The Influence of Climate Transition Risks on the Equity Markets

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Abstract. This paper examines how the climate transition risk affects the performance of stock markets. The assessment of climate transition risk for firms is conducted using the Wind ESG score, while the stock market performance is evaluated by comparing the annual excess return of each company's stock against the Shanghai Composite Index. Among the listed firms in China, there appears to be a weak linkage between the risk associated with climate transition and the performance of their stock prices. In contrast, within the energy industry, a stronger connection is observed between climate transition risks faced by companies and their stock market performance. This reveals that the risks associated with corporate climate transition significantly influence stock market outcomes, especially in sectors that are notably impacted by climate changes. This suggests that companies should actively embrace climate transition, which is not only beneficial to human welfare but also promotes the company's own operations and stock price performance.

Keywords: Transition Risk, China Stock Market, Return

1 Introduction

Recently, there has been a notable rise in the occurrence of severe weather phenomena globally due to the ongoing warming of the planet, leading to circumstances such as intense droughts, heavy rainfall events, and unusually high and low temperatures. The ecological environment on which human survival depends is facing a huge threat. Addressing the challenges posed by climate change has emerged as a critical concern for society during the 21st century. China is a country with complex climate conditions, fragile ecological environment, frequent natural disasters, and is susceptible to the adverse effects of climate change. While climate change and its related risks have a wide impact on the natural ecology, people's health, and economic development, they also bring great challenges to the participants in the financial market. Therefore, China must actively participate in climate transformation, but the risks associated with climate transformation are an important issue worth studying.In particular, this paper will examine how the risks of climate transformation affect the stock market.

The objective of climate finance is to influence economic activities by means of financial strategies, thus playing a role in addressing climate change. This financial

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approach focuses on addressing climate change by leveraging diverse funding avenues and implementing a range of innovative financial tools to foster global low-carbon advancements and bolster society's resilience against climate impacts. The risks associated with climate finance mainly include physical risks and transition risks. These two types of risks are usually interrelated and are mutually influential. As global climate change intensifies and countries commit to achieving carbon neutrality goals, the impact of these risks on financial stability is becoming increasingly prominent. The primary focus of research is on transition risks, which refer to the economic or financial risks brought by changes in climate policies, market sentiment, and consumer preferences that influence the valuation of businesses and assets. Transition risks may also include stricter emission reduction policies introduced by government to combat climate change, such as the introduction of carbon emission trading mechanisms, increased carbon taxes, or more binding restrictive policies, as well as the impact of the development of clean technologies on alternative technologies and industries. The theoretical and practical significance of climate finance is mainly reflected in solving investment and financing issues related to global climate crisis response, reducing greenhouse gas emissions, and mitigating the negative impact of human activities on the global ecosystem.

As an example, during the general debate at the 75th United Nations General Assembly on September 22, 2020, President Xi declared, "China intends to enhance its Intended Nationally Determined Contributions, implement more vigorous policies and measures, aim to reach the peak of carbon dioxide emissions before 2030, and endeavor to achieve carbon neutrality by 2060." This marked the first time China proposed a carbon neutrality goal on the international stage. On December 12, 2020, the president Xi further detailed the targets for carbon emission intensity, reduction scale, and the share of non-fossil energy by 2030 at the "Climate Ambition Summit". In fact, since 2009, China has made carbon emission reduction commitments to the international community and has so far exceeded its targets. On the other hand, climate finance has become an integral part of green finance by guiding and promoting more funds to be invested in areas addressing climate change. For example, Pudong New Area actively responds to the national call for green development, comprehensively advancing the systematic construction of climate investment and financing systems. This is not only an important means to achieve the country's INDC targets and low-carbon development goals but also a crucial pathway to promote high-quality economic and social development. Moreover, the effects of climate change on the stability of financial systems have become a significant area of focus. The uncertainty of climate change triggers issues of asset mispricing, which need to be addressed by strengthening climate information disclosure and supporting market entities in improving pricing decisions.

This article is related to the following two branches of literature:

1.1 Measurement of Climate Transition Risk

Climate transition risks cannot be observed and need to be carefully measured. Wang Bo and Song Yufeng (2020)[1] used the green support factor representing green fi-

nancial policy and the carbon tax representing green fiscal policy to represent climate transition risk. Chen Guojin et al. (2023)[2] used carbon tax policy and green re-lending policy to measure climate transition risk. Zhang Dayong et al. (2023)[3], Guo Kun et al. (2023) [3]used carbon emission intensity to measure the transformation risk of a city in that year. Yang Zihui et al. (2024) [4]used the Wind ESG score to measure climate transition risk, the higher the ESG score, the lower the corporate transition risk. Nobel laureate in Economics Engle and his co-authors pointed out in their 2020 paper that climate change mainly attracts media attention when there is reason for concern, based on which they constructed the Wall Street Journal climate change news index, linking the increase in climate change news reports to the rise in climate risk (Engle et al., 2020)[5]. According to the assumption of Engle et al. (2020)[5], an increase in climate-related concerns leads individuals to focus more on keywords associated with climate change, thus allowing the level of attention to these themes to serve as an indicator of climate risk. When the keywords pertain to tangible risks, one can derive a variable that serves as an indicator for physical risks, a variable that serves as a proxy for transition risk may be derived when the theme words pertain to transition risk. Faccini et al. (2023)[6] conducted text analysis on climate change news and constructed new proxy variables for climate physical risk and transition risk. Specifically, one variable was connected to the subject of natural disasters and the issue of global warming, illustrating climate-related hazards, while another was tied to aspects associated with the U.S. policies regarding climate change and global conferences signify risks associated with transition. Bua et al. (2024)[7] followed the research of Engle et al. (2020)[5], assuming that as climate risk rises, news reports on climate change will increase. They also used natural language processing technology and machine learning methods to construct climate physical risk indicators and transition risk indicators, among which the keywords related to transition risk indicators include 'hydrofluorocarbon' (HFC), 'bioenergy', 'greenhouse gas' (GHG), etc. Bolton and Kacperczyk (2023)[8] used the logarithm of the three methods of carbon emission volume and the growth rate of carbon emissions to measure carbon transition risk. The first method is the carbon emissions produced by the company's directly controlled equipment. The second method encompasses the carbon footprint arising from the company's utilization of externally sourced electricity, heating, steam, and various energy types. The third approach pertains to the carbon emissions resulting from various activities associated with the company's operations and products. This includes the procurement of materials, the usage of products, the disposal of waste, and activities that are outsourced.

1.2 Influence of Climate Transition Risk on Stock Market

Climate transition risk also has a significant influence on the stock market. Du Jian et al. (2023)[9] use text analysis and machine learning techniques to construct climate risk indicators to study the impact of climate risk on the cost of equity capital. An empirical analysis of a sample of 3,215 Chinese A-share listed companies from 2007 to 2020 showed that climate risk leads to an increase in the cost of corporate equity capital, and this result still holds under a series of robustness tests. Reducing the de-

gree of information asymmetry, attracting institutional investors, diversifying operations, and using derivative financial instruments can alleviate the negative impact of climate risk on the cost of equity capital. Further research found that transition risk is significantly positively correlated with the cost of equity capital, while the impact of physical risk on the cost of equity capital is not significant. The relationship between climate risk and the cost of equity capital differs significantly between high-carbon and low-carbon enterprises. Zhu and Wang (2023)[10] deeply analyzed the impact mechanism of climate risk on the energy industry stock market, and they constructed climate risk information data based on Baidu search index. They used a deep learning model for energy industry stock market forecasting based on Convolutional Neural Networks and Long Short-Term Memory Networks. They selected industry indices of the electric power equipment and new energy industry, petroleum and petrochemical industry, and coal industry as the prediction objects. Using the historical information data of Baidu search index and industry index from September 1, 2011, to August 31, 2022, for climate risk keywords, they tested the effectiveness of different types of climate risk information data in predicting energy industry indices. The empirical results found that introducing climate risk information into the industry index forecasting model can effectively improve the accuracy of index forecasting. Climate physical risk and climate transition risk have different impacts on different energy industries and can improve the accuracy of forecasting. Dessaint and Matray (2017)[11] showed that managers' concerns about future hurricane attacks increase the company's cash holdings and disclose the risks of hurricane attacks that the company may face. As a result, the potential risks before the hurricane landing and the risk realization after landing both have a negative influence on the company's market value, but this impact is only significant in the short term. Hong et al. (2019)[12] rank 31 countries globally based on the Palmer Drought Severity Index (PDSI) and found through the performance of the food industry in these countries that the profit margins and stock returns of the food industry in countries with high drought risk are lower, which also indicates that stock prices are insufficiently responsive to drought risk. Bolton and Kacperczyk (2021)[13] and Hsu et al. (2023)[14] find that carbon emissions are positively correlated with stock returns, that is, there is a carbon emission risk premium, which means that companies with higher carbon emissions need to provide higher stock returns as compensation for carbon risk. Reboredo and Ugolini (2022)[15] investigate the impact of climate transition risk on the financial outcomes and pricing dynamics of publicly traded firms in Europe and the United States. By evaluating the carbon risk score (CRS) of individual companies to determine their susceptibility to the transition to a low-carbon economy, the research revealed that firms with minimal transition risk generally exhibit superior financial outcomes, with European entities displaying a heightened sensitivity to transition risks compared to their American counterparts. The research indicated that shares with minimal exposure to transition risks yield greater returns for investors, aligning with the observation that stock prices of companies may not wholly account for potential risks associated with climate transitions. After COP21, the relative financial performance of weak companies and the insufficient response to transition risk have declined. Hsu et al. (2023)[14] believe that from the perspective of transition risk, the higher the level of

corporate carbon emissions, the greater the impact of climate policy, such as the higher transition risk of carbon-intensive enterprises. Because policies to alleviate climate issues often adopt measures such as carbon taxes, carbon emission rights trading, and pollution restrictions, which will have a negative impact on the future cash flow of carbon-intensive enterprises, coupled with the impact of new energy technology, leading to a negative correlation between carbon emissions and corporate value.

2 Data Analysis

Referring to Yang Zihui et al. (2024)[4], this paper uses the Wind ESG score to measure corporate climate transition risk. I first calculate the average ESG score of each company at the industry level to obtain the climate transition risk of each industry. Figure 1 shows the industry ESG scores calculated by us, from which we can see Finance, Public Utilities and Technology Services have relatively high ESG score, which corresponds to low climate transition risk. However, Daily Consumption and Real Estate have low ESG score, which corresponds to high climate transition risk.

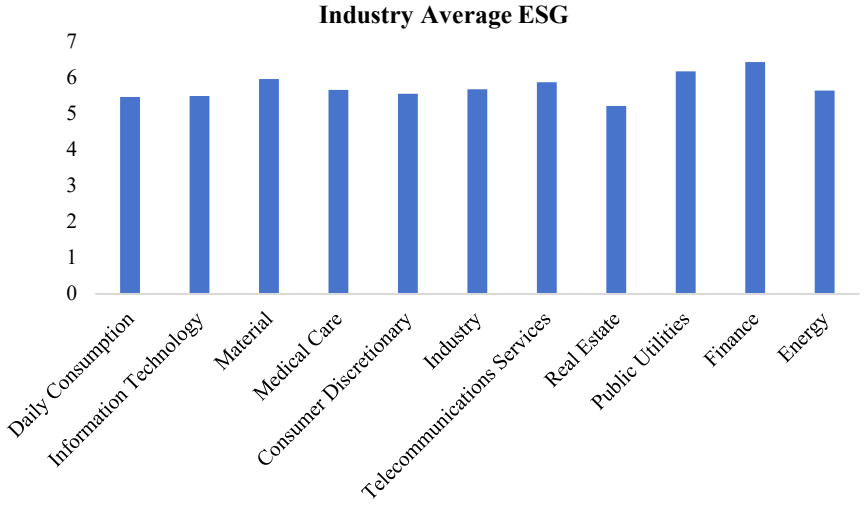

Fig. 1. Industrial ESG Score.

If we look at each company specifically, the relationship between ESG scores and stock performance indicates the impact of corporate climate transition risk on their operations. Figure 2 illustrates the relationship between the ESG scores of each A-share listed company in China and the excess return of its stock price over the Shanghai Composite Index in the past year, showing a weak positive correlation. This is partly because there are many factors affecting stock prices, and ESG scores only capture a very small aspect of them. Also, it may be because climate transition risks

have not had a significant impact on the operations of Chinese companies, and therefore are not reflected in stock prices.

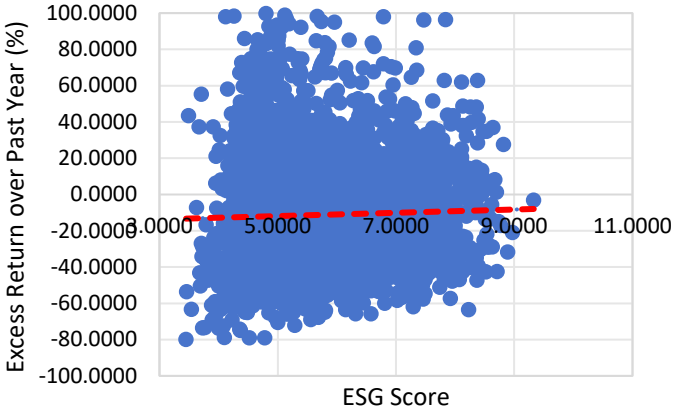

Fig. 2. China Listed Companies' ESG Score v.s. Excess Return.

However, when it comes to the energy industry, which is the sector most affected by climate transition risks, its stock prices are also more influenced by the transition to energy. Figure 3 demonstrates the relationship between the ESG scores of companies in the energy industry and their stock excess returns. It is evident that there is a more pronounced positive correlation between ESG and excess returns in the energy industry. This also indicates that the risk of energy transition does indeed impact business operations, especially in industries that are more significantly affected by transition risks.

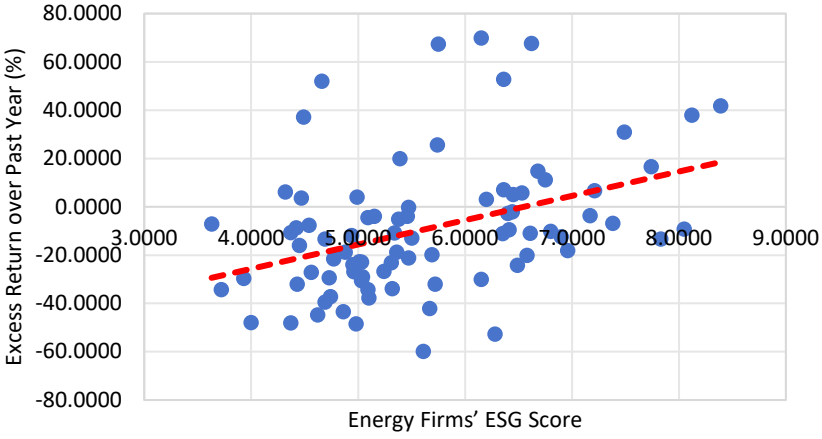

Fig. 3. China Listed Energy Companies' ESG Score v.s. Excess Return.

3 Conclusion

This article explores the relationship between corporate climate transition risk and stock performance. First, by reviewing the literature, I summary the main methods of measuring corporate climate transition and the research on climate transition and stock performance. Based on existing research, I use the Wind ESG score as a measure of corporate climate transition risk and finds that, overall, the financial industry has the lowest climate transition risk, while the real estate industry has a higher climate transition risk. If consider the ESG scores of enterprises and the excess returns of enterprises over the past year relative to the Shanghai Composite Index, there is a weak correlation between these two variables. This may because the performance of enterprise stock prices is more determined by the company's operational performance, which has a smaller correlation with the ESG score. However, considering the energy industry, which has been directly affected by climate transition, there is a significant positive correlation between its stock performance and ESG scores, indicating that climate transition risk can affect stock performance, especially in industries that are more impacted by climate transition.

Climate change is a common challenge for all of humanity, but the climate transition risk contained in the process of addressing climate issues has a direct impact on corporate management. This impact is mainly concentrated in the energy and environmental protection industries. For companies in these industries, it is necessary to actively embrace climate transition and take on the social responsibility of climate transition. This is not only of great significance for the well-being of all humanity but is also directly related to the company's operational status and stock performance.

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