Proceedings of ICMRED 2025 Symposium: Effective Communication as a Powerful Management Tool
DOI: 10.54254/2754-1169/2025.BL24605

The Impact of Extreme Climate on the Allocation of Household Financial Assets—Based on the Survey Data of China Household Finance Survey

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Abstract. Extreme climate not only poses severe challenges to social security issues but also becomes an important factor threatening the stability of the proportion of household financial assets. This paper uses the data from the China Household Finance Survey (CHFS) and the statistical data of climate disasters. By combining the heterogeneity analysis and mechanism test, it systematically explores the impact paths and differential influences of extreme climate events on the allocation of household financial assets. The study finds that extreme climate significantly reduces the proportion of household financial assets, and this effect shows significant heterogeneity among different groups and regions. The mechanism analysis reveals that the frequent occurrence of climate disasters intensifies households' concerns about future economic uncertainties, and their risk appetite is significantly reduced. This paper not only enriches the existing literature on climate financial risks but also provides suggestions and references for households to prevent the impacts of climate disasters and maintain household financial stability.

Keywords: Climate risks, Proportion of financial assets, Region, Income, Educational attainment

1. Introduction

In recent years, the frequency and intensity of global extreme climate events—such as hurricanes, floods, and heatwaves—have shown a significant upward trend. The Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) clearly states that climate change caused by human activities is exacerbating the destructive effects of extreme weather. Against this backdrop, climate risk has evolved from a purely environmental issue into a profound economic and social challenge, with its impact on micro-level household decision-making deserving particular attention. Existing research has mostly focused on the impact of macro-level climate change on economic output or explored corporate strategic adjustments under climate risks, yet it has relatively overlooked the climate sensitivity of households—basic economic units—in their portfolio choices. This paper aims to fill this research gap by constructing a theoretical framework for climate risk exposure and household financial behavior, and empirically testing the dynamic impact mechanism of extreme climate events on household asset allocation using CHFS data. The

DOI: 10.54254/2754-1169/2025.BL24605

conclusions provide micro-level evidence for climate economics research and offer new perspectives for household risk management and the design of climate adaptation policies.

Conducting in-depth research on the impact of extreme climate on household financial asset allocation is of significant theoretical and practical significance. Theoretically, it helps expand the research boundaries of household finance and improve the research framework for the interdisciplinary field of climate economics. Practically, it can provide more comprehensive references for household financial decision-making and help households enhance their ability to cope with extreme climate risks. At the same time, it can also provide a strong basis for governments to formulate relevant policies and financial institutions to develop financial products and enhance the resilience of society as a whole to extreme climate risks.

2. Literature review

Against the backdrop of worsening extreme climate, this paper explores the impact mechanisms of extreme climate on household financial asset allocation. It primarily draws on three strands of literature: firstly, the risks associated with extreme climate; secondly, the influencing factors of household financial asset allocation; and thirdly, the impact of extreme climate on household financial asset allocation.

2.1. Risks of extreme climate

Climate risks are categorized into three types: physical risks, liability risks, and transition risks. Physical risks refer to the depreciation of financial and real economic assets caused by climate change and extreme climate events. Liability risks involve the further transmission of economic losses as those bearing the costs of climate change seek compensation from relevant responsible parties [1]. Transition risks refer to changes in asset valuations and corporate costs during rapid low-carbon transitions [2]. This paper focuses on extreme climate risks, namely physical risks and liability risks.The frequent occurrence of climate disasters not only causes substantial economic losses but also leads to the deterioration of household income and expenditure, impacting household financial stability. Therefore, the impact of climate disasters on household financial risks should not be ignored [3]. When climate risks are not considered, financial institutions often overestimate asset values and may face sudden significant declines in asset values [4]. Under the shock of climate risks, information asymmetry may expose financial institutions to higher moral hazards [5].

Climate risk shocks can lead to higher loan interest rates for enterprises located in regions with high exposure to climate risks [6]. When a country has high climate risk vulnerability or weak resilience to climate risks, its sovereign debt costs may rise significantly [7]. Counties and cities vulnerable to climate change shocks need to pay higher underwriting fees and financing costs when issuing municipal bonds [8].

2.2. Influencing factors of household financial asset allocation

Household economic status serves as the foundation for financial asset allocation: the better the economic situation, the higher the probability that households will allocate both risk-free and risky financial assets. Age has a negative effect on financial asset allocation, while higher financial literacy increases the likelihood of household financial asset allocation, with its impact on risky financial asset allocation being significantly greater than on risk-free ones [9].Households with higher education levels of the household head, higher total household assets, and more housing units

DOI: 10.54254/2754-1169/2025.BL24605

have a promoting effect on risky financial asset allocation, while older household heads, being married, and larger family size tend to inhibit risky financial asset allocation among urban households [10]. Population aging significantly suppresses households' risky asset investments and reduces the number of risky asset types held by households [11]. Furthermore, since housing is the most important form of household wealth, high housing prices can generate a "crowding-out effect" on household financial assets, and this effect manifests differently across various life cycle stages [12].

3. Model construction, variable definition, and data description

3.1. Model construction

This paper constructs a two-period micro-household balanced panel dataset using CHFS (China Household Finance Survey) data, and the baseline regression model is specified as follows:

$$Household_{it} = \beta_0 + \beta_1 * Climate_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

In the equation, the explained variable $Household_{it}$ represents the financial asset allocation of households in county i at time t; the explanatory variable represents $Climate_{it}$ the extreme climate change affecting households in county i at time t; λ_i represents a set of household control variables; μ_t represents a set of time control variables; and ε_{it} represents the error term.

3.2. Variable definition

3.2.1. Extreme weather

Extreme climate refers to abnormal climatic phenomena that significantly deviate from the climatic average of a specific region within a specific time period, characterized by low probability of occurrence, significant impact, and obvious differences in duration or spatial scope. Most literature on climate change at home and abroad focuses on the two most basic climatic elements: temperature and precipitation, such as Aragón et al. and Pan Min et al.. Consistent with the above literature, this paper focuses on the more common extreme heat, extreme cold, and extreme heavy rainfall to study extreme climate. In the empirical study of the impact of climate change on household financial asset allocation, the definition of extreme climate variables needs to be quantifiable, observable, and spatially matched.

Construction of Data Indicators:

A region is determined to experience extreme weather if any of the following conditions is met:

The daily minimum temperature reaches or falls below -10°C;

The daily maximum temperature is greater than or equal to 38°C;

The daily precipitation exceeds 50 millimeters.

Proportion of Extreme Weather Days = (Total number of days with extreme weather in a year) / 360

3.2.2. Household financial asset allocation

In this paper, household financial assets are defined as financial assets divided by total household assets. Total household assets include financial assets, liquid assets, and equity assets.

DOI: 10.54254/2754-1169/2025.BL24605

Table 1. Control variable definition

	Control Variables	Definition
Household Head Control Variables	Marital Status	Married=1,Unmarried=0
	Education Level	Higher values indicate higher education levels
	Gender	Male=1,Female=0
	Age	Household head's age
	Household Registration	Rural household registration=1,Urban household registration=0
	Risk Preference	Lower values indicate higher risk preference
Household Control Variables	Household Size	Total household population
	Log of Total Household Income	Logarithm base 10

3.3. Data description

The data sources used in this paper are as follows: First, household data come from the five rounds of China Household Finance Survey (CHFS) data conducted nationwide by the China Household Finance Survey and Research Center of Southwest University of Finance and Economics from 2011 to 2019. The CHFS data cover 25 provinces and four direct-administered municipalities excluding Xinjiang, Tibet, Hong Kong, Macao, and Taiwan, with survey respondents including all family members in the sampled households. The CHFS data began in 2011, with follow-up surveys conducted every two years; by 2011, 2013, 2015, 2017, and 2019, the sample had completed the baseline survey and five rounds of national follow-up surveys. Second, climate data are sourced from the National Meteorological Science Data Center. This paper selects the meteorological station with the closest spherical distance to the County (District) People's Government where the household is located as the source of climate information for the household's location, and precisely matches the climate data with household data by integrating the time dimension.

DOI: 10.54254/2754-1169/2025.BL24605

4. Empirical process and results analysis

4.1. Main regression analysis

Table 2. Main regression analysis

Variables	Proportion of Financial Assets
Climate	−0.1439983***
	(0.0512644)
Married=1	−0.0136986*
	(0.0071033)
Higher education values indicate higher education levels	0.0012334
	(0.002055)
Male=1	0.0056649
	(0.005347)
Age	-0.0002993
	(0.0001927)
Total household population	0.0158188
	(0.0259891)
Lower values indicate higher risk preference	−0.0068813***
	(0.0018751)
Log of total household income(Base 10)	-0.2239792
	(0.2907197)
Rural household registration=1	−0.0156106**
	(0.0076148)
_cons	0.2260386***
	(0.0769559)

The impact of extreme climate on household financial asset allocation is shown in Table 2.According to the regression results, the coefficient is significantly different from zero, indicating that extreme climate has a significant impact on household financial asset allocation. The overall regression coefficient is negative, meaning that as the extreme climate index increases, the proportion of a certain financial asset allocated by households decreases.

The results of the regression analysis imply that an increase in the frequency of extreme climate events, possibly due to factors such as reduced household income expectations, decreased risk appetite, increased insurance awareness, and limited access to investment information, leads households to increase their savings ratio and reduce their stock investment ratio, thereby decreasing the proportion of risky assets in their portfolios.

DOI: 10.54254/2754-1169/2025.BL24605

4.2. Heterogeneity test

4.2.1. Regional heterogeneity test

Table 3. Regional heterogeneity test

Variable	Proportion of Financial Assets in Eastern Region	Proportion of Financial Assets in Central Region	Proportion of Financial Assets in Western Region
Climate	-0.1275455 (0.1339069)	−0.2298981** (0.0999519)	-0.1197582 (0.0734963)
Married=1	−0.028997** (0.0125562)	-0.0069167 (0.0121913)	-0.0076076 (0.0098305)
Higher education values indicate higher education levels	0.0034275 (0.0034175)	0.0022563 (0.0035808)	-0.0011357 (0.0029395)
Male=1	0.0057609 (0.0097321)	0.0016187 (0.0101995)	0.0069157 (0.0080074)
Age	0.0000104 (0.0003534)	−0.0008781** (0.0003584)	-0.0001622 (0.0002768)
Total household population	0.0377946 (0.0428976)	0.0302537 (0.0355574)	-0.0080857 (0.0028209)
Lower values indicate higher risk preference	−0.0107997*** (0.0036239)	0.0011002 (0.0038429)	−0.0080857*** (0.0028209)
Log of total household income(Base 10)	-0.4233844 (0.4265334)	-0.4379247 (0.3952977)	0.0855851 (0.3114943)
Rural household registration=1	-0.0143035 (0.0136824)	-0.0204991 (0.0145038)	-0.0132281 (0.0104409)
_cons	0.2628002*** (0.0980957)	0.306332*** (0.1059485)	0.1243699 (0.0860736)

The impact of regions on household financial asset allocation is shown in Table 3.According to the results of the heterogeneity test, the coefficients in the central region are significantly different from those in the eastern and western regions, indicating that the impact of extreme climate on household financial asset allocation varies across regions. However, the coefficients in all three regions (eastern, central, and western) are negative, suggesting that extreme climate has a negative effect on household financial asset allocation in any region. Among them, households in the central region are more susceptible to the impact of extreme climate.

An analysis of these results suggests that the central region, as an important agricultural production area in China with higher dependence on agriculture and weaker industrial disaster resistance, may also be influenced by factors such as relatively weak infrastructure and an inadequate social security system. These factors make households in the central region more likely to reduce the proportion of risky assets in their portfolios when facing extreme climate events.

DOI: 10.54254/2754-1169/2025.BL24605

It is recommended that households in regions with frequent extreme climate events should place greater emphasis on the safety and liquidity of their assets, appropriately adjust the structure of their financial asset allocation, and increase the proportion of stable assets. At the same time, these findings provide a reference for governments and financial institutions to formulate relevant policies and products, helping households better cope with the economic impacts of extreme climate.

4.2.2. Income heterogeneity test

Table 4. Income heterogeneity test

Variable	Proportion of Financial Assets for Low-Income Households	Proportion of Financial Assets for High-Income Households
Climate	−0.1776498**	-0.1226309
	(0.0740821)	(0.1180456)
Married=1	−0.0146774*	-0.0124142
	(0.0085298)	(0.0143316)
Higher education values indicate higher education levels	0.0031579	-0.0025353
	(0.0028453)	(0.0031709)
Male=1	0.0054265	-0.00404
	(0.0074974)	(0.00969)
Age	−0.0004278*	-0.0002605
	(0.0002511)	(0.0003826)
Total household population	-0.0114341	0.0107067
	(0.0237328)	(0.0551225)
Lower values indicate higher risk preference	-0.0037306	−0.0083893**
	(0.0026852)	(0.0039404)
Log of total household income(Base 10)	0.1242819	-0.3691894
	(0.2651017)	(0.5311504)
Rural household registration=1	-0.0142271	-0.0188444
	(0.0105204)	(0.0133876)
_cons	0.1098967	0.3742181***
	(0.0723725)	(0.1172974)

The impact of income on household financial asset allocation is shown in Table 4. Low-income households are defined as those with income below the median household income of all households headed by a householder, while high-income households are defined as those with income above the median household income of all households headed by a householder.

According to the results of the heterogeneity test, there are significant differences between low-income and high-income households, indicating that the impact of extreme weather on household financial asset allocation exhibits heterogeneity across different income groups. However, the coefficients for both groups are negative, suggesting that regardless of income level, extreme climate has a negative effect on household financial asset allocation. Among them, low-income

DOI: 10.54254/2754-1169/2025.BL24605

households are more susceptible to adjusting their household financial asset allocation in response to extreme climate events.

An analysis of these results indicates that low-income households typically lack emergency reserve funds. A sudden drop in income caused by extreme climate—such as reduced agricultural output or fewer employment opportunities—forces them to withdraw deposits early or reduce holdings of risky assets like stocks and funds to meet rigid expenses, creating a vicious cycle of "income decline–asset shrinkage." In contrast, high-income households can diversify investments—such as allocating inflation-resistant assets or green financial products—to spread risks and use tools like insurance to hedge against losses, maintaining relatively stable proportions of financial assets.

For low-income households, there is a need to pay more attention to their basic livelihood security and asset safety under extreme climate. Governments and financial institutions can provide targeted financial services and support, such as microinsurance. For high-income households, the focus can be on guiding them to engage in diversified asset allocation to address the potential risks posed by extreme climate.

DOI: 10.54254/2754-1169/2025.BL24605

4.2.3. Educational attainment heterogeneity test

Table 5. Educational attainment heterogeneity test

Variable	Household Financial Asset Allocation of Households with Low Educational Attainment	Household Financial Asset Allocation of Households with High Educational Attainment
Climate	−0.2190669*	−0.3049716**
	(0.1119922)	(0.1298851)
Married=1	0.0046298	−0.0421935**
	(0.0113178)	(0.021284)
Higher education values indicate higher education levels	0.0019082	-0.0067423
	(0.0095164)	(0.0062106)
Male=1	0.0042267	-0.0118615
	(0.0103598)	(0.0148281)
Age	−0.000778**	-0.0005496
	(0.0003768)	(0.0006001)
Total household population	0.0489622	−0.1112067*
	(0.0354552)	(0.061348)
Lower values indicate higher risk preference	-0.000266627	-0.0012706
	(0.0034803)	(0.0055773)
Log of total household income(Base 10)	-0.5342644	0.986471*
	(0.4071872)	(0.5921801)
Rural household registration=1	-0.0247118	−0.0560816**
	(0.0162753)	(0.0227602)
_cons	0.277279**	0.1062311
	(0.1124108)	(0.1361999)

The impact of educational attainment on household financial asset allocation is shown in Table 5. Households with low educational attainment are defined as those where the educational level is below the median educational attainment of all households headed by a householder, while households with high educational attainment are defined as those where the educational level is above the median educational attainment of all households headed by a householder.

According to the results of the heterogeneity test, there are significant differences between households with high and low educational attainment, indicating that the impact of extreme climate on household financial asset allocation exhibits heterogeneity across different educational levels. Specifically, the higher the educational attainment, the greater the negative impact of extreme climate on household financial asset allocation. Since the coefficients for both groups are negative, regardless of educational attainment, extreme climate has a negative effect on household financial asset allocation.

DOI: 10.54254/2754-1169/2025.BL24605

Based on these results, it can be inferred that households with higher educational attainment may be more inclined to mitigate shocks through asset diversification—such as increasing holdings of bonds and gold—and risk hedging tools like climate index insurance. They also have a higher awareness of green financial products, such as new energy funds and carbon trading assets, enabling them to capture investment opportunities in the transitioning economy. In contrast, households with lower educational attainment, due to their lack of financial literacy, rely more on savings and cash. Income fluctuations caused by extreme climate directly narrow the space for their financial asset allocation.

It is recommended that governments and financial institutions strengthen financial literacy promotion and education to enhance the overall financial literacy of the population, particularly conducting targeted financial knowledge training and awareness campaigns for groups with lower educational attainment. These efforts can help them better understand and cope with the financial risks posed by extreme climate. Meanwhile, financial institutions should develop more financial products and services suitable for households with different educational levels to meet their diversified financial needs in addressing climate change.

4.3. Mechanism test

Table 6. Mechanism test for reduction in total income

Variable	$\ln Total\ Income$
Climate	-1.014858^{***}
	(0.1721812)
Married=1	0.2462915^{***}
	(0.0559048)
Higher education values indicate higher education levels	0.2263875^{***}
	(0.0139573)
Male=1	-0.0594911
	(0.045975)
Age	-0.0056632^{***}
	(0.0014539)
Total household population	0.1036585^{***}
	(0.0181285)
Lower values indicate higher risk preference	-0.0939184^{***}
	(0.0160363)
Rural household registration=1	-0.5775653^{***}
	(0.0415919)
_cons	9.971582^{***}
	(0.1549623)

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The impact of various variables on the log of household total income is shown in Table 6.Extreme climate may reduce household total income through channels such as disrupting production and business activities, increasing medical expenses, and reducing labor supply, thereby affecting household financial asset allocation. For example, agricultural households may experience crop failures due to droughts, leading to reduced income; families may incur increased medical expenses due to diseases triggered by extreme climate, reducing their disposable income; extreme climate may cause transportation disruptions and other issues, causing workers to have fewer working hours and lower income; damage to fixed assets such as housing may increase repair costs, further reducing disposable income.

5. Conclusions and recommendations

This paper uses data from 31 provincial administrative regions in China from 2011 to 2019 as a sample to examine the impact of extreme climate on household financial asset allocation and its underlying mechanisms. The main conclusions are as follows: First, extreme climate has a significant negative impact on the proportion of household financial assets. Second, the impact of extreme climate on household financial asset allocation exhibits heterogeneity across regions, income levels, and educational attainments. Specifically, extreme climate is more likely to cause households in central regions, low-income households, and households with lower educational attainment to reduce the proportion of financial assets in their portfolios. Finally, mechanism tests show that climate change can affect the proportion of household financial assets through channels such as reducing household income, shrinking the output scale of household businesses, and increasing medical expenses.

It is recommended that financial institutions develop new financial products and services to help households manage risks in response to the impacts of extreme climate. For example, they can design climate-indexed insurance products that provide economic compensation to households when extreme climate events occur, reducing the pressure to adjust asset allocation; or launch climate risk hedge funds to offer risk management tools for households with such needs.

It is recommended that governments formulate policies to guide households in rational asset allocation and enhance their capacity to cope with extreme climate. For example, providing tax incentives to encourage households to purchase financial products that address climate risks; conducting financial literacy campaigns, especially in regions prone to frequent extreme climate events, to enhance households' understanding of the relationship between asset allocation and climate risks and enable them to make more informed financial decisions.

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