Proceedings of the 3rd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/139/2024.19202

Measuring Regional Green Finance Development Level in China

Jiali Wang[1,a,*]

[1]*Faculty of Business and Economics, Universiti Malaya, Kuala Lumpur, Malaysia*
a. 1584101752@qq.com
**corresponding author*

Abstract: Green finance, defined as supporting the development of green and low-carbon projects, serves as a mechanism for tackling resource shortages and environmental damage caused by Chinese economic reform and opening up. The reason for studying Chinese green finance development path by region is that each region has different economic development policies, investment in education and environment, and investment in scientific and technological innovation. This article employed the entropy method and DEA-Malmquist model to measure the efficiency of Chinese green finance development. The entropy method assigned values to each green financial development efficiency evaluation indicator and determined the weight. Then the DEA-Malmquist method was conducted to calculate the weight of each indicator to measure the dynamic development scale and efficiency. Based on the above research results, three policy recommendations are put forward to improve economic development, enhance innovation capabilities, and improve the green financial system.

Keywords: green finance, development efficiency, economic region, Entropy method, DEA-Malmquist index.

1. Introduction

In recent years, environmental and climate issues have become one of the most concerning long-term global threats. IPCC made a global temperature control target of 1.5°C, as well as specific emission reduction targets [1]. To achieve these goals, governments around the world have set strict climate change targets and measures. Therefore, the formation of green finance aims to guide the expansion of financial resources into various economic sectors committed to sustainable development[2,3,4]. Reform and opening up have enabled China to usher in more than 40 years of economic development. However, extensive development mode such as resource waste and environmental damage[5]. Facing increasingly prominent environmental and economic sustainable development issues, the Chinese government cannot delay the promotion of green financial development and plan to complete a huge transformation in just 30 years[6].

Each province in China has special strengths and weaknesses in addressing climate change. The study of China according to its three major economic regions, namely eastern, central and western regions, is more in line with China's current development situation. This is because China formulated the economic policy for the three major economic regions in the Seventh Five-Year Plan in the 1980s that "the east will drive the central and western regions, and the first rich will drive the later rich".

DOI: 10.54254/2754-1169/139/2024.19202

Differences in economic policies have caused gradual gaps in the economic level, ecological environment and educational level of different economic regions, resulting in the current unbalanced development situation in eastern, central and western China[7]. Therefore, when implementing green finance development goals and tasks, it is more accurate and scientific to monitor according to economic regions.

Previous research focuses on the measurement of green finance. Most evaluation indicators are designed for specific financial products and have not formed scientific and unified standards[8]. Marcel evaluated and analyzed the sustainable development concepts and practices of banks around the world through five dimensions and found that European banks' green financial products are more leading[9]. Penny and Philip studied and analyzed the green service channels of banks and used specific indicators to evaluate the energy conservation and environmental protection performance of banks in their operations[10]. Zhang used a combination of subjective and objective weighting methods to calculate the weighting of development levels from four dimensions, excluding green investment [11]. Yang and Wang used quantitative analysis to measure green finance in Shanghai[12]. Wang used the balanced scorecard method to design an evaluation index system for green financial development of commercial banks that includes three levels, four dimensions, and 17 indicators[13].

This paper uses the entropy method to determine the weight of each part of green finance, and then uses the DEA-Malmquist model to calculate the green finance development efficiency of each province in China from 2010 to 2019. By comparing the development levels of green finance in China's three major economic regions, this study can evaluate the effects of green policy implementation in different economic regions and areas that need improvement.

The possible innovations of this article are: (1) It further enriches the efficiency of green finance development in China's economic regions and provides theoretical support for the formulation of distinctive policies. (2) By constructing new measurement indicators, it provides a more scientific and reasonable research perspective for the regional development of green finance. This article leverages measurement techniques derived from the extant literature and augments them with the inclusion of green credit balances from 28 pertinent banking institutions as assessment indicators. In doing so, it aims to gauge the efficacy of green finance implementation by financial establishments across a range of provincial jurisdictions, thereby contributing to the broader discourse on the environmental impact of fiscal policy.

2. Literature Review

2.1. Green Finance Related Research

Since the 1970s, The practice and connotation of green finance have been enriched and developed. As a kind of financial innovation, green finance mainly discusses the intersection issues between finance and green development, opening up a new research perspective for environmental protection[14,15]. Green finance is a financial tool that aims to improve the environment and ecology[16,17], focusing on green industries[18] and financial products[19] to address environmental pollution and climate change issues.

In terms of green financial development models, governments and financial institutions in various countries have taken different measures. The European Commission has established a sustainable financial framework, promoted green financial standards, and seized the global green economic high ground. Specific measures include the release of the "Sustainable Finance Taxonomy" and the "Green Bond Standard" in 2020[20]. The UK announced a “Green Finance Strategy” during the 2019 Green Finance Summit, which includes working with industry to establish sustainable finance standards while improving investment opportunities for green projects [21]. The Japanese government has increased the participation of the Ministry of Economy, Trade and Industry and the Ministry of

DOI: 10.54254/2754-1169/139/2024.19202

Environment, and the provincial departments are responsible for formulating green financial policies tailored to local conditions. Since China first clearly proposed establishing a top-level design for China's green financial system in 2015, green finance has received policy support. Especially at the strategic level of green sustainable development[22,23] and the practical level of green financial products[24,25,26].

2.2. Theoretical Research on Green Finance

The development method of green finance is different from the traditional financial development model and requires supervision and guidance from the policy and regulatory levels. This article starts from the theories of sustainable development, Marxist ecological theory and environmental Kuznets curve to provide a theoretical basis for China's green finance policy formulation. Sustainable development requires that humans pay attention to ecological harmony and pursue social equity in the process of development, and ultimately achieve the comprehensive development of mankind[27]. Social ecologist James O'Connor published "Natural Reasons - A Study of Ecological Marxism" to explore the causes of ecological problems. By reinterpreting the concept of nature, he tried to give nature historical and cultural connotations, and used such understood concepts of nature and culture to transform traditional theories of productivity and production relations, and re-understand the relationship between nature, culture, and social labor. In this way, historical materialism can be reconstructed[28]. In 1993, Panayotou first proposed the Environmental Kuznets Curve (EKC). The EKC shows that environmental quality and income have an inverted U-shaped relationship[29]. By studying these three theories, this paper incorporates more economic indicators into the measurement system of regional green finance.

3. Research Design

3.1. Model Construction

3.1.1. Entropy Method

This article uses the entropy method to measure the green financial development indicators of each province in China. The entropy method is a weighted method that determines the weight by the information value of the indicator. It is divided into positive indicators and negative indicators. The smaller the entropy, the greater the amount of information, and the greater the weight of the indicator. At present, some scholars use the entropy method when measuring the efficiency of green financial development[30,31,32]. It has also been widely used in other aspects of the economic field, with rich practical experience and strong references. The following are the steps for entropy calculation:

The following are the steps of entropy method measurement.

(a) Data normalization

The individual indicators are first de-normalized. Suppose that m indicators are given.

$$X_1, X_2, X_3, \dots, X_m$$

Where X_i={x1,x2,…,xm}

Assuming that the values normalized to the data of each indicator are

$$Y_1, Y_2, Y_3, \dots, Y_m$$

Then: positive indicator:

DOI: 10.54254/2754-1169/139/2024.19202

$$\mathrm{Yij} = \frac{X_{ij} - \min(X_i)}{\max(X_i) - \min(X_i)} \tag{1}$$

Backward indicator:

$$\mathrm{Yij} = \frac{\max(X_i) - X_{ij}}{\max(X_i) - \min(X_i)} \tag{2}$$

(b) Find the ratio of each indicator under each program

$$\mathrm{pij} = \frac{Y_{ij}}{\sum_{i=1}^{n} Y_{ij}} \tag{3}$$

i=1,2,…,n,j=1,2,…,m

(c) Find the information entropy of each index

$$\mathrm{Ej} = -k \sum_{i=1}^{n} p_{ij} \ \ln p_{ij} \tag{4}$$

where $k=\frac{1}{\ln n}$, Ej≥0。If $p_{ij}=0$, define Ej=0

(d) Determine the weights of each indicator

$$\mathrm{wj} = \frac{1-E_j}{k-\sum E_j} \quad (j = 1,2, \ldots \tag{5}$$

where k refers to the number of indicators, i.e., k=m.

(e) Calculate the composite score for each solution

$$\mathrm{si} = \sum_{j=1}^{m} w_{ij} p_{ij} \tag{6}$$

3.1.2. DEA-Malmquist Exponential Model

Data Envelopment Analysis (DEA) is a new efficiency evaluation method based on the relative efficiency[33]. The advantage is that there is no need to set a production function, and the impact of errors on efficiency accuracy in the parameter estimation process of the parameter method is avoided. In the fields of efficiency research in operations research and economics, the DEA model is a research method frequently used by scholars. The DEA-Malmquist index model derived from the dynamic changes in different periods can calculate the dynamic changes in the production efficiency of decision-making units (DMUs) in different periods. Therefore, it can analyze panel data and has wider applicability.

The Malmquist exponent is operated using the distance function (E) and is expressed in the following mathematical form.

$$\mathrm{MPI}_I^t = \frac{E_I^t(\ x^{t+1},\ y^{t+1})}{E_I^t(\ x^t,\ y^t)} \tag{7}$$

$$\mathrm{MPI}_I^{t+1} = \frac{E_I^{t+1}(\ x^{t+1},\ y^{t+1})}{E_I^{t+1}(\ x^t,\ y^t)} \tag{8}$$

To take into account the level of technology in both periods, their geometric mean is taken.

$$MPI_I^G = (MPI_I^t MPI_I^{t+1})^{1/2} = [(\frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)}) * \frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^t, y^t)})]^{1/2} \tag{9}$$

This productivity index is to be decomposed further into input-oriented EFFCH and TECHC, which in turn will be decomposed into SECH and PECH.

$$MPI_I^G = \text{EFFCHI} * TECHCH_I^G = \frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)}[(\frac{E_I^t(x^t, y^t)}{E_I^{t+1}(x^t, y^t)}) * \frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^{t+1}, y^{t+1})})]^{1/2} \tag{10}$$

$$SECH = [(\frac{E_{vrs}^{t+1}(x^{t+1}, y^{t+1})/E_{crs}^{t+1}(x^{t+1}, y^{t+1})}{E_{vrs}^{t+1}(x^t, y^t)/E_{crs}^{t+1}(x^t, y^t)}) * \frac{E_{vrs}^t(x^{t+1}, y^{t+1})/E_{crs}^t(x^{t+1}, y^{t+1})}{E_{vrs}^t(x^t, y^t)/E_{crs}^t(x^t, y^t)})] \tag{11}$$

$$\text{CH} = \frac{E_{vrs}^{t+1}(x^{t+1}, y^{t+1})}{E_{crs}^t(x^t, y^t)} \tag{12}$$

Where CRS represents technical efficiency and VRS represents pure technical efficiency. When Malmq>1 indicates an increase in productivity level; Malmq =1 indicates a constant productivity level; Malmq <1 indicates a decrease in productivity level. TC represents the degree of the technological production frontier that passes from period t to period t + 1, i.e., the technological change index, and has: TC>1 indicates technological progress; TC=1 indicates technological invariance; TC<1 indicates technological decline. EC represents the degree of change in relative technical efficiency from period t to period t+1, that is, the technical change index, and has EC>1: it means that the distance between DMU in period t + 1 and the frontier of period t + I is closer than the distance between the frontier of period t and period t, and the relative technical efficiency increases; EC=1 means that the technical efficiency remains unchanged; EC<1 means that the technical efficiency declines.

Because this study involves panel data for a total of 30 provinces from 2010-2019, the effectiveness of China's green finance development is evaluated using the DEA-Malmquist index analysis.

3.2. Variable Selection and Data Sources

3.2.1. Variable Selection

Following the principles of combining systematicity, scientificity, comparability and operability, this article draws on the five dimensions of green financial development indicators provided by Ma [34], and refers to the eight secondary indicators added by Zhang et al.[35]. Finally this paper selects two primary indicators, six secondary indicators, and eight tertiary indicators. The specific green financial development level and efficiency-related indicators and their calculation formula are shown in Table 1.

Table 1: Indicators related to the level and efficiency of green finance development.

First-level indicator	Secondary indicator	Tertiary indicator	Indicator calculation
Input	Green credit	Balance of green credit(Billion Yuan)	The green credit balance of 28 relevant banks

Table 1: (continued).

		Interest payments for energy-intensive industries (%)	Interest expense of the top six energy-intensive industries/total interest expense of industrial industries
	Green securities	The proportion of market capitalization of energy-intensive industries (%)	A-share marketing value of six energy intensively consumption industries / total marketing value in A-share
	Green investment	proportion in green investment from government(%)	Fiscal expenditure on environmental protection/expenditure in the general public budget
		investment proportion in environmental pollution control (%)	Investment in controlling environmental pollution / GDP
	Green insurance	The proportion of the income from agricultural insurance (%)	Agricultural insurance income/total agricultural output value
	Carbon finance	The intensity of financial carbon (ten thousand tons / Billion yuan)	Carbon emissions /GDP
Output	Green GDP	Green GDP (Billion Yuan)	GDP- the cost of environmental protection

3.2.2. Data Source and Explanation

This study collects sample data from 30 administrative regions at provincial, autonomous, and municipal level under the administration of Chinese Central Government (except Tibet) from 2010-2019. Among them, bank green credit balances were obtained from People's Bank of China, the China Banking Sector Social Responsibility Report, annual reports, and annual social responsibility reports of each bank. Data on interest expenses of high energy-consuming industries is obtained from China Industrial Statistical Yearbook, Economic Census Bulletin, and China Environmental Database. The data on the market value share of high energy-consuming industries is from China Banking Regulatory Commission and China Business Industry Research Institute. Government green investment data, GDP data and carbon finance data are from the China Statistical Yearbook and the Energy Statistical Yearbook; the proportion of investment in environmental pollution control is from the China Environmental Statistical Yearbook. Green insurance data can be found in the China Insurance Yearbook and provincial statistical yearbooks.

Due to a wide range of data collection and a long period, some data are missing. The green credit balance of banks cannot be decomposed by provinces and cities in the data collection process, so that the data of 28 banks out of 36 listed banks in China are quoted directly. For missing data, an average value is used instead in all cases. The six major energy industries are divided according to the "2010 National Economic and Social Development Statistical Report".

4. Findings

4.1. Measurement Results and Analysis by Entropy Value Method

Firstly, the data in 2010-2019 are dimensionless, and the inverse indicators are standardized to the positive indicators. Then using the concept from the sub-item to the total item, the weight of each

DOI: 10.54254/2754-1169/139/2024.19202

indicator in the two-level indicators is computed, and the weights of the three-level indicators in 2010-2019 are shown in Table 2 below. After calculating the weights of each indicator each year, the total score is annually collated by calculating the comprehensive score of each program. According to the comprehensive scores of each annual indicator in Table 3, the development level in China of green finance is generally stable.

Table 2: Weights of secondary indicators of green finance from 2010 to 2019

Secondary indicator	Green credit	Green securities	Green investment	Green insurance	Carbon finance
2010	42.56%	4.89%	22.48%	26.55%	3.52%
2011	45.17%	4.17%	19.19%	28.94%	2.53%
2012	45.02%	5.88%	25.15%	20.91%	3.04%
2013	47.55%	5.01%	22.91%	21.51%	3.02%
2014	41.64%	5.89%	28.18%	21.56%	2.72%
2015	44.42%	4.04%	24.41%	24.17%	2.96%
2016	41.33%	4.25%	29.44%	21.07%	3.91%
2017	43.29%	4.65%	25.52%	21.08%	8.59%
2018	44.35%	5.18%	24.30%	23.64%	2.91%
2019	46.77%	2.93%	21.25%	25.97%	3.08%
Weight average	44.21%	4.69%	24.28%	23.54%	3.63%

Table 3: Annual Comprehensive Scores of Green Finance

Year	Overall ratings	Year	Overall ratings
2010	7.94	2015	7.73
2011	7.63	2016	7.86
2012	8.12	2017	7.96
2013	8.19	2018	8.35
2014	7.67	2019	8.24

4.2. Sub-regional Annual Measurement Analysis

The efficiency of green financial is unstable across regions in Table 4, but generally shows a year-on-year improvement, which is consistent with the conclusions drawn at the national level. The difference lies in the overall low green financial efficiency of each region due to internal green financial efficiency heterogeneity. The green financial development efficiency fluctuates more significantly in the Eastern region among years, exceeding 10% between 2010-2011 and 2017-2018, and improving slowly in other years. The central region has had the least decrease in green financial development efficiency during the decade, which is consistent with the results of sub-regional measurements. The central area's growth rate of green financial development efficiency over the past ten years has been more consistent than that of the eastern region. After two years of significant growth from 2013 to 2015, the average green financial development efficiency in the western area is lower than that in the eastern and central regions, and the growth rate has slowed down in recent years. This shows that there is still a significant opportunity for western region's green financial growth, which lacks adequate impetus.

DOI: 10.54254/2754-1169/139/2024.19202

Table 4: Efficiency of green finance development in the three regions by year

Year	Eastern	Middle	Western
2010-2011	1.327	0.952	0.910
2011-2012	0.734	0.903	0.941
2012-2013	0.826	0.814	0.841
2013-2014	0.971	1.032	1.059
2014-2015	0.975	0.993	1.070
2015-2016	0.889	0.961	0.988
2016-2017	0.859	1.046	0.973
2017-2018	1.149	1.082	0.920
2018-2019	0.983	1.011	0.925
Mean	0.968	0.977	0.959

5. Research Conclusions and Policy Recommendations

5.1. Research Conclusions

From the each region’s comparative situation, the Chinese green financial development is unbalanced. The efficiency in the eastern region fluctuates more obviously. In contrast, the central region has a more stable growth rate and efficiency. The effectiveness of green financial development is lower in the western area than in the eastern and central regions. Its green financial development efficiency lacks sufficient momentum, and much room is for improvement. By comparing the efficiency and its determinants in the three major regions, it is found that the regions with high economic development levels show a negative correlation effect on green financial. This is contrary to the existing theory that the relationship between economy and finance promotes each other and also to the prediction of this study. This has anything to do with economic progress and national support policies in different regions. Some economically developed regions mainly focus on the economy and neglect the environment, leading to a relatively slow development rate. In contrast, economic development in western regions has contributed much to green financial, which is related to China's policy of focusing on environmental protection during the development of western China in the last decade.

5.2. Policy Recommendations

Improving economic development level and deepening marketization degree in green finance. In the context of sustainable development, the government can only improve the level of economic development by adjusting green finance policy programs to suit the needs of regional economic development. With low market participation enthusiasm, weak professionalism, and an insufficient talent pool of green financial institutions, the Chinese government should deepen the promotion of the marketization degree in green finance to improve the green economic development level.

Enhancing innovation capabilities. First, it is necessary to realize innovation in green financial goods and services. China's green financial products and services are relatively single, mainly green credit. And other products remain at a relatively low and slow development. In this regard, China should accelerate the innovation of green insurance products and bond types. Secondly, strengthen the practical innovation of financial institutions. To improve the participation of financial institutions, they can strengthen their business innovation and stimulate green development by expanding the issuance of green bonds. Finally, enhancing scientific and technological capabilities. Provincial governments should formulate incentive systems based on local conditions to promote the transformation of scientific and technological achievements.

DOI: 10.54254/2754-1169/139/2024.19202

China needs to push for the creation of a green financing system, introduce third-party professional assessment and supervision institutions, and promote the formation of a unified evaluation system. Meanwhile, it should combine the international green financial evaluation standards to form a set of unified green financial standards that align with international standards. The Chinese government should put more energy and effort into preventing and controlling green financial risk and identify the responsibilities and obligations of the government and the market from the legal level. Moreover, it should improve the relevant supervision system, clarify the responsibilities of supervisory agencies, and strengthen the supervision of green enterprises and projects. What is more, risk control and operational compliance reviews should be conducted for financial institutions to guarantee controllable risks and smooth development of green finance. Meanwhile the government can also promote it by attracting non-financial institutions, enterprises, and private investment in green industries through interest rate subsidies and policy support. The government can even participate by investing in green finance supporting facilities.

References

[1] *Livingston, J. E., & Rummukainen, M. (2023). Making policy-relevant knowledge in the IPCC Special Report on 1. 5 degrees: An analysis of reviewer comments. Environmental Science & Policy, 147, 305-314.*

[2] *Gray, R. (2002). Of messiness, systems and sustainability: towards a more social and environmental finance and accounting. The British Accounting Review, 34(4), 357-386.*

[3] *Weber, O. (2014). The financial sector's impact on sustainable development. Journal of Sustainable Finance & Investment, 4(1), 1-8.*

[4] *Yuan, F., & Gallagher, K. P. (2019). Greening development lending in the Americas: Trends and determinants. In Development Banks and Sustainability in the Andean Amazon (pp. 75-101). Routledge.*

[5] *Kang, C., Chen, Z., & Zhang, H. (2023). The outgoing audit of natural resources assets and enterprise productivity: new evidence from difference-in-differences-in-differences in China. Journal of Environmental Management, 328, 116988.*

[6] *Sun, L. L., Cui, H. J., & Ge, Q. S. (2022). Will China achieve its 2060 carbon neutral commitment from the provincial perspective?. Advances in Climate Change Research, 13(2), 169-178.*

[7] *The Seventh Five-Year Plan of the People's Republic of China (https://www.gov.cn/test/2006-03/20/content_231451. htm)*

[8] *Zhang, Y.F, Dong, X.H, & Wu J.Q. (2018) Measuring the level of green financial development in Guangdong Province--a study of neural network model based on genetic algorithm optimization. Foreign Economic and Trade, 10, 95-101.*

[9] *Marcel, J.(2001).Sustainable Finance and Banking: The Financial Sector and the Future of the Planet. https://doi. org/10.4324/9781849776264*

[10] *Penny, S., Philip, E.M. (2007).Assessing the sustainability of bank service channels:the case of the Co-operative Bank. Sustainable Banking. Sheffield, UK.*

[11] *Zhang, Y. (2016). Exploring the level of green finance development measurement in Beijing-Tianjin-Hebei region. China Market, 888(21), 31-32.*

[12] *Yang, Y., & Wang, G.S.(2017). Measuring the level of green financial development - taking Shanghai as an example. Reform Exploration, 4, 22-23*

[13] *Wang, H.L.(2018). Construction of evaluation index system of green financial development of commercial banks in China based on balanced scorecard. Western Finance, 1, 62-66+76. dio:10.16395/j.cnki.61-1462/f.2018.01.014.*

[14] *Cowan, E.(1999). Topical Issues In Environmental Finance. Enviromental Finance, 1, 1-20.*

[15] *Salazar, J. (1998). Environmental Finance: Linking Two World Financial Innovations for Biodiversity Bratislava, 1, 2-18.*

[16] *Labatt, S., & White, R. R. (2002). Environmental finance: a guide to environmental risk assessment and financial products (Vol. 98). John Wiley & Sons.*

[17] *Wang, J.H. (2000). On the "Green Revolution" of the Financial Industry. Ecological Economy, 10, 45-48.*

[18] *Li, X.Y. (2006). A humble opinion on the necessity and methods of green financial tool innovation. Journal of Liaoning Institute of Socialism, 4, 43-44.*

[19] *Deng, X. (2012). A Review of Green Finance Research.Journal of Zhongnan University of Economics and Law, 6, 67-71.*

[20] European Commission. (2020, December). Vice-President Valdis Dombrovskis: College Read-Out and Remarks on the Italian Budget. https://europa.eu/rapid/press-release_SPEECH-18-6886_en.htm
[21] Transforming finance for a greener future: 2019 green finance strategy. (https://www.gov.uk/government/publications/green-finance-strategy/transforming-finance-for-a-greener-future-2019-green-finance-strategy)
[22] Cai Yuping & Zhang Yuanpeng. (2014). Construction of green financial system: problems and solutions. Financial Theory and Practice (09), 66-70.
[23] Jiang Miao, Pan Tieshan, Xu Jing & Yu Zhou. (2018). Development status and countermeasures and suggestions of green finance. Environment and Development (12), 3-4+7.doi:10.16647/j.cnki.cn15- 1369/X.2018.12.002.
[24] Li, R. J.(2014). Marketization and green finance development. China Finance, 4, 17-19.
[25] Ma, Y.L.(2017). Institutional barriers and path options for the development of green finance in China. Financial Vertical, 35 (3), 90-92.
[26] Zhang, Z.L., & Wang X.J.(2015). Reflections on the bottleneck period of green finance development. Environmental Protection, 43 (24). 58-61. dio:10.14026/j.cnki.0253-9705.2015.24.011.
[27] Report of the World Commission on Environment and Development: Our Common Future.(https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf)
[28] Saed. (2019). James Richard O'Connor's Ecological Marxism*. Capitalism Nature Socialism, 30(4), 1–12. https://doi.org/10.1080/10455752.2018.1495307
[29] Stern, D. I., Common, M. S., & Barbier, E. B. (1996). Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development. World development, 24(7), 1151-1160.
[30] Jiang, L., Wang, H., Tong, A., Hu, Z., Duan, H., Zhang, X., & Wang, Y. (2020). The measurement of green finance development index and its poverty reduction effect: Dynamic panel analysis based on improved entropy method. Discrete Dynamics in Nature and Society, 2020(1), 8851684.
[31] Wang, X., Zhao, H., & Bi, K. (2021). The measurement of green finance index and the development forecast of green finance in China. Environmental and Ecological Statistics, 28, 263-285.
[32] Zhou, Y., Liu, H., Wang, J., Yang, H., Liu, Z., & Peng, G. (2022). Spatial differentiation and influencing factors of green finance development level in China. Frontiers in Environmental Science, 10, 1023690.
[33] Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the Efficiency of Decision Making Units. European Journal of Operational Research, 6 (2), 429 -444. doi:10.1016/0377-2217(78)90138-8
[34] Ma Jun. (2015). Goals and framework of green financial system. Financial Expo (Fortune) (03), 42-44.
[35] Zhang, L., Xiao, L.M., & Gao, J.F. (2018). Measurement and comparison of the level and efficiency of green finance development in China - based on micro data of 1040 public companies. China Science and Technology Forum, 9, 100-112+120. dio:10.13580/j.cnki.fstc.2018.09.017.