4	118.6	0.167
	environmentally friendly	3	Fertilizer Application Intensity	ton/ha	0.88	0.17	0.111
		4	Pesticide Application Intensity	ton/ha	0.036	0.0005	0.111
		5	Agricultural film application intensity	ton/ha	0.041	0.0021	0.111
	Economic income	6	Agricultural GDP per capita	Yuan	26377	1259	0.111
		7	Per capita disposable income of rural residents	Yuan	41302	2914	0.111
		8	land output rate	ten thousand yuan/ha	14.71	1.32	0.111

Considering that there is no significant difference in the importance of each indicator, the same weight is assigned.

3.2.2 Explanatory variable: green financial reform and innovation pilot policy

And control group selected in this paper are as follows:

Table 2 Names of the experimental group and the control group

group	name
test group	Jiujiang City, Quzhou City, Huzhou City, Guangzhou City, Nanchang City, Anshun City, Guiyang City
control group	Fuzhou City, Liupanshui City, Huainan City, Qingyuan City, Chizhou City, Jinhua City, Quanzhou City, Ji'an City, Anqing City, Huaibei City

3.3 Control variables

①Regional industrialization development level ②Rural power infrastructure, the rural power consumption in each county is used to represent the rural power infrastructure. ③ Agricultural structure adjustment coefficient ④ Agricultural mechanization investment ⑤ Land quality ⑥ Informatization degree, measured by the number of mobile phones owned by each rural household.

3.4 Analysis of empirical results

3.4.1 Parallel trend test and policy dynamic effect analysis

This paper draws on the practice of Liu & Qiu (2016) and introduces the interaction term between the year dummy variable and the corresponding region dummy variable. The specific model is as follows:

$$GAit=\partial 0+\partial 1Region\_B\times Time\_B+\partial 2Region\times Time$$
$$+\partial 3Region\_A\times Time\_A+\partial xcontrolit+\mu i+\gamma t+\varepsilon it \quad (3)$$

Time _B , *Time _N* , and *Time _A* represent the dummy variables of the green finance pilot cities before, in the year of establishment, and in the year after the establishment, respectively, and ∂_1 , ∂_2 , ∂_3 are the corresponding interaction coefficients, respectively.

The results show that the corresponding coefficients of the green finance pilot cities from 6 years before the start to 1 year after the establishment have not passed the significance test, but have passed the significance test 2-5 years after the establishment, and the parallel trend test has passed . It can be seen from the figure that the pilot policy of green financial reform and innovation has a positive effect on the green development of agriculture in the region.

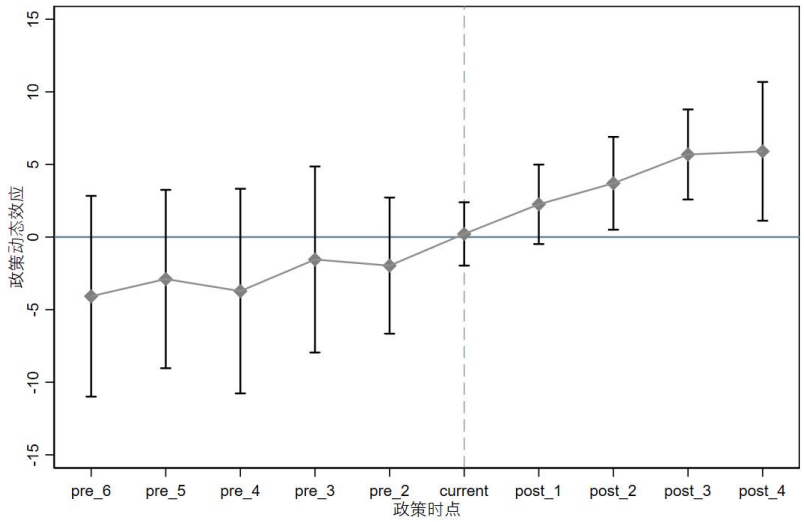

Figure 1 Parallel trend test results

3.4.2 Benchmark regression

Table 4 shows the baseline regression results of the impact of green finance pilot policies on the development of green agriculture. Columns (1) to (7) are the regression results after adding the control variables one by one. At this time, the coefficient of the core explanatory variable (*Region×Time) has declined, but it is still* significantly positive at the 1% level, indicating that if you do not add Coefficients of control variables, core explanatory variables (*Region × Time*) may be overestimated. The results show that the pilot policy of green finance can significantly promote the development of green agriculture.

Table 3 Benchmark regression results

variable	*Green Agriculture*	
	(1)	(7)
Region×Time	6.625***	6.223***
	(5.31)	(5.03)
Ind		25.736

		(1.28)
Ele		0.086
		(0.18)
Agr		-6.469
		(-1.02)
Int		9.092**
		(2.02)
Tec		-0.136
		(-1.55)
Lan		-4.316
		(-0.77)
Constant	17.794***	-9.366
	(13.54)	(-0.41)
time fixed effect	YES	YES
city fixed effect	YES	YES
N	187	187
R2	0.9023	0.9094

Note: *, **, *** indicate significant at the 10%, 5%, and 1% levels, respectively , and the following tables are the same.

3.4.3 Mechanism inspection

In order to further examine the mechanism of the green finance pilot zone's influence on the green development of agriculture, this paper introduces the interaction term between the control variable and the original interaction term into the model to explore the specific mechanism of the green finance pilot policy on the regional agricultural green development . Build the model as follows:

$$GAit=\partial 0+\partial 1Region\times Time+\partial 1Region\times Time\times controlit$$
$$+\partial xcontrolit+\mu i+\gamma t+\varepsilon it \quad (4)$$

The results show that the agricultural structure coefficient and the mechanization input coefficient are positive, and the agricultural power infrastructure interaction coefficient is negative , indicating that the rural power infrastructure has a negative impact on the regional agricultural green development. The reason for this phenomenon may be the local Rural electricity consumption for production accounts for a small proportion of total electricity consumption, and the increase in electricity consumption is mainly for domestic electricity consumption . The " green " benefits brought about by the increase in electricity consumption have not been reflected in agricultural production activities.

Table 4 Mechanism test results

variable	*Green Agriculture*					
	(1)	(2)	(3)	(4)	(5)	(6)
*did*Ind*	22.771					
	(1.53)					
*did*Ele*		-8.295***				
		(-3.08)				
*did*Agr*			18.002***			
			(2.92)			
*did*Int*				6.643		
				(0.21)		
*did*Tec*					1.073**	
					(2.47)	

*did*Lan*						3.816
						(1.33)
control	YES	YES	YES	YES	YES	YES
time fixed effect	YES	YES	YES	YES	YES	YES
city fixed effect	YES	YES	YES	YES	YES	YES
N	187	187	187	187	187	187
R2	0.9622	0.9653	0.9647	0.9603	0.9632	0.9620

3.4.4 Robustness test - placebo test

The interaction items are randomly selected and regressed according to formula (1) . The picture shows the P value and kernel density distribution map of the estimated coefficient of the interaction term (*Region×Time)* in 500 experiments . The results show that in the random process, the estimated coefficients all fall near 0 and meet the normal distribution, and the estimated values of the benchmark regression coefficients are outside this distribution. Therefore, the theoretical conclusion is further confirmed.

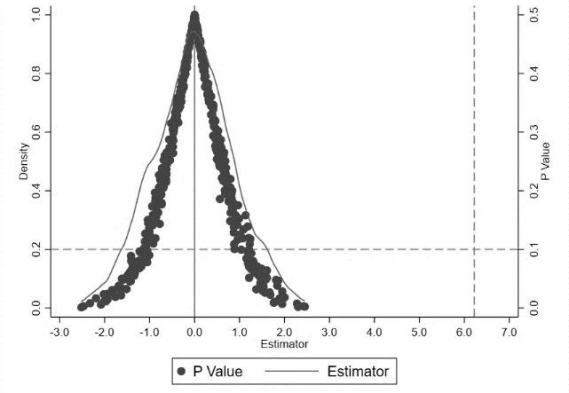

Figure 2 Estimated coefficients and P values of randomly selected interaction terms

4. Conclusions and Suggestions

The research results found that: first, the policy of the green financial reform and innovation pilot zone has a significant role in promoting the green development of agriculture, and after a variety of robustness tests, the conclusion still holds. Second, the policy of the pilot zone can improve the level of agricultural green development by improving the agricultural structure and increasing the investment in agricultural mechanization. For every 1% increase in the agricultural structure adjustment coefficient, the level of agricultural green development will increase by 18.002%, and for every 1% increase in agricultural mechanization investment, the agricultural green Development level increased by 1.073%.

Based on the conclusions of this paper, the following policy recommendations are put forward :

Improve and unify the standards for green agricultural development. my country must speed up the improvement of the agricultural green development system, guide the transformation of agriculture to a green direction, and establish a unified standard for financial support of agricultural green development. Innovate green financial products. In the practice of green finance to help the green transformation of agriculture in my country, we should continue to accelerate the innovation of green agricultural credit products, innovate bond market financing tools and products, learn from foreign experience, develop and popularize carbon financial products and tools such as agricultural carbon forwards and carbon funds, etc. .

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