

Research on the Construction of Collaborative Mechanism between Green Finance and Climate Risk Management Empowered by Financial Technology: Based on the Impact of Green Finance on Corporate Performance

Peilin Chen

Henan University of Economics and law, ZhengZhou, China

Abstract: This article focuses on the impact of green finance on corporate performance, with green finance as the direct variable, climate risk management as the intermediate variable, and financial technology as the moderating variable. Through theoretical analysis and case studies from multiple industries, a collaborative mechanism of "green finance climate risk management fintech" is constructed to elaborate on the direct and indirect effects of green finance on company performance through climate risk management. The regulatory effects of fintech are analyzed in depth, providing comprehensive theoretical basis and practical guidance for enterprises to achieve performance improvement and green transformation through green finance.

Keywords: Green finance, Climate risk management, financial technology, Company operational performance, Cooperative Mechanism.

1. Introduction

The extreme weather events caused by global climate change are becoming increasingly frequent, and the impact on business operations is showing a normalized and diversified trend. According to the International Disaster Database, there were a total of 467 major natural disasters worldwide in 2023, causing economic losses of approximately 313 billion US dollars. Among them, direct losses such as property damage and production interruption accounted for over 60%. For example, the summer floods in northern India in 2023 caused local auto parts suppliers to shut down, forcing multiple global car companies to reduce their production lines and resulting in a 15% decrease in monthly output [1].

In this context, green finance, as a core tool to guide social capital towards green and low-carbon fields, continues to rapidly expand in scale. As of the end of 2023, the global stock of green bonds has exceeded 2 trillion US dollars, and the balance of green loans in China has reached 28.5 trillion yuan, accounting for 12.6% of the total loan balance. Green finance not only provides financial support for green projects of enterprises, but also promotes enterprises to pay attention to environmental and climate risks through financing constraints.

The booming development of financial technology provides technical support for the deep integration of green finance and climate risk management. Technologies such as big data and artificial intelligence have enabled precise assessment of climate risks, blockchain technology ensures transparent use of green funds, and IoT technology enables real-time monitoring of environmental data. The coordinated development of the three has become a key path for enterprises to improve operational performance while addressing climate risks, and is also a focus of attention in the current academic and practical fields [2].

2. Theoretical Analysis

2.1. Green Finance and Corporate Performance

Based on the resource-based theory, a company's competitive advantage comes from the scarce resources it possesses. Green finance provides three key resources for enterprises:

Financial resources: Green financial instruments usually have lower financing costs, such as the average issuance interest rate of green bonds being 50-100 basis points lower than ordinary bonds, directly reducing corporate financial expenses. Taking Longi Green Energy as an example, the 5 billion yuan green bonds issued in 2023 have a coupon rate of 3.2%, which is 0.6 percentage points lower than ordinary corporate bonds issued during the same period, saving an annual interest expense of 30 million yuan.

Technical resources: Projects supported by green finance are mostly technology intensive, and enterprises can increase their research and development investment after obtaining funding, forming technical barriers. In 2023, the average proportion of R&D investment in China's new energy industry will reach 8.5%, which is 3.2 percentage points higher than the average level of the manufacturing industry, with the contribution of green credit funds accounting for over 40%.

Reputation resources: Participate in green finance to convey signals to the market that companies actively fulfill their environmental responsibilities and enhance brand value. According to MSCI research, companies included in the ESG index have a 12% higher customer retention rate and a 30% longer holding period for investors, indirectly promoting improved business performance.

2.2. Green Finance and Climate Risk Management

According to the compliance driven theory, external rules and standards will drive companies to adjust their management behavior. Green finance promotes enterprises to strengthen climate risk management through three mechanisms:

Financing threshold constraint: Financial institutions usually require companies to meet specific environmental and climate standards when issuing green loans or underwriting green bonds, such as carbon emission intensity lower than the industry average and establishing climate risk management systems. A state-owned bank refused to lend for 127 high carbon projects in 2023 due to failure to meet climate risk assessment standards, involving a total amount of over 50 billion yuan.

Guidance on fund utilization: Green finance funds need to be used exclusively for green projects, which often include climate risk prevention and control measures, such as typhoon resistant design for wind power projects and energy-saving insulation renovation for building projects. In 2023, the proportion of funds used for climate adaptation in China's green projects will reach 35%, an increase of 18 percentage points from 2020 [3].

Information disclosure requirements: The issuance and duration of green financial products must disclose environmental and climate related information. For example, green bonds must regularly report on the use of funds and project climate benefits, forcing companies to establish standardized information collection and analysis mechanisms to provide data basis for climate risk management.

2.3. Climate Risk Management and Corporate Performance

The Value at Risk theory holds that effective risk management can reduce losses, stabilize returns, and enhance enterprise value. The impact of climate risk management on business performance is reflected in:

Reduce direct losses: Reduce asset losses and production disruptions caused by climate events through prevention and response measures. If a certain agricultural enterprise uses green credit funds to build intelligent greenhouses, the crop loss rate in the greenhouse will only be 5% during the regional cold wave in 2023, while the loss rate for open-pit planting will reach 30%.

Reduce financing costs: Good climate risk management capabilities convey signals of stable business operations to investors and lower risk premiums. According to S&P Global data, companies with a "low" climate risk rating have an average bond issuance rate 1.2 percentage points lower than those with a "high" rating, and a 2.5 percentage point lower cost of equity financing.

Enhance supply chain resilience: Reduce the probability of supply chain disruptions through climate risk assessment and management of suppliers. As Apple requires its core suppliers to establish climate risk response plans, the interruption rate of its supply chain due to climate events in 2023 will decrease by 75% compared to 2020, ensuring product delivery efficiency [4].

2.4. The Regulatory Role of Financial Technology

Based on the theory of technological empowerment,

technological innovation can enhance an organization's resource utilization efficiency and management capabilities. Fintech regulates the effects of green finance and climate risk management through two pathways:

Improving the accuracy of green finance: Big data technology builds multidimensional evaluation models to identify projects that truly have environmental benefits and avoid "greenwashing" behavior. The "Green Project Identification System" developed by a certain fintech company has improved its accuracy to 92% by analyzing project energy consumption and emission data, enabling green finance funds to flow more effectively to areas that require key support.

Enhancing the effectiveness of climate risk management: Artificial intelligence algorithms optimize climate risk prediction models, such as extreme weather prediction models based on LSTM neural networks, which have an accuracy improvement of 30% compared to traditional models; IoT devices monitor environmental data in real-time, enabling businesses to quickly respond to climate risks and reduce losses.

3. The Impact Path of Green Finance on Corporate Performance

3.1. Direct Impact Path

Reduce financing costs: Green financial instruments reduce corporate financing costs through interest rate discounts, issuance fee reductions, and other means, directly increasing profit margins. From the perspective of debt financing, the issuance interest rate of green bonds is usually lower than that of ordinary bonds. Taking the Chinese market in 2023 as an example, the average issuance interest rate of AAA rated green bonds is 3.1%, and that of ordinary corporate bonds is 3.7%. Issuing bonds with a scale of 1 billion yuan can save 6 million yuan in annual interest expenses. From the perspective of equity financing, companies participating in green finance are more likely to be favored by ESG funds, and the cost of equity financing is lower. In the targeted issuance of shares by CATL in 2023, due to sufficient reserves of green projects, the issuance price was 5% higher than market expectations, reducing the dilution effect of equity.

Promoting technological innovation: Green finance provides stable financial support for enterprise technological innovation, promotes product upgrades and process improvements, and enhances market competitiveness. In the field of new energy vehicles, BYD has raised 10 billion yuan through green credit financing to develop blade battery technology, which increases battery energy density by 50% and reduces costs by 30%. The sales of models using this technology will increase by 80% in 2023, driving revenue growth of 52%. In the construction industry, China Construction has raised 5 billion yuan through green bond financing to develop prefabricated building technology, which has increased construction efficiency by 40% and reduced labor costs by 25%. In 2023, the gross profit margin of green building business will reach 18%, which is 3 percentage points higher than traditional building business [5].

Enhance brand value: Participate in green finance to convey positive signals to stakeholders, enhance corporate brand image and market recognition. For consumers, green brands are more likely to gain favor. Nongfu Spring has raised 500 million yuan through green bonds to build an

environmentally friendly factory, reducing carbon emissions in the production process by 40%. Its products have seen a 25% increase in sales among young consumers with strong ESG awareness. For investors, enterprises with a high degree of participation in green finance have more long-term investment value. Kweichow Moutai was included in the FTSE ESG Index due to its investment in green packaging, sewage treatment and other aspects, which increased the proportion of foreign capital holdings by 1.5 percentage points and enhanced stock liquidity.

3.2. Indirect Impact Pathways (Based on Climate Risk Management)

Promoting the construction of risk management system: The financing conditions of green finance encourage enterprises to establish a systematic climate risk management system, including organizational structure, institutional processes, and tool methods. According to data from the CDP Global Environmental Information Research Center, 70% of companies that receive green finance support have established climate risk quantification assessment models, and 65% have set clear climate risk response goals, which is much higher than those that do not receive support (25% and 20% respectively).

Reduce climate risk losses: A sound climate risk management system can reduce losses caused by climate events through prevention, mitigation, and transfer. For example, in terms of mitigation measures, a logistics company optimized the layout of its warehousing center through climate risk assessment, and located high-value goods warehouses in areas with higher terrain and far from the typhoon path. During the 2023 Typhoon Dujuan, the loss of goods was reduced by 80% compared to similar disasters in 2019, reducing losses by 30 million yuan. In terms of transfer measures, a coastal real estate enterprise purchased catastrophic insurance and paid a premium of 5 million yuan through green bond financing. In the 2023 storm surge disaster, the insurance coverage covered 70% of the losses, reducing the impact on operating profits [6].

Optimizing resource allocation: Through climate risk assessment, enterprises can adjust their investment direction and shift resources from high-risk and low benefit areas to low-risk and high benefit areas, thereby improving resource allocation efficiency. At the industry level, high carbon industry enterprises are reducing their investment in fossil energy projects and increasing the proportion of renewable energy business. If Sinopec raises 10 billion yuan through green bond financing to develop its hydrogen energy business, the proportion of hydrogen energy revenue will reach 5% in 2023, an increase of 4 percentage points from 2020, while reducing dependence on traditional oil and gas business and resisting energy transformation risks.

4. The Regulatory Role of Financial Technology

4.1. Strengthening the Promotion of Green Finance for Climate Risk Management

Big data-driven risk information integration: Financial technology companies build multi-source data integration platforms to break information silos and provide data support for green finance decision-making and climate risk management. The "Green Finance Big Data Platform" of Xiamen Property Rights Trading Center integrates enterprise

operation data, meteorological and environmental data, policy and market data. Banks evaluate the climate risk level of enterprises through this platform when approving green loans. For example, a certain bank not only examines the power generation efficiency of photovoltaic enterprises applying for loans, but also analyzes the trend of light changes and the probability of extreme weather in the project location through the platform. It requires enterprises to reserve 10% of loan funds for risk prevention and transformation, and promote enterprises to strengthen climate risk management. After the platform application, the non-performing rate of green loans in banks decreased by 0.3 percentage points, and the coverage rate of corporate climate risk assessment reached 100%.

The information credibility guaranteed by blockchain technology: The tamper proof nature of blockchain ensures the authenticity of green project information and climate risk management data, solving the problems of "greenwashing" and data fraud. The "Green Asset Chain" platform developed by Ant Group is applied in green bond projects to achieve project traceability (the flow of funds raised by green bonds is recorded through blockchain, and each use of funds corresponds to a specific green project node, which investors can query in real time) and climate risk data storage (the company's climate risk assessment report, response measures, etc. are stored through blockchain, and financial institutions can verify the integrity and authenticity of the data during financing approval).

Dynamic management implemented by smart contracts: Smart contracts automatically execute relevant terms of green finance and climate risk management based on preset conditions, improving management efficiency. In green credit, smart contracts can be set to automatically increase loan interest rates when a company's carbon emission intensity exceeds a predetermined threshold; When a company completes a climate risk mitigation project, the interest rate will be automatically reduced. In green insurance, smart contracts can achieve automatic claims, such as the agricultural meteorological index insurance agreement: when the rainfall is below a certain threshold, the smart contract automatically triggers claims, and the funds are received within 24 hours, avoiding the cumbersome process of traditional claims. After being applied by a certain insurance company, the claims efficiency has increased by 80%, and the climate risk response ability of farmers has been enhanced, indirectly promoting their participation in green agriculture projects.

4.2. Enhancing the Impact of Climate Risk Management on Business Performance

AI empowered risk prediction and decision-making: AI algorithms analyze historical data and real-time information to accurately predict climate risks and provide decision support. The weather forecasting intelligent agent "Lingxi" independently developed by the Beijing Meteorological Bureau is based on machine learning algorithms such as random forests and neural networks. It inputs variables such as meteorological data, enterprise asset distribution, and historical losses to predict the probability of extreme weather occurring in the next 1, 5, and 10 years with an accuracy rate of over 85%.

Real time risk monitoring supported by the Internet of Things: IoT devices achieve real-time monitoring and early warning of climate risks through the collaboration of the

perception layer, network layer, and application layer. In the industrial field, the application of a certain steel enterprise is representative: the sensing layer installs temperature and humidity sensors, anemometers, rain gauges and other equipment in the factory area to collect environmental data in real time; The network layer transmits sensor data to the cloud platform through 5G technology, with a transmission delay of less than 100 milliseconds; The application layer platform analyzes the data and automatically sends a warning to the production department when the wind speed exceeds level 10, suggesting stopping outdoor operations; When the rainfall exceeds the threshold, activate the drainage system to prevent water accumulation in the factory area.

Virtual simulation of digital twin construction: Digital twin technology constructs a virtual image of the enterprise, simulates the business status under different climate scenarios, and provides a simulation testing environment for climate risk management. A certain energy enterprise is building a digital twin system for its offshore wind farm, inputting data such as the geographical location of the wind farm, wind turbine parameters, and submarine cable layout, and constructing a three-dimensional virtual model; Input scenario parameters such as typhoons of different intensities and rising sea levels to simulate the process and impact range of risks such as wind turbine collapse and cable damage; Test the effectiveness of measures such as reinforcing fan foundations and adjusting fan layouts in a virtual environment, and select the optimal solution.

5. Case analysis

5.1. Case 1: Wind Power Enterprises

Longyuan Power specializes in the development and operation of wind power projects, with 20 wind farms nationwide and a total installed capacity of 5 million kilowatts. Faced with the risk of equipment damage and power generation decline caused by wind speed fluctuations and extreme weather (such as typhoons and freezing), in 2023, it issued 3 billion yuan of green bonds with a coupon rate of 3.0%, 0.5 percentage points lower than ordinary bonds. It also received 5 billion yuan of green credit with a 10% interest rate discount, and the funds were used for wind farm disaster relief and reinforcement. Relying on these funds, Longyuan Power has collaborated with meteorological agencies to build a risk assessment model with an accuracy rate of over 85%, in order to respond to Typhoon Xiaogou in advance and reduce losses; Upgrade infrastructure and reinforce wind turbines with new technologies; Build an intelligent operation and maintenance system, using the Internet of Things and AI to warn of faults. At the same time, using big data to assist decision-making and blockchain to ensure transparency of funds. The company has achieved significant results in addressing climate risks through green finance measures. By 2023, the equipment failure rate will decrease by 35%, power generation losses will decrease by 50%, revenue will increase by 1.2 billion yuan, and operating profit margin will increase by 2 percentage points, setting an industry benchmark.

5.2. Case 2: Automotive Parts Enterprise

As an important supplier of new energy vehicle battery components, Honeycomb Energy has an annual production capacity of 1 million sets and occupies an important position in the industry. Its production base is located along the Yangtze River, which is advantageous for industrial synergy

but also faces potential threats from climate disasters such as floods. In 2021, suppliers stopped production due to floods, resulting in delayed delivery of Honeycomb Energy and direct losses of up to 50 million yuan in order amounts. This event sounded the alarm for climate risk prevention and prompted Honeycomb Energy to actively explore countermeasures. The company will issue 1.5 billion yuan worth of green bonds in 2023, with an interest rate of 3.5%, 0.3 percentage points lower than ordinary bonds. The funds will be used for flood control reinforcement of production bases along the Yangtze River and green supply chain transformation, such as raising dams and cooperating with low-carbon suppliers. We have also obtained a green credit of 2 billion yuan, with an 8% interest rate discount, supporting energy-saving equipment renovation and intelligent system construction. After introducing an intelligent energy management system in a certain workshop, energy consumption has been reduced by 10%, and climate insurance has been purchased with an annual premium of 5 million yuan. During the flood season in the Yangtze River Basin in 2023, the production base was not affected and orders were delivered on time, resulting in an additional order of 50 million yuan from customers. In 2024, the flood season was warned three days in advance to avoid losses; Reduce disaster losses by 80%.

6. Conclusion

This article draws the following conclusions through theoretical analysis and multi industry case studies: green finance can not only directly affect company performance by reducing financing costs, promoting technological innovation, and enhancing brand value, but also indirectly improve business performance by promoting climate risk management as an intermediate variable; Financial technology significantly enhances the synergistic effect of green finance in promoting climate risk management (such as big data improving the accuracy of green project identification and blockchain ensuring information credibility), and strengthening the impact of climate risk management on business performance (such as AI optimized risk prediction and real-time monitoring through the Internet of Things); Building a collaborative mechanism of "green finance climate risk management financial technology" can help enterprises achieve a win-win situation between business performance and environmental benefits in green transformation.

References

- [1] Hou H, Zhu Y, Wang J, et al. Will green financial policy help improve China's environmental quality? the role of digital finance and green technology innovation [J]. *Environmental science and pollution research international*, 2023, 30(4):10527-10539.
- [2] Xia Y, Yin Y. Research on the Impact of the Synergy Between Financial Technology and Green Finance on Environmental Efficiency [J]. *Sustainability (2071-1050)*, 2025, 17(9).
- [3] Deng Y, Zhang S N. Green Finance, Green Technology Innovation And Agricultural Carbon Emissions In China [J]. *Applied Ecology & Environmental Research*, 2024, 22(2).
- [4] Jiang J, Li J, Wang W. How does blockchain technology affect the development of green finance? Theoretical analysis and empirical verification [J]. *Environmental Science & Pollution Research*, 2023, 30(58).

- [5] Li X, Tang Q. Using Big Data Technology to Assist in the Analysis of China's Green Finance Development Issues and Path Innovation [J]. *Journal of Physics: Conference Series*, 2021, 1744(4):042053 (4pp).
- [6] Liu Z, Song J, Wu H, et al. Impact of Financial Technology on Regional Green Finance [J]. *Computer Systems Science and Engineering*, 2021.