Has Green Finance Promoted Industrial Structure Optimization?

-Taking Hunan of China as an Example

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Abstract: This paper analyzes the mechanism of green finance development promoting industrial structure optimization. The panel data of 14 cities and states in Hunan Province of China from 2010 to 2017 were used to measure the status of industrial structure and green financial efficiency. The Spatial Interaction Model was constructed to empirically analyze the impact of green finance on the upgrading of industrial structure through the green credit threshold, technological innovation and green consumption. The study finds that the inter-state industrial structure and green financial efficiency have the commonality of time and space; in general, green finance can promote industrial structure's optimization of Hunan Province through three major channels. Among them, green finance can promote the rationalization of industrial structure through the way of technological innovation and green consumption. However, the three major ways of green credit threshold, technological innovation and green consumption are not conducive to the supererogation of industrial structure.

1. Introduction

For the past few years, China has been constantly developing its green finance system along the two paths of "top-down" top-level promotion and "bottom-up" grassroots exploration. Impressive achievements had been made in terms of innovation and international cooperation of green finance. Social and environmental benefits had also been further demonstrated. It brings us to these questions: Did green finance work in the industrial structure optimization of China? Also, is it able to be sustainable developing? These are the important aspects that we have to focus on under current situation.

Green finance was earlier defined as environmental finance or sustainable financing in the American Heritage Dictionary(2000). Salazar(1998) believed that environmental finance is a form of financial innovation which seeks to protect the natural environment, and is thus a bridge between financial and environmental industry. Labatt et al.(2002) pointed out that the heart of environmental finance is to provide financial support for the development of green economy, and its innovative

financial instruments can promote not only the real economy but also the sustainable development of society.

Some scholars have studied the relationship between green finance and industrial structure: Green finance supports the optimization of industrial structure through green credits and green bonds(Wang Yujing, 2017) , and regulates the process of industrial structure optimization by means of capital allocation(Li Miaomiao et al., 2015; Dooley et al., 2016; Yan Chengliang et al., 2016),thereby improving economic structure, promoting supply side reform and ultimately optimizing the macro development of economy(Wang Yao,2016).

However, several aspects about green finance remain controversial. First, some construct their systems of indicators, from macro point of view that seek to evaluate how useful green finance is to promote industrial structure upgrading(Zeng Xuewen et al.,2014; Yang Yang,2017; Zhang Lili, 2018),which measure the level of green finance development in China through indicators such as green credit, green securities, carbon finance, green investment, green insurance, etc. However, from micro point of view, development of green credit is also measured through indicators such as green credit strategy and management of institution, green financial services, organizing skills development, as well as communication and cooperation(Penny, 2001; Research Center for Environment and Economic Policy, Ministry of Environmental Protection, 2012) .

Second, there are different perspectives and conclusions about the mechanism of the green finance promoting the industrial green upgrading. Scholars like Shahbaz et al.(2013) study the mechanism on an empirical level, and believe that by providing financial support to green technology research and development, financial development would help to lower carbon-emission, thereby creating a composition effect. Moreover, result of an empirical study drew by Xiu Jing et al.(2015) reveals that there is a decrease in elasticity of pollution management investments to industrial energy conservation and emission reduction as the proportion of green credit increase. There are also other scholars using empirical research to test mechanism based on mechanism analysis. For instance, Chen Weiguang(2016) thought that green credit could encourage optimization of industrial structure through mechanisms including capital formation, funding and credit creation. The study of Chen Guoqing(2018) indicates that the industrial structure adjustments is promoted by green finance with financing, capital orientation, industry integration, risk prevention and so on.

In conclusion, substantial achievements of the research about green finance and industrial structure optimization have been shown in existing literature. However, there are two unaddressed gaps. For one thing, current green finance indication systems are mainly based on macroscopic or microcosmic level, and there is a lack of research in the area of measurement system that focuses on industry. Measurement index about green finance should be built closely connected to industry as green finance is meant to urge the development of real economy. For another, there is a need for further investigation on problems about the mechanism of green finance to industry optimization. This paper thus aims to make a contribution to the area of studies by establishing an appropriate measurement index system of green finance, and by investigating the way green finance promotes industrial reform and upgrading, using the development of green finance in various cities and states of Hunan Province as an example.

2. Mechanism Analysis of Green Finance Development to Industrial Structure Upgrading

Green finance is a kind of financing activity that can cause environmental effects including the reduction of air, water and soil pollution, decreasing greenhouse gas emission, improvement of resources use efficiency, mitigation and adaptation of climate change and its synergies and so on, therefore provide support for sustainable development(G20) green finance study group, 2016). Green

finance discriminates the funding needs of different industries. To new and high technology enterprises, it brings benefits to make the process of investments about research and production more efficient and rapid in order to accelerate the optimization and development of industrial structure. Yet industries with heavy contamination, high energy-consuming and excess capacity have to deal with strict management policy of credit access and exit, which will strike their production and operation directly, affect the speed of their large amount of capital turnover, increase the financial risk (Yang chi,2013) so as to gradually shut down the outdated production facilities and force enterprises to reform and upgrade. In our opinion, the influence mechanism of green finance promoting industrial optimization is mainly reflected in following three aspects:

Mechanism 1: By reallocating funds through setting credit threshold (Ge Zhaoqiang, 2009; Li Miaomiao et al., 2015; Du Li et al.,2016; Yan Chengliang et al., 2016),which focus on whether a business is green or not, green finance can restrict the development of industries with heavy pollution and high energy and water consuming. Financial risk of the high-polluting and high-consuming businesses is heightened by green credit threshold so the backward production facilities will progressively close and even some of them will be stimulated reversely to rapidly shift to low energy-consuming, low pollution and high production model.

Mechanism 2: By offering sufficient funds, green finance drives technological innovation and high-tech achievements transformation,thereby upgrade the industrial structure. High-tech or R&D companies are often trapped in the so-called situation of 'If you have no hand, you can't make a fist', for the R&D costs is huge in the early stage of technological innovation nevertheless these companies in most cases lack of capital, besides social financing could be too difficult and risky for them, not to mention that it may cause share dispute. Green finance is able to provide the efficient and convenient access for high-tech industry to finance so as to promote innovation in science and technology as well as the conversion of achievements (Gao Xiaoyan, Wang Zhiguo, 2017).

Mechanism 3: Green finance has the ability to gear up the adjustment and upgrading of industrial structure by developing green consumption. For purpose of strengthening financial support for green consumption, urging the reform and upgrading of industrial structure, financial institutions are motivated to bring forth new ideas about consumer credit products and services, to provide credit support for residents who consume green smart production such as new-energy automobiles, green intelligent home appliances, home automation, water-saving apparatuses and so on.

3. Variable Selection and Data Resources

3.1. Explained Variable

Industrial structure optimization refers to the rearrangement of production factors among different industries and sectors of economy as well as changes of proportion of output value of them (Kuznets,1957). Two aspects ought to be considered about industrial structure optimization, its rationalization and supererogation, which we use ia and ib to represent in following. Based on the practice of Han Yonghui et al. (2016), we take the inverse of the Thiel index to measure the rationalization of industrial structure:

$$ia = \frac{1}{\sum_{i=1}^{n}(Y_i / Y)\left|(Y_i / L_i)/(Y / L)-1\right|} \qquad (1)$$

The ia in the above model represents the level of industrial structure rationalization, and Y for the yield, L for labor force, Y_i / Y for output structure and Y / L for productivity. A larger number of ia indicates a more rational industrial structure and a smaller number stands for a less one.

The supererogation of industrial structure is symbolized by proportional relations between different industries. According to Law of Petty-Clark, we use the proportion of output value of the secondary industry to the one of the tertiary industry to represent the level of industrial structure optimization (Gan Chunhui, 2011) .

$$ib = \frac{Y_3}{Y_2} \tag{2}$$

The Y_3 and Y_2 of model(2) respectively stand for the yield of the tertiary and secondary industry. A larger ib indicates a higher level of industrial structure supererogation.

3.2. Explaining Variables

Green finance development can be measured in terms of scale, structure and efficiency. According to the study of Zhang Lili et. al.(2018), we choose the DEA-Malmquist index to evaluate green finance efficiency. The Malmquist index from period t to t+1 is illustrated as followed:

$$TFP = \left[\frac{D^t(x_{t+1}, y_{t+1})}{D^t(x_t, y_t)} \times \frac{D^{t+1}(x_{t+1}, y_{t+1})}{D^{t+1}(x_t, y_t)} \right]^{\frac{1}{2}} = \left[\frac{D^t(x_{t+1}, y_{t+1})}{D^{t+1}(x_{t+1}, y_{t+1})} \times \frac{D^t(x_{t+1}, y_{t+1})}{D^{t+1}(x_t, y_t)} \right]^{\frac{1}{2}} \times \frac{D^{t+1}(x_{t+1}, y_{t+1})}{D^t(x_t, y_t)} = TC \times EC \tag{3}$$

The variation of the Malmquist index(TFP) signifies productivity's change of certain decision making unit from period t to t+1: if the number of TFP is larger than 1 then the productivity is increasing; on the contrary, if the number of TFP is smaller than 1 then the productivity is decreasing. TFP can be divided into changes of technology(TC) and efficiency(EC). TC means the extent to which the movement of production frontiers contributes to productivity and EC means the extent to which the changes in technological efficiency from period t to t+1 contributes to productivity.

It needs input and output indicators of factors to estimate efficiency with DEA-Malmquist index. On the basis of large numbers of literatures and the Guidance on Building a Green Financial System issued by seven ministries and commissions including the central bank in 2016, we select the following green financial input and output indicators in our research.

Table1: Indicators used to estimate the green financial efficiency.

Indicator Categories	Indicators	Specific Variables
Input Indicators	Green Credit	The amount of long-term and short-term loans in enterprises
	Proportion of Green Credit in Regional Credit	The amount of long-term and short-term loans in enterprises/The amount of district social credit
	Expenditure on science and technology	The proportion of science and technology expenditure in fiscal expenditure
	Expenditure on environmental protection	The proportion of environmental protection expenditure in fiscal expenditure

	Patents	Number of valid patents
Output Indicators	Production of new and high technological enterprises	Output value of high-tech enterprises
	Reduction of greenhouse gas emission	Annual reduction rate of greenhouse gas emission
	Economic growth	GDP per capita
	Environmental protection industry	The proportion of income of environmental protection industry in regional GDP

Considering that green credit is the major part of green finance in Hunan, we take those green environmental protection enterprises listed in A-shares and New OTC market of cities and states in Hunan as a sample and regard their overall amount of medium and long-term credit as the total amount of green credit. In addition, the R&D input of science and technology, environmental protection expenditure and number of patents are also considered as the auxiliary indexes of green finance. The output indicators of green finance are development of high-tech company, emission reducing of greenhouse gas, economic growth and income of environmental protection industry.

On the basis of the above mechanism analysis of green finance to industrial structure optimization, we add other explaining variables: green credit threshold(*cre*) represented by the proportion of regional green credit in total in green credit of the whole society, technology orientation(*sci*) represented by regional numbers of patents applied per year and green consumption(*envir*) represented by the substitute variable, income of environmental protection industry, due to the lack of corresponding index.

3.3. Control Variables

①Human capital level(*edu*),measured by the proportion of enrollment of students of higher learning institutions in number of local permanent residents at the end of the year.
②Government intervention(*government*), measured by the proportion of fiscal expenditure of local government in local GDP.
③Urbanization(*urbn*), measured by the proportion of urban permanent residents in local population.

3.4. Data Sources

We select research data from 2010 to 2017. The index datas are all from China Labor Statistics Yearbook, China County Statistical Yearbook, Hunan Statistical Yearbook, China Urban Statistical Yearbook, East Fortune net and statistics bulletins of each city or state of Hunan.

4. Empirical Process and Result Analysis

4.1. Measurement of Industrial Structure Optimization and Green Finance Efficiency Indexes

We calculate the indexes of industrial structure rationalization and supererogation in 14 cities and states of Hunan Province from 2010 to 2017 separately according to model(1) and (2). The indicators of financial development efficiency in those cities and states are estimated with DEAP2.1 software. Generally, both the rationalization and supererogation keep increasing in Hunan. From 2010 to 2012, the green finance efficiency was growing but slowing down from 2012 to 2014, as a result of economy entering the adjustment period of overcapacity and financial industry cutting down the credit of real economy after 4 trillion dollars stimulus before 2012. And the green finance efficiency gradually rose after 2015 for China has been attaching great importance to green development.

4.2. Spatial Autocorrelation Test

It needs to be examined before the spatial autocorrelation test that if there is correlation in space among the optimization of industrial structure in each city or state. Moran's I is the most common used method when examining the spatial correlation. By calculating the global Moran's I we find the Moran's I index for 2010-2017 shows a significant relationship in most years, which make it improper to estimate with traditional quantitative regression model because the results will be subjected to significant deviations. Next, we use the spatial SDM model set in the previous pages to empirically test the relationship between green finance efficiency and industrial structure optimization.

4.3. Model Specification

Following the previous study about mechanism of green finance and industrial structure upgrading, first we construct the basic empirical model based on Spatial Dubin Model(SDM Model):

$$Indu_{it} = c + \rho WIndu_{it} + \beta_0 tpf_{it} + \theta W\sum\nolimits_m \gamma_m C_{it} + \sum\nolimits_m \gamma_m C_{it} + \mu_i + \varepsilon_{it} \tag{4}$$

To inspect the interactive effect of green finance combining each aspect on industrial structure optimization, we build several interaction item models. First, the green threshold interaction item model is as followed:

$$\begin{aligned} Indu_{it} = {} & c + \rho WIndu_{it} + \beta_0 tpf_{it} + \beta_1 \mathrm{cre}_{it} * tfp_{it} + \theta_0 \mathrm{W}tpf_{it} \\ & + \theta_1 \mathrm{W}\mathrm{cre}_{it} * tfp_{it} + \theta W\sum\nolimits_m \gamma_m C_{it} + \sum\nolimits_m \gamma_m C_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{5}$$

Second, the technological innovation interaction item model is as followed:

$$Indu_{it} = c + \rho WIndu_{it} + \beta_0 tpf_{it} + \beta_1 \mathrm{sci}_{it} * tfp_{it} + \theta_0 \mathrm{W}tpf_{it} + \theta_1 \mathrm{W}\mathrm{sci}_{it} * tfp_{it} + \theta W\sum\nolimits_m \gamma_m C_{it} + \sum\nolimits_m \gamma_m C_{it} + \mu_i + \varepsilon_{it} \tag{6}$$

Third, the green consumption interaction item model is as followed:

$$\begin{aligned} Indu_{it} = {} & c + \rho WIndu_{it} + \beta_0 tpf_{it} + \beta_1 \mathrm{envir} * tfp_{it} + \theta_0 \mathrm{W}tpf_{it} \\ & + \theta_1 \mathrm{W}*\mathrm{envir}_{it} * tfp_{it} + \theta W * \sum\nolimits_m \gamma_m C_{it} + \sum\nolimits_m \gamma_m C_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{7}$$

Then we incorporate the interaction items into the regression model to construct the comprehensive effect model:

$$\begin{aligned} Indu_{it} = {} & c + \rho WIndu_{it} + \beta_0 tpf_{it} + \beta_1 \mathrm{cre}_{it} * tfp_{it} + \beta_2 sci_{it} * tfp_{it} + \beta_3 envir_{it} * tfp_{it} + \theta_0 \mathrm{W}tpf_{it} \\ & + \theta_1 \mathrm{W}\mathrm{cre}_{it} * tfp_{it} + \theta_2 \mathrm{W}sci_{it} * tfp_{it} + \theta_3 \mathrm{W}envir_{it} * tfp_{it} + \theta_i \mathrm{W}\sum\nolimits_m \gamma_m C_{it} + \sum\nolimits_m \gamma_m C_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{8}$$

The Indu in above model means industrial structure optimization, including industrial structure rationalization(ia) and supererogation(ib). The TFP represents the core explaining variable: green finance efficiency, and the subscript i and t stands for the regions and years respectively. β_0 and

γ are coefficients of the core explaining variable and control variables. C_{it} represents different sets of control variables. The c is a constant term, u_i represents the individual characteristic effect that is no time-varying. W is spatial weight matrix, β_1、β_2、β_3 is the n*k order coefficient to be evaluated of k variables and ρ is the spatial lag regression coefficient, both of which estimate the incidence between adjacent areas. We use stata15 software to perform the empirical test.

4.4. Analysis of Empirical Results

4.4.1. Spatial Effect of Green Finance on Industrial Structure Rationalization

Based on the analysis result of each model, we can find that the result of the main effect model(1) is not significant, which shows that the influence of simple green finance side is not obvious on industry structure rationalization. Then we add various interaction items with green finance into the main effect model and the testing results of model(2) shows that the regression result of credit threshold interaction item(tfp_cre) is significantly negative .Possible reason is green credit threshold causes the deficiency of funds that some enterprises use to transform. Especially the private enterprises are currently facing the unsolved difficulty to get credit. It is even harder to get corresponding credit from banks for those companies that do not meet the green standard. The testing results of model(3) shows that the regression result of technology innovation interaction item(tfp_sci) is significantly positive. That means the improvement of technology has positive influence on industrial structure upgrading, which conforms to Solow's endogenous growth theory. The testing results of model(4) shows that the regression result of green consumption interaction item(tfp_envir) is significantly positive ,which indicates consumption act as a guide to business production. The green industry has embraced a new developing period as the concept of green consumption gradually enjoying popular support and the guidance of green policies continuing.

In the result of spatial effect analysis, the spatial regression coefficient ρ is significantly positive, showing the existence of spillover effect in the rationalization of industrial structure in cities and states. In terms of the exogenous interaction effect, the regression result of Wx_tfp_cre is significantly negative, denoting that green credit threshold can inhibit the industrial structure rationalization in adjacent areas. A significantly positive regression result of Wx-tfp-sci indicates that the spillover of technological innovation can effectively promote industrial structure rationalization in other areas.

Table 2: Estimation results of SDM model of green finance to industrial structure rationalization.

	Spatial SDM Model					**Traditional Model**
Variables	(1) *ia*	(2) *ia*	(3) *ia*	(4) *ia*	(5) *ia*	OLS *ia*
tfp	0.005 (0.007)	0.010 (0.009)	0.002 (0.009)	-0.010 (0.008)	-0.008 (0.009)	-0.002 (0.009)
tfp_cre		-0.060* (0.038)			0.081* (0.049)	-0.092* (0.044)
tfp_sci			0.001* (1.28e-06)		0.001* (0.001)	-0.001** (0.001)
tfp_envir				0.001* (7.12e-06)	0.001* (0.001)	2.88e-05***(9.13 e-06)

_cons	0.307 (0.185)	0.343 (0.187)	0.318 (0.184)	0.482* (0.235)	0.610* (0.275)	0.548** (0.240)
Wx_tfp	-0.195* (0.080)	0.009 (0.011)	-0.013 (0.015)	-0.015 (0.021)	-0.013 (0.022)	
Wx_tfp_cre		-0.182** (0.059)			-0.161** (0.058)	
Wx_tfp_sci			5.26e-06* (2.96e-06)		0.001* (0.001)	
Wx_tfp_envir				0.001 (0.001)	0.001 (0.001)	
Control Variables	YES	YES	YES	YES	YES	YES
ρ	0.315* (0.125)	0.300* (0.129)	0.316* (0.126)	0.308* (0.135)	0.281* (0.145)	
R^2	0.596	0.603	0.601	0.625	0.643	0.123
Log Likelihood	90.413	90.564	89.303	89.210	92.819	

Note: Numbers in brackets is the standard error, * p<0.05, ** p<0.01, *** p<0.001. The same below.

4.4.2. Spatial Effect of Green Finance to Industrial Structure Supererogation

Based on the analysis result of each model, we can find that the regression result of main effect model(6) of green finance is not obvious. We keep adding each interaction item variable and the regression result of each interaction item in model(7) and model(9) both turn out to be not obvious, which shows that the influence of green finance on industrial structure supererogation through this three aspects is not obvious. The explanation could be as the financial activity intended to promote real economy, green finance mainly focus on the industrial businesses like manufacturing enterprises , especially the green , energy-saving and environmental protection manufacturing enterprises, while the influence on the service sector is relatively small. In the regression results of comprehensive model(10), both the green threshold(tfp_cre) and green consumption interaction item(tfp_envir) are significantly negative, which goes against our hypothesis. The explanation is during the process of green finance functioning on industrial structure supererogation through three ways, the green credit threshold can accelerate the transformation of manufacturing and the green consumption promotes the green industry. Both scale up the secondary industry with the influence of green finance therefore inhibit the speed of supererogation.

In the result analysis of spatial effect, the spatial regression coefficient ρ appears to be significantly positive, proving the spillover effect of industrial supererogation between cities and states. In terms of the exogenous interaction effect, the regression results of Wx_tfp_cre and Wx_tfp_sci in the comprehensive model(10) are both obvious and the former is negative while the latter is positive, which means that local green credit threshold restrain the industrial structure supererogation of adjacent areas but the spillover of technology innovation can effectively promote the industrial structure optimization in other areas.

Table3: Estimate results of SDM Model of Green finance to Industrial Structure Supererogation.

	Spatial SDM model					**Traditional model**
Variables	(6)	(7)	(8)	(9)	(10)	OLS

	ib	*ib*	*ib*	*ib*	*ib*	*ib*
tfp	-0.002 (0.007)	-0.002 (0.009)	-0.010 (0.011)	-0.004 (0.010)	-0.002 (0.010)	-0.007 (0.014)
tfp_cre		-0.006 (0.023)			-0.006* (0.029)	0.010 (0.044)
tfp_sci			0.000 (0.000)		0.001 (0.001)	0.001 (0.001)
tfp_envir				0.001 (0.001)	-0.001* (0.001)	-1.00e-05 (1.74e-05)
_cons	-0.698** (0.253)	-0.689** (0.256)	-0.608* (0.248)	-0.561* (0.277)	-0.783* (0.361)	-1.464*** (0.310)
Wx_tfp	0.009 (0.006)	0.011 (0.008)	-0.006 (0.009)	-0.008 (0.016)	0.009 (0.021)	
Wx_tfp_cre		-0.032 (0.065)			-0.049* (0.068)	
Wx_tfp_sci			0.001* (0.000)		0.001* (0.001)	
Wx_tfp_envir				0.001 (0.001)	-0.001 (0.001)	
Control variables	YES	YES	YES	YES	YES	YES
ρ	0.471*** (0.129)	0.471*** (0.129)	0.420** (0.131)	0.466*** (0.129)	0.396** (0.137)	
R^2	0.341	0.351	0.396	0.384	0.373	0.776
Log Likelihood	74.181	74.214	75.991	74.635	76.837	

4.4.3. Robustness Test

In order to examine the robustness of the estimate results above, first we change the variables to test the robustness of spatial effect of green finance to industrial structure rationalization, which involves model(11) to model(14). We use the proportion of expenditure on science and technology in fiscal expenditure to measure the expenditure level of science and technology, and replace the core explaining variable, the interaction item of technology innovation and green finance with the interaction item of science and technology expenditure with green finance. We also use the proportion of the expenditure on environmental protection in the fiscal expenditure to measure the environmental protection expenditure level and replace the interaction item of green consumption with green finance(tfp_envir) with interaction item of environmental protection expenditure with green finance. Then we add control variables to test the robustness of spatial effect that green finance has on industrial structure supererogation. We put fixed-asset investments into model(15) to model(18) as a control variable and measure it with the proportion of total fixed-asset investments of the whole society in the local GDP. The regression results of major variables in robustness test are shown in Chart 4.

Comparing chart4 to chart2 and chart3, we can find that the robustness test results, and the original model estimate results only differentiate about the regression coefficient, beyond that the significance and effect degree are in accordance. So we can draw a conclusion that the estimate result has passed the robustness test.

Table 4: Estimate results of robustness test of green finance on the rationalization and supererogation of industrial structure

	Industrial Structure Rationalization				Industrial Structure Supererogation				
Variables	(11) *ia*	(12) *ia*	(13) *ia*	(14) *ia*		(15) *ib*	(16) *ib*	(17) *ib*	(18) *ib*
tfp_cre	-0.060 (0.038)			-0.041* (0.039)	tfp_cre	-0.024 (0.024)			-0.009* (0.032)
tfp_tech		0.001** (0.001)		0.001* (0.001)	tfp_sci		0.001 (0.001)		0.001 (0.000)
tfp_proj			0.001 (0.001)	-0.011* (0.023)	tfp_envi			-0.001 (0.001)	-0.001* (0.000)
					invest	-0.232 (0.180)	-0.234 (0.198)	-0.275 (0.224)	-0.357 (0.215)
_cons	0.343 (0.187)	0.559* (0.244)	0.515* (0.238)	0.453 (0.280)	_cons	-1.787*** (0.355)	-1.685*** (0.395)	-1.744*** (0.460)	-1.718*** (0.431)
Wx_tfp_cre	-0.182** (0.059)			-0.123* (0.068)	Wx_tfp_cre	-0.087 (0.065)			-0.092* (0.069)
Wx_tfp_tech		0.001* (0.001)		0.001* (0.001)	Wx_tfp_sci		0.001 (0.001)		0.001* (0.001)
Wx_tfp_proj			0.001 (0.001)	-0.001 (0.001)	Wx_tfp_envir			0.001 (0.001)	0.001 (0.001)
ρ	0.300* (0.129)	0.277* (0.135)	0.306* (0.133)	0.247* (0.128)	ρ	0.267* (0.141)	0.266* (0.142)	0.276* (0.140)	0.258* (0.149)
R^2	0.603	0.626	0.607	0.634	R^2	0.270	0.338	0.258	0.388

5. Conclusions and Policy Suggestions

The research of this paper shows that the industrial structure of cities and states in Hunan Province has spatiotemporal similarity with the green finance efficiency. In general, green finance can promote the reform and upgrading of Hunan's industrial structure through three ways. Specifically, through technology innovation and green consumption, the green finance can accelerate the rationalization of industrial structure, opposite to the influence of green credit threshold. But overall, green finance has a positive effect on industrial structure rationalization through three ways. The spillover of technology innovation can effectively promote the industrial structure rationalization of other regions, while the green credit threshold can inhibit it of adjacent areas. It is hard for green finance to promote the supererogation of industrial structure through those three ways because both the green credit threshold and the green consumption scale up the secondary industry with the influence of green finance therefore restrain the process of supererogation. Besides, the green credit threshold could restrain the industrial structure supererogation of adjacent areas, but the technology innovation spillover can effectively promote the industrial structure supererogation of other areas.

Based on the above conclusions, we propose as followings: First, during the industrial structure upgrading process of green financial service, we should lower the credit threshold properly , give more preferential policies for innovative enterprises such as high-tech companies, for those enterprises have great positive effect on industry not only in local but also in other areas. Second, each city or state should introduce effective measures to guide the regional commercial banks to aggressively develop the green credit business and then propel the optimization and upgrading of industrial structure, given the fact that except Changsha, the green finance development of other areas in Hunan is unsatisfactory. There is even a U-shaped development curve. Green supply has yet to meet the growing demand for green credit. Third, cities and states should make full use of the spatial effect of green finance in the reform and upgrading of industrial structure, be well-coordinated and inner-connected, develop the mutual circulation of capital and technology, and work together to guide green financial policies to promote the upgrading of the industrial structure. Fourth, we should introduce the concept of green consumption to the public by virtue of the call of green development policy of national economy.

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