PROBLEMY EKOROZWOJU/ PROBLEMS OF SUSTAINABLE DEVELOPMENT

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Are Women's Socio-economic Rights at Risk from Extreme Weather?

Czy prawa społeczno-ekonomiczne kobiet są zagrożone z powodu ekstremalnych warunków pogodowych?

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Abstract
The importance of women's socio-economic rights (WSR) has been increasingly recognized, highlighting the critical roles women play and the unequal benefits they receive. The rise in severe extreme weather events intensifies the adverse impacts on women. This study examines data from 146 economies between 2000 and 2021, revealing significant effects of extreme temperatures on WSR (-2.6%). Droughts have been found to positively influence women's professional education rights (28.1%) and political rights (5.4%), but negatively affect women's physical integrity rights (-7.1%) and property rights (15%). Meanwhile, floods result in a decline in WSR (-0.9%), and storms adversely impact professional education (-1.3%) and property rights (-2%). Extreme weather events can alter the level of WSR by influencing industrial structures and innovation, as well as affecting overall development and personal income levels.

Key words: extreme weather, women, socio-economic rights, coefficient of variation

Streszczenie
Znaczenie praw społeczno-ekonomicznych kobiet (WSR) jest coraz bardziej uznawane, podkreślając kluczowe role, jakie odgrywają kobiety, i nierówne korzyści, jakie otrzymują. Wzrost liczby ekstremalnych zjawisk pogodowych nasila negatywny wpływ na kobiety. W badaniu tym przeanalizowano dane ze 146 krajów w latach 2000–2021, ujawniając znaczący wpływ ekstremalnych temperatur na WSR (-2,6%). Stwierdzono, że susze pozytywnie wpływają na prawa kobiet do edukacji zawodowej (28,1%) i prawa polityczne (5,4%), ale negatywnie wpływają na prawa kobiet do integralności fizycznej (-7,1%) i prawa własności (15%). Tymczasem powodzie powodują spadek WSR (-0,9%), a burze negatywnie wpływają na edukację zawodową (-1,3%) i prawa własności (-2%). Ekstremalne zjawiska pogodowe mogą zmieniać poziom WSR, wpływając na struktury przemysłowe i innowacje, a także wpływając na ogólny poziom rozwoju i dochodów osobistych.

Słowa kluczowe: ekstremalne zjawiska pogodowe, kobiety, prawa społeczno-ekonomiczne, współczynnik zmienności

1. Introduction

There is plenty of evidence that women play a critical role in reducing CO_2 emissions and driving policies more equitably and effectively, thus contributing to SDG 13 and sustainable development (Cook et al., 2019; Valls Martínez et al., 2022). However, the rights of this group have not been adequately taken into account. Firstly, women are suffering serious physical harm. According to the United Nations, around one in three women worldwide has experienced sexual violence, while about 811,000 women and girls were intentionally killed in 2021, and the number of such cases sees a rebound since 2020 (United Nations, 2022). Secondly, women's right of education is not guaranteed. Although some data shows the similar performance between girls and boys in maths and science, girls face greater barriers, with less than 25% of female students studying engineering and communication technology in more than two-thirds of countries in the world(UNESCO, 2022). Thirdly, large amounts of unpaid labor

crowd out women's time, thereby weakening the advantages of their property rights. According to One Billion Care Centres, the closure of 512 schools has led to a significant increase in women's childcare time. Combined with few opportunities suitable for women, 380 million women and girls around the world still live in extreme poverty (United Nations, 2022). Finally, while women's excellence in policy making is widely recognized, it is argued that their outstanding abilities in the actual process is still not being maximized.

In recent years, the intensification of climate change has led to more frequent extreme weather events. Extreme weather causes great damage to human health, but it also causes harm to some specific rights of women. As shown in Figure 1, since the beginning of the 21st century, the annual occurrence of extreme weather has remained at more than 250 times (except for 2023, because the data for 2023 were not fully counted), accompanied by a small range of cyclical fluctuations such that the frequency of extreme weather events increased from 2004 to 2009 and from 2018 to 2022. Among all kinds of extreme weather, floods are the most common, followed by windstorms, and the number of droughts and extreme temperatures is relatively low. In addition, extreme weather brings huge economic losses to the society. As shown in Figure 2, except for the huge losses caused by storms in 2005 and 2017, the total loss shows a gradually increasing trend from 2000 to 2022. By 2022, the total losses will reach nearly $200 billion. Extreme weather events can pose threats to human health, among which, the threat of extreme heat is more indirect and hidden. Deaths and diseases caused by high temperatures are often manifested in other forms such as heart failure, so these deaths will not be counted in the loss caused by extreme weather. The damage caused by extreme heat has been underestimated for the most part. Barreca and Schaller(2020) and Yang et al.(2022) found that high temperatures increase the risk of preterm birth and the likelihood of stillbirth.

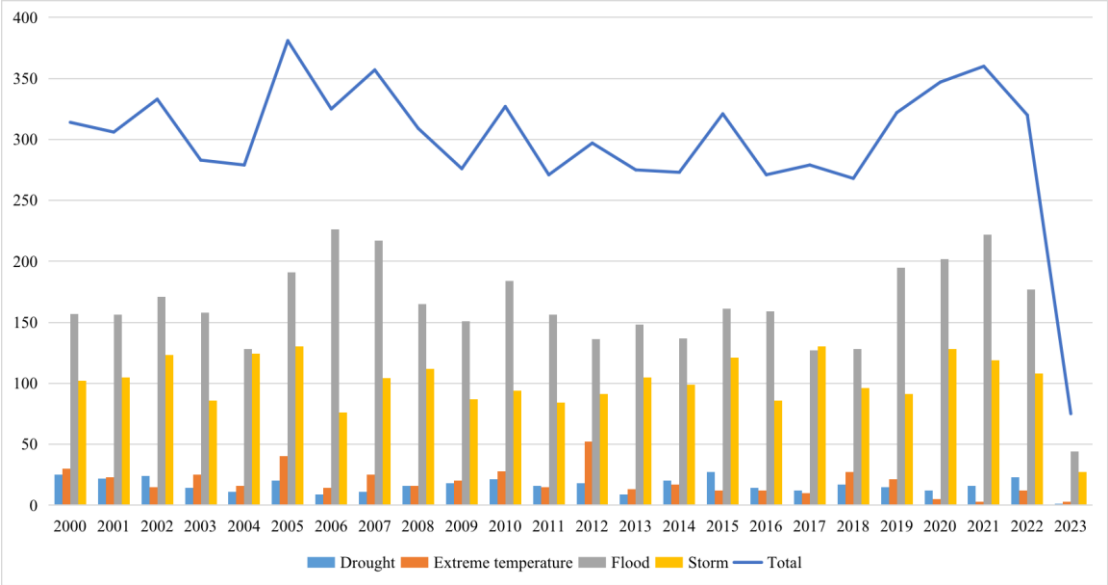

Figure 1. Frequency of extreme weather over the world during 2000-2023, own elaboration

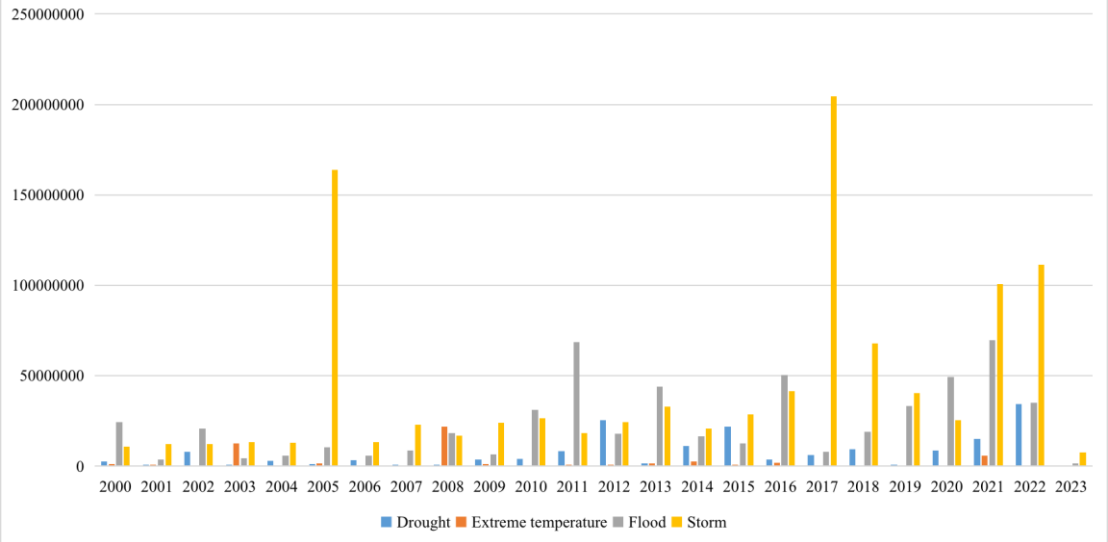

Figure 2. Losses in extreme weather over the world during 2000-2023, own elaboration

Indeed, age and gender have emerged as important markers for differentiating groups affected by climate change and extreme weather events (Liu et al., 2023). At the same time, a significant proportion of women experience negative impacts from extreme weather events, but these impacts have not been accurately measured and analyzed (Adebayo, 2024). As two of the Sustainable Development Goals, women's socio-economic rights and extreme weather events are highlighted by the United Nations as SDG 5, 10 and 13, and pay special attention to the impact of extreme weather events on women's socio-economic rights and the role of women in responding to climate change and extreme weather events, as women are widely recognized as agents of positive change and contributors in the context of climate change. International organizations are beginning to take action, such as seeking policies and programs to protect women's socio-economic rights, to collectively achieve the above goals. The Second Chance Education Program (SCE), launched by UN Women, is one such program. As Figure 3 depicts, although the women's enrolment in economic institutions and programs has remained above 50% since 2000, the increase in graduation rates remains slow. It is difficult to continuously enhance women's socio-economic rights and build a protective barrier in a relatively short period of time.

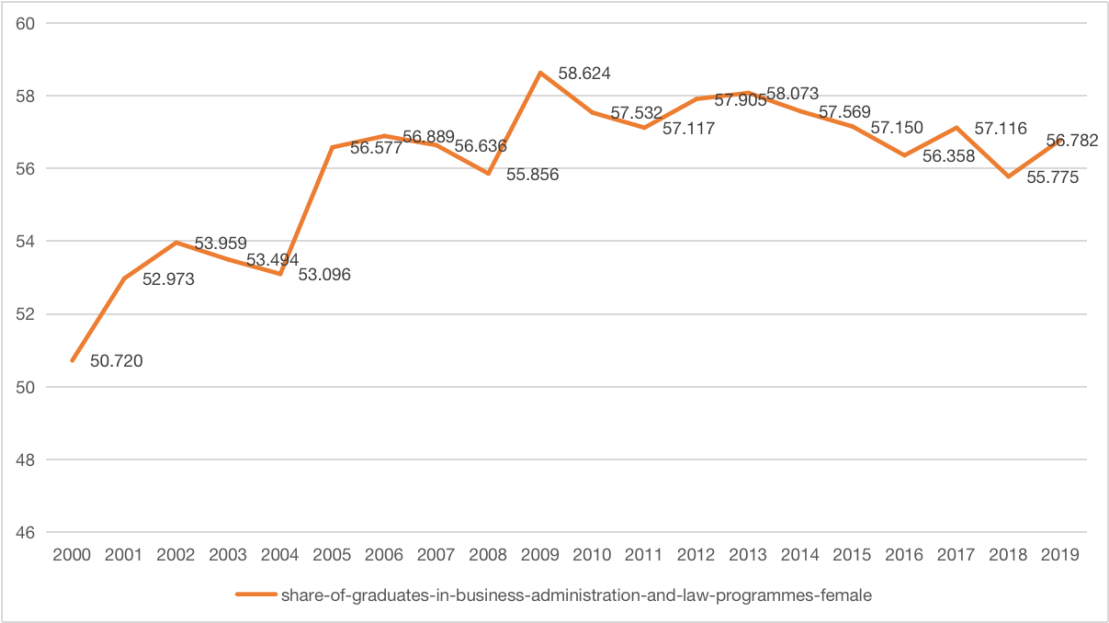

Figure 3. The proportion of female graduates in business programs, own elaboration

Adedeji et al.(2023) indicated that lower socio-economic status is more likely to lead to poorer evaluations of health and life satisfaction ratings. However, the influences of extreme weather or other climatic factors on women's socio-economic rights combined with their mechanisms still lack research. Meanwhile, it is also worthwhile to look at the integral level of women's socio-economic rights rather than a part of them. In this paper, women's socio-economic rights (WSR) are specifically divided into physical rights, vocational education rights, property rights and political rights. Using the data of countries around the world, we explore whether the four extreme weather types – extreme temperature, drought, flood and storm – have similar or heterogeneous impacts and mechanisms through industrial structure and innovation on WSR. In addition, the study divides the sample countries into sub-samples according to their level of development and personal income, to see whether extreme weather manifests itself differently in different groups.

The conclusions of our work may have the following contributions: Firstly, it expands the new influencing factors of women's socio-economic rights under the background of climate change, and explains the influencing mechanisms of extreme weather from the aspects of industrial structure and innovation; Second, this study considers women's socio-economic rights as a comprehensive index, which complements the research gap considering individual rights. Third, in terms of methods, this study divides women's socio-economic rights into four categories: physical rights, vocational education rights, property rights and political rights, which makes the previous classification of international indexes clearer. Fourth, the study found an important role of policies and public order in women's socio-economic rights in the face of natural disasters. Therefore, the conclusions of this paper may also have certain reference value for the comprehensive consideration of climate policies or other policies in the future.

The rest of this paper is organized as follows: Section 2 conducts a literature review. Section 3 gives the econometric model and variables. Section 4 depicts the empirical results. Section 5 draws conclusions and makes proposals.

2. Literature review

2.1. Women's socio-economic rights

According to the integrity of existing research, we hold that women's fundamental rights should include physical integrity rights, vocational education rights, property rights and political rights (UN WOMEN, 2022b). We will first summarize the previous studies on each of these four rights, respectively.

Physical integrity rights refer to the ability of women to be protected from physical abuse such as murder, imprisonment and sexual assault (Rodrigues, 2022). Previous research has explored the factors influencing these kind of rights, and found a surge in child marriage and early pregnancy rates in some poor countries, because families in these areas have to rely on the dowry received by their married daughters to improve their living standards (Corno et al., 2020).

Vocational education rights refer to women having equal opportunities to receive general and higher education. It shows a more difficult progress form women to publish articles in top journals or become tenured professors, although women appear to be more qualified in academic fields(Babcock et al., 2017). Regarding the factors of professional education rights, it has been found the links between women's education and GDP per capita (Andrijevic et al., 2020), and public welfare (Local Burden of Disease Educational Attainment Collaborators, 2020).

Property rights refer to women's right to freely control their own property, including equal access to property and the right to use property flexibly. To date, few studies have focused on property rights, and the main findings in the existing literature are that women's property rights are greatly enhanced by strengthening their ability to manage property through rural microfinance institutions and training on savings (Field et al., 2021).

Some institutions have different names for these four aspects and the concrete content is not quite the same as our concept. For example, UN WOMEN(2022) calculates an indicator called the Women's Empowerment Index (WEI), and United Nations Development Program designs another index called the Gender Development Index (GDI). These two indexes both include the aspects of health, education and economic rights. For the sake of clarity, the above classification is used in the paper, but we also consider some indicators calculated by international institutions as alternative dependent variable in section 4.

2.2. Impact of extreme weather events on women's socio-economic rights

Few researches have explained the relationship between extreme weather events and women's socio-economic rights. Rao et al.(2019) illustrated through case studies that more frequent extreme temperature events and floods would reduce women's leisure time, low their health conditions, and feminize lower level industries such as agriculture that do not require much capital investment. Rusca et al.(2023) pointed out that droughts put greater psychological pressure to on low-income women because of the difficulty of finding clean water.

Some studies realize the inequality during extreme weather events. For instance, under conditions of increasingly severe drought, the heavy water use by the elite class makes it more difficult for people of lower socio-economic status to get access to clean water(Savelli et al., 2023); He et al.(2022) highlighted the importance of urbanization in exacerbating income inequality. Smiley et al.(2022) pointed out that Latino and low-income groups were excluded from the scope of government emergency management when flooding occurred. Given that the role and vulnerability of women should be given priority, as should other special groups such as low-income groups, it is also necessary to analyze how the impact of extreme weather events differs across gender groups.

To sum up, the topic of *women's socio-economic rights*, has attracted more and more scholars' attention, but there is still a large research gap in terms of method and content. Firstly, in regard to research methods, the existing research mostly uses quasi-natural experiments or investigations, but rarely considers econometrics. Secondly, in terms of research content, on the one hand, the previous empirical research just focuses on one of the aspects of women's socio-economic rights. There is a lack of overall research that combines these aspects, which may cause a lack of a coordinated and feasible plan on how to improve women's comprehensive rights. On the other hand, in the context of increasingly severer extreme weather caused by climate change, the relationship between women's situation and extreme weather events is not clear, and the conclusion of this research may play an important role in the fairness and comprehensiveness of future policies.

3. Data and methodology

3.1. Methodology

Different from the previous studies, this paper applies a fixed model as follows to regress the average effect of four kinds of extreme weather on women's socio-economic rights:

$$WSR_{i,t} = \alpha_0 + \alpha_1 \times EW_{i,t} + \alpha_2 Controls_{i,t} + \nu_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

In equation (1), $WSR_{i,t}$ represents women's socio-economic rights, which is calculated by a few indicators based on the variance coefficients approach. Please refer to *3.2. Variables and data* for detailed counting progress. $EW_{i,t}$ represents extreme weather, including extreme temperature, drought, flood and storm in this study. $Controls_{i,t}$

are control variables, including GDP per capita, fixed broadband subscriptions, financial development index, individual access to the Internet, urbanization rate, foreign direct investment, whether there is legislation on sexual harassment in employment and access to electricity. Besides, ν_i and μ_t indicate region fixed effects and year fixed effects and $\varepsilon_{i,t}$ is the random disturbance term.

3.2. Variables and data

3.2.1. Dependent variable

The scope of women's socio-economic rights covers a lot of fields and is becoming increasingly broad. At present, it is generally accepted through reports and research that women's socio-economic rights usually include four aspects: first, physical integrity rights mean women have the power to protect themselves from violence; second, professional education rights refer to the fact that women have he same opportunities to go to school or learn online just as men do; third, poverty rights is the women's ability to have and manage their money or other intangible property; and fourth, the political rights demand that society allow women to participate in the decision-making process.

The variables used in the WSR in the article are listed in Table 1. All the data used to construct the index comes from the World Bank Portal. The Coefficient of Variation Method is used to compound the index. Specifically speaking, there are six steps shown below to obtain the score of each individual during the specified year.

Step 1: data normalization.

Positive indexes:

$$x'_{k,i,t} = \frac{x_{k,i.t} - x_{min}}{x_{max} - x_{min}}$$

Negative indexes:

$$x'_{k,i,t} = \frac{x_{min} - x_{k,i,t}}{x_{max} - x_{min}}$$

Step 2: calculating the weight of index k.

$$p_{k,i,t} = \frac{x_{k,i,t}}{\sum x_{k,i,t}}$$

Step 3: calculating the entropy of index k.

$$e_k = -\sum_{i,j} p_{k,i,t} \times \ln(p_{k,i,t})$$

Step 4: calculating the diversity factor of index k.

$$g_k = 1 - e_k$$

Step 5: calculating the weight of index k according to the diversity factor.

$$\omega_k = \frac{g_k}{\sum_k g_k}$$

Step 6: calculating the score.

$$WEI_{i,t} = \sum_k \omega_k \times x'_{k,i,t}$$

Here, $x_{k,i.t}$ indicates the value of index k of country i in year t.

Table 1. The composition of WSR, own elaboration

Dimensions	Variables
Physical integrity rights	Survival to age 65 of the cohort
	Suicide mortality rate per 100 000 population
	Prevalence of overweight in adults
	Prevalence of HIV ages 15-24
	Mortality rate under 5 per 1 000 live births
	Lifetime risk of maternal death
	Mortality caused by road traffic injuries per 100 000 population
	Adolescent fertility rate: births per 1 000 women ages 15-19
Professional education rights	Secondary school enrollment
	Share of female graduates in business administration and law programs
Property rights	Women business and the law assets indicator score scale: 1-100
	Ratio of female to male youth unemployment rate ages 15-24
	Employment in senior and middle management female
	Labor force female of the total labor force
	Employment to population ratio
Political rights	Proportion of women in ministerial-level positions
	Proportion of seats held by women in national parliaments

3.2.2. Independent variable

Existing research usually collects the amount to represent its frequency or the deaths and damage of extreme weather to scale the severity from the EM-DAT database (Wen et al., 2023, 2021). In this study, the number of deaths in extreme weather is applied only as an independent variable.

3.2.3. Control variables

GDP per capita is used as a proxy variable to eliminate the different scales among sample countries. Cotter et al.(2021) point out that more investment in infrastructure such as communication has a positive impact on sales and employment. A fixed broadband subscription is chosen as the proxy variable. Microfinance or financial education can significantly provide more job opportunities for women and then improve their rights(Field et al., 2021). The Financial Development Index is used to measure the level of financial development in a country. Access to the Internet is an important prerequisite for online learning, a convenient and cheaper way to obtain news and knowledge compared with going to school (UN WOMEN, 2023). Therefore, the proportion of individuals with access to the Internet is used to measure the level of Internet penetration. He et al.(2022) have proved that the increasing level of urbanization is prone to aggrandizing the frequency and duration to which people are exposed in extreme heat environments, which results in low productivity. Foreign direct investment is regarded as one of the most important capital sources for a country (Morsy, 2020). Among all the factors that can affect women's socio-economic rights, regulations and laws are considered to be the two main factors. Controlling the use of alcohol and prescribing women's share in the use of resources can reduce the harm to women and improve their status(Cook et al., 2019). Due to data limitations, we only control for employment legislation. Access to clean energy like electricity or other clean cooking fuel will upgrade women's health condition, shorten their housekeeping time, thus greatly promote their sense of happiness greatly(Belmin et al., 2021). The proportion of people who have accessed electricity in a country is added as a control variable prudently in this paper to discuss the role of clean energy. The data comes from the World Bank, IMF, and Global SDG Indicators Database.

3.2.4. Mediating variables

In retrospect, it is accepted that dominant power in decision-making progress being translated from women to men was due to the shrinking of the scale in agriculture and the expansion of the use of large machinery (Alesina et al., 2013). That indicates that there are some jobs that fit males and females heterogeneously. In addition, Rusca et al.(2023) conclude that the economic structure of a country will determine its residents' employment mode.

Existing studies indicate the strongly positive relationship between innovation and women's socio-economic rights by improving their income and condition of life (Hossain et al., 2023; Shahid et al., 2023). Meanwhile, most researcher acknowledge that extreme weather has negative effects on innovation, especially green innovation (Hu et al., 2022; Li and Lu, 2023; Wen et al., 2023). Therefore, it is worth exploring the mediating effect of innovation on the role of extreme weather on women's socio-economic rights. The data comes from the World Bank and WIPO.

3.3. Data description

According to the World Economic Forum (2022), our study collects data during 2000 and 2021 from 146 sample countries around the world while considering the regions to explore the relationship between women's socio-economic rights and extreme weather. To alleviate multicollinearity and a unified dimension, all the variables except the financial development index are used after the logarithm.

The description of the data is listed in Table 2. On average, the number of deaths in flood events, reaching 19.402, outdistances that in the other three kinds of weather. From the description, we can also see that among the four kinds of extreme weather, flood shows the highest fluctuation, and extreme temperature ranks second, at 63.947 and 31.476, respectively, which indicates the significant heterogeneity of the severity of flood and storm events. On the contrary, the number of droughts is more stable, which probably indicates that droughts are more extensive compared to other types of weather.

4. Empirical results

4.1. Basic results

The effects of four types of extreme weather on WSR are shown in Table 3. Extreme temperatures, floods, and storms all have a negative impact on WSR, but the influence of storms is not significant. A 1% increase in the number of deaths in extreme temperature events will lead to a 2.6% decrease in WSR, and a 1% increase in the number of deaths in flood events will lead to a 0.9% decrease in the index. It is consistent with the conclusion of previous studies, which made a declaration on the negative impact of extreme weather on WSR. Besides, the coefficient of drought is positive, though it is not significant. It may be due to the complex components of WSR, so it's necessary to have a look at the influence of extreme weather on each dimension of the index.

Table 2. Descriptive statistics, own elaboration

Variables	Symbol	Definition	N	Mean	SD
Women's socio-economic rights	WSR	The level of women's socio-economic rights, calculated by several indicators	1,055	53.553	8.570
Extreme Temperature	EW1	Natural log of the number of deaths due to extreme temperatures	3,180	5.096	31.476
Drought	EW2	The number of deaths in drought events	3,212	0.394	9.832
Flood	EW3	The number of deaths in flood events	3,180	19.402	63.947
Storm	EW4	The number of deaths due to windstorms	3,180	6.920	29.283
GDP per capita	GDP	GDP per capita	3,122	9.187	1.170
Individual Access to the Internet	AI	The percentage of the population with access to the Internet	3,086	3.041	1.308
Urbanization Rate	UR	The proportion of urban residents in the total population	3,145	3.973	0.453
Fixed Broadband Subscriptions	FBS	High-speed public Internet subscriptions per 100 people, with downstream speeds of at	2,752	1.652	1.312
Financial Development Index	FD	A comprehensive index that reflects the size of financial institutions and markets, the	2,942	0.329	0.231
Foreign Direct Investment	FDI	Foreign capital, including equity capital, reinvestment of earnings, and other capital (%	2,917	-0.029	0.049
If There is Legislation on Sexual Harassment in Employ-	LSH	Dummy variable equal to 1 if legislation exists and 0 if not	3,212	0.623	0.485
Access to Electricity	AE	Indicator 7.1.1, the percentage of population with access to electricity	2,831	79.758	29.908
Industrial Structure	IS	The share of the services sector in the national economy	3,127	0.742	0.484
Innovation	I	The number of patents gained	2,021	0.344	1.195

As for the role of the control variables, in general, the results are in accordance with the existing research. GDP per capita, individual access to the Internet, FDI, and legislation on sexual harassment in employment all play a strongly positive role in improving the level of WSR. These results have been explained in the existing literature: more investment in telecommunications and other infrastructure will greatly enhance the opportunities for women to learn and thus improve their rights (Cotter et al., 2021; UN WOMEN, 2023). However, the negative influence of the financial development index is significant at the 10% significant level in the regression between extreme temperature and WSR. Noticeably, the positive impacts of urbanization rates and fixed broadband subscriptions are not significant. Moreover, access to electricity is detrimental to WSR regardless of the extreme weather regression, as concluded by Subedi et al. (2023). That proves our previous hypothesis that inequal access to clean energy has an adverse effect on WSR, and this effect has exceeded the positive impact of the increase in the total amount of clean energy used in our sample countries.

Table 3. Effects of extreme weather on WSR, own elaboration

	(1)	(2)	(3)	(4)
Variables	WSR	WSR	WSR	WSR
EW1	-0.026***			
	(0.008)			
EW2		0.286		
		(0.256)		
EW3			-0.009***	
			(0.003)	
EW4				-0.008
				(0.008)
Region effect	YES	YES	YES	YES
Year effect	YES	YES	YES	YES
Constant	17.60*	18.40**	17.82**	18.12**
	(9.001)	(8.902)	(8.810)	(8.939)
Observations	692	699	696	688
R-squared	0.575	0.572	0.572	0.571

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The same below. Control variables are included but not reported to save space. The same below.

Furthermore, the results of the regression on four types of extreme weather and four dimensions of WSR are shown in Table 4. Panel A to Panel D represents the result of panel regression using variable EW1 to EW4, respectively. From column (1) to column (3), we can find that regardless of women's physical integrity rights, professional education rights, or property rights, extreme weather including drought, flood, and storm all have a negative impact (except for coefficient of EW2 in column (2)). Especially, the coefficients of the number of deaths in flood events on women's physical integrity rights and property rights have an approximate value with that of WSR. It may be because the feather of a flood is different from that of extreme temperature and drought, that is, it takes a shorter time that a flood weather continues while the span of damage in extreme temperature and drought events is more lasting. Sequentially, the deaths in extreme temperature and drought events are more likely to contribute to a number of chain reactions, but not only the injury to women's bodies or property, which is the mechanism of the impact of flood weather, so that the weight of physical integrity rights or property rights is not very high in extreme temperature and drought events while the coefficient of flood is close to the total effect.

It is noteworthy that the coefficient of the number of deaths in drought weather is 0.281 (p<0.01), which seems to not be consistent with existing conclusions of articles and reports that indicate drought causes a longer time for women to find water for the whole family, thus depriving them of their time to learn. It needs to be mentioned here that the professional education rights in the regression consisted of the women's percentage of secondary school enrollment and the share of female graduates in business administration and law programs. The reason why the coefficient is positive may lie in the improvement in the integral level of infrastructure in the sample countries, and the score of infrastructure in only some of the sample economies is lower. The results of the regression of extreme weather on women's political rights are listed in Column (4). It is interesting to note that the role of drought, flood, and storm on political rights are all positive, though the role of storm is not significant. This result illustrates, to some extent, that women play an important role in the progress of decision-making on environmental issues due to their special feathers, just as some previous studies conclude. Therefore, when the extreme weather events become more frequent or severe, society as a whole begins to eagerly seek a solution in which the role of women is crucial.

Table 4. Effects of extreme weather on women's different dimensions of rights, own elaboration

		(1)	(2)	(3)	(4)
Regression panels	Variables	Physical integrity rights	Professional education rights	Property rights	Political rights
Panel A	EW1	-0.003	0.004	-0.001	-0.005
		(0.003)	(0.002)	(0.004)	(0.007)
Panel B	EW2	-0.071***	0.281***	-0.150***	0.054*
		(0.017)	(0.049)	(0.021)	(0.031)
Panel C	EW3	-0.008***	-0.007**	-0.008**	0.007**
		(0.002)	(0.003)	(0.004)	(0.004)
Panel D	EW4	-0.002	-0.013***	-0.020***	0.006
		(0.003)	(0.005)	(0.007)	(0.009)
Region effect		YES	YES	YES	YES
Year effect		YES	YES	YES	YES
Observations		1,306 - 1,319	1,289 - 1,306	1,326 - 1,347	1,769 - 1,794
R-squared		0.864 - 0.869	0.898 - 0.899	0.606 - 0.619	0.412 - 0.414

Overall, the effects of the four kinds of extreme weather appear to be complex. Extreme temperature brings to bear on WSR from an overall perspective, but not from one or some of the aspects. The influence of drought represents a positive effect on women's professional education rights and political rights and a negative effect on women's physical integrity rights and property rights, with the value of coefficients being approximate between physical integrity rights and political rights and between professional education rights and property rights, which may be able to explain the inapparent role of that on WSR. Except in the regression on women's political rights, the impacts of floods are negative, and the values are close to those on WSR. The coefficient of the number of deaths in storm events on WSR is insignificant, but in the regressions between deaths in storm events and each dimension of WSR, we can find an important negative role for women's vocational education and property rights.

4.2. Robustness test

To ensure the robustness of the conclusion, four kinds of tests are conducted in this part: substituting variables, extreme value trimming, and sub-sample regression.

4.2.1. Considering substitute variables

Given the possible bias caused by the complex composition of the index, it's a necessity to conduct another regression using other dependent variables. The gender development index (GDI) gained from UN WOMEN provides a suitable substitution. These two indexes can both measure the level of women's socio-economic rights, but they consider more information about gender equality than our index.

The results are described in Column (1) in Table 5 as follows. The results show that when more information on gender equality is added to the regression, the significance of the coefficients improves dramatically, especially in the role of storm. It demonstrated that, on the basis of women's basic rights, we are now being urged to pay close attention to their relative rights. However, though the effect of drought events changes to negative, its coefficient is still not significant. This confirms the earlier finding that drought is usually considered to be a persistent weather condition compared to the other three types of extreme weather. Thus, the government of the country is prone to improving its infrastructure constructions to prevent the inhabitants from the damages of drought, such as upgrading the materials of the infrastructures (Walker and Van Loon, 2023). It is worth noting that the values of the coefficients in Column (1) are much smaller than those in the basic regression.

4.2.2. Dealing with the extreme values

It is well known that there is are large differences in the severity of extreme weather events as a result of a country's geographical location and the governance capability. Therefore, the treatment of the sample data may contribute to a different consequence. The results of regression with a 5% quantile of bilateral trimming are in Column (2) in Table 5. It is worth a noting that the treatment of the number of deaths in drought events is not changing in this progress because its data range is so small that a 5% quantile of bilateral trimming is enough to make all the data trimmed. According to the results, the significance of the extreme weather coefficients is getting worse. The possible reason lies in the special distribution of extreme weather, which demonstrates *more extreme value, less average value*. Hence, when a trimming takes place, most of the extreme but more frequent commoner data are simply neglected, making the role of the remaining extreme weather data left less significant.

4.2.3. Sub-sample analysis

Here, development level, personal income and religious areas are chosen as the indicators in this section to divide the country into different groups.

4.2.3.1. Sub-sample regression in countries with different development levels

Columns (3) to (6) in Table 5 describes the result of sub-sample regression. The role of extreme temperature on WSR in the countries ranked low, medium, high, and very high countries is shown in Panel A, that of drought in Panel B, that of floods in Panel C and that of storms in Panel D. Except for some impacts of extreme weather, which can't be observed because of the data omitted, the negative influence can only be seen in the regression between WSR and extreme temperature in high developed countries. The reason for this may be that in the countries with a very high level of development, the governance is advanced enough to protect the country from extreme temperatures, whereas in countries with a medium level of development, the infrastructure is not perfect enough. Meanwhile, the samples are also sorted into advanced and developing economies, and the results in columns (7) and (8) are similar to those for the level of development.

4.2.3.2. Sub-sample regression in countries with different personal incomes

The results of the sub sample regressions are in Columns (9) to (11) in Table 5 as follows. The role of extreme temperature on WSR in low-income, medium-income, and high-income countries is shown in Panel A, that of drought in Panel B, that of floods in Panel C and that of storms in Panel D. There is also some data omitted in the

results. It has been discovered that flood events have a significantly negative impact on WSR, whereas the roles of the other three extreme weather events are insignificant.

4.2.3.2. Sub-sample regression in countries with different religious adherents

Previous studies have found evidence that religious norms influence gender equality. Some studies point out that many religions impose stricter regulations on women, including restrictions on going out, education, career development, and emphasizing their subordinate status in the family (Glas et al., 2019). The results in (12) and (13) in Table 5 prove that the impact is significant in countries with more religious influence.

4.3. Further research

4.3.1. Industrial structure

The results of extreme weather on women's socio-economic rights through industrial structure are depicted below in Columns (1) to (3) in Table 6. Panel A to Panel D represents the roles of extreme temperature, drought, flood, and storm, respectively. Moreover, the results of the regression on four dimensions of WSR are shown in Table 7. According to the results in Table 7, the severer the extreme temperature events are, the lower the level of industrial structure ranks, whatever the index or on each of the four dimensions. A 1% increase in the number of deaths in extreme temperatures will lead to a 0.1% decrease in the percentage of the third sector in national economy, which is considered to be more suitable for women's access to work and to reduce the harms of backbreaking labour (Alesina et al., 2013). However, the impact of industrial structure on WSR is significantly positive, which is somehow inconsistent with the existing conclusion. By listing the results of four dimensions, we deduce that the reason why the impact above is negative lies in the regression in column (10) – (12) in Table 7. When women face a dilemma with fewer positions suitable for them and find it difficult to improve their own social status and life standard of living, they will seek strive for more rights from political regions. This rule can also be found in the roles of drought, flood, and storm.

4.3.2. Innovation

As is summarized above, innovation can be an important mediating variable in the impact of extreme weather events on women's socio-economic rights. The results of the mediating role of innovation are listed from Columns (4) to (6) in Table 6 and Table 8. There are some varying degrees of increase in innovation as the severity of extreme weather increases, among which floods and storms have the highest degree of increase and extreme temperatures have the lowest degree of increase at 1.3% and 0.4%, respectively. This result is consistent with the previous conclusion that floods and storms are two kinds of weather with a more lasting mechanism, while extreme temperatures are less enduring but more drastic. Thus, it will give people time to adapt and protect themselves from the bad weather.

5. Conclusions and implications

Given the high attention given to women's basic rights and the increasingly serious issue of extreme weather and aiming to achieve sustainable development, this study conducts regressions between the two factors from four aspects of women's socio-economic rights, namely physical integrity rights, professional education rights, property rights, and political rights. Controlling other possible variables, extreme weather shows a complicated influence. The impact of extreme temperatures on the index is significant, but appears to be flat for each aspect of the index. The coefficient of drought is 28.1%, and 5.37% for women's vocational education rights and political rights, but negative for women's physical integrity rights and property rights. The impacts of flooding are negative, except for women's political rights. Storm can only play a role in vocational education and property rights.

The impact of these extreme weather events on women's socio-economic rights is also related to the level of development and personal income. The coefficients are significant only in the regression between WSR and extreme temperature in highly developed countries and in the regressions between WSR and flood in medium-income and high-income countries. Extreme weather can play a part in the level of WSR through industrial structure and innovation. The role of extreme weather on industrial structure is negative, but industrial structure will accelerate the improvement in WSR that can result from more active participation in political affairs. On the contrary, when the impact of innovation on WSR is positive, extreme weather is also conducive to the aggrandization of innovation.

The conclusion of this article also provides new evidence on the issue of women's rights in the process of sustainable development and offers policy insights for achieving the SDGs, especially in the context of addressing extreme weather events. From a sustainable development perspective, the protection of women's socio-economic rights, as a key force in social development, is directly related to social equity and harmony, and is also one of the core elements of sustainable development. The complex impact of extreme weather events on women's socio-economic rights indicates that gender differences must be fully considered in the process of addressing climate change and pursuing sustainable development. Failure to do so may exacerbate gender inequality and hinder the achievement of sustainable development goals.

Table 5. Robustness test, own elaboration

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Regression panels	Variables	GDI	WSR	Low	Medium	High	Very high	Advanced economies	Developing economies	Low-income	Medium-income	High-income	Religious area	Non-religious area
Panel A	EW1	-0.0001***	-0.187*	-	0.017	-0.053**	-0.005	-0.014	-0.104**	-	-0.004	-0.010	-0.030***	-0.026***
		(2.67e-05)	(0.104)		(0.011)	(0.024)	(0.008)	(0.013)	(0.042)		(0.019)	(0.007)	(0.012)	(0.007)
Panel B	EW2	-0.0003	0.092	-	-	-0.104	1.100***	-	0.397**	-	-0.067	-	0.135	-
		(0.0003)	(0.205)			(0.089)	(0.170)		(0.189)		(0.082)		(0.233)	
Panel C	EW3	-0.0001***	-0.012	0.026	-0.004	-0.003	0.009	-0.080	-0.011***	0.026	-0.015***	-0.035**	-0.011***	-0.011
		(1.89e-05)	(0.009)	(0.027)	(0.006)	(0.002)	(0.013)	(0.081)	(0.004)	(0.027)	(0.003)	(0.016)	(0.003)	(0.018)
Panel D	EW4	-0.0002***	0.025	0.021	-0.003	0.013	0.012	-0.013	-0.002	0.021	0.008	-0.043	0.006	-0.020
		(4.21e-05)	(0.0338)	(0.035)	(0.005)	(0.008)	(0.060)	(0.090)	(0.009)	(0.035)	(0.006)	(0.037)	(0.006)	(0.021)
Region effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations		1,764 - 1,790	501 - 536	40	123 - 133	179 - 181	331 - 338	160-168	401-412	40	406 - 417	232 - 239	506-517	181
R-squared		0.702 - 0.707	0.586 - 0.600	0.870 - 0.874	0.834 - 0.842	0.892 - 0.895	0.559 – 0.563	0.648-0.653	0.568-0.577	0.870 - 0.874	0.715 - 0.727	0.710 – 0.715	0.643-0.648	0.725-0.729

Table 6. Test on the intermediary effect: WSR, own elaboration

		(1)	(2)	(3)	(4)	(5)	(6)
Regression panels	Variables	WSR	IS	WSR	WSR	I	WSR
Panel A:	IS	-	-	-2.844***	-	-	-
				(0.866)			
	I	-	-		-	-	1.098***
							(0.178)
	EW1	-0.026***	-0.001**	-0.028***	-0.026***	0.004***	-0.029***
		(0.008)	(0.000)	(0.008)	(0.008)	(0.002)	(0.008)
Panel B:	IS	-	-	-2.785***	-	-	-
				(0.861)			
	I	-	-		-	-	1.080***
							(0.177)
	EW2	0.286	-0.001	0.283	0.286	0.013**	0.241
		(0.256)	(0.002)	(0.285)	(0.256)	(0.005)	(0.223)
Panel C:	IS	-	-	-3.188***	-	-	
				(0.878)			
	I	-	-		-	-	1.095***
							(0.180)
	EW3	-0.009***	-0.001***	-0.012***	-0.009***	0.005***	-0.008**
		(0.003)	(0.000)	(0.003)	(0.003)	(0.001)	(0.003)
Panel D:	IS	-	-	-3.001***	-	-	
				(0.879)			
	I	-	-	-	-	-	1.103***
							(0.178)
	EW4	-0.008	-0.002***	-0.008	-0.008	0.013***	-0.012
		(0.008)	(0.000)	(0.008)	(0.008)	(0.002)	(0.009)
Region effect		YES	YES	YES	YES	YES	YES
Year effect		YES	YES	YES	YES	YES	YES
Observations		688 - 699	1,783 - 2,093	688 - 699	688 - 699	1,292 – 1,318	568 - 576
R-squared		0.571 - 0.575	0.439 - 0.466	0.578 - 0.581	0.571 - 0.575	0.674 - 0.697	0.608 - 0.613

Table 7. Test on the intermediary effect of industrial structure: different dimensions, own elaboration

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Regression	Variables	Physical	IS	Physical	Professional	IS	Professional	Property	IS	Property	Political	IS	Political
Panel A:	IS	-	-	1.225***	-	-	3.487***	-	-	-0.040	-	-	-2.691***
				(0.242)			(0.543)			(0.806)			(0.934)
	EW1	-0.003	-0.001**	-0.002	0.004	-0.001**	0.004*	-0.001	-0.001**	-0.002	-0.005	-0.001**	-0.007
		(0.003)	(0.000)	(0.004)	(0.002)	(0.000)	(0.002)	(0.004)	(0.000)	(0.004)	(0.007)	(0.000)	(0.007)
Panel B:	IS	-	-	1.239***	-	-	3.460***	-	-	-0.099	-	-	-2.533***
				(0.242)			(0.542)			(0.787)			(0.926)
	EW2	-0.071***	-0.001	-0.075***	0.281***	-0.001	0.236***	-0.150***	-0.001	-0.149***	0.0537*	-0.001	0.050*
		(0.017)	(0.002)	(0.016)	(0.049)	(0.002)	(0.049)	(0.021)	(0.002)	(0.021)	(0.0308)	(0.002)	(0.028)
Panel C:	IS	-	-	1.166***	-	-	3.379***	-	-	-0.102	-	-	-2.566***
				(0.240)			(0.546)			(0.832)			(0.959)
	EW3	-0.008***	-0.001***	-0.008***	-0.007**	-0.001***	-0.004	-0.008**	-0.001***	-0.009**	0.007**	-0.001***	0.005
		(0.002)	(0.000)	(0.002)	(0.003)	(0.000)	(0.003)	(0.004)	(0.000)	(0.004)	(0.004)	(0.000)	(0.004)
Panel D:	IS	-	-	1.211***	-	-	3.442***	-	-	-0.083	-	-	-2.433**
				(0.243)			(0.545)			(0.792)			(0.946)
	EW4	-0.002	-0.002***	-0.001	-0.013***	-0.002***	-0.011**	-0.020***	-0.002***	-0.023***	0.007	-0.002***	0.003
		(0.003)	(0.000)	(0.004)	(0.005)	(0.000)	(0.005)	(0.007)	(0.000)	(0.008)	(0.009)	(0.000)	(0.009)
Region effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations		1,306 – 1,319	1,783 – 2,093	1,300 – 1,313	1,289 – 1,306	1,787 – 2,093	1,289 – 1,306	1,326 – 1,347	1,783 – 2,093	1,306 – 1,327	1,769 – 1,794	1,783 – 2,093	1,745 – 1,770
R-squared		0.864 – 0.869	0.439 – 0.466	0.866 – 0.871	0.898 – 0.899	0.439 – 0.466	0.903	0.606 – 0.619	0.439 – 0.466	0.591 - 0.606	0.412 – 0.414	0.439 – 0.466	0.406 – 0.409

Table 8. Test on the intermediary effect of innovation: different dimensions, own elaboration

3		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Regressi	Variab	Physi	I	Physi	Professi	I	Professi	Prope	I	Prope	Politica	I	Politica
Panel A:	I	-	-	-	-	-	0.393**	-	-	0.581	-	-	1.127*
				(0.097			(0.114)			(0.189			(0.225)
	EW1	-0.003	0.004	-0.002	0.004	0.004**	0.004*	-0.001	0.004	-0.003	-0.005	0.004*	-0.010
		(0.003	(0.002	(0.003	(0.002)	(0.002)	(0.002)	(0.004	(0.002	(0.004	(0.007)	(0.002)	(0.008)
Panel B:	I	-	-	-	-	-	0.371**	-	-	0.579	-	-	1.045*
				(0.096			(0.113)			(0.190			(0.218)
	EW2	-	0.013	-	0.281**	0.013**	0.252**	-	0.013	-	0.054*	0.013*	0.0382
		(0.017	(0.005	(0.013	(0.049)	(0.005)	(0.0521)	(0.021	(0.005	(0.023	(0.031)	(0.005)	(0.030)
Panel C:	I	-	-	-	-	-	0.407**	-	-	0.600	-	-	1.171*
				(0.097			(0.113)			(0.175			(0.245)
	EW3	-	0.005	-	-0.007**	0.005**	-0.005	-	0.005	-	0.007*	0.005*	0.002
		(0.002	(0.001	(0.002	(0.003)	(0.001)	(0.003)	(0.004	(0.001	(0.004	(0.004)	(0.001)	(0.004)
Panel D:	I	-	-	-	-	-	0.400**	-	-	0.724	-	-	1.037*
				(0.097			(0.113)			(0.183			(0.230)
	EW4	-0.002	0.013	0.006	-	0.013**	-0.012**	-	0.013	-	0.007	0.013*	-0.001
		(0.003	(0.002	(0.005	(0.005)	(0.002)	(0.005)	(0.007	(0.002	(0.007	(0.009)	(0.002)	(0.012)
Region effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year effect		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations		1,306 – 1,319	1,292 – 1,318	879 – 891	1,289 – 1,306	1,292 – 1,318	1,026 – 1,042	1,326 – 1,347	1,292 – 1,318	1,026 – 1,047	1,769 – 1,794	1,292 – 1,318	1,275 – 1,300
R-squared		0.864 – 0.869	0.674 – 0.697	0.856 – 0.860	0.898 – 0.899	0.674 – 0.697	0.861 – 0.862	0.606 – 0.619	0.674 – 0.697	0.660 –0.677	0.412 – 0.414	0.674 – 0.697	0.458 – 0.461

The conclusions of this paper have some policy implications, to some extent. Firstly, women's socio-economic rights are closely related to extreme weather; thus, so there is an opportunity to address gender issues and climate change in a synergistic way. Secondly, infrastructure construction can be an effective way to deal with the impairment of women's socio-economic rights, so it is necessary to improve the comprehensive development level of the country, though it may be somehow hard to make progress. Thirdly, it is urged to encourage more innovation because innovation is likely to reduce the damage of extreme weather and strengthen the country's defense capability.

Our study does have some limitations. First of all, subject to variable selection, it is hard to unify the macroeconomic and microeconomic data into the same study, which neglects household information. Besides, in terms of the mechanism, we also left the decision-making progress in the households behind. At last, the index in this paper ignores the relative rights of women compared to men, which considered to be lacking in this field of research.

Furthermore, we hope that future research will continue to focus on how to better integrate women's socio-economic rights into the sustainable development framework. On the one hand, it is necessary to explore in depth the differences in the impact of extreme weather events on women's socio-economic rights in different cultural, social and economic contexts as a basis for formulating more targeted policies. On the other hand, more efforts should be devoted to researching the interactive relationship between macroeconomic policies and micro-household decisions, clarifying the mechanism through which families safeguard women's socio-economic rights in the face of extreme weather impacts.

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Appendix

Table A.1. Sample countries and groups.

Country	(1)	(2)	(3)	(4)
	HDI	Advanced economies	Income	Religious area
Afghanistan	low	0	low income	1
Albania	high	0	middle income	0
Algeria	high	0	middle income	1
Angola	middle	0	middle income	1
Argentina	very high	0	middle income	1
Armenia	high	0	middle income	0
Australia	very high	1	high income	1
Austria	very high	1	high income	1
Azerbaijan	high	0	middle income	1
Bahrain		0	high income	0
Bangladesh	middle	0	middle income	1
Barbados	high	0	high income	0
Belarus	very high	0	middle income	1
Belgium	very high	1	high income	1
Belize	middle	0	middle income	1
Benin	low	0	middle income	0
Bhutan	middle	0	middle income	0
Bolivia		0	middle income	1
Bosnia and Herzegovina	high	0	middle income	0
Botswana	middle	0	middle income	0
Brazil	high	0	middle income	1
Brunei Darussalam		0	high income	0
Bulgaria	high	0	middle income	1
Burkina Faso	low	0	low income	1
Burundi	low	0	low income	1
Cabo Verde	middle	0	middle income	1
Cambodia	middle	0	middle income	1
Cameroon	middle	0	middle income	1
Canada	very high	1	high income	1
Chad	low	0	low income	1
Chile	very high	0	high income	1
China	high	0	middle income	1
Colombia	high	0	middle income	1
Comoros	middle	0	middle income	0
Congo, Dem. Rep.		0	low income	0
Costa Rica	very high	0	middle income	0
Cote d'Ivoire		0	middle income	1
Cyprus	very high	1	high income	0
Czechia	very high	1	high income	1
Denmark	very high	1	high income	0
Dominican Republic	high	0	middle income	1
Ecuador	high	0	middle income	1
Egypt, Arab Rep.		0	middle income	1
El Salvador	middle	0	middle income	1
Equatorial Guinea		0	middle income	1
Estonia	very high	1	high income	0
Eswatini		0	middle income	1
Ethiopia	low	0	low income	1
Fiji	high	0	middle income	0
Finland	very high	1	high income	0
France	very high	1	high income	1
Gambia, The		0	low income	0
Georgia	very high	0	middle income	1
Germany	very high	1	high income	1
Ghana	middle	0	middle income	1
Greece	very high	1	high income	1
Guatemala	middle	0	middle income	1
Guyana	high	0	middle income	0
Honduras	middle	0	middle income	0

Country	(1)	(2)	(3)	(4)
	HDI	Advanced economies	Income	Religious area
Hungary	very high	0	high income	1
Iceland		1	high income	0
India	middle	0	middle income	1
Indonesia	high	0	middle income	1
Iran, Islamic Rep.		0	middle income	1
Ireland	very high	1	high income	0
Israel	very high	1	high income	0
Italy	very high	1	high income	1
Jamaica	high	0	middle income	0
Japan	very high	1	high income	1
Jordan	high	0	middle income	1
Kazakhstan	very high	0	middle income	1
Kenya	middle	0	middle income	1
Korea, Rep.		1	high income	1
Kuwait	very high	0	high income	0
Kyrgyz Republic		0	middle income	0
Lao PDR		0	middle income	0
Latvia	very high	1	high income	0
Lebanon	high	0	middle income	0
Lesotho	low	0	middle income	0
Liberia	low	0	low income	0
Lithuania	very high	1	high income	0
Luxembourg	very high	1	high income	0
Madagascar	low	0	low income	0
Malawi	low	0	low income	1
Malaysia	very high	0	middle income	1
Maldives	high	0	middle income	1
Mali	low	0	low income	1
Malta		0	high income	1
Mauritius	very high	0	middle income	1
Mexico	high	0	middle income	1
Moldova		0	middle income	1
Mongolia	high	0	middle income	0
Montenegro	very high	0	middle income	0
Morocco	middle	0	middle income	1
Mozambique	low	0	low income	1
Myanmar	middle	0	middle income	1
Namibia	middle	0	middle income	0
Nepal	middle	0	middle income	0
Netherlands	very high	1	high income	1
New Zealand	very high	1	high income	0
Nicaragua	middle	0	middle income	0
Niger	low	0	low income	1
Nigeria	low	0	middle income	1
North Macedonia		0	middle income	0
Norway	very high	1	high income	0
Oman	very high	0	high income	0
Pakistan	low	0	middle income	1
Panama	very high	0	high income	0
Paraguay	high	0	middle income	0
Peru	high	0	middle income	1
Philippines	middle	0	middle income	1
Poland	very high	0	high income	1
Portugal	very high	1	high income	1
Qatar	very high	0	high income	0
Romania	very high	0	high income	1
Rwanda	low	0	low income	1
Saudi Arabia	very high	0	high income	1
Senegal	low	0	middle income	1
Serbia	very high	0	middle income	1
Sierra Leone	low	0	low income	0
Singapore	very high	1	high income	0

Country	(1)	(2)	(3)	(4)
	HDI	Advanced economies	Income	Religious area
Slovak Republic		1	high income	0
Slovenia	very high	1	high income	0
South Africa	high	0	middle income	1
Spain	very high	1	high income	1
Sri Lanka	high	0	middle income	1
Suriname	high	0	middle income	0
Sweden	very high	1	high income	1
Switzerland	very high	1	high income	1
Tajikistan	middle	0	middle income	0
Tanzania		0	middle income	1
Thailand	very high	0	middle income	1
Timor-Leste	middle	0	middle income	1
Togo	low	0	low income	0
Tunisia	high	0	middle income	1
Turkiye		0	middle income	1
Uganda	low	0	low income	1
Ukraine	high	0	middle income	1
United Arab Emirates		0	high income	1
United Kingdom	very high	0	high income	1
United States	very high	1	high income	1
Uruguay	very high	0	high income	0
Vanuatu	middle	0	middle income	0
Vietnam		0	middle income	1
Zambia	middle	0	low income	1
Zimbabwe	middle	0	middle income	1

Notes: The table presents a list of countries categorized according to different criteria. Specifically, in column (2), a value of 1 indicates that the country is a developed economy, while a value of 0 denotes a developing economy. In column (4), a value of 1 signifies that the country is a religious region, whereas a value of 0 indicates a non-religious region.