

Can Green Finance Policies Have Impact on Brown Sector Stocks?

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Abstract. In recent years, in response to climate change, China has introduced a series of green finance policies to support the low-carbon transformation of the economy, which may have a negative impact on the brown industry while promoting the development of green industries. This article uses the event study methodology to study the impact of the introduction of three typical green finance policies on the returns of brown industry stocks. The results show that there is consistency in the effects of different types of policies on brown industry stock returns. Overall, Green finance policy has a strong negative impact on the stock returns of brown enterprises in the short term, but has a significant positive impact on those enterprises with good financial performance in the long term.

Keywords: green finance, brown sector, event study, CAR.

1. Introduction

In recent years, with the vigorous implementation of sustainable development, in order to alleviate the fossil energy crisis, avoid the aggravation of environmental pollution, and actively respond to a series of negative impacts on human society by climate change, all countries have made corresponding commitments to carbon neutrality, vigorously developed new energy industries, and promoted such as the development of climate investment and financing, Carry out a number of relevant policies such as carbon emission trading. These policies provide favorable conditions for the development of low-carbon industries, but have a negative impact on traditional high-pollution and energy-consuming industries. For example, the new energy industry has more favorable financing conditions than the traditional fossil energy industry, and can obtain loans at a faster speed and relatively more relaxed audit conditions. Traditional fossil energy enterprises not only face a series of financing constraints, but also increase the cost of carbon emissions, which undoubtedly has a great impact on such enterprises. In the financial market, it will reduce people's expectations for the future return of their stocks, thus reducing the liquidity of stocks. And it indirectly has a negative impact on the issuance of the primary market, which further makes it more difficult to obtain funds.

In order to quantitatively characterize the impact of low-carbon transformation policies on the stocks of traditional high-pollution and high-energy-consuming industry companies, this article will use the event study methodology to study the impact intensity and duration of relevant policies on the return and liquidity of such stocks by building a market pricing model and t-test, which is the risk of investors. It provides a reference for the construction of management and asset portfolios, and also provides a basis for estimating the impact of similar policies on the market.

2. Literature review

Guo et al [1] (2020) using the event study methodology and heterogeneity analysis, it is found that the announcement of the new environmental policy has damaged the stock returns of heavily polluting enterprises in the short term. At the same time, stricter environmental regulatory policies will lead to more adverse market reactions. Investors' attention to environmental issues plays a crucial role in predicting the stock market response. The higher the attention, the lower the stock return of heavily polluting enterprises. Ren et al [2] (2023) using the time-varying Granger test, it is found that in the overflow of market fluctuations, climate policy uncertainty (CPU) tends to act as a risk recipient

rather than a sender. When encountering extreme climate events or major climate policy changes, the causal relationship between climate policy uncertainty and traditional energy and green energy stock markets will increase significantly. Shao et al [3] (2022) using channel test, it was found that the green credit guidelines increased the risk of stock price crash of heavily polluting enterprises by imposing financial constraints, and through cross-sectional inspection, it was found that the impact of green credit guidelines on the risk of stock price crash was more significant in state-owned enterprises and enterprises with low level of corporate governance and low information transparency. Birindelli et al [4] (2023) using the event study methodology, it was found that the stock market's response to climate policy depends on the strength of its commitment to the transition to a green economy, which confirms that the stock market reacts negatively to strict climate policies and not too strictly regulated. Ramiah et al [5] (2013) using the event study methodology, they studied the impact of the promulgation of 19 different environmental regulatory policies on the Australian stock market, and found that green policies will lead to significantly negative excess returns in the energy industry and will affect systemic risks in the stock market for a long time. Wen et al [6] (2020) using the nonlinear auto-regressive distributed lag (NARDL) model, it is found that there is a significant asymmetric transmission relationship between China's carbon emission trading market and the overall stock market. The impact of the rise of carbon emission trading prices on stock prices is greater than that of its decline. At the industry level, the carbon emission trading price is closely related to the stock market of some energy-intensive industries and financial industries, but neither the overall level of the stock market nor the industry level has a significant impact on the carbon emission trading price. Reboredo and Wen [7] (2015) using a regression model with a GARCH specification and dummy variables, it is found that the price fluctuation of all sub-industry indexes has decreased after the announcement of the energy legislative policy, and economic incentives have a positive policy announcement effect on all sub-industry index prices. Zheng et al [8] (2023) using the annual data of China's heavily polluted listed enterprises from 2008 to 2020, we studied the relationship between the green credit policy and the stock price synchronization of heavily polluting enterprises, and found that the green credit policy has improved the stock price synchronization of heavily polluting enterprises, and surplus management and financialization play an intermediary role in this relationship.

To sum up, studies have begun to pay attention to the impact of the promulgation or implementation of various environmental policies on the stock market. Most of them use the event study methodology, risk overflow analysis, time series models with virtual variables and other methods, and relevant policies will have a heterogeneous impact on the stock market to varying degrees. However, at present, most studies are from the perspective of the stock market as a whole or industry index, and only focusses on the impact on the return of the stock market. Few studies are carried out at the level of individual stocks and the impact on stock liquidity. Therefore, on the basis of the existing research, this article adopts the event study methodology, and studies the impact intensity and duration of relevant policies on the return and liquidity of such stocks by building a market pricing model and t-test, which provides a reference for investors' risk management and asset portfolio construction, and also for estimating similar It provides a basis for the impact of the policy on the market.

3. Date and methods

3.1. Data

In order to measure the impact of different green financial policies on the stock return of high-pollution and high-energy-consuming enterprises, this article takes the coal industry as an example. The daily return of 28 Shenwan coal industry stocks is the research object, and the return of HS300 index is taken as the market return. After removing the missing values from all sequences and aligning the data time, the logarithmic can be obtained using formulas (1) and (2):

$$R_{it} = 100 \times \ln\left(\frac{P_{it}}{P_{it-1}}\right) \quad (1)$$

$$R_{mt} = 100 \times \ln\left(\frac{P_{mt}}{P_{mt-1}}\right) \quad (2)$$

Among them, P_{it} is the closing price of stock i at t -moment, and P_{mt} is the closing price of the market index at t -moment.

3.2. Event analysis method

This article uses the event study methodology to discuss the impact of different green financial policies on the stock return in the coal industry. In terms of event selection, this article selects three typical green financial policies with a certain time interval, all of which are policy types that have a large impact and will have a substantial impact on relevant industries.

This article defines the release time of three policies, namely March 6, 2019, February 22, 2021 and June 1, 2022, as event days, that is, time $t = 0$. In order to reflect the impact of the three events on the stock return in different length event windows as much as possible, (t_1, t_2) was selected as $[-5, 5]$, $[-5, 10]$, $[0, 5]$, $[0, 10]$, $[0, 15]$, $[0, 30]$. At the same time, the estimate window of the normal rate of return is set 2 years before the event.

There are three methods for estimating normal return: constant average return model, market model and market adjustment model. The constant average return model assumes that the normal rate of return remains a constant for a period of time; the market model assumes that there is a stable linear relationship between the actual return R_{it} of stock i and the market return R_{mt} on the t trading day; the market adjustment model directly assumes that the normal rate of return of each period of individual stocks is equal to market income. Profit rate. This article adopts the most commonly used market model for event analysis of the stock market.

Using the market model, the normal rate of return of the i stock is estimated through the data of the estimation window as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (3)$$

Among them, R_{it} is the return of the t of the i stock, R_{mt} is the market index, α_i and β_i are the model estimation coefficients, and ε_{it} is the residual item.

The coefficient of model (3) is obtained through the data of the estimation window. Based on the model, the normal return $\bar{R}_{it}$ in the event window is predicted. The excess return AC_{it} is the difference between the actual return R_{it} and the normal return $\bar{R}_{it}$, that is

$$AC_{it} = R_{it} - \bar{R}_{it} \quad (4)$$

The cumulative excess rate of return CAR_{it} is the sum of the excess rate of return in the event window (t_1, t_2) , that is,

$$CAR_i = \sum_{t=t_1}^{t=t_2} AC_{it} \quad (5)$$

By estimating the standard deviation of the average cumulative excess return in the event window (t_1, t_2) , it is possible to construct a t-statistic to test whether the cumulative excess returns are equal to 0. This, in turn, allows for the assessment of whether the release of the three policies has a significant impact on the natural logarithm of stock returns. The specific testing hypotheses are as follows:

H_0 : The cumulative excess returns are equal to 0, implying that the policy releases have no significant impact on stock returns.

H_1 : The cumulative excess returns are not equal to 0, indicating that the policy releases have a significant impact on stock returns.

Following the methodology proposed by Kaketsis and Sarantis [9](2006) for setting the testing statistics, this study ultimately employs the following testing statistic:

$$SCAR_i = \frac{\overline{CAR}_i}{\sqrt{var(\overline{CAR}_i)}} \sim t(V - 1) \quad (6)$$

Among them, $var(\overline{CAR}_i)$ is the standard deviation of the average cumulative excess rate of return within the time period (t_1, t_2) . The calculation formula is as follows:

$$var(\overline{CAR}_i) = \frac{\overline{CAR}(t_1, t_2)}{\sqrt{t_2 - t_1 + 1}} \hat{\sigma}_\eta \quad (7)$$

In this context, $\hat{\sigma}_\eta$ represents the standard deviation of the research sample within the estimation window, and SCAR follows a $t(N - 1)$ distribution, where N denotes the sample size within the estimation window.

4. Empirical results and explanation

Based on the market model, this article examines the impact of different policies on industry stocks. According to the superposition of other events during the policy release period and the difference in policy types, three relevant policies are selected, including:

Policy 1: The Green Industry Guidance Catalogue (2019 Edition) issued by the National Development and Reform Commission and the Ministry of Industry and Information Technology on March 6, 2019;

Policy2: The Guiding Opinions of the State Council on Accelerating the Establishment and Improvement of the Green and Low-Carbon Cycle Expand the economy System, issued by the State Council on February 22, 2021;

Policy 3: guidelines on Green Finance for Banking and Insurance Industry issued by the China Banking Insurance Regulatory Commission on June 1, 2022.

The "Guidance Catalog for Green Industries (2019 Edition)" drew upon internationally recognized green industry identification criteria, thereby categorizing green industries into six major classifications. This categorization has provided a well-defined boundary for the concept of "green industries." Concurrently, the "State Council's Guidance on Accelerating the Establishment and Improvement of a Green, Low-Carbon, and Circular Development Economic System" has introduced initiatives to foster the development of green credit and green direct financing.

Moreover, it has established unified standards for green bonds and green bond rating criteria. This standardization has significantly facilitated the financing endeavors of eligible green industry enterprises. Simultaneously, efforts have been initiated to promote climate investment and financing, involving further enhancements in the trading mechanisms for emission rights, energy rights, water rights, carbon emission rights, and other such tradeable instruments. These measures aim to reduce transaction costs and augment operational efficiency.

However, it's important to note that such developments have placed additional operational costs on brown industries. The "Guidance for Green Finance in the Banking and Insurance Industries" has undertaken the task of refining credit and investment policies. It demonstrates commitment to implementing carbon emission and carbon intensity policy requirements while avoiding a one-size-fits-all approach in carbon reduction efforts.

These collective efforts are directed towards the gradual reduction of carbon intensity in asset portfolios. The ultimate goal is to achieve carbon neutrality within asset portfolios, thereby aligning with the broader objectives of building a robust, sustainable, and environmentally conscious economic system.

Table 1. The proportion of stocks significantly affected

event window policy	[-5,5]	[-5,10]	[0,5]	[0,10]	[0,15]	[0,30]
POLICY 1	0%	0%	0%	0%	0%	0%
POLICY 2	15.79%	18.42%	2.63%	2.63%	7.89%	2.63%
POLICY 3	26.32%	7.89%	2.63%	0%	0%	0%

As shown in Table 1, the proportion of stocks that generate abnormal returns for the three policies during different event windows is calculated. It can be seen that, because policy 1 only gives the green industry guidance catalogue, the policy is divided into six categories from the macro level, and does not give substantive policies, so the impact of the policy on each stock is not significant. Policy 2 is the first time that China has made a top-level design and overall deployment from a global perspective to establish and improve a green, low-carbon and circular development economic system. To make systematic arrangements to achieve carbon peak before 2030, it is clear that increasing green performance assessment has a substantial impact on the development of related industries. Therefore, the impact of policy 2 on industry stocks is relatively large, and the continuous event is long; Policy 3 requires bancassurance institutions to urge customers to strengthen environmental, social and governance risk management by improving contract terms, and encourages bancassurance institutions to improve green finance management. The adoption of differentiated and convenient management measures has had a greater impact on financial institutions, but the impact on the relevant entity industries is relatively indirect, so the impact of the policy only stays in the short window period of the policy release.

Further examine the abnormal returns caused by the latter two policies in different window periods, and draw box plots, as shown in Figure 1 and Figure 2. It can be seen that the introduction of policy 2 and policy 3 has a significant impact on the stocks of coal listed companies. The cumulative abnormal return is basically distributed in the range of greater than 0, that is, the relevant policies of green finance have not had a cumulative negative impact on the stocks of these companies during the window period, but have a positive pulling effect.

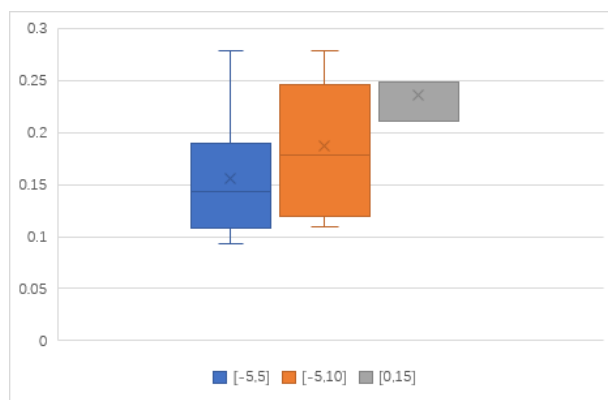


Figure 1. Distribution of the CAR
for Policy 2

(Note: Only one stock is significantly not listed in the figure)

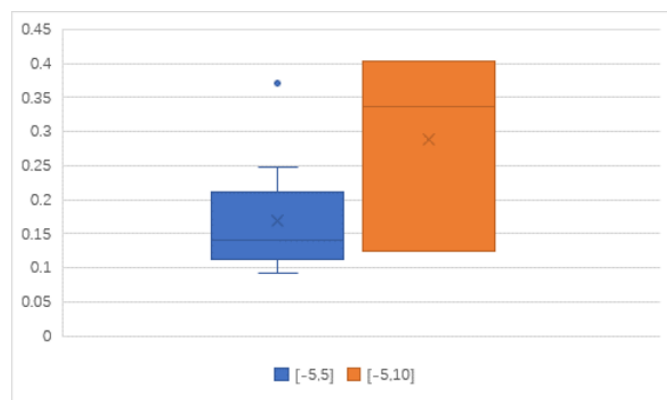


Figure 2. Distribution of the CAR
for Policy 3

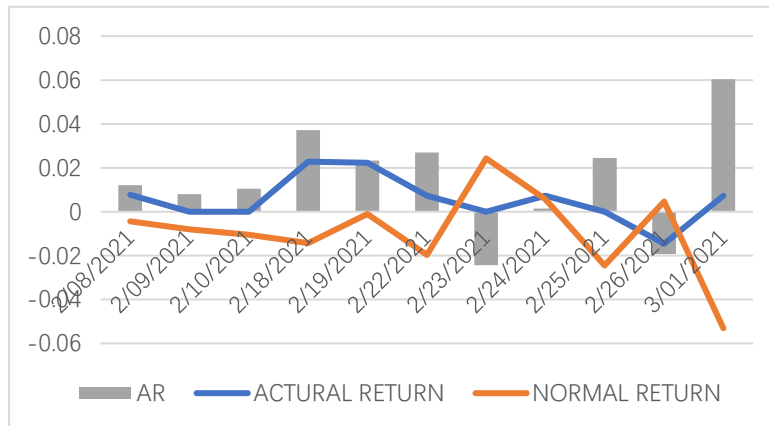


Figure 3. CAR of 600157.SH

From the perspective of the volatility of the excess return rate of specific stocks, the stock 600157.SH in the [-5,5] window of policy 2, for example, is shown in Figure 3, and policy 2 has a positive excess return rate on the whole for the stock. However, it can be found that on the second day of the policy release, that is, on February 23, 2021, the actual return of the stock was significantly lower than its normal, resulting in a negative abnormal return, that is, the introduction of policy 2 still had a negative impact on the stock in the short term.

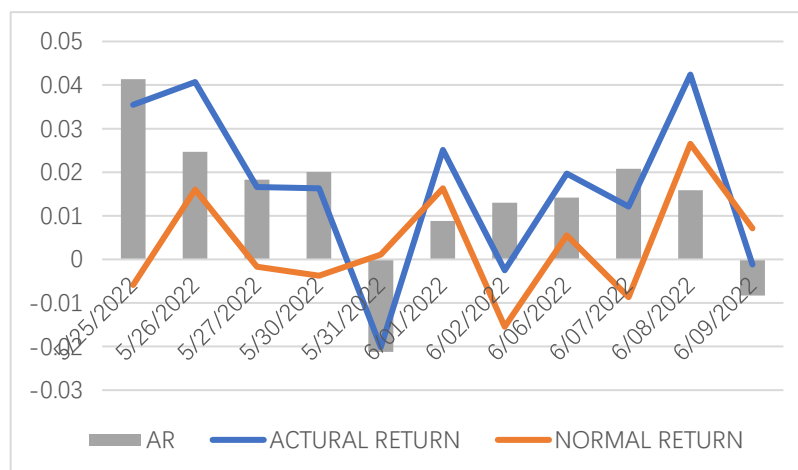


Figure 4. CAR of 000937.SZ

Take 000937.SZ as an example at the [-5,5] window of policy 3, As can be seen from Figure 4, similar to policy 2, policy 3 also has a positive impact on the stock as a whole, and on the day of the policy release, that is, June 1, 2022, the stock was immediately affected by the policy.

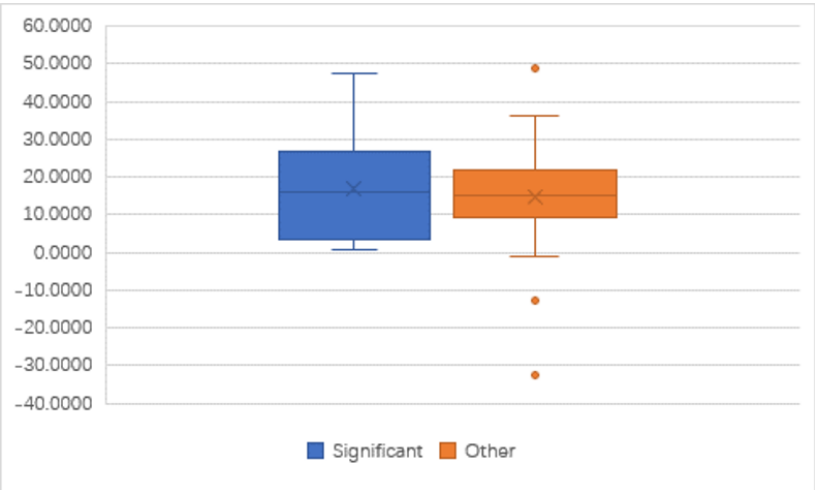


Figure 5. Equity Distribution of Stocks with Significant Impact of Policy 2 Compared to Other Stocks
(Note: Use the ROE of the year the policy is introduced for statistics)

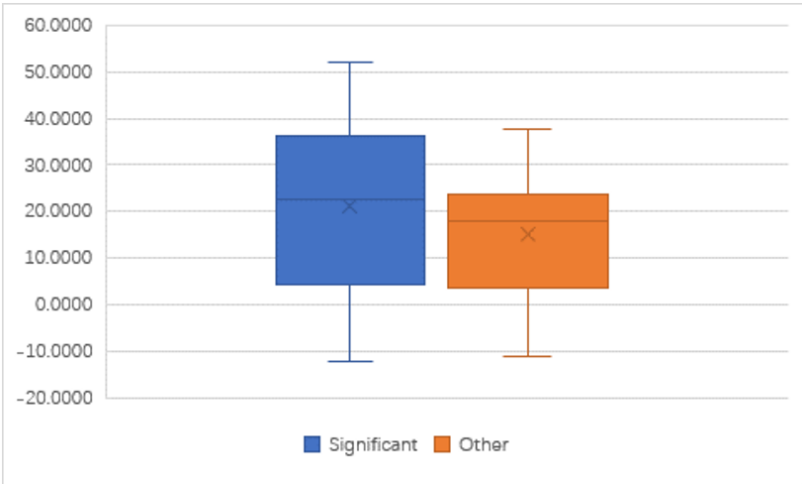


Figure 6. Equity Distribution of Stocks with a Significant Impact of Policy 3 Compared to Other Stocks
(Note: Use the ROE of the year the policy is introduced for statistics)

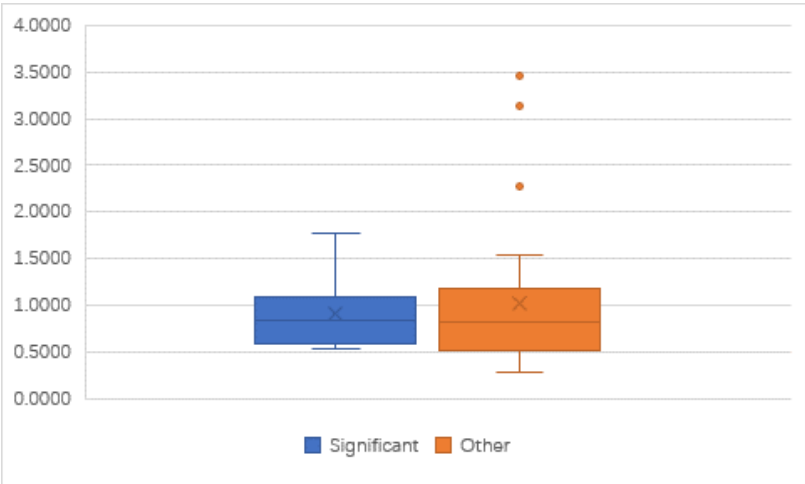


Figure 7. The CR Distribution of Stocks with a Significant Impact of Policy 2 Compared to Other Stocks

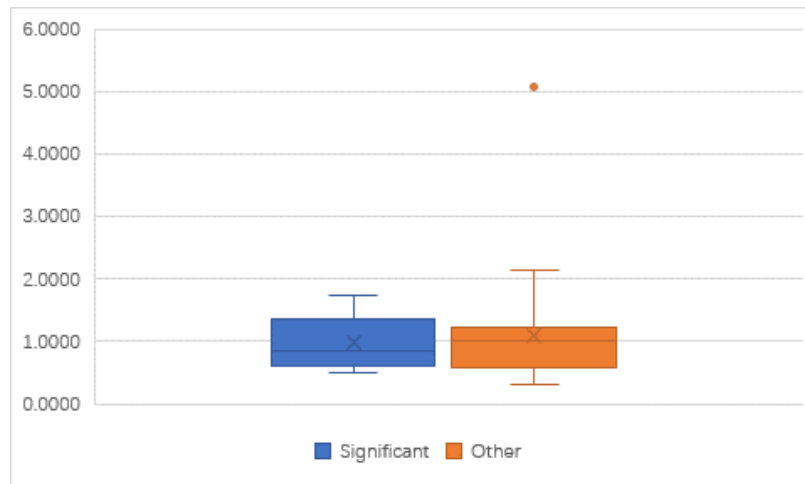


Figure 8. The CR Distribution of Stocks with a Significant Impact of Policy 3 Compared to Other Stocks

In order to examine which types of listed company stocks are susceptible to the impact of relevant green finance policies, this article compares the ROE and CR of stocks significantly affected by policies with those of other stocks (when ROE and CR first appear, Given the full range), as shown in Figure 5-8, it can be found that listed companies significantly affected by the policy have relatively higher ROE and CR, and take relatively good performance, Therefore, when they are impacted by negative policies, they are impacted negatively in a relatively short period of time (1 day), and in the window period, the overall cumulative rate of return is positive, that is, due to the higher quality of listed companies, compared with other companies in the industry, they have more excellent market performance.

5. Summaries and Recommendations

This article uses the event study methodology to study the impact of different types of green finance policies on the stock returns of the coal industry. The study finds that different types of policies have different effects on the stock returns of the coal industry, and the policies with substantive measures have a greater impact on the market than the standard policies. In terms of the impact of policy shocks, in the short term, on the day or day after the policy is issued, green finance related policies have a significant negative impact on the coal enterprises. In the long run, the introduction of policies has a significant positive effect on listed companies with better financial performance and lower capital risk in the industry.

With the proposal of China's double carbon target, the introduction of various green finance policies will have a certain impact on the market. Therefore, relevant institutions need to pay attention to and monitor the impact and impact of various green financial policies on the capital market, and make reasonable financial risk management and asset allocation in a timely manner according to the impact of these policies. Enterprises should pay close attention to low-carbon green transformation, learn from the shortcomings of the transition and learn from the advantages of the success of the transition, and do a good job in the research of the coupling development of coal and new energy resources industry. Jointly promote the construction of wind and solar power generation bases, coal power supporting power sources, new energy storage projects and outgoing power channels, promote the transformation of traditional energy sources to new comprehensive and energy service providers, and actively cooperate with relevant policies to mitigate the impact of green financial policies on themselves.

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