

Crimes in Extreme Weather: Social Psyche and Economic Predicament Veiled in Rain and Parching Winds

Preliminary Research Proposal by Jiadi HE

1 Background and Research Questions

Extreme weather events such as heavy rainfall, droughts, and other precipitation anomalies have profound effects on both the natural environment and human societies. With the rising frequency and intensity of these events, likely driven by global climate change, numerous studies have focused on their direct environmental and economic tolls of such phenomena, but less attention has been devoted to their inducement of crimes, possibly channeled through subtle distortions in social psyche and economic conditions.

The study explores the impact of extreme drought and prolonged rainfall on crimes. Specifically, using the Standardized Precipitation Index (SPI) to evaluate weather patterns, the analysis combines (1) fixed-effects panel data analysis and (2) autoregressive distributed lag model (ARDL) to capture both immediate and cumulative effects on social psyche, economic predicament, and crimes across various provinces in China from 2012 to 2022. This research seeks to reveal the complex dynamics between meteorological factors and human behavior, providing a new perspective for understanding how weather conditions influence social outcomes. Three preliminary research questions are proposed.

- Do extreme rainfall and drought induce crimes?
- Could social psyche and economic pressure serve as pathways for extreme weather to induce crimes?
- Do rainfall and drought have varying effects on different types of crime and demographic groups (Michel et al., 2016; Blakeslee et al., 2021; Ishak, 2022)? For instance, might short-term rainfall anomalies more strongly influence opportunistic crimes like theft, robbery, and assault, while prolonged extreme weather impacts non-opportunistic crimes such as human trafficking, homicide, and economic offenses?

2 Data Collection and Variable Definitions

2.1 Potential Outcome Variables

The dependent variables primarily include three interrelated dimensions: social psyche, economic predicament, and crimes. These aspects reveal a society's vulnerability to disruptions caused by extreme weather, suggesting key focus areas for policymakers addressing climate challenge.

Social psyche reflects the potential mental stress and psychological disorders people may experience under climate disruptions. Possible indicators are: (1) Frequency of medical incidents (Bhattacharyya and Millham, 2001). This includes emergency cases related to weather-induced stress, such as dehydration, heatstroke, and waterborne or

vector-borne diseases caused by heavy rainfall; (2) Frequency of mental health reports (Hwang et al., 2024). This encompasses incidences of anxiety and depression triggered by weather-related stress. Statistics above are typically available from public health departments or hospital records. Alternatively, (3) Social media sentiment extracted by Natural Language Processing (NLP) techniques; (4) The frequency and scale of social events such as protests, strikes, and gatherings.

Extreme weather shocks can also shift socioeconomic structures, leading to economic hardship. Proxies might be: (1) Surveyed urban unemployment rate, particularly a rise in short-term unemployment and informal employment; (2) The frequency of business bankruptcy or suspensions (Chen et al., 2023), especially among small enterprises more susceptible to macroeconomic situations; (3) The Gini coefficient, a key measure of income or wealth inequality; (4) Increase in local government non-tax revenues, which often translates into hidden costs across the value chain, imposing heavier burdens on residents and businesses. This can fuel public resentment, casting doubt on the government’s fairness and legitimacy. The relevant data can hopefully be collected from the National Bureau of Statistics of China website, and the China Fiscal Statistical Yearbook, and similar sources.

The primary outcome variable is crime, measured by the number of criminal cases reported by local public security authorities, categorized by crime type.

2.2 Regressors: Drought and Deluge Shock

Weather shock proxy *Drought* is indicated by a dummy set to 1 as $SPI < -1.5$, and *Deluge* set to 1 as $SPI > 1.5$ (Wang et al., 2024). SPI is used instead of direct rainfall measures due to its ability to capture the unique climatic and geographic characteristics of precipitation, which often deviate from a normal distribution. SPI is calculated using long-term precipitation data, fitting the data to a probability distribution (commonly gamma), which is then transformed into a normal distribution. Positive SPI values indicate wetter conditions, while negative values signify drier conditions (Lloyd-Hughes and Saunders, 2002). Precipitation data will be collected from national and regional meteorological databases for the period 2012-2022 and the SPI calculation is conducted using python-gma library.

2.3 Other Control Variables

Other control variables aimed at minimizing endogeneity mainly cover three aspects: natural environment, social structure, and fiscal management. Specifically, these variables may include population-weighted average temperature (Dell et al., 2012), GDP per capita, urbanization, industrial structure, aging-related fiscal burden, topography, and geographic location.

3 Empirical Strategies

The research aims to evaluate both panel data results and lag model outcomes.

3.1 Panel evidence

Panel equation (1a) provides estimates of the immediate impacts of drought and rainfall.

$$Y_{i,t} = \beta_0 + \beta_1 Drought_{i,t} + \beta_2 Deluge_{i,t} + \sum \beta W_{i,t} + \alpha_i + \lambda_t + \varepsilon_{i,t} \quad (1a)$$

W is a controlling vector representing regional characteristics. Year fixed effect λ_t and province fixed effect α_i are considered.

3.2 Autoregressive Distributed Lag (ARDL) Model

ARDL model treats the target and other variables as jointly stationary time series. It acknowledges and captures the lagged and cumulative effects of weather anomalies, elucidating both short-term and long-term influences. The equation (2a) further incorporates interaction terms between the control variable set W and the core regressors (Kahn et al., 2021).

$$\begin{aligned} Y_{i,t} = & \alpha_i + \sum_{j=1}^p \beta_j Y_{i,t-j} + \sum_{j=0}^q \gamma_j Drought_{i,t-j} + \sum_{j=0}^q \theta_j Deluge_{i,t-j} \\ & + \sum_{j=0}^q \gamma_j Drought_{i,t-j} W_{i,t-j} + \sum_{j=0}^q \eta_j Deluge_{i,t-j} W_{i,t-j} + \varepsilon_{i,t} \end{aligned} \quad (2a)$$

The Akaike Information Criterion (AIC) and sequential tests will be used to determine the autoregressive order p and lag order q .

4 Expected Contribution

This study enhances existing literature by exploring how prolonged climate anomalies impact social psychology and crime, an area less examined compared to effects on agriculture and infrastructure. While previous research often focuses on immediate shocks and their short-term consequences, this study uses lag models to investigate the long-term, cumulative effects of extreme weather on criminal behavior. By examining regional variations in China, the study reveals how climate anomalies influence crime across different economic and social contexts, offering new insights into chronic climate impacts and providing a framework for similar research in other developing countries.

Beyond enriching the literature, the research offers potential real-world applications in public safety, economic policy, and mental health. It aims to help city planners understand how weather conditions influence social behavior and crime rates, allowing for preemptive measures like increased police presence during extreme weather. This approach could enhance citizen security and emergency response. Additionally, the research might reveal how weather anomalies impact economies, such as through rising unemployment or small business closures, enabling the development of targeted economic policies like financial aid or tax relief. Finally, if the study shows that extreme weather exacerbates social stress and mental health issues, it could inform tailored interventions, such as promoting mental health services and community support during such events, to alleviate psychological strain and build resilience.

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