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Article

Extreme Climate Risk and Financial Performance in the Construction Industry: Empirical Evidence from Listed Companies in China

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Abstract: Climate change has led to frequent occurrence of extreme weather events, which seriously affect human life and production in terms of frequency, intensity and duration. It has become one of the important risk factors faced by enterprises, and the construction industry occupies an important position in China's national economy, which is inevitably affected by extreme weather. Therefore, based on the panel data of Chinese A-share construction enterprises from 2010 to 2022, this article studies the impact of extreme climate on corporate financial performance. It is found that the extreme low temperature climate significantly improves the financial performance risk of the construction industry, while the extreme high temperature climate and extreme rainfall climate have no significant impact on the financial performance of the construction industry. This study expands the literature on the impact of extreme weather on the performance of listed companies, encourages enterprises to further recognize the importance of extreme climate, and provides suggestions for corporate managers on how to deal with extreme climate.

Keywords: Extreme Climate; Extreme Climate Risk; Financial Performance; Construction Industry; Listed Companies

1. Introduction

In recent years, due to the impact of global warming, the frequency of extreme weather events such as extreme high temperatures, extreme low temperatures, extreme droughts and extreme precipitation has significantly increased, posing a huge threat to the ecological environment on which humans rely for survival. Since the mid-20th century, the global average surface temperature has increased by about 0.2 ℃ every decade (Kozarcanin et al., 2019) [1]. The global average temperature in 2021 is about 1.11 ℃ higher than the pre industrial level (1850-1900), close to the lower limit of the temperature control target of 1.5 ℃ in the Paris Agreement. In the Global Risk Report released by WEF in 2022, it was pointed out that extreme weather events are a prominent risk that human society must face. In 2021, extreme weather events have occurred in almost all parts of the world, and climate risk will remain the most critical global risk in the next decade. Mitigating, and adapting to global climate change is urgent. In the exploratory Scenario analysis of 135 countries' vulnerability and preparedness to climate change in the next 30 years, S&P Global Ratings found that if we do not take positive measures, global GDP may decline to about 4% by 2050, which will cause economic losses of up to 7.9 trillion US dollars. The Intergovernmental Panel on Climate Change (IPCC) of the United Nations said in its latest scientific assessment of climate change in 2021 that the Climate crisis is worsening, global warming is inevitable, and the probability and severity of extreme weather events have increased. In China, Henan province suffered the heaviest rainfall on record, with daily rainfall exceeding the highest level on record. China's Central Meteorological Observatory issued its first red alert for high temperature: The comprehensive intensity of regional high temperature events from 2022 has reached the strongest since complete meteorological observation records began in 1961. Other countries are also experiencing extreme weather, with the number of hot days in North America continuing, with average daily temperatures in many places exceeding 40 ℃; A third of Pakistan is under water because of floods, which is rare in history!

Research on construction shows that climate change has a huge impact on the construction environment, building materials, energy consumption and other aspects of the construction industry. For example, long-term low temperature weather will lead to delays in earthworks, and floods caused by rainstorm will cause serious damage to large equipment; extreme temperatures may lead to rapid or slow evaporation of water in concrete, resulting in poor pouring quality and even temperature cracks during mass concrete construction. In December 2021, under the influence of continued extreme low temperature weather, Donghai of Jiangsu Province issued a notice to stop construction. In the same year, under the influence of extreme weather, a building collapse accident occurred at a construction site in Shijiazhuang, Hebei Province, resulting in two deaths and four injuries to workers. In July and August 2022, affected by extreme high temperature weather, many provinces in southern China adopted power rationing measures, resulting in a significant decline in the output of construction steel enterprises, and the construction progress of construction enterprises had to be postponed; In the same year, five workers at a construction site in Harbin, Heilongjiang province, were injured when extreme rainfall caused soil to loosen and slide. In 2023, under the influence of extreme rainfall and strong winds, a tower crane collapsed during construction at a construction site in Ningbo, Zhejiang Province, resulting in a serious safety accident. In these aspects, the impact of extreme weather on the construction industry is significant, and theoretically, this will inevitably have an impact on the financial performance of construction companies.

In the current governance of construction companies, extreme weather is rarely included in the financial risk management of enterprises. Most enterprises often do not realize the importance of extreme weather risks or do not understand the impact of extreme weather on their financial performance, thus failing to take corresponding measures in a timely manner. Moreover, in previous and recent studies on corporate financial performance, most of them have mainly studied from the perspectives of digitization, equity incentives, green transformation, etc. There is no literature on the impact of extreme weather on corporate financial performance, and there is even little research on the impact of climate change on corporate financial performance. In view of this, based on the Panel data of A-share construction industry listed companies in China from 2010 to 2022, this article uses the annual extreme weather days as the proxy variable to measure extreme weather, and the total Return on assets as the economic indicator to measure the financial performance of China's construction industry listed companies. Through the selected variables, a fixed effect regression model is established to study the impact of extreme weather on the performance of the construction industry; Promote the sustainable development of the construction industry and enhance the company's enthusiasm for addressing climate change.

2. Theoretical Analysis and Research Hypotheses

Research has shown that weather and temperature can affect people's willingness to take risks. Less sunlight in winter can lead to depression, thereby reducing risk-taking behavior (Kamstra et al., 2003) [2]. On sunny days, individuals are more able to bear risks, while adverse weather can reduce participants' risk-taking behavior (Bassi et al., 2013) [3]; frequent and intense heatwaves, droughts, cold waves, and extreme precipitation expose agricultural activities to climate risks, thereby affecting the risk preferences and risk-taking behavior of farmers and agricultural enterprises. Chang et al. (2017) [4] pointed out that heat exposure increases risk-taking behavior. In the market value management of listed companies, the impact of weather factors has always been a concern in the academic community. Extreme weather makes the business environment more complex and variable. Previous studies have found a negative correlation between cloud cover, temperature, and stock returns. Griffin et al. (2019) [5] found that within one month after the occurrence of extreme temperature events, the average market value of US listed companies decreased by about 0.5%. In research on the Chinese capital market, it has also been found that temperature, humidity, visibility, wind speed, and extreme weather have a significant impact on A-share listed companies.

Due to the unique nature of the construction industry, most workplaces are conducted outdoors, and construction work also involves heavy physical labor and the use of personal protective equipment. The most used protective equipment in the construction industry, such as safety helmets, reflective vests, and hard boots, often increases the heat load on workers and threatens their physical health (Rowlinson et al., 2014) [6], significantly reduces body heat loss and increases heat stress (Grifoni et al., 2021) [7]. Fatima et al. (2023) [8] state that exposure to high temperatures leads to reduced physical capacity, impaired mental alertness, and altered behavior in workers, which impairs work, health and safety, labor productivity, and economic output in occupational Settings. Li et al. (2022) [9] found that in extreme hot weather, the cost of ordinary labor will increase significantly. Outdoor work activities will stop when the temperature exceeds 40 ℃ (Han et al., 2021) [10]. Therefore, when facing extreme high temperature weather, considering the health of employees and other factors, construction companies must slow down the construction progress, making production efficiency reduced. Cai et al. (2018) [11] also demonstrated an inverse U-shaped relationship between temperature and worker productivity, as either too high or too low temperature may have a negative impact on production. Temperatures below 0 ℃ can cause unprotected water pipes and soil to freeze, affecting excavation and water supply operations in the construction industry; the reinforced concrete in the structure process below -20 ℃ is easy to be brittle, resulting in delayed start or failure of mechanical equipment, affecting the progress of the project. Zhang et al. (2023) [12], in using the data of construction enterprises in 31 provinces of mainland China from 2006 to 2019 on the impact of temperature on labor productivity, pointed out that long-term exposure to low temperature environment will reduce tactile discrimination ability and significantly reduce limb operational flexibility, thus reducing labor productivity. When the temperature has an impact on building construction, the construction process of construction enterprises is more sensitive to low temperature than high temperature weather (Fan et al., 2023) [13]. In addition, low temperatures may cause roads to freeze, affecting the passage of traffic, and resulting in delayed delivery of building materials required by the construction industry. Based on this, the article proposes Hypothesis 1 and

Hypothesis 2:

Hypothesis 1: Extreme high temperatures can lead to a decrease in the financial performance of listed companies in the construction industry.

Hypothesis 2: Extreme low temperatures can lead to a decrease in the financial performance of listed companies in the construction industry.

The extreme effects caused by climate change make socio-economic development more uncertain. Many studies have shown that extreme rainfall conditions, including excessive and deficit rainfall, have certain adverse effects on many industries such as mining, tourism, construction, transportation, and bring unpredictable risks to the production and operation of enterprises. Rao et al. (2022) [14] pointed out that information asymmetry caused by extreme rainfall conditions can lead to lower market prices, affecting investors' requirements for their own return rate, and thus immediately affecting the market value of the company after extreme rainfall leaves. Extreme rainfall can also cause depreciation or even damage to the physical assets of enterprises, which has a significant impact on rain-sensitive enterprises such as manufacturing (Yang et al., 2022) [15]. Under the influence of extreme rainfall conditions, enterprises will decline in financial performance, corporate value and other aspect (Lin et al., 2015) [16]. Kotz et al. (2022) [17] simulated the relationship between economic growth and rainfall and found that the economic growth rate would be reduced by the increase in the number of rainy days and the extreme daily rainfall. Wang et al. (2021) [18] found that the impact of severe rainfall on outdoor workers is heterogeneous, and for workers lacking work experience, extreme rainfall has a more significant impact on labor productivity. Huang (2023) [19] pointed out that extreme rainfall would have certain adverse effects on architectural design and construction of construction projects. In addition, extreme heavy rainfall may bring serious flooding disasters, which not only may cause serious losses to the physical assets of enterprises, but also lead to the paralysis of the transportation road system, affecting the distribution of raw materials in factories. Given this, the article proposes hypothesis 3:

Hypothesis 3: Extreme rainfall can lead to a decrease in the financial performance of listed companies in the construction industry.

3. Research Design

3.1. Sample Selection and Data Sources

This article takes listed companies in the construction industry of Shanghai and Shenzhen A-shares in China as samples, and selects the data from 2010 to 2022. Based on the availability of relevant data and to ensure the accuracy of the data; in the analysis sample, the article excluded B-share listed companies, ST companies and companies listed after 2022, to obtain A panel data including 103 Chinese A-share listed companies in the construction industry. For the selection of climate data, the article first selects the cities where the sample companies are located to determine the meteorological indicators, so there are 43 meteorological station data actually used: They are Baoding City, Beijing City, Binzhou city, Changzhou city, Chengdu city, Dongguan city, Guiyang City, Harbin city, Haikou City, Hangzhou city, Hefei city, Hengyang City, Jinan City, Jiaozuo City, Jinhua City, Kunming City, Lanzhou City, Liaocheng City, Nanchang City, Nanjing City, Zhengzhou City, Chongqing City and other 43 cities. Then, the daily minimum temperature, daily maximum temperature, and daily rainfall climate data of these 43 cities from 1981 to 2022 (with 1981-2010 as the reference period for determining climate extreme thresholds) over the past 40 years were selected. Among them, climate data is sourced from the China's National Meteorological Science Data Center, while data on the number and finance of listed companies in the construction industry are sourced from Guo tai An.

To avoid the impact of Outlier on the research of this article, this article conducts "winsor2" tail reduction processing on Panel data at the level of 1% -99% before empirical research.

3.2. Variable Definition

3.2.1. Dependent Variable

The independent variable of this article is the corporate financial performance. In terms of measuring corporate financial performance, domestic and foreign scholars mainly use the following indicators to measure corporate financial performance: return on total assets (ROA), return on equity (ROE) and Tobin Q. Due to the fact that Tobin Q focuses more on the study of financial risk and market value, which is more practical in effective capital markets, and China's current capital market development is relatively immature, Tobin Q value still has certain limitations in the application of market research in China. Therefore, the article removes Tobin Q in the selection of independent variables. Sun et al. (2023) [20] used ROE as an economic indicator to measure the company's financial performance when studying the impact of climate change on the financial performance of the power industry. Sun et al. (2020) [21] chose return on total assets (ROA) to represent the financial performance of the enterprise in studying the impact of climate change risk on the financial performance of the mining industry. Wang et al. (2023) [22] also selected the return on total assets (ROA) to represent the financial performance of enterprises when studying the impact of extreme temperature on enterprise value.

Return on equity (ROE) plays a guiding role in evaluating a company's financial performance. The higher the return on equity of the company, the higher the return on investment of the company, the stronger the profitability, the better the financial performance of the company, and vice versa. Therefore, this article selects return on equity (ROE) as the explained variable by referring to the practice of Sun et al. (2023) [20].

3.2.2. Independent Variables

Considering the availability of other extreme climate data, this article refers to the method proposed by Pan et al. (2022) [23] and uses extreme high temperature (Htd), extreme low temperature (Ltd), and extreme heavy precipitation (Ipd) as representatives of extreme climate for empirical analysis. Due to the vast territory of China, the climate difference between different places is relatively obvious, it is not suitable to use absolute threshold to determine the threshold of extreme climate. Therefore, this article uses the percentile relative threshold method, which is currently popular internationally, to determine the threshold of extreme climate events in China. This article selects 1981 to 2010 as the climate reference period, using daily meteorological data observed by meteorological stations during the reference period and the percentile relative threshold method to define the extreme threshold of meteorological indicators in cities where listed companies in the construction industry are located in different places (There are cases where some cities do not have meteorological stations, and in order to ensure the accuracy of the results, the article chooses meteorological data observed by nearby meteorological stations as a substitute). Then, the annual occurrence days of extreme high temperature climate, extreme low temperature climate and extreme precipitation climate during the 2010-2022 sample period are calculated.

Referring to the method adopted by Ren et al. (2010) [24], firstly, the daily maximum temperature and daily minimum temperature data of the same date (such as January 1 each year) in each 30 years of the climate base period are extracted and arranged in ascending order. Then, the values of the 90% quantile of the maximum temperature and the 10% quantile of the minimum temperature are defined as the extreme high temperature threshold and the extreme low temperature threshold respectively. The extreme precipitation threshold is to first arrange the data of daily precipitation greater than 0 per year during the climate reference period in ascending order, then take the 95th quantile value of the data arranged each year, and finally define the average of the 30 values obtained as the extreme precipitation threshold. When the maximum temperature of a city on a certain day exceeds the extreme high temperature threshold for that day, it can be considered that an extreme high temperature event has occurred in that city on that day. Then, the number of days of extreme high temperature occurrence in a year can be summarized and calculated using this method to obtain the annual data of extreme high temperature. For the days of extreme low temperature events and extreme precipitation events, the annual data is also determined using the method of determining the days of extreme high temperature events.

3.2.3. Control Variables

Table 1. The variables' definitions.

Variable Type	Variable Code	Variable Name	Variable Description
Dependent Variable	ROE	Return on equity	Net profit/av
Independent Variables	Htd	Extreme high temperature	Daily Maximum Temperature > The number of days at the 90th percentile after the same date in ascending order during the climate base period
	Ltd	Extreme low temperature	Daily Minimum temperature < Number of days at the 10th percentile after the same date in ascending order during the climate base period
	Ipd	Extreme rainfall	Daily rainfall > Arrange the annual daily precipitation data greater than 0 in ascending order during the climate reference period, then take the 95th quantile of the annual data, and finally average the average of the 30 values obtained
Control Variables	Holder	Ownership concentration	The shareholding ratio of the largest shareholder
	Size	Company size	The logarithm of the company's total assets
	Lever	Asset liability ratio	Total liabilities/total assets
	Tat	Total Asset turnover	Operating income/total assets Closing balance
	Growth	Enterprise Growth	Operating revenue growth rate

Following Sun et al. (2020) [21], Pan et al. (2022) [23], Chen (2023) [25], this article has decided to choose the following variables as the control variables for the article: (1) Company size: Company size is directly proportional to economies of scale, and the larger the company size, the greater the likelihood of economies of scale occurring; And there is a certain correlation between economies of scale and corporate performance. Therefore, to better enhance the accuracy and correctness of the research in the article, the company size of the sample companies was controlled. The size of a company can generally be measured by total assets; however, due to the industry characteristics of listed companies in the construction industry, their total assets are usually large, and excessively large values may affect the stability of the regression coefficient. In view of this, the article takes the logarithm of the total assets of the sample company before using it as a measure of this control variable. (2) Holder: An increase in equity concentration may exacerbate information asymmetry, reduce social trust in the company, and thus have a negative impact on the company's financial performance. Therefore, the article also controls the concentration of equity and selects appropriate variables to represent the concentration of equity, following the method of Sun et al. (2020) [21]. (3) Asset liability ratio (Lever): The asset liability ratio is a comparison between a company's total liabilities and total assets. It can reflect both the company's debt level and its operating status. The higher the asset liability ratio of a company, the greater the corresponding operational risk, which will have a certain negative impact on the company's financial performance. Therefore, this article also uses the asset liability ratio as a control variable indicator. (4) Total Asset Turnover (Tat): This is an important indicator to measure the efficiency of enterprise asset operations. The higher its value, the more it can improve the financial performance of the enterprise, so it has been controlled. (5) Growth: The growth of a company is directly proportional to its financial performance. The better its growth, the higher its financial performance; Therefore, it is set as a control variable.

3.3. Model Construction

To test the above research hypotheses, this article constructs a fixed effects model as follows:

$$ROE_{i,t} = \beta_0+\beta_1 Climate_{r,t}+\beta_2 Size_{i,t}+\beta_3 Holder_{i,t}+\beta_4 Lever_{i,t}+\beta_5 Tat_{i,t}+\beta_6 Growth_{i,t}+\varepsilon_{i,t} \quad (1)$$

Where *i* represents the enterprise, *r* represents the prefecture-level city or provincial capital city where the listed company is located, and *t* represents the year so all other variables are the average values of that variable in the specific year. $ROE_{i,t}$ represents the return on equity rate of an enterprise in a certain year, $Climate_{r,t}$ represents the extreme climate index of a certain city in a certain year, $Size_{i,t}$ represents the company size of a certain enterprise in a certain year, $Holder_{i,t}$ represents the equity concentration of a certain enterprise in a certain year, $Lever_{i,t}$ represents the asset liability ratio of a certain enterprise in a certain year, $Tat_{i,t}$ represents the total asset turnover rate of a certain enterprise in a certain year, $Growth_{i,t}$ represents the company growth of a certain enterprise in a certain year, β_0, β_1, β_2, β_3, β_4, β_5 *and* β_6 are constant terms in the equation, $\varepsilon_{i.t}$ represents the residual term in the equation.

4. Empirical Analysis

4.1. Descriptive

According to the descriptive statistical analysis table, the minimum return on equity of A-share listed companies in the construction industry is -1.609, the maximum is 0.259, and the average is 0.031. The degree of dispersion is relatively low and stable. The three extreme climate indicators, extreme high temperature, extreme low temperature and extreme rainfall, differ greatly among themselves. In particular, the number of days of extreme high temperature events and extreme low temperature events ranges from 10 to 114 and from 4 to 131 respectively, indicating a high degree of dispersion. The reason for this may be due to global warming caused by climate change in recent years and the vast territory of China, which makes the temperature fluctuation during the study period more frequent and drastic compared with the temperature in the climate base period, resulting in a large difference between the extreme temperature threshold of various cities. At the same time, it can be seen from the table that the asset scale of listed companies in the construction industry ranges from 20.16 to 28.02, with an average value of 23.13 and A standard deviation of 1.824, which indicates that the asset scale of A-share listed companies in the construction industry is significantly different. In addition, on average, the shareholding ratio of the largest shareholder is about 37.2%, indicating that the corporate control of A-share listed companies in the construction industry is relatively concentrated; The maximum value is 73.56% and the minimum value is 6.93%, indicating that some enterprises in the construction industry have a large difference in ownership concentration. In the above table, the average value of asset-liability ratio is 0.179, and the average value is between 0.4-0.6, indicating that the debt level of listed companies in the construction industry is generally appropriate; The standard deviation of total asset turnover is 0.271, the mean value is 0.596, the minimum value is 0.0873, and the maximum value is 1.345, which can be considered that the overall operating effect is good. The minimum value of enterprise growth is -0.684, and the maximum value is 6.008, indicating that there is a large difference in the growth of enterprises in the samples.

Table 2. Descriptive Statistics.

Variables	Number	Mean	Standard Deviation	Min	Max
ROE	915	0.031	0.237	-1.609	0.259
Htd	915	51.15	22.20	10	114
Ltd	915	42.55	32.30	4	131
Ipd	915	14.63	4.707	6	26
Lever	915	0.646	0.179	0.144	0.949
Size	915	23.13	1.824	20.16	28.02
Holder	915	37.20	15.42	6.930	73.56
Tat	915	0.596	0.271	0.0873	1.345
Growth	915	0.504	0.895	-0.684	6.008

4.2. Pearson Correlation Analysis

The analysis software used in this article is stata17, in which the Pearson correlation coefficient is analyzed and the Pearson phase relation table in Table 3 is obtained. In the Pearson relational table, if the correlation coefficient between each variable is above 0.8, it indicates that there may be severe multicollinearity between the related variables. By observing Table 3 in this article, the correlation coefficients among the variables selected in this article are all less than 0.8, and the maximum value is 0.396. Therefore, it can be preliminarily judged that there is no multicollinearity problem among the variables. However, further tests are needed to determine whether there is a multicollinearity problem.

Table 3. Analysis of Pearson Correlation Coefficient.

Variables	ROE	Htd	Ltd	Ipd	Lever	Size	Holder	Tat	Growth
ROE	1								
Htd	-0.0583	1							
Ltd	0.0291	-0.3890	1						
Ipd	0.0943	0.0153	0.0299	1					
Lever	-0.0862	-0.0145	0.0990	0.0738	1				
Size	0.1700	0.0144	0.3040	0.0719	0.5900	1			
Holder	0.1300	-0.1680	0.3960	0.0286	0.2330	0.3850	1		
Tat	0.2670	-0.0748	0.0342	0.0199	0.1950	0.1400	0.2960	1	
Growth	0.1080	0.0025	-0.0372	0.0358	0.0140	-0.0396	-0.0162	-0.0587	1

4.3. Multicollinearity

To further ensure the preciseness of the variables used in the regression model, this article decided to use the variance expansion factor test, which is often called the VIF test, to further test and analyze whether there is Multicollinearity among the variables. The specific inspection results are shown in Table 4.

Table 4. VIF Inspection.

Variables	VIF	1/VIF
Size	1.85	0.541047
Lever	1.60	0.626589
Ltd	1.48	0.677476
Holder	1.42	0.703522
Htd	1.22	0.816794
Tat	1.14	0.878797
Growth	1.01	0.990061
Ipd	1.01	0.991151
Mean VIF	1.34	--

In VIF test, when the value of VIF is less than 10, there is no multicollinearity problem between variables; otherwise, there is a collinearity problem. The VIF values of each meteorological variable and control variable in the above statistical table are 1.39, 1.36, 1.20, 1.20, 1.19, 1.06, 1.06, 1.05 and 1.03 respectively, all of which are below 10 and far below. Therefore, there is no multicollinearity problem between the meteorological variable and control variable selected in this article.

4.4. Regression Analysis

After determining the use of panel data, it is equally important to choose a suitable model. Generally, the models used in economic research are mostly fixed effect models, and some use random effect models. Although fixed effect models are mostly used in economic research nowadays, to ensure the correctness of the models, Hausman test is carried out on which model is used in the two models. The test results show that "chi2(9) = 277.54", "Prob > chi2 = 0.0000"; In the Hausman test, when the P-value is < 0.05, it means that the fixed-effect model is better, so this article finally determines to use the fixed-effect model. This choice is consistent with regression models commonly used in economic research. Detailed regression results are shown in Table 5.

Table 5. Regression Analysis.

Variables	ROE
Htd	-0.0004
	(-0.56)
Ltd	-0.0013***
	(-2.64)
Ipd	0.0006
	(0.43)
Lever	-1.0909***
	(-6.19)
Size	0.1636***
	(4.55)
Holder	-0.0011
	(-0.74)
Tat	0.4405***
	(4.41)
Growth	0.0259***
	(3.23)
Constant	-3.0991***
	(-4.15)
Observation	915
R-squared	0.364

Note: *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively, and () is the estimated standard error.

According to the regression results, the coefficient of days of extreme low temperature (Lpd) in the model test with ROE as the explained variable is -0.0013***, which is significant at the 1% confidence level and significantly negative. However, the coefficients of extreme high temperature days (Htd) and extreme heavy precipitation days (Itd) are -0.0004 and -0.0006, respectively, which are not significant in the model test with ROE as the explained variable. The conclusion shows that extreme low temperature weather will have a significant negative impact on the financial performance of listed companies in the construction industry, but extreme high temperature weather and extreme precipitation weather have almost no impact on the financial performance of the construction industry. Therefore, this verifies the validity of hypothesis 2, and negates hypothesis 1 and hypothesis 3. The article believes that the above empirical results may be caused by: for the construction industry enterprises, the loss caused by extreme low temperature is greater than the loss caused by extreme high temperature and extreme precipitation. The activities of the construction industry cannot be separated from the procurement of raw materials. Extreme low temperature weather events make the traffic situation more complicated, and the obstacles to the transportation of raw materials are far greater than the extreme high temperature weather and extreme precipitation weather. Secondly, from the perspective of construction progress, although extreme high temperature will affect the normal working hours of construction workers, it will not shorten the project. In China, extreme high temperature weather and extreme rainfall weather tend to occur in summer, and the daytime in summer is longer, so construction companies often choose to adjust working hours to make up for the lost construction progress. The occurrence of extreme low temperature weather will make the equipment on the construction site more prone to brittle fracture. To ensure the safety of the project, construction enterprises must choose to delay the construction progress to eliminate security threats. However, the seasonal daylight time of extreme low temperature weather is relatively short, and the construction progress is difficult to make up for by adjusting the time.

It should be noted that in the regression results, the estimated coefficients of extreme weather are small compared with other estimated coefficients. The reason for this may be that the distance between the data values of extreme weather and the data values of the explained variables is larger than that between the data values of other control variables and the data values of the explained variables.

5. Robustness Testing

Table 6. Robustness Test.

Variables	ROA
Htd	-0.0001
	(-0.39)
Ltd	-0.0003**
	(-2.50)
Ipd	0.0002
	(0.65)
Lever	-0.2031***
	(-6.15)
Size	0.0293***
	(4.17)
Holder	0.0001
	(0.38)
Tat	0.1106***
	(5.35)
Growth	0.0071***
	(3.32)
Constant	-0.5680***
	(-3.68)
Observation	915
R-squared	0.340

Note: *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively, and () is the estimated standard error.

To test the robustness of the results, this article chooses to change the financial performance measurement index return on equity to test the rationality of the above regression conclusions. In addition to the measurement indicators of corporate financial performance used in the article model, ROA, also known as return on total assets, can well reflect financial performance. The higher the return on total assets, the higher the asset efficiency, the stronger the profitability and the better the financial performance of the company. Therefore, to further verify the robustness of the results of the article, this article selects ROA as the alternative explained variable for robustness test, and processes outliers and missing values before regression. The regression results are shown in Table 6. The results in Table 6 show that the coefficient of days of extreme low temperature (Lpd) is significantly negative at the significance level of 5% in the model test with ROA as the explained variable, while the days of extreme high temperature and days of extreme rainfall are not significant in the regression, which is consistent with the conclusion obtained when ROE is used as the independent variable. Replacing the explained variables does not change the conclusions of the previous regression, so the regression results in this article can be considered reliable.

6. Conclusion and Suggestions

At present, there is relatively little research on the impact of extreme weather on enterprises in China, especially on the impact of extreme weather on financial performance of enterprises. Most of the research focuses on the impact of climate change on enterprises. Based on the panel data of listed companies in China's A-share construction industry from 2010 to 2022, this article constructs A fixed-effect model to empirically test the impact of extreme climate on the financial performance of listed companies in the construction industry through descriptive statistical analysis, VIF test and other analyses, enriching the research on the relationship between extreme climate and corporate financial performance. It can help make corporate management more aware of the impacts of extreme weather. The empirical results of this article show that extreme high temperature and extreme rainfall have no significant impact on the financial performance of listed companies in the construction industry, while extreme low temperature significantly increases the financial performance risk of listed companies in the construction industry.

The article believes that for extreme climate, construction enterprises can cope with the following aspects: First, improve the climate resilience of infrastructure, improve the technical standard system of infrastructure and major projects that adapt to climate change, assess the relevant extreme climate risks before planning and construction, and make extreme weather early warning and emergency plans. Secondly, strengthen the on-site inspection and monitoring work during the construction process, report and dispose of the danger in the first time when found, at the same time, implement protective measures, in extreme weather conditions, take necessary measures to stop operation, reasonable arrangement of operation time, construction process and so on. Finally, after the extreme weather, safety checks are carried out to eliminate the safety hazards caused by extreme weather, and work is resumed under the condition that the construction site has safe production conditions. In addition, the Chinese weather index futures market has been continuously improving in recent years. Construction companies can consider purchasing weather index futures and other financial derivatives, and use them in situations such as project delays and safety accidents caused by weather conditions, in order to achieve the effect of hedging risks. In conclusion, in view of the impact of extreme climate on the financial performance of enterprises, enterprise managers should pay attention to extreme climate in time.

There are also some shortcomings in the research, and there are certain limitations in variable measurement. This article uses the city where the listed companies in the construction industry are located to match with the nearest meteorological station to determine extreme high temperature conditions, extreme low temperature conditions, and extreme rainfall conditions. However, listed companies in the construction industry may have multiple business departments, and their business scope may be more extensive, it does not entirely depend on the abnormal climate change in the location of the listed company. Based on this, further exploration and research can be conducted in future research.

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