IMPACTS OF GOVERNORS' EARLY-LIFE HEATWAVE EXPERIENCES ON LOCAL ENVIRONMENTAL PERFORMANCE

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Executive Summary

Climate change is a global phenomenon that has significant impacts on the environment, economy, and society. As the Earth's temperature continues to rise, the frequency and intensity of extreme weather events such as heatwaves have increased, causing not only physical but also psychological trauma to human beings. However, the mental influence of heatwaves on decision-making has not been frequently studied.

Previous studies have investigated the impact of early-life experiences, including natural disasters, famine, and political upheaval, on decision-making, particularly in the top management literature concerned about corporate behaviors and CEOs' previous experiences. These studies suggest that individuals who have experienced traumatic events in their early life stages may have a heightened concern for the well-being of others in the future, leading to post-traumatic growth. This psychological impact has been found to have positive effects on organizational performance, such as higher levels of corporate social responsibility. In the public sector, understanding the effect of early-life experiences on decision-making processes is crucial in shaping policies that address climate change and mitigate its social impacts.

Despite the increasing attention to the impact of climate change on decision-making, little is known about the role of early-life heatwave experiences on public sector decision-making. Therefore, this study specifically focuses on public sector governors, who play a critical role in local environmental performance. The objective of this study is to explore the psychological impact of early-life heatwave events on top managers and the subsequent effect on organizational performance.

This study hypothesizes that governors who experienced heatwave events during their early life stages will be more likely to promote local environmental outcomes when they come to power. The study employs an Ordinary Least Squares (OLS) approach and two unique datasets to analyze the relationships between the biographical experiences of 4018 municipal governors over 1951-2000 and pollution levels of 288 cities over 2000-2016.

The results indicate that early-life heatwave exposure significantly reduces jurisdictional CO_2 emissions by 1.1% and $PM_{2.5}$ by 2.1%, after controlling other variables, considering fixed effects, and clustering variances at the county level. The underlying influence pathway could be that early-life heatwave exposure leaves lasting subconscious imprints on the governors' minds, leading them to prioritize the welfare of the public and the environment, resulting in improved environmental outcomes during their tenure.

In conclusion, this study presents compelling and robust evidence that early-life heatwave exposure influences governors' decision-making, resulting in a greater likelihood of promoting environmental outcomes during their tenure. This is reflected by the significant reduction in jurisdictional CO_2 emissions and $PM_{2.5}$ pollution. The study contributes to the existing literature on top managers' traits and decision-making by highlighting the effect of early-life heatwave exposure on their subsequent policy decisions related to the environment. These findings underscore the importance of recognizing the psychological effects of climate change, thereby challenging the prevailing assumption of public apathy towards this issue. Additionally, this study may have important policy implications for the design of environmental policies and the selection and training of public sector leaders, emphasizing the need for a more holistic understanding of the determinants of effective decision-making in the public sector.

Contents

1 Introduction

In recent decades, rising temperatures have resulted in a significant increase in heatwave events (Robine et al., 2008) which have caused physical and psychological trauma to human beings (Pascal, 2008). However, compared to physical consequences evaluated by the morbidity and mortality (e.g., Peng et al., 2011; Xu et al., 2016), the mental influence of heatwaves has not been frequently mentioned (with notable exceptions of Clayton et al., 2017; Charlson et al., 2021; Lawrance et al., 2022) and quantified.

Notably, psychological impacts caused by heatwaves could have long-lasting impacts particularly when they occur during early life stages. As the heatwave is defined as a type of traumatizing experience (American Psychiatric Association, 2013; Pascal, 2008), psychological literature shows that people who have experienced early-life trauma will be more concerned about the well-being of others in the future (Frazier et al., 2013; Zoellner and Maercker, 2006), namely the post-traumatic growth (Tedeschi and Calhoun, 2004). Similar phenomena have also gained support from management studies and summarized in the upper echelons and imprinting theories (Hambrick and Mason, 1984; Marquis and Tilcsik, 2013; Pieper et al., 2015).

When focusing on top managers concretely, extensive evidence about the impacts of their early-life disaster experiences on organizational behaviors has been found but with a few blind spots. The literature has seen a rise in empirical studies concerned about corporate behaviors and CEO's experiences such as the natural disaster (O'Sullivan, Zolotoy, and Fan, 2021; Chen et al., 2018), China's great famine (Feng and Johansson, 2018; Long et al., 2020), or Cultural Revolution (Kong, Zhao, and Liu, 2021). However, the literature focusing on the public sector, i.e., governors, and the traumatizing effects of past climate change remains scant. This gap in knowledge warrants further attention, as understanding the effect of early-life experiences on governors' decision-making processes helps shape policies that address climate change and mitigate its social impacts.

Therefore, the objective of this study is to explore whether governors who experi-

enced heatwave events in their early life will be more likely to promote local environmental outcomes during their tenure. To test the hypothesis, a baseline Ordinary Least Squares (OLS) model is employed to determine the impact of mayors' and municipal party secretaries' early-life exposure to heatwaves on the environmental performances of their jurisdictions. The outcome is quantified by the concentration of local air pollutants CO_2 and $PM_{2.5}$. To mitigate the possible concerns of serial correlation and heteroskedasticity, the standard errors of observations are clustered to the county level (Bertrand, Duflo, and Mullainathan, 2004). The regression analysis was conducted at the county level, which allowed for a larger sample size and enabled the capture of more variations. Thus, this approach increases the statistical power of the analysis and strengthens the robustness of the findings.

A unique dataset comprising weather, municipality, and air pollution data was constructed for this study. To ensure reliability and remedy data scarcity, each data type was obtained from two sources and the robustness was examined. Early-life exposure was measured by integrating information on governors' birthplace and weather during their childhood. However, native place and birthplace information were insufficient for all records, and missing data were obtained manually. The definition of a heatwave was also varied to ensure the robustness of results, using different criteria such as five or seven consecutive days with daily highest temperatures all exceeding the 99^{th} or 95^{th} percentile, based on a 15-day moving window over 1961 – 1990. (Seneviratne et al., 2012; Perkins and Alexander, 2013; Sillmann et al., 2013).

The study offers several contributions. Firstly, it contributes to the literature about top managers' traits and decision-making by examining the impacts of early-life heatwave experiences on government officials in particular. The effects of disasters experienced in early life on decision-making have been investigated in prior studies, but few have distinguished the disaster types and linked these disaster experiences to natural climate change phenomena. Garel and Petit-Romec (2022) found that CEOs' exposure to exceptionally

high temperatures alters their impression of the truth of global warming, resulting in lower carbon emissions. Moreover, Demski et al. (2017) showed that experiencing direct flooding (a form of extreme weather) leads to a heightened awareness of climate change, intensified emotional reactions, elevated personal risk perceptions, and a stronger inclination towards behavioral intentions beyond individual sustainability measures, such as endorsing mitigation policies. Nonetheless, the climate change incidents examined in their research do not transpire during the early stages of life. Szymczak, Wagner, and Busch (2022) studied the exact early-life extreme weather experiences (EWE), but the weather indicator it used is derived from a comprehensive dataset. Thus, it could be too broad to reflect the direct influence of climate change. Relevant literature is even rarer under the government rather than the business setting. Some studies tested the relationship between local green performance and the promotion of governors (Zheng et al., 2014; Pu and Fu, 2018; Wu and Cao, 2021), but few have explored the intrinsic characteristics and self-motivation that influence the governors' green decision-making.

Secondly, this paper has constructed a novel dataset of climate change indicators. As Wu, Snell, and Samji (2020) have pointed out, the climate crisis may result in new psychiatric problems or exacerbate existing mental illnesses, yet the lack of comprehensive data limits the ability to intervene. Therefore, this study has created a large dataset that covers 370 cities in China from 1951 to 2011, capturing governors' early-life experiences of climate change. Heatwaves have been chosen as the indicator due to their severe threats to physical and mental health, which can have lasting psychological impacts and influence people's behaviors and decisions (Marquis and Tilcsik, 2013; Pascal, 2008). To determine the exposure to climate change, heatwave events have been generated from perennial weather station data and interpolated at the city level using established defining criteria (Sillmann et al., 2013; Xu et al., 2016). And then the events were linked to the governors' early-life information to evaluate their childhood exposure to climate change.

Thirdly, this research also challenges current literature on climate change recognition

and provides guidance for the development of future policies and publicity. Previous research has shown that despite the lethality of heat and heatwaves, the hazard of extreme heat exposure is not widely recognized by the public, indicating a deficiency in public perception (Luber and McGeehin, 2008). Additionally, people have cognitive barriers to recognizing climate change hazards as environmental or climate change issues (O'neill and Hulme, 2009). But this research provides opposite evidence that people's past exposure to traumatizing climate change events does matter and causes continuous impacts deeply rooted in their personalities.

The rest of this paper is structured as follows: Section 2 outlines the development of hypotheses, while Section 3 details the data sources, variable construction, and benchmark empirical model. Section 4 presents the empirical findings, robustness checks, and mechanism discussion. Finally, Section 5 concludes the paper and highlights potential implications and limitations.

2 Hypothesis Development

2.1 Governors' early-life experiences and government behaviors

Factors influencing organizational performance have long been a concern for scholars (Lenz, 1981; Becker and Gerhart, 1996; Shahzad et al., 2012). Based on Child (1972)'s perspective that top managers' decision is one of the key factors, Hambrick and Mason (1984) originated the upper echelon theory. It provided a theoretical framework on how top executives' values, personalities, and past experiences significantly influence their organization's performance (Hambrick, 2007; Hambrick and Mason, 1984). According to the theory, individuals, including chief managers, operate within bounded rationality (Cyert, March et al., 1963), with their choices influenced by their personal backgrounds. Consequently, the organizational strategy and outcome are believed to mirror a portion of the top managers' personal values and past experiences given the centrality of their role (Hambrick and Mason, 1984).

The upper echelons theory provides a framework for understanding the impact of top executives' personal characteristics on organizational performance. However, the process by which these personal characteristics come into play is not well understood (Hambrick, 2007). Management scholars have employed the imprinting theory rooted in biology (Immelmann, 1975) to offer a plausible explanation and bridge this gap. The imprinting theory emphasizes the importance of "sensitive periods" such as the early developmental stage, early career, or significant successes and failures, during which individuals or organizations are more susceptible to external disruptions (Marquis and Tilcsik, 2013; Pieper et al., 2015). During these periods, individuals may unconsciously undergo imprinting that can persistently and unconsciously influence their behavior and decision-making in future careers (Marquis and Tilcsik, 2013).

The prevalence of upper echelons theory and imprinting theory has drawn attention from scholars to the early-life experiences of top managers, as it is one of the crucial sen-

sitive periods. Several scholars have investigated the impact of various early-life personal factors on organizational performance. For instance, O'Sullivan, Zolotoy, and Fan (2021) found a positive correlation between a CEO's early-life disaster experience and their firm's corporate social performance. Additionally, Campbell, Jeong, and Graffin (2019) explored the effects of birth order, while Kish-Gephart and Campbell (2015) investigated the influence of social class background on strategic risk-taking. In the Chinese context, studies have measured early-life exposures to events with local features, such as China's cultural revolution and the great famine (Feng and Johansson, 2018; Long et al., 2020; Kong, Zhao, and Liu, 2021). Despite the fact that the early-life stage is a crucial source of imprints that shape cognition and behavior in adulthood, early-life studies have not received as much attention as early-career studies (O'Sullivan, Zolotoy, and Fan, 2021). This is despite evidence from the psychopharmacology literature supporting the significance of early-life experiences in shaping adult behavior and cognition (Pechtel and Pizzagalli, 2011).

While the majority of research on this topic has focused on the private sector, limited studies have extended these theories to the public sector. Given the likelihood of the applicability of these theories in different organizational contexts and individual settings, there is a need for further investigation in this area (Kim, 2022). Previous literature has investigated the effects of top managers' past career experiences in public agencies and observable background information on public organizational decisions, and fiscal and service performance (Olvera and Avellaneda, 2019; Anessi-Pessina and Sicilia, 2020). However, research specifically focusing on the influence of early-life experiences on leaders from the public sector is rather limited.

2.2 Mental impacts caused by traumatizing heatwave events

Climate extremes are of great interest globally due to their significant monetary, human, and physical consequences (Coumou and Rahmstorf, 2012; Christidis, Jones, and Stott, 2015). Among these extremes, heatwaves are a particular type of extreme

temperature event characterized by a prolonged period of excessive heat (Perkins and Alexander, 2013). Heatwaves are commonly recognized as a significant indicator for evaluating the health consequences of climate change (Xu et al., 2016). Additionally, previous studies have also emphasized the need to understand how future heatwaves could affect mortality and morbidity, as such investigations are crucial for comprehending the overall impact of climate change on human health (e.g., Peng et al., 2011).

Heatwaves are a serious concern due to their potential to cause physical and mental harm, and the situation may worsen in the future as global warming intensifies. In the past, heatwaves have caused catastrophic and long-lasting impacts, as was observed during the summer heatwave of 2003 (Schär et al., 2004). The 2003 heatwave was characterized by prolonged duration, extensive spatial coverage, and devastating effects (Christidis, Jones, and Stott, 2015). Moreover, the health impact of the 2003 heatwave was so severe that it was regarded as a physical trauma for Europe (Pascal, 2008). Therefore, it is reasonable to assume that similar severe heatwaves are capable to cause mental trauma to many people due to the associated (actual or threatened) risk of death or serious injury (American Psychiatric Association, 2013). However, the extent to which heatwaves can cause psychological trauma may vary from person to person (Van der Kolk, 2003).

Despite the widespread attention to the physical health consequences of heatwaves, research on the psychological consequences is currently limited. Nevertheless, there is an increasing trend in the literature globally that links climate change with mental health (Lawrance et al., 2022). Natural disasters induced by climate change such as heatwaves can cause immediate psychological consequences, such as increased rates of anxiety, depression, post-traumatic stress disorder, and other mental health disorders (Hayes et al., 2018; Charlson et al., 2021). As heatwaves become more severe and frequent, it is essential to comprehend the mechanisms linking climate change to mental health and identify potential interventions to safeguard psychological well-being in the face of a changing climate.

2.3 Post-traumatic growth

Psychological research suggests that imprints from traumatic early-life experiences are more lasting and profound compared to other experiences (e.g., Parry and Chesler, 2005). While traumatic events can elicit distress and pain, they can also lead to positive psychological growth (Calhoun and Tedeschi, 1999; Schaefer and Moos, 1998). Post-traumatic growth is the term used to describe the positive psychological changes that some individuals undergo after coping with a highly challenging life situation (Tedeschi and Calhoun, 2004). Following a traumatic event, people may engage in rumination about their experiences and reevaluate their goals and values (Calhoun and Tedeschi, 1999; Tedeschi and Calhoun, 2004). As a result, individuals can develop increased levels of adaptation, mental functioning, and life awareness than they did previously (Tedeschi and Calhoun, 2004), which can be summarized as a change in an individual's personal qualities brought about by a traumatic incident.

Evidence from empirical studies and neuroimaging research jointly support the theory. In a variety of empirical settings, the cognitive and behavioral consequences of traumatic experiences have been confirmed. People who have gone through traumatic events were found to be more concerned about the welfare of other people (Frazier et al., 2013; Zoellner and Maercker, 2006), likely due to a feeling of mutual reliance and support in recovering from trauma (Staub and Vollhardt, 2008). And these beneficial psychological consequences resulting from traumatic experiences can persist into adulthood even for those who suffered as children (Holgersen, Boe, and Holen, 2010). Furthermore, neuroimaging studies (e.g., Nakagawa et al., 2016) reveal that traumatic events leave a persistent imprint on the prefrontal brain (PFC). PFC is observed to be activated while cognitively processing traumatic experiences (Nakagawa et al., 2016) because it functions when people cope with and respond to stress (Cerqueira, Almeida, and Sousa, 2008).

3 Methodology

3.1 Data sources

Biographical information of the mayors and municipal party secretaries (e.g., name, birthplace, birth date, gender, education, age, tenure) was collected from two sources: the online database of local party and government leaders from China Economic Net (China Economic Net, 2023); and the Chinese Political Elite Database (Jiang, 2018). Through manual supplementation and crosschecking, the final comprehensive dataset contains information of 4018 mayors and secretaries covering leadership of 288 prefecture-level cities over 2000-2016 with their early-life information from 1951 to 1990. The place where governors spent their childhood and teenage is regarded as the same as their birthplace due to the household registration system in China which restricts population migration.

The temperature data used for constructing heatwave indicators also comes from two sources: one is the station data from the National Climatic Data Center (NCDC) of America, and the other is from the China Meteorological Data Website. The latter covers a longer period but with the potential for data manipulation, which was eliminated by calculating the correlation between the two datasets. The station data were then interpolated to the city level using the IDW method, yielding daily maximum temperature records for each city from 1951 to 2011. The daily temperature data was later used to detect heatwave events.

The environmental performance is reflected by the concentration of CO_2 and $PM_{2.5}$, which are common air pollutants widely used in previous research as indicators of city greenness (e.g., Cao, Kostka, and Xu, 2019; Wu and Cao, 2021). Annual CO_2 concentration is estimated from DMSP/OLS and NPP/VIIRS satellite imagery employing a particle swarm optimization-back propagation (PSO-BP) algorithm (Chen et al., 2020). And $PM_{2.5}$ data is acquired based on global annual grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) (Hammer et al., 2020). After that, the satellite images were resampled

and aggregated at the city level. To ensure reliability, the pollution data from previous literature have been referred to and used in robustness checks (Chen et al., 2020; Buchard et al., 2016).

This research controls for a series of city characteristic variables (e.g., per capita GDP, fiscal revenue, total population, infrastructure expenditures) and governors' features (e.g., gender, education, age, tenure length). The data of city controls come from the annual China Statistical Yearbook. The summary statistics for the main variables included in the analysis are presented in Table 1.

Table 1: Summary statistics for key variables

Variable	Definition	Obs	Mean	Std.Dev.
CO_2	CO_2 concentration of city i and year t	4896	21.975	21.668
$PM_{2.5}$	$PM_{2.5}$ concentration of city i and year t	4896	48.749	18.189
Heatwave_{dum}	= 1 if governors of city i in year t exposed to heatwaves	4896	0.650	0.477
Heatwave_{eve}	the sum of experienced early-life heatwave events	4896	1.144	1.310
Gender	Female = 0, male = 1	4896	0.954	0.144
Age	Age of governors in each year	4896	51.367	3.351
Tenure	The number of years spent at current tenure	4896	4.123	1.338
GDP	GDP per capita in each city-year, yuan (log)	4896	10.002	0.855

Notes: observations of individual-level variables have been aggregated to the city-year level

3.2 Variable construction

3.2.1 Heatwave events

Heatwaves are characterized by various factors such as intensity, frequency, duration, time, and spatial extent. In addition, due to the wide-ranging impacts of heatwaves and potential limitations of original datasets, there are various approaches to define each feature(Perkins-Kirkpatrick and Lewis, 2020). In this paper, considering the criteria of the expert team on climate change detection and indices (ETCCDI) and the meta-analysis evaluation, I defined a heatwave event in two sets of standards: 1) a period of or above five consecutive days with their daily highest temperature all above 99 percentile of a 15-day

moving window over 1961-1990; 2) a period of or above seven consecutive days with their daily highest temperature all above 95 percentile of the same moving window (Sillmann et al., 2013; Xu et al., 2016, 2018). While the two standards emphasize different aspects of intensity and duration, they are expected to produce similar regression results as trends of the same heatwave were found to show significant similarities with different definitions, which minimizes the uncertainty in heatwave measurement methodologies (Perkins and Alexander, 2013; Seneviratne et al., 2012).

3.2.2 Governors' early-life experience

The governors' early-life exposure to heatwaves is quantified according to their heatwave experiences. Their heatwave exposure is captured by two sets of variables: 1) a binary variable that equals "1" if the heatwave event occurred at least once where the governors lived between their 5 and 15-year-old and "0" otherwise; 2) a numeric variable that equals the total number of heatwaves happened at the governors' early life. The period between the ages of 5 to 15 is considered a phase of both biological and social transition that increases susceptibility to external factors (Fuhrmann, Knoll, and Blakemore, 2015). Thus, this period aligns with the definitions of sensitive periods highlighted in the imprinting theory (e.g., Marquis and Tilcsik, 2013).

3.2.3 Local environmental performance

The city environmental performance is reflected by the concentration of $PM_{2.5}$ and CO_2. The concentration data are obtained by averaging the raster cells of satellite images within the boundary of the corresponding administrative unit. $PM_{2.5}$ is a type of particulate matter that can be harmful to human health, and CO_2 is a greenhouse gas that can contribute to climate change. Therefore, measuring their concentrations can provide insight into the potential impacts of heatwaves on air quality and public health. Moreover, $PM_{2.5}$ and CO_2 concentrations are frequently employed as markers of a city's environmen-

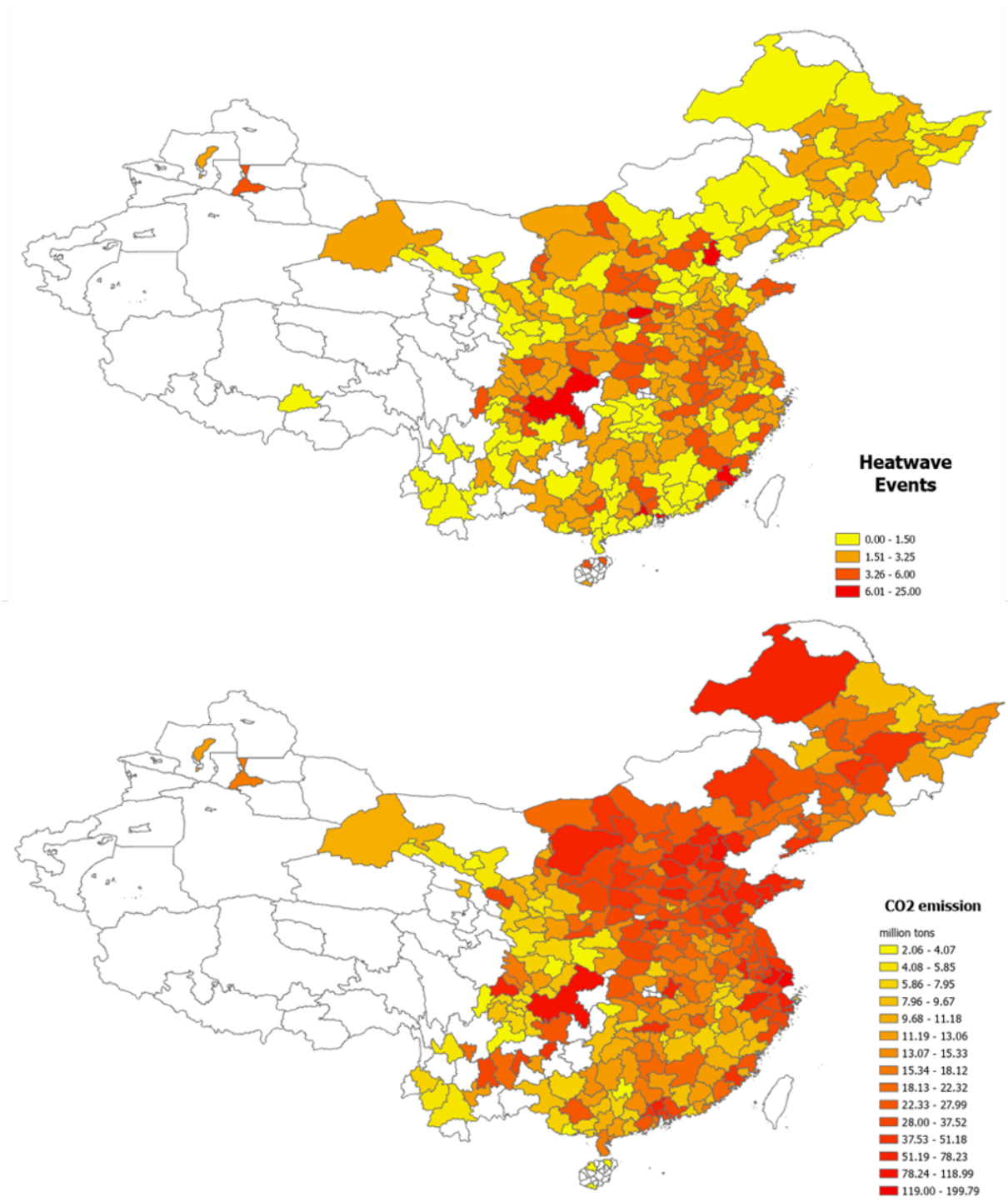

Figure 1: Distribution of previous heatwaves (above) and CO_2 emission (below) in 2008

tal performance (e.g., Cao, Kostka, and Xu, 2019; Wu and Cao, 2021). By monitoring these atmospheric constituents, the efficiency of regional environmental policies and initiatives aimed at mitigating greenhouse gas emissions and enhancing air quality can be assessed.

3.3 Empirical model

This empirical study employs the ordinary least squares (OLS) regression to examine the effect of mayors' and municipal party secretaries' early-life exposure to heatwaves on the jurisdiction's environmental outcomes during their tenure.

The baseline model is shown below:

$$Env_{i,t} = \alpha_0 + \alpha_1 \times Heatwave_{i,t} + \beta_1 \times X_{i,t} + \beta_2 \times Z_{i,t} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (1)$$

Where $Env_{i,t}$ stands for several measures of local environmental performance including the concentrations of $PM_{2.5}$ and CO_2 respectively in the county i and year t. The independent variable $Heatwave_{i,t}$ reflects both the binary and numerical indicators implying the existence and the number of early-life heatwave experiences of the governors. Features of mayors and secretaries are merged together for each city-year observation. $X_{i,t}$ represents a series of time-varying city characteristics. Similarly, $Z_{i,t}$ reflects the control variables of aggregated governors' features. γ_i and δ_t imply the city and time fixed effects. $\epsilon_{i,t}$ is the error term. Further, the potential serial correlation and heteroskedasticity issues are addressed by clustering the standard errors at the county level (Bertrand, Duflo, and Mullainathan, 2004).

In this study, the observed governors are mayors and municipal party secretaries, who are city-level governors. However, county-level OLS regression is conducted instead of city-level regression for several reasons. Firstly, counties are administrative units that are commonly used to report environmental data in China, and county-level data provides more detailed information on the local environmental performance. Secondly, the county

is a more homogeneous unit compared to the city, and there is less heterogeneity in socio-economic characteristics and environmental conditions within a county, making it easier to control for potential confounding variables in the regression analysis. Finally, the county-level data provides more observations, which can improve the statistical power of the regression analysis, making it more robust and reliable. Therefore, county-level OLS regression is considered more appropriate for this study, even though the observed governors are city-level governors.

4 Results

4.1 Main results

Empirical results revealed a significant negative relationship between governors' early-life heatwave experiences and city greenness, as reflected by levels of $PM_{2.5}$ and CO_2 concentrations during their tenure. Table 2 shows the regression results for the two dependent variables, $lnPM_{2.5}$ and $lnCO_2$, with the independent variable being the dummy and the sum of governors' early-life experiences of heatwave events. The regression model controls for gender, age, tenure, GDP, and county and year fixed effects.

Specifically, cities with governors who experienced heatwaves during their early life had significantly lower levels of $PM_{2.5}$ (-2.1%) and CO_2 (-1.1%) compared to those whose governors did not experience heatwaves. This finding suggests that early-life exposure to heatwaves may have a lasting impact on governors' decision-making processes that can influence urban environmental outcomes. Further, I investigated the association between the amount of early-life heatwave exposure and city greenness. The results indicate that the numeric variable measuring the amount of heatwave experiences is also statistically significant in explaining the variations in $PM_{2.5}$ (-1.8%) and CO_2 (-3.1%) levels. The estimate coefficients of $Heatwave_{eve}$ are found to be similar to the previous dummy predictor $Heatwave_{dum}$, implying similar impacts of the existence and frequency of early-life heatwave experiences.

These findings are robust to a range of control variables, including gender, age, tenure, and GDP. The inclusion of county and year fixed effects further strengthens the results, indicating that the observed relationship between early-life heatwave exposure and city greenness is not driven by unobserved county or year-level characteristics.

The findings of this study emphasize the significance of early-life experiences in influencing individuals' attitudes and behaviors toward environmental issues. They suggest that policies aimed at promoting environmental awareness and sustainable practices

Table 2: Effect of governors' early-life heatwave exposure on city greenness

Variable	(1) $\ln PM_{2.5}$	(2) $\ln PM_{2.5}$	(3) $\ln CO_2$	(4) $\ln CO_2$
$Heatwave_{dum}$	-0.021***		-0.011***	
	(0.003)		(0.004)	
$Heatwave_{eve}$		-0.018***		-0.031***
		(0.004)		(0.005)
Gender	0.045***	0.045***	0.003	0.005
	(0.008)	(0.008)	(0.013)	(0.013)
Age	0.004***	0.004***	0.000	0.001*
	(0.000)	(0.000)	(0.001)	(0.001)
Tenure	-0.003***	-0.003***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
lnGDP	-0.084***	-0.085***	0.128***	0.127***
	(0.006)	(0.006)	(0.011)	(0.011)
Constant	4.831***	4.848***	-1.125***	-1.157***
	(0.100)	(0.101)	(0.190)	(0.188)
Observations	40155	40155	39481	39481
R-squared	0.439	0.438	0.902	0.902
Number of County	2183	2183	2158	2158
County FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

should be implemented from an early age to effectively improve the environmental conditions of cities. These results hold important implications for policymakers and urban planners, as they shed light on the need to prioritize early-life environmental education and intervention programs in creating more sustainable and livable urban environments.

4.2 Robustness check

To ensure the robustness of our findings, I conducted a series of additional analyses to assess the sensitivity of the results to different datasets and heatwave criteria. Firstly, I investigated the use of alternative datasets for $PM_{2.5}$ and CO_2 measurements, including the Odiac fossil fuel CO_2 emission dataset and the China High Air Pollutants (CHAP) dataset. The analysis indicates that the main findings hold when changing data sources.

Secondly, I tested the impact of different heatwave criteria on the results. I examined alternative criteria with different durations and thresholds to determine whether the intensity of heatwaves influences human decision-making differently. However, I found no evidence to support the intensity hypothesis, and the results were robust to changes in heatwave criteria. These findings are consistent with previous research indicating that the choice of heatwave criteria is unlikely to significantly impact study results (Perkins and Alexander, 2013; Seneviratne et al., 2012). Overall, the robustness checks provide further support for the reliability of the main findings and underscore the importance of early-life experiences in shaping attitudes and behaviors toward environmental issues.

5 Discussion

This study examines the effect of early-life heatwave exposure on the environmental performance of public sector governors and finds that it significantly reduces CO_2 and $PM_{2.5}$ emissions in their jurisdictions. The results support the idea that early-life heatwave experiences have a positive influence on environmental concerns, which could be evidence for the imprinting and upper echelons theories. These findings highlight the importance of considering not only physical but also mental impacts of climate change and suggest that past traumatic experiences can shape the behavior and decision-making of top managers.

The findings of this study have important implications for policymakers, organizations, and society as a whole. Firstly, policymakers should consider public sector governors who have experienced heatwaves in their early life as potential candidates for promoting environmental sustainability. Secondly, organizations should be aware of the psychological impacts of climate change and understand that traumatic experiences can shape the values and behavior of their leaders. Therefore, organizations can provide training and education for their leaders to increase their environmental awareness and skills. This is particularly important as the early career period is also a sensitive period of human development (Marquis and Tilcsik, 2013; Pieper et al., 2015; O'Sullivan, Zolotoy, and Fan, 2021). Thirdly, society should recognize the importance of mental health in the face of climate change and provide support for those who have experienced early-life trauma. This may include access to mental health services, as well as the development of community-based support systems. Additionally, society should prioritize early-life environmental education and intervention programs in creating more sustainable and livable urban environments.

This study has several limitations that should be considered. First, the dataset only covers public sector governors in China, which may limit the generalizability of the findings to other countries or contexts. Future research could replicate the study in other settings to test the external validity of the results. Second, the use of native place data to

measure early-life heatwave exposure may not accurately capture participants' early-life experiences. Combining this data with self-reported information may improve the accuracy of exposure measurement. Third, there are other potential factors that could have influenced politicians' decisions that were not considered in this study, such as economic concerns, pressure from interest groups and constituents, and promotion considerations (e.g., Li and Zhou, 2005). Thus, the study's findings may be limited by these potentially influential factors. Finally, this study only examines the effect of early-life heatwave exposure on environmental performance. Future research could investigate the impact of other types of climate-related traumas on the behavior and decision-making of top managers.

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