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# The Impact of Environmental Finance Development on the Growth of Environmental Protection Industry

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Abstract—Environmental protection industry is the product of the contradiction between supply and demand of natural environment and the long-term accumulation of social and economic development. In China, the environmental protection industry is changing from the initial stage to the promotion stage of establishing policy mechanism. The development of environmental protection industry cannot be separated from the support of various systems and policy means, and the financial element is one of the important driving factors. In this paper, the spatial model is used to study the development of regional finance and environmental protection industry. Through the five mechanisms of regional finance affecting the comprehensive benefit development of environmental protection industry, the panel model is used for empirical study and the relative importance of the mechanism is discussed. The main results are as follows: the comprehensive benefits of environmental protection industry show significant auto-correlation. Financial agglomeration, financial capital support, enterprise supervision and environmental finance have relatively obvious effects. Among them, financial agglomeration has the most significant effect and has positive spatial spillover effect.

Keywords—environmental finance; environmental protection industry; financial agglomeration; sustainable development

#### I. INTRODUCTION

Environmental protection industry is the product of the contradiction between supply and demand of natural environment and the long-term accumulation of social and economic development. It first appeared in the developed countries in the 1970s. The market scale of the global environmental protection industry is increasing every year. In 1992, the market size of the global environmental protection industry was 250 billion US dollars, and in 2018, it was increased to 600 billion US dollars, with an average annual growth rate of 8%. It has become a "sunrise industry" that attracts the attention of all countries. The market scale of the

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global environmental protection industry is increasing every year. In 1992, the market size of the global environmental protection industry was 250 billion US dollars, and in 2018, it was increased to 600 billion US dollars, with an average annual growth rate of 8%. It has become a "sunrise industry" that attracts the attention of all countries.

The rapid economic development of countries in the world has led to serious ecological environment deterioration, resulting in a variety of adverse environmental crises, such as greenhouse effect, energy crisis and so on, which has caused serious distress to human beings living on the earth. According to the environmental forms and their own national conditions, countries have launched a series of policies to protect the environment and support the development of green industries, and urge enterprises to change the mode of economic growth, and finally move to the path of low-carbon sustainable development. Compared with developed countries, China's environmental protection industry has some problems such as weak independent innovation ability and financing difficulties. Due to low credit rating and weak competitiveness, a large number of environmental protection enterprises can only survive through self financing, which is difficult to compete with other enterprises. Investment in environmental protection enterprises has high risk, the amount of investment in the early stage is large, and the whole industry cycle is long, so it is difficult to make profits in a short time. Only relying on government investment and bank loans cannot meet the development requirements of environmental protection industry. It needs to rely on green finance and social capital to solve the financing difficulties of environmental industry in China, which is the prerequisite for the development of environmental protection enterprises.

On the research of environmental finance, foreign scholars usually focus on the development of high-tech industry. Arestis and Demetriades (1997) studied the impact of financial environment on industry and believe that good external



environment could promote industrial development [1]. Fratzscher (2002) believes that in the domestic and international community, there are difficulties in the financing of emerging industries. The financing demand and borrowing frequency of emerging enterprises are very high, so it is difficult to find a stable and reliable financing channel, which makes the capital shift to the sunset industry to the new industry. Marcel Yuken points out that the financing of environmental protection enterprises is closely related to the external market, which easily leads to the risk of bankruptcy and bankruptcy of some environmental protection enterprises [2]. Labatt, S., & white, R.R. (2002) analyzes the environmental risk problems faced by financial institutions and how to manage them effectively [3].

In recent years, Chinese scholars have also carried out a lot of research on environmental finance. Zhang Wei (2005) defines the concept of environmental finance, analyzes the related theories of environmental finance, and give the characteristics of environmental finance [4]. Wang Huitong and Chen Baoqi (2006) believe that environmental finance is a win-win path for financial innovation and circular economy [5]. Xie Qinghe (2010) analyzes the relationship between financial reform and the development of low-carbon economy [6]. Li Hong, Yuan Yingchao and Wang Na (2019) study the coupling and coordinated development of regional green finance and ecological environment [7].

On the whole, the environmental protection industry is a technology LED industry, which determines that the development of environmental protection industry depends on funds. However, there are serious problems in the financial system that provides funds and loans to the environmental protection industry, which makes it difficult for it to obtain financing from the market. This paper analyzes the relationship between environmental finance and the development of environmental protection industry, analyzes the reasons that restrict the development of environmental protection industry, and tries to find ways to improve the financial system, improve the efficiency of capital allocation in the financial market, and promote the sustainable and healthy development of environmental protection industry.

## II. THEORY OF ENVIRONMENTAL PROTECTION INDUSTRY GROWTH

#### A. Sustainable Development Theory

Sustainable Development Theory refers to the use of resources not only to meet the needs of contemporary people, but also to meet the use of future generations. It emphasizes common, coordinated, fair, efficient and multidimensional development, with fairness, sustainability and commonality as its three basic principles. Its core is to carry out economic and social development under the premise of strict environmental protection and sustainable use of resources.

"Sustainable development" was first proposed in the world natural protection strategy in 1980. In the past 40 years, it has been widely studied and applied in the fields of population, economy and ecological environment. In 1972, Daniela meadows systematically expound the relationship between economic development and population, food, resources and environmental pollution. In 1987, the Brundtland Commission (WCED) put forward the definition of sustainable development for the first time, pointing out that "sustainable development is not only to meet the needs of contemporary people, but also not to endanger the ability of future generations to meet their needs". In 1992, at the conference on Environment and Development held in Rio de Janeiro, the United Nations adopts a series of documents focusing on sustainable development. In September 2015, leaders of all countries hold a meeting at the United Nations and adopted 17 goals for sustainable development. The 2019 UN summit on sustainable development goals adopts a political declaration, in which the UN member states committee to achieving the signs by 2030.

#### B. Theory of Environmental Economics

Economist Pareto once discusses the efficiency of resource allocation from the perspective of economic ethics, and puts forward Pareto optimal theory on this basis. Marshall thinks that under the theoretical premise of Pigou and others, the Externality theory was established. Since then, environmental economics has attracted people's attention. As a branch of economics, environmental economics first appeared in the 1950s and 1960s and was introduced into China in the late 1970s. Environmental economics emphasizes the value theory of environmental resources and regards it as the theoretical core. It emphasizes that environmental resources are valuable, and their value is objective existence which is not transferred by people's will, and makes scientific measurement on the value of environmental resources.



Fig. 1. Impact of environmental protection finance on comprehensive benefits of environmental protection industry

#### III. PROBLEMS IN THE DEVELOPMENT OF GREEN FINANCE IN CHINA'S ENVIRONMENTAL PROTECTION INDUSTRY

#### A. The Shortage of Funds is Still a Bottleneck

The Chinese government has made great efforts to support the energy conservation and environmental protection industry. During 2017, the total investment in pollution control reaches more than 880 billion Yuan, accounting for 1.28% of China's total GDP. In addition, the state also attaches great importance to the introduction of social capital in the energy conservation and environmental protection industry, which eventually forms a diversified financing pattern with the participation of green



finance and industrial funds in this market. According to the data report s, in a total of five years from 2015 to 2020, the capital demand of this market is about 2.9 trillion Yuan, but the government's investment is only 10% to 15%, which puts great pressure on the energy conservation and environmental protection industry. The current financing structure in the market is not conducive to the development of environmental protection enterprises. It is necessary to improve the financing structure and improve the utilization ability of social capital in order to promote the healthy development of environmental protection enterprises.

# B. Unbalanced Financing Structure of Environmental Finance

For a long time, the scale of environmental protection enterprises in China is generally small, and it is difficult to get the financing benefits of green finance, which usually shows as high financing cost. At present, there are still many "short boards" in China's environmental financial system, such as too single financing tools, unbalanced financing structure, excessive dependence on loans, and underdeveloped capital market. In all kinds of green financing balance structure in China, credit financing accounts for a large proportion, and credit financing is often based on the analysis and comparison of enterprise information by financial institutions. Therefore, for enterprises with incomplete information disclosure or unclear development trend, financial institutions will carefully decide whether to carry out financing for them, resulting in some enterprises unable to obtain funds Support from financial institutions.

## C. The Integration of Environmental Finance and Environmental Protection Industry is Not High

Environmental protection industry is a heavy asset and technology industry. As a heavy asset industry, environmental protection enterprises invest a large amount of fixed assets, and the initial investment of fixed assets is high, which brings heavy capital pressure to enterprises. However, at present, China's environmental finance and environmental protection industry have not fully realized symbiosis, and its help to environmental protection industry is not direct. Environmental finance still treats environmental protection industry based on the traditional perspective. It thinks that the environmental protection industry is relatively an investment with high risk and low yield. Therefore, the investment in environmental protection industry is reduced correspondingly, which can not really solve the problem of investment and financing of environmental protection industry.

## IV. AN EMPIRICAL ANALYSIS OF THE IMPACT OF FINANCIAL DEVELOPMENT ON ENVIRONMENTAL PROTECTION INDUSTRY

#### A. Research Hypothesis

Hypothesis 1: the level of financial development is positively correlated with the comprehensive benefits of environmental protection industry. From the four channels of financial development level, namely, capital support, capital allocation level, government support, enterprise supervision level and industrial development goal (Green Finance), we can find that if the government supports it, the environmental protection industry can attract more financing funds, reduce the capital pressure of environmental protection industry and reduce the financing cost pressure of environmental protection industry. When the environmental protection industry initially developed, it relied heavily on non industrial capital. The higher the level of financial development, the greater the promotion efficiency of the comprehensive development of environmental protection industry is.

Hypothesis 2: Regional finance and financial gathering affect the development of environmental protection industry, but the impact is lagging behind. Regional finance can integrate resources and allocate high-quality resources to industries that need support. The development of environmental protection industry in Chinese market is not mature, which needs the government's policy support. Industrial development needs resources and time. Although the state is increasing efforts to support the development of environmental protection industry, it will take a long time for the environmental protection industry to develop. The comprehensive benefits of regional financial support for environmental protection industry cannot achieve good results in the short term.

#### B. Theoretical Model

Based on Los & Verspagen's method, a production function model is built. Considering the spillover theory, the production function of comprehensive benefits of environmental protection industry can be obtained:

$$Y_i - Af(K_i, L_i, RF_i)$$

 $Y_i$  stands for comprehensive benefits brought by environmental protection industry,  $K_i$  means capital,  $L_i$  means labour,  $RF_i$  means regional financial support for environmental protection industry. It is further rewritten as follows:

$$Y_i = \delta \cdot K_i^{\alpha} \cdot L_i^{\beta} \cdot RF_i^{\gamma}$$

 $\delta$  represents the impact of other factors on the comprehensive benefits of environmental protection industry.  $\alpha$ ,  $\beta$  and  $\gamma$  represent the output elasticity of different factors.

$$Y_i / L_i = \delta \cdot (K / L)_i^{\alpha} \cdot (RF / L)_i^{\gamma} \cdot L_i^{\lambda - 1}$$

#### C. Financial Development Indicators

Since goldsmith put forward the financial structure measurement index represented by financial relevance degree, scholars at home and abroad have put forward more index systems to measure financial development from different angles. Scholars use the two indicators of scale and efficiency to evaluate the development level of the financial industry. Therefore, this paper selects the following three indicators for analysis.

TABLE I. MEASURES OF FINANCIAL DEVELOPMENT

Financial Indicators	Formula				
Financial scale indicators	Total deposits minus total losss				
Financial structure indicators	Equity financing/Total financial				
	assetu				
Financial efficiency indicators	Loan balance/Deposit balance				

### D. Development Index of Energy Conservation and Environmental Protection Industry

## 1) Basic principle and steps of factor analysis

The basic purpose of factor analysis is to use several factors to describe the relationship between many indexes or factors. That is to put several closely related variables in the same category, each category of variables become a factor, and use several factors to reflect most of the information of the original data. Using this research technology, we can easily find out the main factors that affect consumers' purchase, consumption and satisfaction and their influence. It is expressed as follows:

$$\begin{cases} x_1 = a_{11}f_1 + a_{12}f_2 + \dots + a_{1m}f_m + \varepsilon_1 \\ x_2 = a_{21}f_2 + a_{22}f_2 + \dots + a_{2m}f_m + \varepsilon_2 \\ \vdots \\ x_m = a_{m1}f_1 + a_{m2}f_2 + \dots + a_{mm}f_m + \varepsilon_n \end{cases}$$

Where: X is the standardized variable, f is the common factor, and a is the factor load matrix. By means of factor analysis, we can know the variance contribution of common factor F, that is, the influence of the selected factor on the total variance of the original variable.

$$\mathbf{g}_{j} = \sum_{i=1}^{n} \sigma_{i}^{2}$$

We choose and standardize the model variables as follows:

$$X_{g}^{*} = \frac{X_{g} - X_{e}}{S_{e}}$$

Before factor analysis, kmo test can be used to complete the variable suitability test. The closer the kmo value is to 1, the stronger the correlation of each variable is, and factor analysis can be carried out.

2) Development index definition of energy conservation and environmental protection industry based on factor analysis

We take Dongfang fortune energy conservation and environmental protection concept shares as the research object, selects 68 listed companies with energy conservation and environmental protection as the main business, and takes their financial data in recent years as the research object. There are four indicators: growth Capacity indicators, profitability indicators, operating capacity indicators and financial risk indicators. We have a total of eight indicators from the four categories of screening analysis, the comprehensive scoring results are obtained by factor analysis.

 
 TABLE II.
 Average Financial Indicators of Listed Companies in Energy

Year	Growth	Not	Per	Weighted	Net	Total	NegativeFlow	
	rate of operating income(%)	profit Growth rate (%)	share Income (Yuan)	net Asset Receipts Benefit rate (%)	interest rate CN	assets Turnover (times)	assets Debt ratio (%)	ratio Rate (%)
2008	20.92	23.10	0, 26	9.58	8. 93	0.42	37.75	2, 38
2009	47.43	-8.36	0.21	8.26	10.64	0.53	48.74	1.61
2010	17.27	-16.88	0.17	0.66	7. 60	0.50	51.31	1.51
2011	44.01	63. 67	0.22	15.62	6.90	0.58	54.76	1.29
2012	29.67	1046, 20	0.39	39.21	13.69	3.40	55.25	1.58
2013	67.61	37. 52	0.48	23.58	12.96	3.58	55.46	1.45
2014	18.42	63.78	0.52	25.75	16.85	3.00	53.18	1.57
2015	47.10	60.10	0. 62	23.46	16.92	1, 49	45.05	2.71
2016	22.91	46.61	0.64	17.58	16.40	1.50	41.20	2.87
2017	17, 77	-824. 62	0.46	8.23	14.61	0.53	36.73	3.25

The first step of factor analysis is to analyze the applicability of the data, so we get the following table.

TABLE III. TESTS OF KMO AND BARTLETT FOR SAMPLE INDICATORS

Kaiser-Meyer - Olki	n Measure for sampling enough	, 665
Bartlett's	Approximate chi-square	54.386
sphericality test		
	df	28
	Sig.	. 002

Note: The data processing and inspection of factor analysis method are completed by SPSS20.0

Secondly, the contribution of factor variables to the total variance of the original variables is analyzed, which shows that two common factors can be extracted.

TABLE IV. THE EXPLANATION OF SAMPLE INDEX FACTORS TO THE TOTAL VARIANCE OF ORIGINAL VARIABLES DEGREE TABLE STYLES

Com pos	Initial Eigenvalues			Extract Suma of Squared Loadings			Rotation Summa of Squared Loadings		
111 00	Sun	% of varianc #	% of Cun.	Sun	% of variance	% of Cum	5un	% of varian ce	% of Cum
1	3,513	43.914	43,914	9.513	43.914	43.914	3.416	42, 701	42.701
2	2.861	35.768	79.682	2.861	35.768	79.682	2,958	36.981	79.682
3	.913	11.413	91.095						
4	427	5.340	96.435						
5	. 126	1.571	98.006						
£	.078	. 979	98, 985						
7	. 059	. 735	99, 720						
8	. 022	, 280	100.00						

 TABLE V.
 Component score coefficient matrix of sample index

Index	Element F1	Element F2
Growth rate of operating income	0.134	-0.066
Growth rate of net profit	0.220	-0.067
Earnings per share	0.075	0.325
Weighted return on net assets	0.249	0.127
Net interest rate	0.082	0.322
Total asset turnover	0.255	0.102
Ratio of assets to liabilities	0.227	-0.177
Current ratio	-0.165	0.270

# V. MODEL CONSTRUCTION AND EMPIRICAL RESEARCH

#### A. Variable Selection and Model Establishments

The comprehensive score of environmental protection listed companies is a dependent variable, expressed as  $EEI_t$ . Financial scale index is an independent variable, which can be abbreviated as  $FSC_t$ . Financial structure index is used to evaluate the level of financial industry development structure. It is an independent variable and can be abbreviated as  $FST_t$ . Financial efficiency index is used to evaluate the quality of financial business. It is an independent variable and can be abbreviated as  $FE_t$ . R & D expenditure can be used to measure the level of technological progress. It is an independent variable and can be abbreviated as  $LNR \& D_t$ .

 $EEI_t = \beta_0 + \beta_1 FSC_t + \beta_2 FST_t + \beta_4 LnR \& D_t + e_t$ 

## B. Empirical Test and Result Analysis

The test results show that these indicators are stationary series, as shown in the Table.

 TABLE VI.
 ADF Test Results of Variables in Sample Model

Variable	T-Statistics	P-Value	Test results	
EEI	-0.9441 00	0.2817	Existence unit roots	
D ( EEI)	-2.104537	0.0410	No unit roots	
FSC	-0.152923	0.6037	Existence unit roots	
D ( F5C)	-8.616547	0.0000	Existence unit roots	
FST.	-0.816497	0.3343	No unit roota	
D (FST)	-3.924283	0.0017	Existence unit roots	
FE.	- 2.487213	0.1482	No unit roots	
D(FI) - 20.52308		0.0001	Existence unit roots	
C&8n1	-2.809915	0.0946	No unit roots	
D ( LnR&D) -8,493936		0.0049	Existence unit roots	

The results are as follows:

 $Tr 2 = 5.847 \le x 20.05 (g)$ 

The results passed LM Test, and the results are as follows:

e<sub>r</sub> =-0.79e<sub>r,1</sub>-0.54+0.04FSC<sub>r</sub>-4.08FST<sub>r</sub>+1.30FE<sub>r</sub>-0.04LnR&D<sub>r</sub> (-0.936173)(-0.338004)(0.341289)(-0.324330)(0.325485)(-0.098372)

 $LM = TR^{2} = 10 \times 0.226380 = 2.2 < \chi^{2} 0.05(1) = 3.84$ 

Which has no autocorrelation, and we get the regression results.

 $EEI_{t} = 6.35 + 0.18FSC_{t} + 32.52 FST_{t} + 13.43FE_{t} - 1.76 LnR \& D$  (4.912704)(2.631266)(3.188239)(5.920290)(-6.363390)  $R^{2} = 0.929944 F = 16.59299 DW = 2.217507$ 

We believe that the significance level is more than 5%, and the following conclusions are obtained.

First, the development quality of energy-saving and environmental protection industry depends on the development scale of the financial industry and the current financial structure. At the same time, the operation efficiency of the financial industry also affects the development of the energysaving and environmental protection industry, which is consistent with the traditional logic.

Secondly, the development scale of financial industry has the least impact on the development of energy-saving and environmental protection industry, while the two indicators of financial structure and efficiency have a greater impact on the development of energy-saving and environmental protection industry.

## VI. CONCLUSION AND SUGGESTION OF EMPIRICAL ANALYSIS

#### A. Conclusion

The conclusion is that regional finance affects the comprehensive benefits of environmental protection industry through the degree of financial agglomeration, capital support, capital allocation, enterprise supervision, government guidance and green finance. Financial agglomeration, financial capital support, enterprise supervision and green finance are more significant. However, the allocation of financial capital has not played a very positive role in the environmental protection industry, and the guiding role of the government in the comprehensive benefits of the environmental protection industry is not very significant. The regulatory capacity and capital allocation efficiency of enterprises are still relatively small and need to be further improved.

#### **B.** Suggestions

- The financial market will make the optimal allocation of resources and accelerate the adjustment of economic structure. In the new normal economy, the traditional old industrial structure supporting economic development has gradually weakened its power to promote economic growth. And the representative new economy has become the new driving force to support economic development and the main driving force to promote economic growth. Under the guidance of market price, the financial market will be more and more perfect, and finally the transformation of old and new industrial structure will be realized.
- The steady development of the financial industry is conducive to accelerating the transformation and upgrading of the environmental protection industry. The work to be done at this stage is to eliminate backward production capacity and guide the whole industry to take the road of innovation and



development. Financial industry and environmental protection industry promote and support each other. The financial industry can bring capital to the environmental protection industry and solve the problem of insufficient funds for the development of environmental protection industry.

• Environmental protection enterprises should take the road of innovation and development and make good use of comprehensive finance to serve themselves. Environmental protection enterprises can raise funds through initial public offering or issuing corporate bonds, and they can also provide funds through investment banks. Environmental protection enterprises should also use other channels to obtain funds, such as stocks and bonds. So the establishment of a perfect green financial product system can meet their needs.

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