



# Green Finance and Industrial Structure Optimization- Research Based on Data and Statistical Analysis Tools

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**Abstract.** Under the background of “Carbon Neutrality”, changing the development model and adjusting the industrial structure has become the top priority, and the development of green finance plays an important supporting role. Based on the municipal panel data of Guizhou Province from 2007 to 2020, this paper studies the relationship between the development of green finance and the optimization of industrial structure in Guizhou Province. It is found that after becoming a green finance pilot area, Guizhou Green Finance has a significant positive effect on the upgrading of industrial structure in the current period. However, after further analysis, it is found that the development of green finance and the optimization and upgrading of industrial institutions in Guizhou have not had a positive effect on the efficient economic development of Guizhou. Therefore, this paper puts forward relevant suggestions for the development of green finance in Guizhou in order to promote its economic development.

**Keywords:** Green Finance · Industrial Structure

## 1 Introduction

In order to alleviate global warming and achieve green, coordinated and sustainable economic and social development, countries around the world have put forward carbon emission reduction plans in recent two years. In 2020, China clearly put forward the carbon emission reduction targets of “Carbon Peak” in 2030 and “Carbon Neutralization” in 2060. In the past, there have been extensive, high energy consumption, high pollution and other problems in the economic development of many regions in China, which not only has low economic benefits, but also destroys the environment and seriously violates the objectives of green development and “Carbon Neutrality”. Therefore, it is necessary to change the development mode, adjust and optimize the industrial structure and gradually realize the green development of economy and society. At this stage, domestic research on green finance started relatively late. Under the background of “Carbon Neutrality”, green finance has gradually become a hot topic in academia and industry in recent two years, but there is still less research on green finance. At present, there are more theoretical analysis and less empirical test. In view of the important role

of green finance in the process of realizing the green transformation of economy and society, we must strengthen the research on this issue. Based on the above logic, this paper focuses on the relationship between green finance and industrial structure, starting from the above topics. As one of the less developed provinces in Guizhou, the research on the transformation of green financial structure plays an important role in promoting the development of green finance in the eastern part of Guizhou. At the same time, it plays an important role in promoting the reform and upgrading of green financial structure, which is of practical significance for Guizhou.

## 2 Literature Review and Research Hypothesis

### 2.1 Literature Review

There was literature advocated the concept of green transformation, and believes that by reasonably adjusting the price of production factors and using differential taxation, we can eliminate backward industries with high pollution and high energy consumption, gradually change the extensive economic development model, promote the development of low-carbon and environmental protection industries, realize transformation and upgrading, and promote green and sustainable economic development [3]. And illustrated that vigorously developing green finance is an inevitable way to achieve sustainable development under the deteriorating situation of resources and environment through the case of green finance participating in green energy investment [2].

Zou found that the rapid development of green finance in ethnic minority areas can promote the improvement of the supply structure and quality of production factors, and finally make the economy in ethnic minority areas develop steadily under the “new normal” [4]. Dang constructed indicators and models for the development of green finance and the upgrading of industrial structure in different regions of China [1]. The analysis results show that the development of green finance in the region has a synergistic effect with the optimization and upgrading of industrial structure, and the development of green finance plays a significant role in promoting the upgrading of industrial structure.

The research on green finance started earlier by foreign scholars, and relatively late and less by domestic scholars; The academic research on green finance is mostly from the perspective of environmental protection and realizing the sustainable and coordinated development of economy and environment, and there is less research on economic structure and the quality of economic development; It can also be seen from the research at home and abroad that the development and research of green finance is very necessary, but most of the current research is focused on the national scope or large regional scope, and there is little research on ethnic minority areas; And the current research, theoretical research is mostly, empirical research is less. Based on the existing research results and the shortcomings of previous research, this paper attempts to analyze the relationship between green finance and industrial structure optimization in Guizhou through demonstration, test the promotion effect of green finance development and industrial structure optimization on the quality of economic development, and put forward some suggestions on optimizing industrial structure and realizing green development in Guizhou.

## 2.2 Research Hypothesis

According to statistics, as of March 2021, Guizhou has studied and issued 15 policies to support green finance and 62 innovative green financial products and services. Nine financial institutions in the province have established green finance business departments and three state-owned banks have established green finance sub branches; The province has provided 377.1 billion yuan of green credit to green projects, issued 13 billion yuan of green bonds, raised 11.6 billion yuan of green funds, and 52.5 billion yuan of domestic stock financing of green enterprises. Guizhou has made positive progress in promoting green finance.

By promoting the development of green finance, Guizhou strengthens the agglomeration effect of financial resources and the innovation of green financial products, reduces the financing cost of green projects, gives play to the scale effect and cultivates green industries; And restrict high pollution and high energy consuming industries to promote the adjustment of economic structure, which is conducive to industrial transformation and upgrading, ecological environment protection and the maintenance of development speed. However, if the development speed of green finance is too fast and the promotion process is too rough and extreme, it is bound to quickly eliminate a large number of industries and production capacity, bring higher transformation costs, and hinder the optimization of industrial structure. Therefore, the following assumptions are made in this paper:

Hypothesis 1A: the development of green finance in Guizhou promotes the optimization of industrial structure.

## 3 Research Design and Empirical Results Description of Specimens

This paper selects the panel data of 6 prefecture level cities and 3 autonomous prefectures in Guizhou Province from 2007 to 2020 for empirical research. The data comes from the statistical bulletin of national economic and social development, statistical yearbook, website data and national research network database of cities and autonomous prefectures (Table 1).

This paper mainly studies the impact of the development of Green Finance on the optimization of industrial structure. However, due to the lag in the transformation and upgrading of industrial structure, that is, the industrial transformation and optimization of the previous period will also have an impact on the industrial structure of the current period. Therefore, in addition to the development of green finance, this paper also introduces the industrial structure of the previous period as an explanatory variable. The model is set as follows (Table 2):

$$IS_{i,t} = \alpha_1 Green_{i,t} + \alpha_2 IS_{i,t-1} + \alpha_3 control_{i,t} + \mu_{i,t}$$

According to descriptive statistics, the average value of green finance development is 0.360. This is because the policy of green finance pilot zone began in 2017, so there are more panel data in the period of non green finance development. There are obvious differences between the minimum and maximum values of industrial structure in T and T-1, indicating that there are differences in the optimization level of industrial structure

**Table 1.** variable description

Variable type	Variable name	Variable code	Variable definition
Explained variable	Industrial Structure Optimization	IS	Added value of tertiary industry/added value of secondary industry
Explanatory variable	Green Financial Development	Green	The value of dummy variable after 2017 is 1, otherwise it is 0
Control variable	Government Intervention	GM	Government expenditure/GDP
	Urbanization Level	UR	Urban population/total population of each region at the end of the year
	Opening Up Level	IE	Total imports and exports

**Table 2.** Results of Descriptive Statistics

VARIABLES	N	Mean	Sd	Min	Max
Green	100	0.360	0.482	0	1
IS	100	1.268	0.453	0.488	2.662
UR	100	0.348	0.185	0.105	0.801
IE	100	812.4	1,659	9.790	9,121
GM	100	295.0	82.80	156.9	476.3
IS-1	100	1.213	0.425	0.488	2.564

in Guizhou. The minimum value of urbanization level is 0.105 and the maximum value is 0.801, indicating that there are great differences in urbanization level in time and region in Guizhou, which means that there is also a gap in its economic development level.

The regression result (1) is an overall regression analysis of 6 prefecture level cities and 3 autonomous prefectures in Guizhou. The results show that there is a significant positive correlation between the impact of Green Finance on industrial structure. When the development of green finance increases by 1%, the upgrading and optimization rate of industrial structure increases by 0.174%. At the same time, it can be seen that the industrial structure of the previous period also has a significant positive impact on the optimization and upgrading of the industrial structure of the current period, and the impact of other control variables on the industrial structure is not significant enough.

In order to verify the impact of the development of Green Finance on the optimization and upgrading of industrial structure in Guizhou, this paper uses the fixed effect model to conduct regression analysis on the relationship between green finance and industrial structure. The regression results are shown in Table 3.

**Table 3.** Test Results of Regression

VARIABLES	(1)	(2)	
	All	D1	D2
Green	0.174*** (3.35)	0.293** (2.16)	0.112* (1.95)
IS-1	0.527*** (5.62)	0.383* (1.77)	0.618*** (5.02)
UR	0.092 (0.27)	0.711 (0.35)	0.184 (0.56)
IE	0.000 (0.28)	-0.000 (-0.71)	0.000 (0.16)
GM	-0.001 (-0.77)	0.001 (0.42)	-0.001 (-0.80)
Constant	0.685*** (2.78)	0.265 (0.22)	0.541** (2.23)
Observations	100	29	71
Number of city	9	3	6
R-squared	0.608	0.662	0.602

Robust t-statistics in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

The regression result (2) is that six prefecture level cities are divided into one group and three autonomous prefectures are divided into another group. The result is consistent with the result (1). The difference is that for the three ethnic autonomous prefectures, the positive promotion effect is better. When the development of green finance increases by 1%, the upgrading and optimization rate of industrial structure increases by 0.293%; For the six prefecture level cities, when the development of green finance increases by 1%, the upgrading and optimization rate of industrial structure increases by 0.112%. The reason should be that the foundation of the Autonomous Prefecture's own economic development level is poor. The development of green finance is also a good opportunity for its financial development and has a good impact on it. At the same time, the impact of industrial institutions in the previous period on the optimization and upgrading of industrial structure in the current period is more significant in prefecture level cities, indicating that the basis of industrial structure optimization in prefecture level cities is better than that in autonomous prefectures.

#### 4 Further Analysis and Robustness Test

Based on the role of green financial development in promoting the optimization of industrial structure, and the optimization and upgrading of industrial structure is closely related

to economic development, this paper further analyzes the impact of green financial development and industrial structure optimization on economic development in Guizhou. This paper tests the impact of green financial development and industrial structure optimization on economic and efficient development in Guizhou, measures it with capital, labor and land productivity, and synthesizes it into a comprehensive index of economic and efficient development according to principal component analysis. The test shows that the coefficient of Green Finance on economic and efficient development is 0.0864, but it is not significant, indicating that the development of green finance in Guizhou has no significant effect on economic and efficient development. In addition, when dealing with outliers, tail reduction processing should be carried out. In order to further verify the robustness of the previous conclusions, this paper also carries out bilateral tail reduction processing on 1% quantile for all continuous variables. After testing, the results are consistent with the previous text and more significant, so the results are robust.

## 5 Conclusion

### 5.1 Main Research Conclusions

Firstly, through the panel data of Guizhou, in the overall regression model, green finance and the change of industrial structure in the previous period have a significant positive effect on the upgrading of industrial structure in the current period.

Secondly, in the grouping regression, green finance has a positive role in promoting the industrial structure, but it has a higher utility in Ethnic Autonomous Prefecture. The characteristics of economic development in ethnic minority areas can be explained for this result.

Finally, it is further tested that green finance in Guizhou has no significant impact on economic and efficient development. The reason may be that the emerging industries implementing green projects in Guizhou are in the initial stage, the technology and other aspects are still in the initial research and development period, the green finance has not developed efficiently, and its long-term effect on economic development has not been shown.

### 5.2 Policy Recommendations

Under the dual carbon goal of “Carbon Peaking and Carbon Neutralization”, Guizhou will usher in the in-depth adjustment of economic structure, energy structure, industrial structure and other fields, which also means a huge demand for funds, in which green low-carbon finance will play the role of “accelerator”. Green low-carbon finance has the functions of resource allocation optimization, environmental risk control and green investment guidance. It stimulates the production and consumption of green low-carbon industries from both supply and demand. It is an important guarantee to achieve the goal of “double carbon”. Under this opportunity, Guizhou Province should grasp the development opportunity in order to win economic and efficient development. First, the government should pay attention to its guiding and supporting role and increase financial investment. Second, ethnic areas should vigorously develop the economy with ethnic characteristics and optimize the allocation of industrial resources. Third, stimulate the innovation vitality of the main body of green economy development.

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