Humanities & Social Sciences Communications

ARTICLE

https://doi.org/10.1057/s41599-023-01689-9 OPEN

# How Chief Executive Officers' first-hand experience of the Great Chinese Famine affects risk-taking?

Dayuan Li[1], Chen Huang[1] & Ding Wang[1]✉

To understand the influence of Chief Executive Officers' (CEOs) early life experiences on their firms' strategic decision-making, here we explore the impacts of CEOs' experience of the Great Chinese Famine (1959–1961) on their cognitions and firm risk-taking. Using longitudinal data from publicly listed companies in China from 2006 to 2017, we found that CEOs who experienced the 3-year-long famine are more risk-averse, but that this relationship only exists among CEOs who experienced the famine during their formative years (between 6 and 18 years old). In addition, we found that the negative relationship between CEOs' early experiences of famine and firms' risk-taking is weaker when the firm is state-owned and stronger when the firm is facing fiercely competitive markets. We also take a step further to explore the impact of the severity of the famine on individuals, and we find that there is a positive relationship between the severity of the famine and firm risk-taking only within a moderate level. When the severity exceeds a certain level, CEOs are reluctant to take risks with the increase in the severity of the famine. Our findings provide a new theoretical and practical perspective in studying the relationship between CEOs' early experiences with disaster and firm risk-taking.

[1] School of Business, Central South University, 410006 Changsha, China. ✉email: wding@zju.edu.cn

## Introduction

The 3-year-long Great Chinese Famine (1959–1961), which led to at least 17 million deaths, is undoubtedly one of the most significant disasters in China's history. Studies have shown that individuals who experience this famine in childhood grew to a significantly lower adult height and received substantially less education (Chen and Zhou, 2007). Much evidence has demonstrated the significant impact that the 3-year-long disaster had on the economy and the health and education of those affected (Chen and Zhou, 2007; Gluckman et al., 2005). The most recent scholarly attention, however, has been paid to the long-term economic effects of the famine on those who experienced the disaster—especially top managers—and their firm outcomes (Feng and Johansson, 2018; Zhang, 2017).

The influence of the personal characteristics of top managers on corporate strategy and performance has been a growing area of interest for proponents of the upper echelons theory (Hambrick and Mason, 1984; Shi et al., 2017; Wong et al., 2011). Previous studies have shown that the political ideologies, social class, psychological traits and career paths of Chief Executive Officers impact their firm performance and outcomes (Li and Tang, 2010; Wong et al., 2011). Recently, scholars have expanded this literature to include the sensitive period of early life, when value creation occurs, and have looked at how CEOs' experiences prior to the start of their career (including their birth order and traumatic experiences) influence their cognition and leadership behaviour (Bernile et al., 2017; Campbell et al., 2019; Koch-Bayram and Wernicke, 2018; Malmendier and Nagel, 2011; O'Sullivan et al., 2021; Simpson and Sariol, 2019). Among these early life experiences, traumatic experiences seem to have the most significant impact on one's personal values and cognition (Lyoo et al., 2011; Yechiam et al., 2005). Studies in the areas of neuroscience and epigenetics have also shown that experiencing adverse disasters do indeed affect those survivors (Labonté et al., 2012; Lyoo et al., 2011; Mehta et al., 2013).

In this study, we focus on how CEOs' exposure to a traumatic event (in this case, the Great Chinese Famine) in their early lives are reflected in their firms' corporate decisions. We base this view by drawing on imprinting theory literature, which suggests that even if a person's environment changes, the imprints that are left by major events continue to impact his or her values and behaviours (Marquis and Tilcsik, 2013; Stinchcombe, 2000), and upper echelons theory, which suggests that the characteristics of top managers will influence the firm's strategies (Hambrick and Mason, 1984). Our argument specifically centres around CEOs who lived through the Great Chinese Famine, which occurred between 1959 and 1961. The fact that this disaster had a continuous impact on survivors makes it suitable for confirming our arguments. By looking at the insights from the combination of upper echelons theory and imprinting theory literature, we argue that experiencing this traumatic disaster event during the CEOs' formative years has a negative impact on their firms' willingness to take risks.

We examine the moderating effect of state ownership and market competition, which showed that state ownership negatively affects the relationship between CEOs' early life experience of famine and firm risk-taking, while market competition positively moderates this relationship. Besides, we further explore the impact of the severity of the famine on firm risk-taking. While previous studies suggest that the intensity of the famine will strengthen the psychological imprint left on the individual, we found a more complex relationship than expected between famine severity and firm risk-taking: there is a positive relationship between the severity of the famine and firm risk-taking only within a moderate level. When the severity exceeds a certain level, CEOs are reluctant to take risks with the increase in the severity of the famine.

This study makes several contributions to the relevant literature. First, we found CEOs who experienced famine are more risk-averse, which is consistent with previous studies. We further found that the relationship between the severity of famine and firm risk-taking was not linear, but rather an inverted U-shaped relationship, which provides new insight and a new direction for CEO early life experience research. Second, our study sheds light on imprinting theory by treating historic events as a source of imprinting, exploring when and how early life famine experiences are most likely to change CEOs' values and their firms' behaviours (Campbell et al. 2019; Kish-Gephart and Campbell, 2015; Marquis and Tilcsik, 2013). Specifically, we have highlighted CEOs' early life famine experiences and have considered how and when these historic events shape CEOs' strategic decision-making behaviours. In addition, we also explore the persistence and decay of the imprint by matching it with the existing environment of the firm. Finally, we extend the existing firm risk-taking literature by shifting the focus onto the period during which CEOs' values were formed. Our findings suggest that early disaster experiences play a significant role in influencing CEOs' risk preferences and firm risk-taking behaviour.

## Theory and hypotheses

**The three-year-long Great Chinese Famine**. Up until 1959, China had been experiencing the initial success of its collectivisation campaign. In pursuit of rapid development, the Chinese government put forward a series of policies, of which the Great Leap Forward and the steelmaking movement had the greatest impact (Kung and Lin, 2003). Coupled with the influence of leftist thinking, the government blindly pursued the rapid development of industry and weakened its emphasis on agriculture (Li and Yang, 2005). These practices led to the devastating destruction of most of the country's means of production. In the spring of 1959, due to a sudden and sharp reduction in precipitation, a long drought plagued the country, resulting in widespread crop failure. The country's peasants thus had no harvest, which led to a severe shortage of both staple and non-staple foods across the country. Despite this extreme situation, the Chinese government continued to export grain to other countries in exchange for industrial resources, which further exacerbated the famine. According to Liu Shaoqi, one of the main leaders of the Communist Party of China, this crisis was 'three-parts natural disaster and seven-parts human disaster'. By 1961, due to the dissolution of public canteens and other policy changes, some provinces (such as Henan) had emerged from the famine. With most parts of China experiencing the end of this disaster, the Great Chinese Famine was officially declared over in 1962.

**Imprinting theory and the Great Chinese Famine**. Imprinting theory, which originated in biology, has received much scholarly attention after it was introduced into organisation research. Unlike path dependence and cohort effects, the imprinting theory emphasises the process of imprinting, which contains three essential features: first, there needs to be a sensitive period, during which an individual is susceptible to environmental influences; second, during the brief susceptibility period, the focal individual develops characteristics that reflect the salient features of the environment; third, that these characteristics persist despite significant environmental changes in the ensuing period (Marquis and Tilcsik, 2013).

While previous studies have documented that early life experience can be seen as a resource of imprints, we propose that the Great Chinese Famine also made a kind of imprint that changed individuals' cognition and behaviours significantly. First,

we focus on individuals' early life experiences, more specifically, during the period of childhood and adolescence (6–18 years old), which is an important time for individuals to form values and perceptions. During this period, individuals are more sensitive to environmental changes and these changes affect their later cognitions and behaviours. Second, the famine was essentially a disaster caused by nature and human beings and it had an enormous impact on the country. That is, we reasonably propose that any individual born between 1942–1954 has experienced this catastrophe in some form. Considering the enormous impact this famine had on individuals and the nation, we theorise that this famine had an imprinting effect that had lasting, life-long effects.

Next, we discuss the imprint of this famine on individuals who experienced this disaster. Taking the Great Chinese Famine as our research background, we propose that people who experienced this famine were left with an imprint of the catastrophe of lacking resources (Marquis and Tilcsik, 2013). Because of the extreme scarcity of food and resources, most of the children who survived the famine experienced a level of consumption that was only enough to sustain survival (Chen and Zhou, 2007). This kind of survival consumption is often positively related to savings consciousness (Carroll and Weil, 1994); that is, it is reasonable to infer that people who experienced the famine showed a stronger propensity to save money in adulthood. In addition, the imprint of the famine also makes people more cautious about projects that require a lot of resources. As food was the most precious resource during the three-year famine, in such a situation, the individual would be extremely sensitive to resources, as this was extremely significant to survival during this catastrophe.

**CEOs' early life experiences of the Great Chinese Famine and firm risk-taking**. Firm risk-taking, defined as the inherent risk during companies' investments, may affect the company's profitability, due to either external or internal factors. High risks can bring high returns, which can accelerate social capital accumulation and technological progress and promote the development of an entire society (Acemoglu and Zilibotti, 1997; John et al., 2008). To some extent, risk-taking is the foundation for the survival and development of enterprises (Shapira, 1995). Combining with upper echelons theory, which suggests that the cognition and characteristics of executives will influence the implementation of corporate strategies as they are the decision-makers (Hambrick and Mason, 1984), we propose that for firms to obtain more investment income, their leaders must be willing to take risks in investment.

As we have discussed before, it is hypothesised that experiencing the famine will leave an imprint on people who lived during that time. Specifically, these people have a stronger tendency to save and a greater appreciation for resources. According to the imprinting theory, the imprint will persist despite significant environmental changes; we, therefore, discuss how these imprints are reflected in CEO's strategic decisions. First, a stronger propensity to save leads to a precautionary saving motive; that is, CEOs who have experienced famine are more willing to save resources when making decisions. That is to say, CEOs who experienced the famine will have a tendency to overestimate the possible risks and underestimate the possible future returns from these risks (Hu et al., 2019), so they would rather save resources to avoid possible negative shocks or financial crises. For example, due to the precautionary saving motive, these CEOs would tend to increase their cash holdings and capital spending to cope with future uncertainty (Hu et al., 2019; Zhang, 2017). During a crisis, companies managed by CEOs who have experienced famine have higher market value and better performance, because these companies have higher capital expenditure and are less likely to be affected by the financial crisis (Feng and Johansson, 2018; Hu et al., 2019).

Second, the imprint of scarcity can make CEOs more conservative about projects that require a lot of resources. This means that they can be expected to abandon some high-risk projects, even if these projects bring more resources and profits. For example, as acquisitions are resource-intensive and with high risk, these CEOs who experienced the famine will perform fewer takeovers to reduce possible losses (Zhang, 2017). In addition, these CEOs will use more conservative accounting policies and management decisions to reduce firm risk (Feng and Johansson, 2018). In sum, based on imprinting theory, we hypothesise that those CEOs who experienced the Great Chinese Famine early in life will be more risk-averse and conservative when investing and that this will negatively affect their firms' willingness to take risks.

**Hypothesis 1**. There is a negative relationship between CEOs' early life experiences of the Great Chinese Famine and their firms' willingness to take risks.

*Boundary conditions*. Our baseline hypothesis is based on the argument that early life famine experience imprints CEOs' cognition and behaviour by making them more risk averse. However, we would like to further investigate the dynamics of imprinting; that is, whether this imprinting may decay or strengthen over time (Marquis and Tilcsik, 2013; Simsek et al., 2015). We argue that the dynamics of imprinting are largely context-dependent. For example, if the current environment that the CEO is facing matches the characteristics of the imprint, the imprint will persist or even be enhanced. Conversely, a mismatch between the environment and the imprint will perhaps erode or change the imprint (Wang et al., 2019; Zhang et al., 2022). Therefore, we then discuss whether the imprint will persist or decay when the environment is different.

In 1978, due to the sluggish economic development caused by the implementation of previous policies, China began to carry out the Reform and Opening Up policy, introducing the market economy into the Chinese economic space. China has implemented market reforms for more than 30 years (Nee, 1992; Peng and Heath, 1996), and in the current Chinese economic system, the market plays a decisive role in the allocation of resources, while the government simplifies administration and decentralisation, reduces its own direct allocation of resources and works to create a market environment of fair competition.

Therefore, Chinese firms have to face two types of logic when operating in the country (Greve and Zhang, 2017). The first is the state logic, which is also called the planned economy, which refers to the government allocates its resources independent of the market; the second is market logic, by which the allocation of resources is determined through free competition. These two logics are essentially different, but they exist alongside and complement each other, forming a market environment with Chinese characteristics. We use state ownership as a proxy for state logic (Maung et al., 2016) and market competition to represent market logic (Peng, 2003). Then, we explore the separate and joint impacts of state logic and market logic on firm risk-taking.

*The moderating effect of state ownership*. As China is a typical socialist country: the planned economy, an economic operation system in which the government regulates economic activities, still persists in the Chinese system. Within the planned economy, the government uses equity participation and other forms of joint ventures and cooperation with various ownership enterprises to improve the efficiency of state-owned capital operation and allocation and develop a mixed-ownership economy (Zhou et al., 2017).

Under state logic, we propose that state-owned firms can obtain more support and resources from the government, due to their natural connection with the government. For those companies with high levels of state ownership, government support can be used as a non-market resource to provide scarce resources to enterprises (Guo et al., 2016). For example, state-owned companies can get more government subsidies and policy support (Zhou et al., 2017). Besides, due to their nature, these firms can get more and faster loans from banks.

As we mentioned before, CEOs with famine experience are expected to have stronger saving habits and be more conservative. Under state logic, working in a state-owned firm with sufficient resources is inconsistent with the environment of the famine, leading to the erosion of the imprint left by the famine. Compared with state-owned firms, private-owned firms are at a disadvantage with respect to obtaining government support. Therefore, it is thought that the imprint left by the famine will be strengthened in CEOs working in private-owned firms.

**Hypothesis 2**. The negative relationship between a CEO's early life experience of the Great Chinese Famine and firms' willingness to take risks is weaker in firms that are state-owned.

*The moderating effect of market competition*. In 1978, China began its reforms, introducing the market economy into the Chinese economic system. The market economy refers to the way in which social resources are allocated through the market (Barnett, 1997). Different from state logic, market logic is created spontaneously by the competition of enterprises in the industry. Under market logic, firms must obtain scarce resources through fair competition.

Market competition, which means that only through competition can firms obtain resources and advantages, is one important manifestation of market logic (Barnett, 1997). In less competitive markets, the resources available are monopolised by some large firms. As competitors in the industry increase, the environment faced by enterprises becomes more complicated and the market competition becomes fiercer (Keats and Hitt, 1988; Tang et al., 2015; Zhang et al., 2020). In such an environment, how to survive is the main focus for firms, and their leaders must also make decisions more cautiously.

Therefore, we propose that under the market logic, the imprint left on a CEO by the famine is more suitable for a competitive environment. As we have discussed before, CEOs who have experienced famine are expected to be more cautious about high-risk projects, as these projects require a lot of resources. In a highly competitive environment, firms need to obtain scarce resources by fair competition, which further reduces their availability. The failure of any risky investment will lead to an existential crisis for the firm. Therefore, CEOs must make careful decisions to ensure the survival of their business and, under these circumstances, the imprint left by famine will persist and even be strengthened. However, working in a less competitive environment will erode the imprint left by the famine because such an environment will not require the firm or its leader to be especially cautious.

**Hypothesis 3**. The negative relationship between CEOs' early life experiences of the Great Chinese Famine and their firms' willingness to take risks is stronger when their firms face intense market competition.

**Severity of the Great Chinese Famine and firm risk-taking**. We suggest that compared with CEOs without early life experience of famine, firms led by CEOs that experienced famine in early life will be more cautious about investing their resources. However, even though the disaster was nationwide, the severity of the famine varied from region to region and its survivors feel differently about resource scarcity. For example, Guizhou, Anhui, Sichuan and Chongqing were the four most severely impacted provinces; people in these provinces faced a more serious existential crisis than elsewhere in the country. Therefore, we propose that for those who experienced the famine, the imprint left by the famine will be stronger if the famine was more severe. We then explore the impact of the severity of the famine on firm risk-taking, as even individuals who have experienced famine may have a different imprint from the experience. Unlike previous studies about famine severity, we suggest that there is a nonlinear relationship between famine severity and firm risk-taking. Specifically, we propose that of those CEOs who experienced the famine in early life, CEOs living in places where the famine was more severe will be more conservative, while CEOs living in places where the famine was moderate are more willing to take risks.

Psychological research has shown that there is a non-monotonous relationship between motivation (stress) and performance, and that performance will increase when motivation (pressure) increases, but when the motivation (pressure) is too high, performance will decrease (Kleim and Ehlers, 2009). As for the Great Chinese Famine, we propose that the 'stress' means the imprint left by the severity of the famine, as it is related to the survival resources of individuals. That is, when the severity of the famine did not threaten the survival of the individuals, they be more insensitive to the negative consequences of risk.

In addition, disaster experiences may increase their willingness to take risks and engage in risky investing. In this case, they value the benefits of the investment more than the risks and become more aggressive with the increasing severity of the famine they have experienced (Bernile et al., 2017). For example, studies found that survivors are more willing to engage in some aggressive behaviour if the magnitude of the earthquake is higher (Filipski et al., 2019; Hanaoka et al., 2018). Therefore, we propose that when the severity of famine does not affect the individual's survival resources, the disaster experience will not have a serious negative impact on the psychology of executives but will increase the experience and confidence of executives in dealing with risks and promote them to be more risk-taking.

However, when the severity of famine has affected personal survival resources, the serious potential consequences of disaster will make executives amplify the negative consequences of risk failure, become resistant to the risk and reduce their personal willingness to take risks. Some studies can serve as evidence, as they found that survivors who have experienced natural disasters are more likely to form a habit of saving (Kun et al., 2013; Nolen-Hoeksema and Morrow, 1991). Under these circumstances, CEOs will be more reluctant to take risks with the increase in the severity of the famine they experienced. Therefore, we propose that there is an inverted U-shaped relationship between the severity of the Great Chinese Famine and firm risk-taking.

**Hypothesis 4**. There is an inverted U-shape relationship between the severity of CEOs' early life experiences of the Great Chinese Famine and their firm's willingness to take risks.

## Method

**Sample and data**. The public data of all listed companies in the A-share market of China from 2006 to 2017 were selected as our research sample. We collected our data from multiple sources. The firm data were collected from the CSMAR database, a prominent database of financial data on Chinese-listed companies (Marquis and Bird, 2018). We collected the CEOs' origin information from their resumes and the information of CEOs who did not have this on their resumes was collected manually, mainly through the company's official website, Baidu and other websites.

To ensure the reliability and effectiveness of the sample data, some abnormal data that may have caused interference were excluded. We first deleted data of firms in the financial industry, considering the particularity of the financial industry's operations and performance accounting, which make this industry obviously different from other industries. Then, we excluded specially treated (ST) firms, because these companies may have abnormal data; we also dropped firms with missing CEO information. After deleting missing data, our sample included 14,555 firm-year observations with 2163 unique firms. However, since our data relates to the origins of individual CEOs, even if we have collected some CEO information through other means, there is still a lot of missing information on CEO origin. Finally, our sample comprises 6451 firm-year observations.

## Measures

*Dependent variable*

Firm risk-taking: Considering the availability and independence of data (not subject to manipulation by top managers), market-based risk measurement standards were used to measure firm risk-taking (Chen et al., 2006). The standard deviations of daily stock returns (total risk) generated from daily stock market return data were used as the dependent variable. The total risk was composed of the unique firm-specific risk and market risk. All returns used for these calculations excluded dividends. To ensure consistency in the data measurement (all data are annual), firm risk-taking was multiplied by the square root of 250 (representing the 250 working days in a year).

$$\text{Firm risk} - \text{taking} = \sqrt{250}^{*}\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(u_i - \overline{u}\right)}$$

*Independent and moderating variables*

CEOs' early life experiences of the famine: First, we need to identify whether the CEOs experienced famine during their sensitive period. Modern psychologists believe that the period of childhood and adolescence (6–18 years old) is the most important time for people to understand the world, preserve permanent memories and form their character (Tulving, 2002). Experiencing a major disaster at this stage will reshape a person's character and beliefs and have a significant subsequent impact. Therefore, if the CEO was born between 1942 and 1954, the CEO (who was between 6 and 18 years old when the famine was triggered) was considered to have experienced the famine; we coded these CEOs as 1, otherwise, we coded them as 0.

Severity of the famine: In addition, we also included the severity of the famine, as the severity of the famine varied by region and this affected CEOs' experience of the famine. Referring to the measurement of Feng and Johansson (2018), we use the excess death rate to measure the severity of the famine in different provinces; the excess death rate is calculated as the gap between the death rate in 1960 and the average death rate of the 3 years before it began (1955–1958).

State ownership: After China's market environment was reformed, the Chinese government still had corporate equity. Therefore, we code state ownership as 1 if the government hold the firm's shares, otherwise, we coded it as 0 (Liang et al., 2015; Pan et al., 2014).

Market competition: Expressed by the square of the market shares of all companies in a particular market, the Herfindahl–Hirschman Index (HHI), which reflects the market structure and market share of the industry, is a comprehensive index that measures market concentration. A higher degree of monopoly means less market competition; we hence use 1/HHI to measure market competition (Palmer and Wiseman, 1999).

**Table 1 Descriptive statistics.**

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| Firm risk-taking | 0.496 | 0.160 | 0.206 | 0.959 |
| CEOs' early life experiences of the famine | 0.088 | 0.283 | 0 | 1 |
| Severity of the famine | 0.036 | 0.008 | 0.001 | 0.057 |
| CEO that experienced famine | 0.004 | 0.012 | 0 | 0.038 |
| State ownership | 0.078 | 0.168 | 0 | 0.707 |
| Market competition | 15.01 | 12.25 | 1.115 | 63.41 |
| CEO age | 48.35 | 6.318 | 33 | 64 |
| CEO gender | 0.942 | 0.234 | 0 | 1 |
| CEO education | 3.380 | 0.870 | 1 | 5 |
| Duality | 0.277 | 0.448 | 0 | 1 |
| ROA | 0.044 | 0.055 | −0.200 | 0.209 |
| Concentration | 7.524 | 1.313 | 3.807 | 11.06 |
| Size | 49.07 | 15.05 | 16.50 | 85.81 |
| Slack | 2.396 | 2.687 | 0.218 | 16.77 |
| TMT famine experience | 0.06 | 0.111 | 0 | 1 |
| MI | 7.864 | 1.590 | 3.590 | 10.27 |

*Control variables*. Multiple control variables were added to the analysis. First, the variables related to CEO characteristics were controlled for (Bozoğlu Batı and Armutlulu, 2020; Eze et al., 2021; Lewis et al., 2014; Tang et al., 2015); these included CEO Age, Gender (coded 1 for male and 0 for female), Education (coded 1 if the CEO holds a bachelor degree or above and 0 otherwise) and Duality (coded 1 if the CEO also serves as the chairman of the board and 0 otherwise). Corporate characteristics were also controlled for (Tang et al., 2015; Voss et al., 2008), including the ROA (return on assets), Concentration (the share percentage of the top shareholder), Size (the natural logarithm of the total number of employees), Slack (the reciprocal of debt to asset ratio) and Top-Management Team Famine Experience (the ratio of the number of top management team members who were born during the period between 1942 and 1954 to the total number). Finally, we controlled for the context variables of the China Marketisation General Index, or MI (Fan et al., 2003).

In order to control all enduring observable or unobservable differences, we used a panel regression model to test our hypotheses. First, we did a Hausman test to examine whether we should use firm fixed effects or random effects. The results of this test show that firm fixed-effect regression is more suitable for our data ($p = 0.000$). In addition, we also collect our independent, moderating and control variables at year t and our dependent variable at year $t + 1$ to reduce endogenous problems. Finally, we included year-fixed effects and industry-fixed effects to control for potential economy-wide trends in firm risk-taking. Otherwise, we controlled for CEOs' birthplace fixed effects (whether the CEO was born in Guizhou, Anhui, Sichuan or Chongqing, the four most severely impacted provinces) and birth status fixed effects (whether the CEO was born when the famine began) when we test the relationship between severity of the Great Chinese Famine and firm risk-taking.

## Results

**Hypothesis tests**. Table 1 presents the descriptive statistics of all the variables. All continuous variables were winsorised at the top and bottom 1%. The average value of CEOs' Early Life Experiences of Famine in the sample data was 0.088, and the mean value of firm risk-taking is 0.496.

**Table 2 Correlations.**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm risk-taking | | | | | | | | | | | | | |
| CEOs' early life experiences of the famine | 0.003 | | | | | | | | | | | | |
| State ownership | 0.145 | 0.056 | | | | | | | | | | | |
| Market Competition | 0.008 | −0.010 | −0.038 | | | | | | | | | | |
| CEO age | −0.088 | 0.514 | −0.016 | −0.009 | | | | | | | | | |
| CEO gender | 0.006 | −0.004 | 0.052 | 0.013 | 0.029 | | | | | | | | |
| CEO education | −0.037 | −0.228 | 0.041 | 0.004 | −0.141 | 0.005 | | | | | | | |
| Duality | 0.021 | 0.066 | −0.162 | 0.000 | 0.176 | 0.027 | 0.000 | | | | | | |
| ROA | −0.055 | 0.021 | −0.020 | −0.002 | −0.029 | −0.028 | 0.015 | 0.060 | | | | | |
| Concentration | 0.003 | −0.005 | 0.027 | −0.002 | 0.006 | −0.008 | 0.016 | −0.026 | −0.020 | | | | |
| Size | 0.007 | 0.029 | 0.187 | −0.016 | −0.021 | −0.043 | 0.003 | 0.025 | 0.185 | −0.017 | | | |
| Slack | −0.030 | −0.047 | −0.061 | −0.012 | −0.014 | −0.012 | −0.031 | 0.088 | 0.041 | −0.250 | 0.093 | | |
| TMT famine experience | 0.061 | 0.525 | 0.225 | −0.037 | 0.251 | 0.028 | −0.125 | −0.018 | −0.007 | 0.019 | 0.036 | −0.050 | |
| MI | 0.009 | 0.041 | 0.013 | 0.003 | 0.030 | 0.005 | 0.016 | −0.015 | −0.029 | 0.234 | −0.056 | −0.122 | 0.021 |

Correlation coefficients with a magnitude >0.01 are significant at $p < 0.05$ level.

**Table 3 CEOs' early life experiences of the famine and firm risk-taking.**

| Variables | Firm risk-taking $t+1$ | | | | |
|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
| CEO age | −0.001*** (0.000) | −0.000* (0.000) | −0.000* (0.000) | −0.000* (0.000) | −0.000* (0.000) |
| CEO gender | −0.000 (0.005) | −0.001 (0.005) | −0.001 (0.005) | −0.001 (0.005) | −0.001 (0.005) |
| CEO education | −0.005** (0.002) | −0.006** (0.002) | −0.006** (0.002) | −0.005** (0.002) | −0.005** (0.002) |
| Duality | 0.007** (0.003) | 0.007** (0.003) | 0.007*** (0.003) | 0.007*** (0.003) | 0.007*** (0.003) |
| ROA | 0.055*** (0.017) | 0.056*** (0.017) | 0.057*** (0.017) | 0.056*** (0.017) | 0.057*** (0.017) |
| Concentration | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) |
| Size | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Slack | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) |
| TMT famine experience | 0.002 (0.011) | 0.009 (0.012) | 0.008 (0.012) | 0.009 (0.012) | 0.009 (0.012) |
| MI | −0.005*** (0.002) | −0.005*** (0.002) | −0.005*** (0.002) | −0.005*** (0.002) | −0.005*** (0.002) |
| State ownership | 0.004 (0.002) | 0.004 (0.002) | 0.003 (0.002) | 0.004 (0.002) | 0.003 (0.002) |
| Market competition | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) | −0.000 (0.000) |
| CEOs' early life experiences of the famine | | −0.010* (0.005) | −0.016** (0.006) | −0.003 (0.007) | −0.009 (0.007) |
| CEOs' early life experiences of the famine*state ownership | | | 0.012* (0.006) | | 0.012* (0.006) |
| CEOs' early life experiences of the famine*market competition | | | | −0.001* (0.000) | −0.000* (0.000) |
| Constant | 0.727*** (0.027) | 0.718*** (0.028) | 0.717*** (0.028) | 0.718*** (0.028) | 0.717*** (0.028) |
| Year fixed effect | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effect | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Observations | 14,555 | 14,555 | 14,555 | 14,555 | 14,555 |

Robust standard errors are in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, two-tailed test.

Table 2 presents the correlation coefficients of all the variables. The coefficients of all variables were <0.6, indicating that the multicollinearity between all variables was within an acceptable range. In addition, the variance inflation factors (VIFs) of the variables were also calculated. All VIF values were below 2. Therefore, multicollinearity between these variables was not a serious problem.

Fixed-effect regressions with robust standard errors were used to test the hypotheses. Table 3 lists the estimated results of the relationship between CEOs' Early Life Experiences of the Famine on firm risk-taking. Model 1 includes all the control variables, and CEOs' Early Life Experiences of the Famine were incorporated into model 2. This result suggests that there is a negative and significant relationship between CEOs' Early Life Experiences of Famine and firm risk-taking ($\beta = -0.010$, $p = 0.082$), thereby supporting hypothesis 1. We also examine the economic significance of this effect: compared with CEOs without Early Life Experiences of the Famine, firm risk-taking

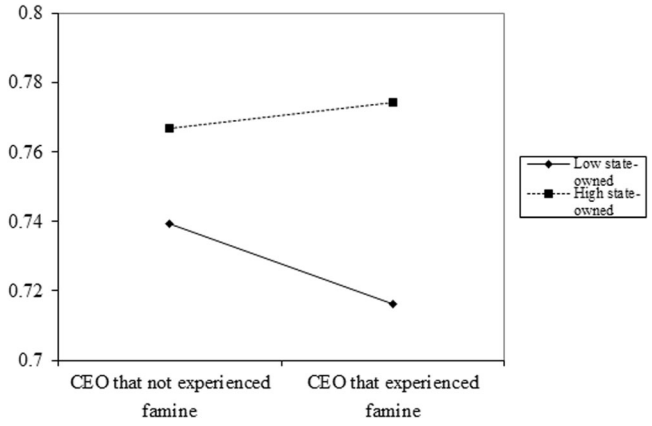


**Fig. 1** The moderating effect of state ownership.

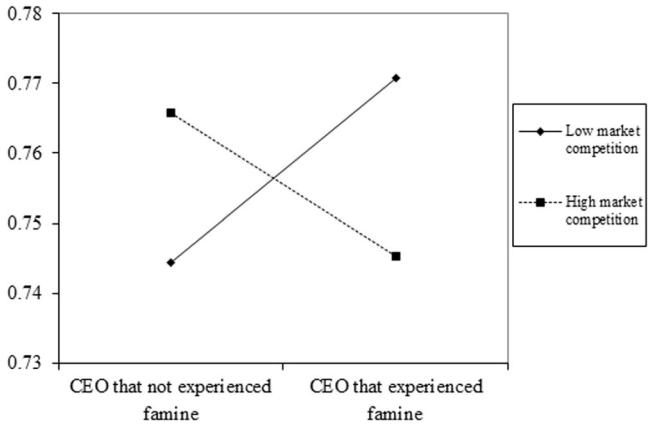


**Fig. 2** The moderating effect of market competition.

would be 2.02% (−0.010/0.496) lower with CEOs' Early Life Experiences of the Famine, considering the average firm risk-taking in Table 1 is 0.496.

We test our moderating effects of state ownership and market competition in models 3–5. Models 3 and 5 included the interaction between CEOs' Early Life Experiences of the Famine and state ownership, which was found to be positive and significant ($\beta = 1.61$, $p = 0.061$). In order to better understand the moderating effect of state ownership, we have drawn a diagram of the moderating effect. As shown in Fig. 1, in the low state ownership situation, the negative correlation between CEOs' Early Life Experiences of Famine and firm risk-taking is more obvious (see Fig. 1). Working in a firm which is non-state-owned, CEOs who experienced 3-year-long famine will be more inclined to invest in low-risk projects and forgo high-risk projects for the long-term development and benefit of the enterprise. Thus, Hypothesis 2 was strongly supported.

In models 4 and 5, an interaction term was included between CEOs' early life experiences of famine and market competition. The result suggests that this interaction is negative and significant ($\beta = -0.022$, $p = 0.042$). We also drew a graph of the moderating effect of market competition. As shown in Fig. 2, in the case of fierce market competition, the negative correlation between CEOs' early life experiences of famine and firm risk-taking is more obvious (see Fig. 2). In other words, for firms facing fierce market competition, CEOs who experienced the 3-year-long famine will have a stronger sense of risk aversion and will therefore reduce the company's high-risk investments, thereby supporting Hypothesis 3.

**Table 4 Severity of the famine and firm risk-taking.**

| Variables | Firm risk-taking $t+1$ | |
|---|---|---|
| | Model 1 | Model 2 |
| CEO age | −0.003*** | −0.003*** |
| | (0.000) | (0.000) |
| CEO gender | −0.001 (0.009) | 0.000 (0.009) |
| CEO education | −0.017*** | −0.016*** |
| | (0.004) | (0.004) |
| Duality | 0.017*** (0.004) | 0.017*** (0.004) |
| ROA | −0.204*** | −0.207*** |
| | (0.036) | (0.036) |
| Concentration | −0.003** | −0.003** (0.002) |
| | (0.002) | |
| Size | −0.000 (0.000) | −0.000 (0.000) |
| Slack | −0.003*** | −0.003*** |
| | (0.001) | (0.001) |
| TMT famine experience | 0.072*** (0.020) | 0.075*** (0.020) |
| MI | 0.013*** (0.001) | 0.013*** (0.001) |
| State ownership | 0.042*** (0.005) | 0.042*** (0.005) |
| Market competition | 0.000 (0.000) | 0.000 (0.000) |
| Severity of the famine | 0.524 (0.389) | 3.501*** (1.333) |
| Severity of the famine* | | −57.044** |
| Severity of the famine | | (24.427) |
| Constant | 0.589*** (0.025) | 0.588*** (0.025) |
| Birth place fixed effects | Yes | Yes |
| Birth status fixed effects | Yes | Yes |
| Observations | 6451 | 6451 |

Robust standard errors are in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, two-tailed test.

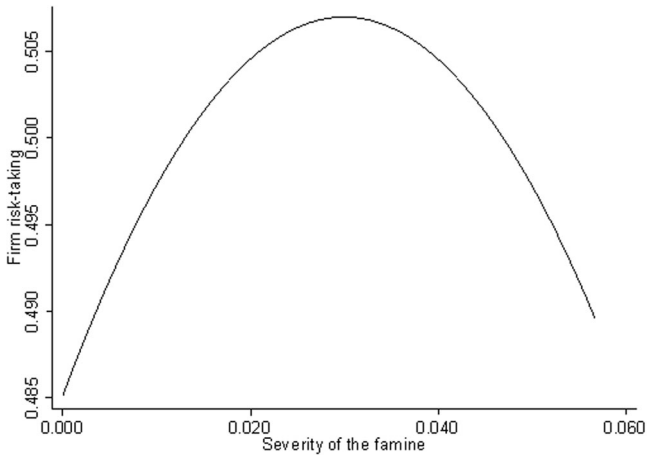


**Fig. 3** The relationship between severity of the famine and firm risk-taking.

Table 4 shows the results of the relationship between the severity of the Great Chinese Famine and firm risk-taking. First, we examine the relationship between the severity of the Great Chinese Famine and firm risk-taking in model 1, and the results show that the relationship is significant. We then include the quadratic term of severity in our model. Model 2 demonstrates a significant and negative relationship between the quadratic term of severity and firm risk-taking. We then examine the extreme point of this relationship and find the point is within the range of severity.

To clarify this curvilinear relationship, we drew an inverted U-shaped curve of severity of the Great Chinese Famine and firm risk-taking (see Fig. 3). Figure 3 illustrates that the strength of severity of the famine has an increasingly positive effect on firm

risk-taking. However, this positive effect declines after a certain point. Therefore, we find there is an inverted U-shaped relationship between the severity of the Great Chinese Famine and firm risk-taking, which supports hypothesis 4.

**Robustness tests**. To ensure the robustness of our results, we adopted several robustness tests. First, we changed the measurement the of dependent variables. Considering that R&D and overseas investment represent a company's willingness to take risks (Coles et al., 2006)—R&D investment is usually used to measure the company's focus on innovation and innovation and is inherently risky—we use the ratio of R&D investment to operating income and the percentage of overseas business to operating income to measure firm risk-taking. Table 5 presents the results of firm risk-taking measured by other measures. Across the models, the results were found to be generally consistent with those reported in Table 2, which means our results are reliable.

Second, we also changed the measurement of the independent variable. According to the method of Feng and Johansson (2018), CEOs who experienced the famine were divided into three cohorts, namely those who experienced it in infancy and early childhood (coh1, born in 1955–1961), childhood and adolescence (coh2, born in 1942–1954) and adulthood (coh3, born in 1941 or before). As presented in model 1 in Table 6, the effect of CEOs who experienced famine during infancy and early childhood on firm risk-taking were examined and the results were positive but insignificant. The results of model 2 show that companies with CEOs who experienced a 3-year-long disaster during their childhood and adolescence are less willing to take risks. The results of model 3 show that the experience of famine in adulthood does not affect firm risk-taking. The robustness results demonstrate that CEOs who only experienced the three-year-long Great Chinese Famine during their mental and value development period (age 6–18) are more frugal and risk-averse, and that this tendency continued to affect these individuals throughout their careers.

**Table 5 Results of different measurement of firm risk-taking.**

| Variables | Model | |
|---|---|---|
| | R&D | Inter |
| CEOs' early life experiences of the famine | −0.419** (0.206) | −1.847*** (0.477) |
| Constant | 0.033 (0.043) | 0.114 (0.103) |
| Controls | Yes | Yes |
| Year fixed effect | Yes | Yes |
| Industry fixed effect | Yes | Yes |
| Observations | 3107 | 4290 |

Robust standard errors are in parentheses.
***$p < 0.01$, **$p < 0.05$, two-tailed test.

**Endogeneity tests**. To avoid the problem of endogeneity that may be caused by sample self-selection bias, propensity score matching (PSM) was adopted to carry out the endogeneity test. We match data based on company characteristics, and the 1:10 nearest-neighbour matching method was used for sample matching: for a firm with a CEO that experienced famine in early life, we find ten matching companies with the closest propensity score but with a CEO who did not experience famine. Then we treated the firms with famine-experienced CEOs as the experimental group and other companies as the control group. During the matching, we choose a logit model to regress and use CEO Age, Gender, ROA, Concentration, Size, Slack and Market Competition as the control variables, since these have been argued to significantly affect firm risk-taking. In addition, firm risk-taking is the dependent variable in our model.

After matching, we first check the validity of this match; the results show that the matching is successful and significant (ATT = 0.025, $|t| > 1.96$). Then, we use the matched data for regression, and the results are shown in Table 5. After matching, the total number of samples was 1786 firm-year observations with 541 unique firms. As exhibited in Table 7, model 1 shows that there is a negative relationship between CEOs that experienced famine and firm risk. Models 2–4 show the moderating effects of state ownership and market competition individually, which are consistent with our previous results.

Finally, we used the year of birth of the CEO to determine whether the CEO experienced a famine, which could lead to endogeneity problems. Therefore, we use an instrumental variable (IV) approach to estimate endogeneity issues. As we mentioned before, the Chinese government's eagerness to accelerate China's industrialisation and increase the amount of food requisitioned led to a national food shortage and famine (Li and Yang, 2005). The Chinese government launched a mass movement attempting to achieve high industrial and agricultural production targets. Due to the high expectations of the government, various regions put forward unrealistic goals greatly increased and revised the planned indicators and even made false reports. Among them, the people's communes, characterised by centralised power, provided the necessary institutional basis for the implementation of excessive grain collection. These political actions had a profound impact on initiating, exacerbating and prolonging the famine. Therefore, we selected the number of people's communes in each province at the end of 1959 as an instrumental variable.

**Table 6 Results of CEO that experienced famine measured by different periods.**

| Variables | Firm risk-taking $t+1$ | | |
|---|---|---|---|
| | Model 1 | Model 2 | Model 3 |
| CEOs' early life experiences of the famine 1 (coh1, born in 1955-19611) | 0.001 (0.003) | | |
| CEOs' early life experiences of the famine 2 (coh2, born in 1942-1954) | | −0.010* (0.005) | |
| CEOs' early life experiences of the famine 3 (coh3, born in 1941 and before) | | | −0.018 (0.023) |
| Constant | 0.728*** (0.027) | 0.718*** (0.028) | 0.726*** (0.027) |
| Controls | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes |
| Industry fixed effect | Yes | Yes | Yes |
| Observations | 14,555 | 14,555 | 14,555 |

Robust standard errors are in parentheses.
***$p < 0.01$, *$p < 0.1$, two-tailed test.

**Table 7 Regression of CEO that experienced famine on Firm Risk-taking: PSM.**

| Variables | Firm risk-taking $t+1$ | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| CEOs' early life experiences of the famine | −0.055*** (0.017) | −0.063*** (0.018) | −0.032* (0.018) | −0.040** (0.019) |
| CEOs' early life experiences of the famine*state ownership | | 0.031** (0.013) | | 0.027** (0.013) |
| CEOs' early life experiences of the famine*market competition | | | −0.002*** (0.001) | −0.002*** (0.001) |
| Constant | 0.490*** (0.143) | 0.483*** (0.143) | 0.470*** (0.142) | 0.464*** (0.142) |
| Controls | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes |
| Industry fixed effect | Yes | Yes | Yes | Yes |
| Observations | 1786 | 1786 | 1786 | 1786 |

Robust standard errors are in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, two-tailed test.

**Table 8 Results of IV.**

| Variables | Firm risk-taking |
|---|---|
| CEOs' early life experiences of the famine | −6.423* (3.891) |
| Constant | 0.761 (0.197) |
| Controls | Yes |
| Year fixed effect | Yes |
| Industry fixed effect | Yes |
| Birth place fixed effects | Yes |
| Birth status fixed effects | Yes |
| Observations | 6417 |

Robust standard errors are in parentheses.
*$p < 0.1$, two-tailed test.

We propose that the presence of people's communes will affect how people feel about the severity of famine but will not affect firm risk-taking. First, we examine whether the instrumental variable will significantly affect CEOs' early life experiences of the severity of the famine, and the result shows that the relationship is significant ($p = 0.000$). In addition, the F test is 26.66, which is above the critical value of 8.96 (Stock et al., 2002), suggesting that the weak instrument problem does not pose a concern. Table 8 shows the results of the fourth estimation, and the coefficient of the severity of the famine is negative and significant, which shows that after controlling for the instrumental variables, the CEO's experience of the severity of the famine in early life still has an impact on firm risk-taking.

## Discussion

The purpose of this study is to explore the influence of CEOs' early experiences during the Great Chinese Famine on their firms' risk-taking behaviour. We first explore whether the CEO experienced the famine in early life will impact firm risk-taking, as well as the boundary conditions of this relationship. Using a longitudinal analysis of listed Chinese companies, we found that there is a negative relationship between CEOs who experienced the three-year-long disaster and their firms' willingness to take risks, which we found to be the result of the risk-aversion imprint left by the famine. We further explore the boundary conditions of this relationship. Our results suggest that state ownership weakens the relationship between CEOs that experienced famine and firm risk-taking, whereas market competition strengthens this relationship. The second question we want to explore is the relationship between the severity of famine and firm risk-taking. Contrary to the conclusions of previous studies, we found there is an inverted U-shaped relationship between the severity of the Great Chinese Famine and firm risk-taking. That is to say, CEOs who lived in places where the famine was more severe are more conservative, while CEOs who lived in places where the famine was less severe are more risk-loving.

**Theoretical contribution**. Our research makes the following three theoretical contributions to the literature. First, our study sheds new light on the relationship between CEO's early life experience and firm strategies. Previous studies found that CEOs who had experienced the Great Chinese Famine are more risk-averse and thus will implement less risky management decisions (Zhang, 2017). For example, CEOs who experienced famine in early life are more willing to hold cash, reduce stack crash risk and adopt more conservative accounting policies (Hu et al., 2019, 2020). Consistent with these studies, we found that CEOs who experienced the famine will have an imprint of lacking resources and thus will reduce their firms' risk-taking.

However, our study goes a step further and explores the impact of the severity of the famine on individuals, as the severity of famine varied from region to region, perhaps resulting in different imprints. While previous research suggests that CEOs with more intense famine experience are more risk averse (Hu et al., 2020; Zhang, 2017), we found there is not a linear relationship but an inverted U-shaped relationship between the severity of the Great Chinese Famine through which the CEO lived and firm risk-taking. Our research offers a new hypothesis and a direction for studying CEOs' early experiences of famine.

Second, we contribute to imprinting theory by exploring what imprint will be formed and when. Studies have documented that economic, technological and institutional conditions will leave imprints on individuals and organisations (Marquis, 2003; Marquis and Huang, 2010; Marquis and Tilcsik, 2013; Wang et al., 2019). Our research on historic events can also be seen as an important source of imprinting, especially for those people who experienced such events during their critical period for forming values and cognition (Tulving, 2002). Specifically, we suggest that experiencing the Great Chinese Famine in early life will leave an imprint of lacking resources on individuals because this disaster happened around the country and changed the living environment. Besides, responding to the work of Marquis and Tilcsik (2013), we further discuss the persistence and decay of the imprint. We find that the environment that the CEO faces will greatly change the imprint; that is, if the imprint left in early life is consistent with the environment, the imprint is strengthened, otherwise, the imprint is weakened (Marquis and Tilcsik, 2013; Wang et al., 2019; Zhang et al., 2022). Specifically, we take China's unique market environment into consideration and discuss how the imprint left by famine changes CEOs' strategic decisions under different market logic situations. Our findings provide a new direction for

future research on exploring the imprint of other historic events and the match of the imprint and current environment.

Finally, our study expands on existing firm risk-taking literature by exploring how and why executives' risk-taking preferences vary and when they are likely to be more pronounced. As firm risk-taking is related to the development and success of companies and to the core decisions CEOs undertake, many studies have focused specifically on the relationship between CEOs' personal traits and their risk-taking behaviour. Over-confident managers, for example, show a stronger preference for risk and will thus choose riskier investment projects that offer higher returns (Li and Tang, 2010). By focusing specifically on CEOs' formative years, our study explores how and when early trauma—in this case, experiencing the Great Chinese Famine—shapes CEOs' risk preferences and their risk-taking behaviour.

**Managerial implications**. The findings of our research have several implications for firm management. During the selection of executives, the focus tends to mainly be on their personal information, professional experience and success. Our study reveals that CEOs' early life experiences play a significant part in their leadership abilities and should therefore be considered, as these experiences can have enduring impacts on their behaviour. Given that executives who experienced natural disasters during their formative years tend to be more risk-averse, companies that aspire to take fewer risks may wish to hire such CEOs. Meanwhile, our findings also suggest that state ownership and market environments can influence CEOs' and firms' risk aversion, which should also be considered during hiring.

**Limitations and future research directions**. Our research has some limitations. First, we propose that experiencing the famine will make a CEO more risk-averse, but actually, it is hard to clarify whether it was the famine that made the CEO more conservative or that the CEO was naturally more conservative, which allowed him to survive the famine. Future research could analyse the impact of disasters on individuals through experiments. Besides, due to data availability, only the data of Chinese companies that were listed between 2006 and 2017 were selected for analysis. Taking into consideration the problem of sample selection bias, future research can incorporate unlisted companies into the sample. Finally, this article only studies the impact of CEO famine experience on their risk-taking behaviour, but CEOs' characteristics affect corporate outcomes in many ways. Research can also focus on the impact of CEO famine experience on other strategic initiatives, such as mergers and acquisitions, innovation and corporate social responsibility.

## Data availability

The datasets generated during and/or analysed during the current study are not publicly available due to the confidentiality of manual collection of natural disaster data in this paper but are available from the corresponding author on reasonable request.

Received: 30 January 2022; Accepted: 18 April 2023;
Published online: 03 May 2023

## References

Acemoglu D, Zilibotti F (1997) Was Prometheus unbound by chance? Risk, diversification, and growth. J Political Econ 105:709–751
Barnett WP (1997) The dynamics of competitive intensity. Adm Sci Q 42:128–160
Bernile G, Bhagwat V, Rau PR (2017) What doesn't kill you will only make you more risk-loving: early-life disasters and CEO behavior. J Finance 72:167–206
Bozoğlu Batı G, Armutlulu İH (2020) Work and family conflict analysis of female entrepreneurs in Turkey and classification with rough set theory. Humanit Soc Sci Commun 7:1–12
Campbell RJ, Jeong S-H, Graffin SD (2019) Born to take risk? The effect of CEO birth order on strategic risk taking. Acad Manag J 62:1278–1306
Carroll CD, Weil DN (1994) Saving and growth: a reinterpretation. In: Carnegie-Rochester conference series on public policy. Elsevier
Chen CR, Steiner TL, Whyte AM (2006) Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. J Bank Finance 30:915–945
Chen Y, Zhou L-A (2007) The long-term health and economic consequences of the 1959–1961 famine in China. J Health Econ 26:659–681
Coles JL, Daniel ND, Naveen L (2006) Managerial incentives and risk-taking. J Financ Econ 79:431–468
Eze SC, Awa HO, Chinedu-Eze VC, Bello AO (2021) Demographic determinants of mobile marketing technology adoption by small and medium enterprises (SMEs) in Ekiti State, Nigeria. Humanit Soc Sci Commun 8:1–11
Fan G, Wang X, Zhu H (2003) The report on the relative process of marketization of each region in China. Econ Res J 3:259–288
Feng X, Johansson AC (2018) Living through the Great Chinese Famine: early-life experiences and managerial decisions. J Corp Finance 48:638–657
Filipski MJ, Ling Z, Xiaobo C, Kevin Z (2019) Living like there's no tomorrow: The psychological effects of an earthquake on savings and spending behavior. Eur Econ Rev 116:107–128
Gluckman PD, Cutfield W, Hofman P, Hanson MA (2005) The fetal, neonatal, and infant environments—the long-term consequences for disease risk. Early Hum Dev 81:51–59
Greve HR, Zhang C (2017) Institutional logics and power sources: merger and acquisition decisions. Acad Manag J 60:671–694
Guo D, Guo Y, Jiang K (2016) Government-subsidized R&D and firm innovation: evidence from China. Res Policy 45:1129–1144
Hanaoka C, Hitoshi S, Yasutora W (2018) Do Risk Preferences Change? Evidence from the Great East Japan Earthquake. Am Econ J Appl Econ 10:298–330
Hambrick DC, Mason PA (1984) Upper echelons: the organization as a reflection of its top managers. Acad Manag Rev 9:193–206
Hu J, Li A, Luo Y (2019) CEO early life experiences and cash holding: Evidence from China's great famine. Pacific-Basin Finance. Journal 57:101184
Hu J, Long W, Tian GG, Yao D (2020) CEOs' experience of the Great Chinese Famine and accounting conservatism. J Bus Finance Account 47:1089–1112
John K, Litov L, Yeung B (2008) Corporate governance and risk-taking. J Finance 63:1679–1728
Keats BW, Hitt MA (1988) A causal model of linkages among environmental dimensions, macro organizational characteristics, and performance. Acad Manag J 31:570–598
Kish-Gephart JJ, Campbell JT (2015) You don't forget your roots: The influence of CEO social class background on strategic risk taking. Acad Manag J 58:1614–1636
Kleim B, Ehlers A (2009) Evidence for a curvilinear relationship between post-traumatic growth and posttrauma depression and PTSD in assault survivors. J Trauma Stress 22:45–52
Koch-Bayram IF, Wernicke G (2018) Drilled to obey? Ex-military CEOs and financial misconduct. Strateg Manag J 39:2943–2964
Kun P, Tong X, Liu Y, Pei X, Luo H (2013) What are the determinants of post-traumatic stress disorder: age, gender, ethnicity or other? Evidence from 2008 Wenchuan earthquake. Public Health 127:644–652
Kung JK-S, Lin JY (2003) The causes of China's great leap famine, 1959–1961. Econ Dev Cult Change 52:51–73
Labonté B et al. (2012) Genome-wide epigenetic regulation by early-life trauma. Arch Gen Psychiatry 69:722–731
Lewis BW, Walls JL, Dowell GW (2014) Difference in degrees: CEO characteristics and firm environmental disclosure. Strateg Manag J 35:712–722
Li J, Tang Y (2010) CEO hubris and firm risk taking in China: the moderating role of managerial discretion. Acad Manag J 53:45–68
Li W, Yang DT (2005) The great leap forward: anatomy of a central planning disaster. J Political Econ 113:840–877
Liang H, Ren B, Sun SL (2015) An anatomy of state control in the globalization of state-owned enterprises. J Int Bus Stud 46:223–240
Lyoo IK, Kim JE, Yoon SJ, Hwang J, Bae S, Kim DJ (2011) The neurobiological role of the dorsolateral prefrontal cortex in recovery from trauma: longitudinal brain imaging study among survivors of the South Korean subway disaster. Arch Gen Psychiatry 68:701–713
Malmendier U, Nagel S (2011) Depression babies: do macroeconomic experiences affect risk taking? Q J Econ 126:373–416
Marquis C (2003) The pressure of the past: network imprinting in intercorporate communities. Adm Sci Q 48:655–689
Marquis C, Huang Z (2010) Acquisitions as exaptation: the legacy of founding institutions in the US commercial banking industry. Acad Manag J 53:1441–1473

Marquis C, Tilcsik A (2013) Imprinting: toward a multilevel theory. Acad Manag Ann 7:195–245
Marquis C, Bird Y (2018) The paradox of responsive authoritarianism: how civic activism spurs environmental penalties in China. Organ Sci 29:948–968
Maung M, Wilson C, Tang X (2016) Political connections and industrial pollution: evidence based on state ownership and environmental levies in China. J Bus Eth 138:649–659
Mehta D et al. (2013) Childhood maltreatment is associated with distinct genomic and epigenetic profiles in posttraumatic stress disorder. Proc Natl Acad Sci USA 110:8302–8307
Nee V (1992) Organizational dynamics of market transition: hybrid forms, property rights, and mixed economy in China. Adm Sci Q 59:1–27
Nolen-Hoeksema S, Morrow J (1991) A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. J Personal Soc Psychol 61:115–121
O'Sullivan D, Zolotoy L, Fan Q (2021) CEO early-life disaster experience and corporate social performance. Strateg Manag J 42:2137–2161
Palmer TB, Wiseman RM (1999) Decoupling risk taking from income stream uncertainty: a holistic model of risk. Strateg Manag J 20:1037–1062
Pan Y, Teng L, Supapol AB, Lu X, Huang D, Wang Z (2014) Firms' FDI ownership: the influence of government ownership and legislative connections. J Int Bus Stud 45:1029–1043
Peng MW (2003) Institutional transitions and strategic choices. Acad Manag Rev 28:275–296
Peng MW, Heath PS (1996) The growth of the firm in planned economies in transition: institutions, organizations, and strategic choice. Acad Manag Rev 21:492–528
Shapira Z (1995) Risk taking: a managerial perspective. Russell Sage Foundation
Shi W, Zhang Y, Hoskisson RE (2017) Ripple effects of CEO awards: investigating the acquisition activities of superstar CEOs' competitors. Strateg Manag J 38:2080–2102
Simpson J, Sariol AM (2019) Squared away: veterans on the board of directors. J Bus Eth 160:1035–1045
Simsek Z, Fox BC, Heavey C (2015) "What's past is prologue" A framework, review, and future directions for organizational research on imprinting. J Manag 41:288–317
Stinchcombe AL (2000) Social structure and organizations. Adv Strateg Manag 17:29–259
Stock JH, Wright JH, Yogo M (2002) A survey of weak instruments and weak identification in generalized method of moments. J Bus Econ Stat 20:518–529
Tang Y, Qian C, Chen G, Shen R (2015) How CEO hubris affects corporate social (ir) responsibility. Strateg Manag J 36:1338–1357
Tulving E (2002) Episodic memory: from mind to brain. Annu Rev Psychol 53:1–25
Voss GB, Sirdeshmukh D, Voss ZG (2008) The effects of slack resources and environmental threat on product exploration and exploitation. Acad Manag J 51:147–164
Wang D, Du F, Marquis C (2019) Defending Mao's dream: how politicians' ideological imprinting affects firms' political appointment in China. Acad Manag J 62:1111–1136
Wong EM, Ormiston ME, Tetlock PE (2011) The effects of top management team integrative complexity and decentralized decision making on corporate social performance. Acad Manag J 54:1207–1228
Yechiam E, Busemeyer JR, Stout JC, Bechara A (2005) Using cognitive models to map relations between neuropsychological disorders and human decision-making deficits. Psychol Sci 16:973–978
Zhang L (2017) CEOs' early-life experiences and corporate policy: evidence from China's great famine. Pac-Basin Finance J 46:57–77
Zhang L, Ren S, Chen X, Li D, Yin D (2020) CEO hubris and firm pollution: State and market contingencies in a transitional economy. J Bus Eth 161:459–478
Zhang Z, Zhang B, Jia M (2022) The military imprint: the effect of executives' military experience on firm pollution and environmental innovation. Leadersh Q 33:101562
Zhou KZ, Gao GY, Zhao H (2017) State ownership and firm innovation in China: an integrated view of institutional and efficiency logics. Adm Sci Q 62:375–404

## Acknowledgements

This work is supported by the National Natural Science Foundation of China (72091313, 71672194, 72102235) and the Hunan Natural Science Foundation (2022JJ40648).

## Competing interests

The authors declare no competing interests.

## Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

## Informed consent

This article does not contain any studies with human participants performed by any of the authors.

## Additional information

**Correspondence** and requests for materials should be addressed to Ding Wang.

**Reprints and permission information** is available at http://www.nature.com/reprints

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.