Empirical Analysis of the Impact of Green Finance Development on the Development of New Energy Industry under the Background of Double Carbon

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Abstract. High carbon dioxide emissions and the imminent depletion of primary energy are urgent problems to be solved. In order to improve global climate warming and air quality, China formally put forward the carbon neutrality target in September 2020, and the development of green finance has played a decisive role in realizing this target. In addition, the new energy sector is dedicated to energy transformation and lowering carbon dioxide emissions, both of which are essential steps in the attainment of carbon neutrality. The purpose of this study is to examine the relationship between green finance and the expansion of the new energy sector from the perspective of the three primary effects of green finance on the new energy sector using SPSS software and a regression model. The conclusion shows that green finance has a significant role in promoting the development of new energy industry.

Keywords: carbon neutral, carbon peak, green finance, new energy industry

1 Introduction

Many nations have taken action to ameliorate the situation in recent years due to the acceleration of global warming and the ongoing worsening of air quality. China announced its intention to achieve carbon neutrality by 2060 and the carbon peak by 2030 in September 2020, along with a number of other initiatives to cut carbon emissions. In order to achieve the double carbon goal, financial support is crucial. Therefore, the financial sector should focus on the creation of a low-carbon economy, develop green financial instruments and products, and come up with innovative ways to foster the growth of green finance.[1] While primary energy sources are running out and must be replaced in order to reduce high carbon dioxide emissions and achieve double carbon, renewable and environmental characteristics of new energy, rather than traditional primary energy, the solution to the problem of financial support has emerged as the key to the development of new energy industry. Green finance can offer avenues for financing the new energy sector, design financial products that support its growth, and significantly accelerate the sector's development.[2] This paper will analyze the impact of green finance development on the development of new energy industry from an empirical perspective, and discuss the capital agglomeration effect, investment orientation effect and scientific and technological innovation effect of green finance on the new energy industry.

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2 Theoretical Analysis

2.1 Development process of green finance under the background of double carbon

The Guidance on Building a Green Financial System, released in 2016 by the People's Bank of China and seven other ministries and commissions, mandates project financing and investment in the areas of environmental protection, energy conservation, clean energy, green transportation, and other related areas. "Green finance" business has high risks and low returns, and relevant policies are not perfect before 2021. Chinese financial institutions have a prospect and enthusiasm for the "green finance" project, but they lack practical experience and face many obstacles. The nation released a number of green finance-related regulatory frameworks in 2021, and it has since established a market environment and policy framework to encourage the growth of green finance. The Chinese green finance industry is currently going through a vital phase of adjustment and completion.

Green financing is used to fund initiatives that help the environment. A variety of green financial products have emerged, including green credit, green bonds, and green stocks, which play an important role in promoting the transformation of green finance.[3] China unambiguously proposed the dual carbon target in September 2020, and in 2021, The State Council also convened and published related meetings and working guidelines. Under the influence of double carbon, green finance has reached a major turning point in its evolution.

2.2 Information technology promotes green economy development

It will take the combined efforts of people from all walks of life to meet the "double carbon" target on time and create a green and low-carbon economy, with digital transformation unquestionably being a vital factor.

The rapid advancement of information technology has given rise to the digital economy, which has a significant impact on the advancement of technical innovation. By enhancing the effectiveness of energy and resource use and encouraging the development and use of renewable energy, digital technologies can have a significant impact. Can not only save information search costs, improve efficiency of resource allocation, and can accurately identify new ecological environment problems, timely tracking, to provide support for scientific protection, system management, also can promote the coordinated development of the digital economy and green economy, to improve the ecological environment management system and the management ability level of modernization provides a new method.

2.3 Development path and challenges of new energy industry

In the 12th Five-Year Plan from 2011 to 2015, our nation's industrial structure gradually gave new energy and the growth of the low-carbon industrial sector more attention in line with trends in global economic development. In 2009, the country put forward the new energy pilot proposal, and then began to issue relevant policies. After 2018, the transition period began, and the weak development was caused by insufficient energy, and the new energy market fluctuated greatly. In 2020, the dual carbon target was proposed and the new energy industry began to show a rapid and stable combination of development trend. The growth of the new economic cycle is largely influenced by the new energy sector, which also starts to determine the long-term development path.

While the new energy industry is developing steadily and rapidly, there are still many difficulties and challenges.[4] First, the uneven transition to the green economy and the disorganized design of the national industrial chain are caused by the disparity in economic development between the eastern, central, and western areas. Second, the development does not show the trend of high technology and high capitalization, too much dependence on policy, and insufficient capacity. Third, it is difficult to transform industries with high pollution and energy consumption. Capital investment is too high, return time is too long, and risk management mechanism is not perfect. Fourth, there is still room for improvement in the cost management structure.

2.4 Influence of green finance development on the development of new energy industry

Three consequences show how the emergence of green finance has impacted the new energy industry. First, capital aggregation effect. Capitalization and cross-regional resource allocation enable the capital aggregation effect of green financing on the growth of the new energy industry.[5] The capitalization process is the process of transforming available scarce resources into profitable commercial capital, which can improve the financing efficiency of new energy enterprises. Cross-regional resource allocation can achieve a high degree of integration and optimal allocation of resources and capital in resource-rich but capital-poor regions and resource-poor but capital-sufficient regions. Second, the investment-oriented effect. This effect can be achieved by coordinating monetary, fiscal, industrial, and income policies. This will cause labor, capital, and technology to move to places that lack them, which will then encourage the growth of the new energy industry. Third, the effect of scientific and technological innovation. This effect is reflected in information processing and risk management. The information processing function of finance can enable new energy enterprises to obtain information and make investment at a lower cost when information is disclosed. The issue of high investment risk for new energy firms in the early stages can be resolved by risk management in green finance, which also achieves risk diversification.[6]

3 Model establishment and data selection

3.1 Variable Selection

This paper adopts the level of new energy industry development as the dependent variable, the level of capital agglomeration effect, investment orientation effect, and scientific and technological innovation effect as the independent variables, and the level of labor input of enterprises as the control variable based on the research methodologies and variable design of Zhiguo Wang (2019).[7] Specific variable selection is shown in **Table 1**.

Table 1. Variable selection

	Variable name	Variable symbol	Meaning
Dependent variable	Total assets	TotAss	Reflects the development level of the new energy industry
Independent variables	Total market value	Trdsum	Reflects the level of capital agglomeration effect

	Interest payable	IntrPay	Reflects the level of investment oriented effect
	Intangible assets	IntangAss	Reflects the effect level of scientific and technological innovation
Control variables	Staff remuneration payable	SalarPay	Reflect enterprise labor input level

3.2 Data sources and processing

This paper takes 40 listed new energy companies as the research object. The sample period is the yearly report data from 2015 to 2020, and all the data are from the RESSET database. A total of 219 original data were obtained by sorting out the sample data obtained. The original data were checked and processed by using SPSS software in order to produce a total of 217 valid sample data, which helped to lessen the influence of aberrant data on empirical analysis.

3.3 Model Establishment

Based on the research model of Zhiguo Wang (2019), this paper constructed the following model:

$$\ln TotAss_{it} = \beta_0 + \beta_1 \ln Trdsum_{it} + \beta_2 \ln IntrPay_{it} + \beta_3 \ln IntangAss_{it} + \beta_4 \ln SalarPay_{it} \quad (1)$$

Among them, TotAss represents total assets, Trdsum represents total market value, IntrPay represents interest payable, IntangAss represents intangible assets, SalarPay represents employee compensation payable, i represents different individual enterprises in the new energy industry, and t represents different periods (here, the interval is one year).

4 Empirical Analysis

4.1 Descriptive Statistics

SPSS software was used for descriptive statistical analysis of the maximum, minimum, mean, standard deviation, skewness and kurtosis of each variable.

Table 2. Descriptive statistics of variables

	Minimum	Maximum	mean	Standard	Skewness	Kurtosis
ln IntangAss	7.413	14.051	10.395	1.379	0.151	-0.115
ln TotAss	11.080	17.459	13.962	1.471	0.173	-0.622
ln SalarPay	4.005	13.089	8.723	1.673	0.202	0.024
ln IntrPay	-0.287	11.164	6.593	2.533	-0.417	-0.757
ln Trdsum	12.168	18.281	15.674	1.073	-0.066	0.022

As can be seen from **Table 2**, the mean value and standard deviation of intangible assets are 10.395 and 1.379, showing a right-skewed flat peak distribution, indicating that the mean value, as a representative of central tendency, is overestimated and the overall dispersion trend is

weak. The mean value of total assets is 13.962, the maximum value is 17.459, the minimum value is 11.080, the standard deviation is 1.471, showing a right-skewed flat peak distribution. The mean value of employee compensation payable is 8.723, showing a right-skewed peak distribution, indicating that the mean value, as a representative of central tendency, is overestimated, and the overall dispersion trend is strong. The mean value of interest payable is 6.593, showing a left-skewed flat peak distribution, indicating that the mean value, as a representative of central tendency, is underestimated, and the overall dispersion trend is weak. The mean value of the total market value is 15.674, showing a left-leaning peak distribution, indicating that the mean value, as a representative of the central tendency, is underestimated, and the overall dispersion trend is strong.

4.2 Statistical test

4.2.1 Test simple correlation coefficient

Through SPSS analysis, the correlation coefficients of ln TotAss, ln IntangAss, ln SalarPay, ln IntrPay and ln Trdsum are shown in **Table 3**. According to the data in the table, ln TotAss is highly correlated with ln IntangAss and ln SalarPay.

Table 3. Pearson correlation

	ln TotAss	ln IntangAss	ln SalarPay	ln IntrPay	ln Trdsum
ln TotAss	1.000	0.701	0.670	0.588	0.318
ln IntangAss	0.701	1.000	0.567	0.471	0.317
ln SalarPay	0.670	0.567	1.000	0.318	0.299
ln IntrPay	0.588	0.471	0.318	1.000	0.224
ln Trdsum	0.318	0.317	0.299	0.224	1.000

4.2.2 Significance test of variables and significance test of equations

The regression model was subjected to a T-test to determine the significance of the variables by using SPSS software, as shown in **Table 4**. As can be seen from the table, ln IntangAss, ln SalarPay, ln IntrPay and constant terms all pass the significance test at the significance level of 1%. At the 5% threshold of significance, ln Trdsum was found to be significant.

Table 4. T-test

	Unstandardized coefficient		Coefficient of standardization Beta	t	Significant
	B	Standard error			
(Constant)	5.970	1.286		4.644	0.000
ln IntangAss	0.346	0.075	0.337	4.629	0.000
ln SalarPay	0.305	0.055	0.373	5.506	0.000
ln IntrPay	0.169	0.035	0.304	4.835	0.000
ln Trdsum	0.044	0.084	0.031	1.104	0.047

To ascertain whether the equation was significant, the regression model's F-test was also run. The results showed that F value was 55.559, which was significantly larger than $F_{0.1}$(4.212), indicating that the regression equation was significant.

4.2.3 Goodness-of-fit test

By evaluating the size of the adjusted determinable coefficient R^2, through SPSS software, the goodness-of-fit test of the regression model was used to determine if the explanatory factors could explain the explained variables. As shown in **Table 5**, the adjusted determination coefficient R^2 is 0.663, indicating that 66.3% of the change in ln TotAss can be explained by the change in ln IntangAss, ln SalarPay, ln IntrPay and ln Trdsum. The relationship between goodness of fit and the significance test of the equation demonstrates that the equation is significant even if the adjusted determination coefficient value is small as long as it passes the F-test, despite the fact that the adjusted determination coefficient value is not very high.

Table 5. Goodness-of-fit test

R	Square of R	R squared after adjustment	Errors in standard estimates
0.822	0.675	0.663	0.808

4.3 Regression Analysis

Through the analysis of SPSS software, it can be seen from Table 4 that the regression equation is:

$$\ln TotAss_{it} = 5.970 + 0.044 \ln Trdsum_{it} + 0.169 \ln IntrPay_{it} + 0.346 \ln IntangAss_{it} + 0.305 \ln SalarPay_{it} \quad (2)$$

The regression analysis reveals a favorable correlation between the new energy industry's level of development and the level of the capital agglomeration impact, investment orientation effect, and scientific and technology innovation effect. Every 1% increase in the total market value of an enterprise will increase the total assets of an enterprise by 0.044%. Similarly, every 1% increase in the interest payable, intangible assets and employee compensation payable will increase the total assets of an enterprise by 0.169%, 0.346% and 0.305%.

5 Conclusions

Through the construction of multiple linear regression model, it can be seen that green finance has the greatest effect on the scientific and technological innovation effect of the new energy industry, followed by the investment-oriented effect and the capital agglomeration effect. The effect of scientific and technological innovation effect is about twice as large as that of investment-oriented effect, and about seven times as large as that of capital aggregation effect, and the effect of capital aggregation effect is at a low level.

6 Development Suggestions

Based on the results of empirical analysis, this paper puts forward the following suggestions:

In order for each region to fully utilize and tap into local advantages of resources, it is first important to position relevant industries clearly, balance regional development, and establish research groups related to the green economic development of the transition between traditional energy and new energy in all regions of the nation.[8]

Second, enhance the relevant industrial management system, optimize cost structure management, cut new energy enterprise administrative costs, shatter the current energy pattern, and set a new ecological standard.[9] Large energy enterprises shall be used as the main body to empower small and medium-sized green energy industries. The government must optimize capital allocation, offer leading new energy companies with suitable financial subsidies, and further expand the planning for new energy development against a background of double carbon.

Third, focus on digital green development economy, use blockchain and big data platform, form a digital green economy development service mode, make full disclosure of green economy information, ensure the healthy operation of green finance market, and promote the transformation of green energy economy.[10]

Fourth, finance is a crucial tool for achieving the goal of reducing carbon emissions and the carbon cycle.[11] A sound financial strategy can be assigned to address the needs of the transition to a green economy and a high carbon industry, provide a mechanism for constraining the traditional energy sector, spark interest in financial institutions' services for green financial products, and set the stage for the active growth of the new high-energy industry.

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