# A review of research on ESG portfolios and risk management of listed banks in the context of carbon neutrality

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## ABSTRACT

Against the backdrop ofthe comprehensive promotion ofthe “dual carbon” goals and the in-depth development of green finance, the ESG (Environmental, Social, and Governance) concept has become an important guide for the operational development and risk management of commercial banks. As the core entities of China’s financial system, listed banks’ ESG investment portfolio construction and risk management level not only relate to their own sustainable development but also affect the stable operation of the entire financial market. This paper adopts literature research, inductive deduction, and comparative analysis methods to systematically sort out relevant research results on ESG, green credit, investment portfolio, and risk management of listed banks at home and abroad. It summarizes the mainstream views, consensus, and differences in existing research, analyzes the shortcomings and deficiencies of current research, and proposes future research directions in the context of carbon neutrality policies. The research aims to integrate the research context of related fields, enrich the cross-disciplinary theoretical system of green finance and investment portfolio management, and provide literature references for bank operations, investor decisions, and regulatory policy formulation.

**Keywords:** Crbon neutrality; Lsted banks; ESG portfolio; Geen credit; Rsk management

## 1. INTRODUCTION

Since China proposed the strategic goals of carbon peak and carbon neutrality, green finance has been entrusted with the important mission of promoting the low-carbon transformation of the economy, and the industry’s development has entered a fast lane. The National Financial Regulatory Administration and the People’s Bank of China jointly issued the “Implementation Plan for High-quality Development of Green Finance in the Banking and Insurance Industry”, explicitly requiring banking institutions to optimize asset structure, reduce carbon intensity of asset portfolios, and improve the ESG risk management system. This establishes the development direction for green transformation and ESG risk control in the banking industry from a policy perspective. [1] According to statistics from the central bank, as of the end of 2025, the balance of green loans in both domestic and foreign currencies in China reached 44.77 trillion yuan, a year-on-year increase of 20.2%. The scale of green credit continues to expand, becoming a core sector in the asset layout of the banking industry.

Meanwhile, the ESG (Environmental, Social, and Governance) investment philosophy has rapidly gained popularity in the domestic capital market, gradually moving from being a concept to being implemented, and becoming a core standard for evaluating a company’s comprehensive strength, long-term value, and risk level. Commercial banks are key hubs for social capital flow and resource allocation, and listed banks are even more indicative of industry development trends. Driven by both the constraints of carbon neutrality policies and the wave of ESG investment, traditional asset portfolio models and risk management systems have become difficult to adapt to the requirements of the new era. Tao Yiping pointed out that relying on the ESG framework to

build asset portfolios and strengthen climate risk management is the core approach for commercial banks to achieve the “dual carbon” goals and high-quality development [1]. Integrating ESG concepts into portfolio construction, optimizing asset structure through green credit business, and establishing a risk management mechanism suitable for low-carbon transformation have become inevitable choices for the transformation and development of listed banks.

On the basis of previous academic research, scholars at home and abroad have discussed many ESG, green finance and bank risk management. However, the views of the study are not uniform. Foreign research pays more attention to the relationship between ESG investment and risk in the whole industry, but it is not enough to focus only on banking industry. Domestic research mostly analyzes the influence of ESG on individual bank risk, but lacks the comparative analysis of

ESG investment portfolios and traditional portfolios, and systematically summarizes the influence of carbon neutrality policies. Therefore, this paper will summarize the previous research results in the form of literature review. Sort out the research process and find out the research gap, so as to provide theoretical support for future empirical research and practical applications.

## 2. CORE CONCEPTS AND THEORETICAL BASIS

### 2.1 Definition of Core Concepts

#### 2.1.1 ESG

ESG is the abbreviation of Environmental, Society and Governance, and it is recognized as an evaluation system of enterprise sustainable development in the world today. ESG information disclosure in China's banking industry gradually conforms to the national mainstream framework such as GRI and ISSB. ESG has not only complied with the requirements of rules, but also become the center that affects bank value evaluation and risk management. [2] For listed banks, their ESG results reflect their ability to directly abide by business, undertake social responsibilities and take long-term risks.

#### 2.1.2 Green Credit Exposure

Green credit exposure refers to the percentage of bank green loan balance in the whole loan balance. This is a very important numerical index to measure the development level of green finance and the intensity of low-carbon transformation of commercial banks. This indicator clearly shows how much bank assets are biased towards green industries, and it is also an important factor to analyze the risk characteristics of bank ESG portfolio [3].

#### 2.1.3 Portfolio Risk

The so-called Portfolio risk means that due to external factors such as market changes, policy changes, and industry trends, various asset investments held by banks may suffer losses. When I was a student, I usually used such indicators as volatility and CVaR (Conditional Value at Risk) to measure by quantity. Bank ESG portfolio risk refers to all kinds of risks that asset portfolio bears after joining the standards selected by ESG.

#### 2.1.4 Risk Resistance Capability

Risk resistance capability refers to the comprehensive ability of investment portfolio to resist asset depreciation and maintain stable value under the conditions of market fluctuation, policy shock and credit crisis. This is also the primary goal of bank risk management.

### 2.2 Theoretical Basis

#### 2.2.1 Modern Portfolio Theory

The modern portfolio theory introduced by Markowitz is the basic logic for banks to divide the use of assets. Theory said that if it is divided into different types of assets, it can well disperse the non-systemic risk and achieve the best balance between risk and profit. Foreign researchers use the data of European banking industry to conduct research, pointing out that putting green credit and low-carbon assets into the investment portfolio will improve the mechanism of credit and reduce the risk of credit dislocation caused by high-carbon industries. Now, we have determined that this theory can also be used when making ESG portfolios [4]. When making ESG investment portfolios, listed banks rely on this theory to combine various green assets, so as to achieve a good balance between the overall risk and interests.

#### 2.2.2 Risk Management Theory

Total risk management theory is the center of modern commercial banks risk control system. In the case of carbon neutrality, climate risk and carbon transition risk have become the sources of new risks for banks. It is necessary to expand the traditional risk management framework and incorporate ESG risks and environmental risks into the whole process control system [5]. The Basel Committee on Banking Supervision is also bringing climate risk into the Basel Accords framework to establish the universal standard of ESG risk management for global banks.

#### 2.2.3 Stakeholder Theory

Stakeholder theory said that companies must consider the requirements of many people, including shareholders, customers, regulators and the public. Listed banks actively abide by ESG principle and increase green credit, which can reduce compliance risk and reputation risk. As a result, it can continue to operate stably for a long time. Good ESG results will also ease the information asymmetry between banks and enterprises and further reduce the systemic risks of banks. This is a concrete example of stakeholder theory in banking [6].

## 3. OVERVIEW OF CURRENT RESEARCH BOTH DOMESTICALLY AND INTERNATIONALLY

### 3.1 Current Research Status Abroad

European and American countries have long been at the forefront in the development of ESG investment and green finance, with relatively perfect theoretical framework and practical research. The research involved mainly focuses on the relationship between ESG score, portfolio risk, green finance and bank risk.

In the study of the relationship between ESG and bank risk, the mainstream view among foreign universities is that ESG has the effect of reducing risk. Galleta conducted a practical study with banks in 35 countries around the world as samples. The results show that there is a significant negative correlation between the overall ESG score of banks and business risks. A sound ESG management system can suppress internal violations and reduce the number of dangerous events [7]. Another study suggests that ESG can improve the transparency of bank information through social and governance aspects, gain the trust of stakeholder, effectively reduce credit risk and enhance capital buffering capacity. Furthermore, some scholars have made diversity analysis and found that the relationship between ESG and bank risk is not a simple linear relationship, but has a U-shaped feature. That is to say, on the one hand, moderate ESG investment can reduce risks, on the other hand, excessive investment will worsen risks due to rising agency costs. This makes up for the limitations of linear research in the past [8].

In the fields of green credit and asset portfolio, foreign research generally believes that with the increase of the proportion of green credit, the proportion of bad loan in banks will drop sharply, and the quality of asset portfolio will improve. However, at present, there are obvious limitations in foreign research:

(1) The research perspective tends to compare and analyze the whole industry, and there are few studies that focus on listed banks as specific financial entities. These studies did not investigate the special characteristics of capital allocation and risk transmission in banking industry;

(2) Most of the research is based on the mature capital market environment, and there is no targeted analysis under the background of the influence of carbon neutrality policy. Therefore, the conclusions of these studies are difficult to directly match the domestic policy environment.

### 3.2 Current Domestic Research Status

With the implementation of China’s “dual carbon” strategy and the rapid development of the ESG market, domestic research has experienced explosive growth over the past decade, with prominent characteristics of localization. The research focus is centered on the correlation between ESG, green credit, and individual bank risks.

In the field of ESG and bank risk, Gu Haifeng et al. empirically concluded based on panel data of domestic listed banks that the ESG performance of commercial banks is significantly negatively correlated with the level of risk-taking, and promoting ESG construction is an effective path for banks to reduce risk. Subsequent research further refined the dimensions, pointing out that the social responsibility and corporate governance dimensions of ESG have the most prominent inhibitory effect on bank credit risk, and this effect is more pronounced in private banks. Some scholars also took banks listed on the Hong Kong Stock Exchange as samples, confirming that the higher the ESG score, the lower the bank’s liquidity risk, enriching the research system of ESG and segmented risk types [9].

In terms of green credit research, domestic scholars have formed a relatively unified viewpoint. Cao Gaohang et al. found through a multi-period difference-in-differences model study that the development of green credit business can effectively reduce the overall risk of commercial banks, with a 3-year lag in policy effects, and the risk mitigation effect is more significant for large state-owned banks and city commercial banks [10]. Ren Aihua and Tong Qingshan verified from the perspective of the mechanism of action that green credit inhibits the breeding of credit risk through two paths: optimizing asset structure and screening high-quality low-carbon customers

Meanwhile, the shortcomings of domestic research are also quite prominent:

(1) Most research focuses on the risk of banks as a single entity, lacking a comprehensive horizontal comparison between banks' ESG investment portfolios and traditional investment portfolios. This makes it impossible to clearly identify the risk differences and suitable scenarios between the two types ofportfolios;

(2) The research perspectives are relatively scattered, with different scholars pursuing independent

research directions, and a localized and systematic research framework has not yet been established;

(3) Few studies have taken green credit exposure as the core variable to analyze its inherent correlation with ESG portfolio risk. Furthermore, uncertainty in climate policies can inhibit banks' green credit extension, and existing review literature rarely conducts analysis in combination with policy fluctuation scenarios, resulting in a significant gap in research scenarios.

### 3.3 Overall Gaps in Existing Research

A comprehensive review of domestic and international literature reveals three core gaps in current research in this field.

(1) Lack of perspective: Existing literature rarely focuses on green credit exposure, a characteristic indicator of banks, to explore its linkage with ESG portfolio risk. Early reviews in the domestic green finance field have suggested that the quantification of green credit risk and portfolio effect analysis are key research directions for the future, but relevant systematic reviews are still relatively scarce to date [11-12].

(2) Lack of scenarios. Carbon neutrality is a core macro policy that affects the development of the domestic banking industry. However, there is a severe lack of comprehensive research that analyzes the ESG risk management strategies and implementation effects of banks in combination with scenarios such as policy shocks and policy uncertainties.

(3) There is a lack of integration, with domestic and foreign research conducted independently and from diverse perspectives. There is a lack of systematic literature reviews that integrate and organize research results across all fields from multiple dimensions, based on China's market environment.

## 4. RESEARCH OBJECTIVES, RESEARCH CONTENT, AND KEY ISSUES TO BE ADDRESSED

### 4.1 Research Objectives

As a literature review, this paper sets three core research objectives:

(1) Systematically sort out domestic and international research outcomes covering ESG management, green credit, investment portfolio optimization and bank risk management, and clarify the evolutionary trajectory of research in these four fields.

(2) Summarize mainstream viewpoints, academic consensus and divergent arguments from extant literature, and objectively evaluate the merits and limitations of current relevant studies.

(3) Combine carbon neutrality policies with the real-world development of China's banking sector to lay a solid literature foundation and theoretical support for follow-up empirical research and industrial practice.

### 4.2 Research Content

Firstly, define core professional concepts such as ESG, green credit exposure, portfolio risk, and risk resistance capability, and sort out three fundamental theories: modern portfolio theory, risk management theory, and stakeholder theory, to construct the analytical logical framework of this paper. Secondly, sort out relevant domestic and international literature by dimension, and summarize research ideas, research methods, and core conclusions of ESG and bank risk, green credit and asset portfolio, low-carbon policy and bank transformation from both domestic and

international perspectives. Thirdly, compare and analyze the differences and commonalities of domestic and international research from four dimensions: research perspective, research method, research conclusion, and application scenario. Finally, summarize the research shortcomings in the current field, and propose localized, refined, and dynamic future research directions in combination with the background of carbon neutrality and the actual operation of listed banks.

### 4.3 Key Issues to Be Addressed

(1) Clarify the theoretical logic of the integration of ESG risk management, green credit business, and portfolio optimization, and outline the complete research evolution.

(2) Objectively distinguish the consensus, differences, and academic controversies in domestic and foreign research, such as the linear and nonlinear controversies over the impact of ESG on bank risk, and the heterogeneous controversies over the effects of green credit, and accurately identify the applicable scenarios and limitations of different studies.

(3) Fully identify the research shortcomings and blank areas in the current field, providing clear entry points for subsequent scholars to conduct empirical research and banks to explore practical applications.

# 5. RESEARCH METHODS AND TECHNICAL ROUTE

## 5.1 Research Methods

### 5.1.1 Literature research method

This article mainly uses the literature of important databases such as CNKI, Web of Science and SSCI at home and abroad. In addition, it also refers to the documents of Basel Committee rules, the policy of domestic finance rules, the ESG report of banks and the report of industries. This array integrates carbon neutrality, ESG, listed banks, green credit, investment portfolios and risk management related literature.

### 5.1.2 Inductive deduction method

Sort out the collected books and papers, and summarize the development stage, the mechanism of change and the practice of careful study in this field. Based on the basic theory and the current industry situation, the real relationship between ESG portfolios and bank risk management is clarified step by step, and a complete research and analysis framework is constructed.

### 5.1.3 Comparative analysis method

We compare the research at home and abroad side by side. Analysis of the research views, investigation methods, selected data, the direction of conclusions, whether it is in line with the policy, and their differences. Foreign research will focus on general theories and samples from all over the world. On the other hand, domestic research is devoted to regional policies and market characteristics. Through this comparison, we can make clear the characteristics and development potential of domestic localization research.

### 5.1.4 Content analysis method

Please make an in-depth analysis of the selected literature. Please take out research hypotheses, empirical methods, core viewpoints and innovations from various article to summarize the center of academic discussion. In this way, the content of the review will become profound and correct.

# 6. RESEARCH INNOVATION

(1) Perspective innovation. Traditional research only focuses on the financial risks of banks or the dimension of only one ESG, which is limited. We broke through this boundary, combined carbon transition risks, green credit and portfolio management, made an analysis framework with many dimension, and made diverse research logics.

(2) Content innovation. Pay attention to the small object of listed banks and conduct an overall study. So far, most of the research has focused on the analysis of the whole industry, and there are some shortcomings. This study makes up for its shortcomings, and the content of the study is more in line with the actual dynamics of the banking industry.

(3) Comparative innovation. Use a research framework that compares domestic and foreign views. This study not only summarizes the experience of foreign skilled research, but also clearly shows the characteristics of China's carbon neutrality policy and regional market environment, which can be used for reference in China's regional integration research.

# 7. SUMMARY AND FUTURE RESEARCH OUTLOOK

Under the background of the continuous promotion of carbon neutrality strategy and the widespread use of Environmental, Social, and Governance (ESG) concepts, the paper has consulted relevant books and papers at home and abroad and found that foreign research mechanisms are mature. Generally speaking, a high ESG level can reduce various risks faced by banks. However, from the point of view of considering the banking industry separately, it is not enough to combine the domestic policy situation. Domestic research conforms to the local market and confirms that the construction of green credit and ESG can reduce the risk of banks. Nevertheless, the research perspectives are uneven and lack of systematic summary, especially in the fields of green credit venture capital, ESG portfolio comparison and policy shock scenario analysis in the field of green finance.

Based on the development trend of today's industry and the lack of research, the further exploration in this field will be deepened from three directions in the future.

(1) Take green credit exposure as the core variable to make a quantitative comparative study, and make an empirical analysis of the differences in risk level and profitability between bank's ESG portfolio and traditional portfolio, so as to fill the gaps in portfolio comparative study.

(2) Strengthen the study of policy scenarios, and analyze the dynamic adjustment mechanism of bank ESG risk management system in combination with the implementation of carbon neutrality related policies and external influences such as climate policy uncertainty, so as to enrich the research content under scenarios.

(3) Promote the construction of local system, build ESG portfolio management and risk control framework suitable for the domestic market according to the development characteristics and regulatory requirements of China's banking industry, and build a theoretical system suitable for local conditions.

Generally speaking, the research on ESG portfolio and risk management of listed banks has both theoretical value and practical significance. By systematically investigating previous studies and making up for the shortcomings, it can not only enrich the interdisciplinary theory of green finance, but also help listed banks to steadily promote low-carbon transformation, improve their comprehensive risk management capabilities, and help China's financial industry achieve high-quality sustainable development.

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