Financial Leverage and Green Economic Growth—Based on the Study of 287 Prefecture-Level Cities and Above from 2014 to 2021

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Abstract: Aiming at the research on the impact of financial leverage on the growth of green economy, this paper selects the sample data of 287 cities from 2014 to 2021, applies the fixed-effect model, and draws three conclusions: (1)The increase of financial leverage has a significant promoting effect on the growth of green economy; (2)The robustness analysis shows that the promotion effect of financial leverage on green economic growth is consistent with the benchmark regression results;(3)Through the heterogeneity test, it can be seen that the role of financial leverage on green economic growth in different regions is eastern, central and western from large to small; Financial leverage has a more significant role in promoting green economic growth in non-low-carbon pilot cities.

1. Introduction

With the great achievements of national industrialization development, environmental pollution and climate warming problems have also followed. In 2020, the government stated that it will strive to achieve carbon peak before 2030 and carbon neutrality before 2060; The 20th National Congress in 2022 proposed to accelerate the green transformation of development methods, implement a comprehensive conservation strategy, develop green and low-carbon industries, advocate green consumption, and promote the formation of green and low-carbon production methods and lifestyles. These policies all show the country's determination to both economy and silver, and the impact of financial levers as economic and social regulators on the future development of green economy cannot be underestimated. The important impact of financial leverage on the economy and society has aroused discussion and research among a wide range of scholars [1-2], but under the special background of low-carbon economic development, what impact will financial leverage have on the development of green economy? How do financial leverage affect the green economy? Is there a difference in the degree of impact in different regions? These issues have far-reaching significance for the sustainable development of contemporary society and still deserve in-depth research and discussion by scholars.

2. Literature Review

Financial leverage is an important means for finance to realize the function of financial integration and assist in the function of capital allocation [3]. After the outbreak of the subprime mortgage crisis in the US, more domestic and foreign scholars have become interested in the relationship between financial leverage and economic growth. A series of studies have shown that there is a significant positive correlation between financial leverage and economic growth[4]; On the contrary, in the process of "deleveraging", it is often accompanied by recession, which has a negative impact on economic growth [5-6]. At the same time, studies have shown that the relationship between financial leverage and economic growth is not simply linear[7]. Some studies further show that there is an inverted "U" relationship between financial leverage and economic growth, on both sides of the critical point of the inverted "U" curve of financial leverage ratio, financial leverage plays different roles in economic growth [8-9].

In general, the relevant literature on the influence and mechanism of financial leverage on economic growth has been very rich, but there are still few related studies on financial leverage and

green economic growth. Compared with the previous research conclusions, the main marginal contributions of this paper are: (1) Adapting to the historical background of the national development of low-carbon economy, based on the panel data of prefecture-level cities and above in recent 8 years, this paper makes an in-depth study of the relationship between financial leverage and green economy growth; (2) Through the fixed-effect model and random-effect model, it is concluded that the increase of financial leverage has a significant role in promoting the growth of green economy; (3) The heterogeneity analysis of different economic zone regions and low-carbon pilot cities and non-pilot cities should be adapted to local conditions to promote the development of low-carbon economy in different regions.

3. Data Sources and Descriptive Statistics

3.1 Data Sources

This paper refers to the index selection ideas and data collection sources of Qi Shaozhou et al. in the 2015 paper[10], expands the dimension of sample data to the whole country, and selects the relevant data of 287 prefecture-level cities and above cities in China from 2014 to 2021, with a total sample of 2296, all from the China Urban Statistical Yearbook, the Statistical Bulletin of National Economic and Social Development of various cities and the China Energy Statistical Yearbook. Table 1 lists the types, names, meanings, measurements, and units of variables.

Table 1 Variables and Units of the Impact of Financial Leverage on Green Economic Growth

Types	Variables	Meaning and measurement	Unit
Explained variable	polu1	Pollutant output per unit of GDP (Total emissions of industrial wastewater and sulphur dioxide/GDP)	Tons / 10,000 yuan
	polu2	Energy consumption per unit of GDP (Electricity consumption / GDP)	10,000kWh /10,000 yuan
Explanatory variables	leve	Financial leverage (Balance of various loans of financial institutions/GDP)	10,000 yuan / 10,000 yuan
Control variables	vest	Scale of foreign investment (Amount of external funds actually used/GDP)	10,000 dollars / 10,000 yuan
	popu	Population density (Total population at the end of the year/land area of administrative area)	People/square kilometers
	tran	Public transport infrastructure (Number of public (electric) vehicles operating at the end of the year / Total population of the municipal district at the end of the year)	Vehicles/ 10000 people
	glan	Green space per capita (Area of green space of municipal district/ Total population of municipal districts at year-end)	Hectares / 10,000 people
	grat	Greening rate (Green coverage rate of built-up area of municipal district)	%

3.2 Descriptive Statistics on the Impact of Financial Leverage on Green Economic Growth

Table 2 Descriptive Statistics On the Impact of Financial Leverage on Green Economic Growth

Variables	Variable meaning	Sample number	Average	Standard deviation	Minimum	Maximum
polu1	Pollutant output per unit of GDP	2107	0.529	1.064	0	21.518
polu2	Energy consumption per unit of GDP	1932	0.566	0.763	0	14.348
leve	Financial leverage	2291	1.276	1.017	0.184	16.743
vest	Scale of foreign investment	1877	0.022	0.031	0.003	0.803
popu	Population density	2008	438.070	347.679	5.712	2759.139
tran	Public transportation infrastructure	2248	8.616	8.215	0.589	225.505
glan	Green space per capita	2215	46.970	46.276	0	601.236
grat	Greening rate	2213	40.068	6.494	0.390	95.250

The descriptive statistical results of all research variables in this paper can be seen in Table 2. Among them, the mean value of the explained variable polu1 is 0.529 and the standard deviation is 1.064; the mean value of the explained variable polu2 is 0.566 and the standard deviation is 0.763; the mean value of the explained variable leve is 1.276 and the standard deviation is 1.017. Therefore, the stability of the data is relatively high and the average value is highly representative.

4. Empirical Analysis of the Impact of Financial Leverage on Green Economic Growth

4.1 The Benchmark for the Impact of Financial Leverage on Green Economic Growth Returns

This paper uses the panel data of 287 cities from 2014 to 2021, rejects the random effects model through the F test and hausman test, and uses the fixed-effect model to test the impact of financial leverage on green economic growth, and the benchmark regression results are shown in Table 3.

Analyzing the regression results, the financial leverage coefficient can remain positive at the significance level of 1% under the condition that the number of control variables remains variable, indicating that the improvement of financial leverage has a significant role in promoting the growth of green economy. At the same time, it also shows that the green finance-related policies implemented by the state in recent years have contributed to the development of green industries, indicating the correctness of the practical direction and contributing to the subsequent policy promotion. From the perspective of control variables, foreign investment scale, population density and greening rate and other factors have a significant impact on green economic growth, among which the scale of foreign investment has a significant inhibitory effect on the development of green economy, population density and greening rate have a significant positive effect on the development of green economy, and variables such as the amount of public transport infrastructure and per capita green space area are also in line with the sustainable development concept of China's green economy, and the regression coefficients are all positive, which is in line with the hypothetical expectations.

Table 3 the Benchmark For the Impact of Financial Leverage on Green Economic Growth Returns

	(1)	(2)	(3)	(4)	(5)	(6)
leve	0.1022*** (0.0271)	0.1300*** (0.0268)	0.1272*** (0.0268)	0.1251*** (0.0263)	0.1299*** (0.0271)	0.1299*** (0.0279)
vest		-2.499*** (0.8413)	-2.4334*** (0.8397)	-2.3686*** (0.8272)	-2.4156*** (0.8365)	-2.4357*** (0.8469)
popu			0.0021*** (0.0008)	0.0019** (0.0008)	0.0019** (0.0008)	0.0018** (0.0008)
tran				0.0026 (0.0035)	0.0023 (0.0035)	0.0025 (0.0035)
glan					0.0006 (0.0009)	0.0006 (0.0009)
grat						0.0092** (0.0048)
Constant term	0.3999*** (0.0412)	0.3874*** (0.0362)	-0.5866* (0.3514)	-0.4953 (0.3600)	-0.5292 (0.3664)	-0.8598** (0.4105)
R^2	0.0074	0.0168	0.0220	0.0209	0.0220	0.0249
F	13.60	12.32	10.84	7.65	6.33	5.84

Note: *, ** and *** represent 10%, 5% and 1% significance levels respectively, standard error level in parentheses, the same below.

4.2 Robustness Test of the Influence of Financial Leverage on Green Economic Growth

In order to further verify the robustness and reliability of the conclusions in this paper, this paper adopts two methods for robustness test, namely eliminating individual city samples and using random effects model. The conclusions obtained are similar to the results of benchmark regression, indicating the robustness of the conclusions.The regression results are shown on Table 4.

Table 4 Robustness Test Of the Influence of Financial Leverage on Green Economic Growth

	(1)	(4)	(6)	(1)	(4)	(6)
leve	0.0752*** (0.0246)	0.0843*** (0.0224)	0.0890*** (0.0235)	0.1047*** (0.0298)	0.1287*** (0.0285)	0.1334*** (0.0300)
vest		-1.4462** (0.6911)	-1.6584** (0.7040)		-2.4290*** (0.8972)	-2.5094*** (0.9144)
popu		-0.0001 (0.0001)	-0.0001 (0.0001)		0.0028** (0.0013)	0.0027** (0.0014)
tran		-0.0015 (0.0026)	-0.0015 (0.0027)		0.0026 (0.0037)	0.0026 (0.0038)
glan			-0.0003 (0.0005)			0.0005 (0.0009)
grat			0.0094*** (0.0036)			0.0097* (0.0052)
Constant term	0.4341*** (0.0439)	0.4655*** (0.0510)	0.1205 (0.1435)	0.4475*** (0.0419)	-0.7642 (0.5648)	-1.1291* (0.6069)
R^2	0.0026	0.0078	0.0139	0.0077	0.0207	0.0250
F	9.30	17.25	25.26	12.33	6.59	5.14

Note: Same as table 3.

4.3 Heterogeneity Test of the Impact of Financial Leverage on Green Economic Growth

(1) Divided according to different economic zones

In this paper, the 287 sample cities are divided into four types: eastern, central, western and northeastern with reference to the latest economic zone concept stipulated by the state, and the regression results are shown in Table 5.

According to the regression results, the regression coefficients of financial leverage were eastern> central> western > northeastern, and by comparing the significance level, the promotion effect of financial leverage on green economic growth in different regions was eastern, central and western from large to small, and had no significant impact on the northeast. The analysis shows that the impact of financial leverage on green economic growth in different regions shows heterogeneity, reflecting the differences in the development of green finance in different regions.

Table 5 Heterogeneity Test of the Impact of Financial Leverage on Green Economic Growth--Based on different economic zones

	East (7)	Center (8)	West (9)	Northeast (10)
leve	0.1935*** (0.0807)	0.1447*** (0.0234)	0.0957* (0.0627)	0.0790 (0.0798)
Constant term	-0.7674 (1.0541)	-0.8714** (0.4421)	-0.2169 (0.9587)	5.2240* (3.2501)
R^2	0.0276	0.1251	0.0169	0.0637
F	2.11	9.63	1.03	1.69

Note: Same as table 3.

(2) Divided by non-low-carbon pilot cities

Table 6 Heterogeneity Test of the Impact of Financial Leverage on Green Economic Growth--Based on the Classification of Non-low-carbon Pilot Cities

	Low-carbon pilot cities		Non-low-carbon pilot cities	
	(11)	(12)	(13)	(14)
leve	0.0500 (0.0598)	0.1233** (0.0608)	0.1060*** (0.0318)	0.1264*** (0.0325)
Constant term	0.4031*** (0.1077)	-1.1204* (0.6658)	0.4159*** (0.0449)	-1.0815* (0.6151)
R^2	0.0020	0.0408	0.0076	0.0221
F	0.70	1.72	11.08	4.13

Note: Same as table 3.

According to the list of the first, second and third batches of low-carbon pilot cities released by

the state, 67 pilot cities and 220 non-pilot cities were regressionally analyzed, and the results are shown in Table 6. (11) and (13) are listed as regression results without control variables, and columns (12) and (14) are regression results with control variables.

According to the regression results, the regression coefficient of available financial leverage was positive at the significance level of 1% in non-low-carbon cities, indicating that financial leverage had a greater effect on promoting the green economy of non-low-carbon pilot cities than that of low-carbon pilot cities.

5. Research Conclusions and Policy Implications

5.1 Research Conclusions

Aiming at the research on the impact of financial leverage on the growth of green economy, this paper selects the sample data of 287 cities from 2014 to 2021, applies the fixed-effect model, and draws three conclusions:

(1) The improvement of financial leverage has a significant promoting effect on the growth of green economy.

(2) By eliminating individual city samples and using random effects model for robustness test, it is concluded that the promoting effect of financial leverage on green economy growth is consistent with the baseline regression results, which reflects the robustness of the conclusion.

(3) The promoting effect of financial leverage on the growth of green economy in different regions was in descending order of eastern, central and western regions, but had no significant effect on the growth of green economy in northeast China; Compared with pilot low-carbon cities, financial leverage plays a more significant role in promoting green economic growth in non-pilot low-carbon cities.

5.2 Policy Implications

Considering the above three research conclusions, the following policy suggestions are given, correspondingly:

(1) Policymakers should establish a mechanism for sharing information on environmental credit evaluation between financial and ecological environment departments. This will guide banking and insurance institutions to use the environmental credit evaluation results of enterprises and institutions as the implementation of differentiated green credit policies, and increase financial support for the green economy.

(2) Urban planners and administrators need to strengthen the environmental greening construction of the city, cultivate compound management talents of finance and environmental development, and promote the development of urban green economy and industry.

(3) Government agencies should promote the construction of the financial system in economically underdeveloped areas, increase the credit scale of their financial institutions, promote the structural upgrading of regional industries, and achieve sustainable, green and healthy economic development.

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