# Inherited Culture and Corporate Innovation

Jianlei Han
Macquarie Business School, Macquarie University, Sydney NSW 2109, Australia
Email: jianlei.han@mq.edu.au

Xiaona Ji
Macquarie Business School, Macquarie University, Sydney NSW 2109, Australia
Email: xiaona.ji@hdr.mq.edu.au

Zheyao Pan
Macquarie Business School, Macquarie University, Sydney NSW 2109, Australia
Email: terry.pan@mq.edu.au

**Abstract**

We use a cultural measure derived from folklore to study its economic outcomes. Specifically, we investigate the impact of CEO's risk-taking propensity, derived from ancestral folklore, on corporate innovation. Our findings show that firms led by CEOs with higher levels of folklore-based risk-taking achieve better innovation performance and more breakthrough innovations. This effect is stronger when the company faces intense creative destruction pressures and heightened product market competition. We also find that CEOs enhance innovation by improving efficiency rather than increasing R&D investment. Our findings underscore the practical value of folklore as a cultural measure in understanding economic outcomes.

**JEL classification:** G30; G41; O31; Z13

**Keywords**: Culture; Folklore; Innovation; Risk-taking; Efficiency

# 1. INTRODUCTION

Culture, which profoundly impacts economic development, shapes economic behavior, corporate practices, and policymaking (Granato, Inglehar, and Leblang, 1996; Herbig and Dunphy, 1998; Guiso, Sapienza, and Zingales, 2006; Giuliano and Nunn, 2021). Among the diverse elements of culture, folklore, as a mirror of culture (Dundes, 1969), is seldom used as a cultural measure in economic studies due to measurement difficulties. Recently, Michalopoulos and Xue (2021) developed a novel measure to capture folklore culture to address this measurement challenge, and their results highlight the importance of folklore in the study of cultural economics. Building on these earlier studies, this paper uses folklore as a cultural measure to study its impact on economic outcomes. Specifically, it explores how the cultural heritage derived from folklore influences CEO risk-taking behavior and its subsequent impact on corporate innovation.

Folklore is the collection of a community's traditional beliefs, customs, and stories passed down through generations by word of mouth (Michalopoulos and Xue, 2021). These narratives and practices connect actions to the community's values and needs, acting as a repository for cultural expression and a crucial means of cultural transmission (Bauman, 1986). Folklore as a cultural measure has distinct advantages. Its intrinsic locality shows subtle cultural distinctions, resulting in a more accurate representation of native cultures (Dundes, 1969). Rooted in oral traditions, folklore remains less influenced by external forces, providing a clearer view of the true essence of local culture. Therefore, folklore can be used as a valuable tool for understanding the impact of cultural narratives on economic behaviors and outcomes.

Previous research has extensively examined various cultural measures, such as Hofstede's cultural dimensions (1984, 2001) and Schwartz's cultural value orientations (1994, 2004). These measures are typically survey-based. Survey-based approaches may be susceptible to biases, such as hypothetical bias, social desirability bias and reverse causality (Loomis, 2011; Podsakoff, MacKenzie, Lee, and Podsakoff, 2003), wherein respondents provide socially acceptable responses rather than reflecting their true beliefs and practices. Since folklore stories predate contemporary economic growth, using them avoids these problems. Additionally, these measures may fail to reflect the deeper, more long-lasting cultural factors that affect a person's fundamental views from a young age. These cultural effects, which develop during a person's formative years, can have a long-term impact on their tendency and may not be fully reflected by the traditional cultural measurement (Zanella and Bellani, 2024). Folklore captures deeply held cultural standards. It reflects the values, beliefs, and worldviews established in a society's culture over time. Cultural values and norms, which are strongly established in childhood, can significantly impact an individual's decision-making processes and strategic choices (Michalopoulos and Xue, 2021).

Our study aims to provide empirical evidence for the practical value of folklore as a cultural measure. We focus on CEOs of publicly listed firms in the United States and investigate the relationship between the CEOs' risk-taking propensity based on the cultural heritage derived from folklore and corporate innovation. While Michalopoulos and Xue (2021) examined how folklore affects entrepreneurial activity at a societal level, as measured by the number of patents filed by residents and new business registrations by the working-age population, our study extends the understanding of the impact of cultural narratives on economic behavior by adding a new dimension focusing on corporate-level outcomes. By exploring the specific mechanisms through which folklore-based risk-taking influences corporate innovation via CEO decision-making, we provide a more detailed understanding of how inherited culture shapes corporate innovation and offer a comprehensive view of the economic impact of folklore. Moreover, concentrating solely on the U.S. market helps mitigate the limitations of cross-country analysis, given the significant differences among countries in terms of education, institutions, legal systems, and demographics, in addition to cultural variations (Gao, Han, Pan, and Zhang, 2023).

As a country of immigrants, the United States has significant family-level variations in cultural heritage, allowing us to investigate the transmission of CEOs' cultural heritage (Guiso, Sapienza, and Zingales, 2006; Pan, Siegel, and Wang, 2020). To determine the CEOs' cultural origins, we use their last name to infer their cultural heritage[1], based on the nationality information of passengers with the same last name who arrived at the Port of New York between 1820 and 1957. We then assign risk-taking values derived from folklore-based measurements to each CEO based on their assumed cultural history related to their last name. The folklore-based measure created by Michalopoulos and Xue (2021) systematically codes and analyzes the content of folklore stories across societies to record historical cultural attitudes about risk and challenges. According to this approach, countries with a higher proportion of challenge and competition-related motifs in their folklore are more risk-tolerant. This measure directly assesses an individual's underlying risk preferences from an early age by concentrating on the risk attitudes entrenched in a CEO's cultural background.

[1] The approach of using surnames to identify people's cultural background has been widely adopted in business disciplines (see e.g., Gompers et al., 2016; Liu, 2016; Pan et al., 2017, 2020; Brochet et al., 2019; and Fitzgerald and Liu, 2020; Adhikari and Agrawal, 2016; Nguyen et al., 2018).

Next, we explore how a CEO's folklore-based risk-taking affects corporate innovation performance. We find that the presence of CEOs with a greater level of folklore-based risk-taking significantly improves the firm's innovation performance. Economically, increasing the CEO's folklore-based risk-taking propensity by one standard deviation relates to around a 2% rise in the number of patents, citations, and market value of patents. To mitigate concerns that the observed relationship between CEOs' folklore-based risk-taking and corporate innovation performance might be driven by unobservable firm-specific factors unrelated to the CEO, we conduct analyses focusing on CEO turnover events. We investigate how exogenous CEO turnover events affect innovation performance. We find that firms that choose CEOs from more risk-taking cultural backgrounds compared to their predecessors see an economically and statistically significant boost in corporate innovation output. These findings imply that appointing CEOs with risk-taking cultures enhances innovation performance. Furthermore, our findings show that the presence of risk-taking CEOs promotes breakthrough innovation rather than incremental innovation. Additionally, we conduct heterogeneity tests to determine whether a CEO's risk-taking background is more conducive to corporate innovation when firms confront more creative destruction pressures or product market competition. We aim to observe the differences in the relationship between folk-based risk-taking and innovation under varying levels of environments. The result indicates that the CEO's folk-based risk-taking is more effective when the company is facing high creative destruction pressures and high product market competition.

To further explore the mechanisms through which folklore-based risk-taking CEOs enhance innovation, we investigate two potential pathways: increased R&D input and improved innovation efficiency. First, we examine whether these CEOs achieve higher levels of innovation outcomes by increasing R&D investments. Our analysis reveals no significant relationship between the folklore-based risk-taking score and R&D expenditure, suggesting that increased input is not the primary mechanism. Second, we investigate whether folklore-based risk-taking CEOs improve innovation productivity. We find a significant and positive association between the folklore-based risk-taking score and firm innovation efficiency across all innovation measures. These findings suggest that folklore-based risk-taking CEOs primarily enhance corporate innovation through improved efficiency rather than increased R&D input.

Finally, we implement additional explanations to ensure the robustness of our results. First, to address potential concerns that CEOs' risk-taking behavior might be influenced by their compensation structure rather than cultural factors (Mao and Zhang, 2018), we incorporate compensation-related risk-taking measures into our analysis. The result shows that the observed effect of folklore-based risk-taking on innovation is robust and not driven by compensation-related risk-taking incentives. Second, we incorporate other cultural factors identified in the literature, including individualism and uncertainty avoidance (Hofstede, 1984, 2001), and harmony (Schwartz, 1994, 2004). The result shows that even after accounting for these additional cultural risk-taking measures, the positive impact of folklore-based risk-taking on innovation remains significant. Third, we use an alternative definition of risk-taking. We redefine risk-taking by considering only the motifs where the character is successful and show that the main effects of folklore-based risk-taking on innovation outcomes remain. Fourth, we conduct an additional analysis by recalculating the weighted average risk-taking value for each CEO based on their last name and including returning U.S. citizens. Fifth, we conducted a test excluding female CEOs to control for potential last name changes, as married women may adopt their husbands' last names after marriage. Our findings show that the significant relationship remains unaffected. Finally, we conduct a Tobit regression to confirm that the results are robust across different econometric estimation techniques.

Our study contributes to several strands of literature. First, it validates the use of folklore as a novel cultural measure in economic studies. It provides empirical evidence for how cultural heritage derived from folklore influences CEO risk-taking behavior and its subsequent impact on corporate innovation. While existing research on cultural factors in economic development has primarily centered on frameworks like Hofstede's cultural dimensions and Schwartz's cultural value orientations (Li, Griffin, Yue, and Zhao, 2013; Delis, Hasan, Iosifidi, and Tsoumas, 2023), religious influences (Barr and McCleary, 2003), and traditional values (Inglehart and Baker, 2000), we broaden this understanding by integrating folklore. We offer a new perspective on assessing the role of cultural elements in shaping corporate behavior and outcomes.

Second, our work extends research on the association between the traits and backgrounds of CEOs and corporate innovation. While prior studies have examined how CEOs' traits and backgrounds like individualism (Gao et al., 2023), compensation incentive (Mao and Zhang, 2018), sensation seeking (Sunder, Sunder, and Zhang, 2017), and overconfidence (Galasso and Simcoe, 2011; Hirshleifer, Low, and Teoh, 2012) influence innovation, we specifically focus on the role of CEOs' risk-taking propensity derived from their ancestral folklore. Our findings provide empirical evidence which demonstrates that firms led by CEOs from cultures with a richer tradition of folklore-based risk-taking produce more innovation.

Third, our findings contribute to the existing literature on how informal institutions such as cultural norms influence firm strategies and outcomes (Fernandez and Fogli, 2009; Fernandez, 2011; Gorodnichenko & Roland, 2011,2017; Boubakri, Chkir, Saadi, and Zhu 2021). Extending beyond formal rules and regulations, we demonstrate the impact that a society's engrained cultural traditions can have on firm-level innovation through the CEOs' folklore-based risk-taking propensity. Our findings show that CEOs' cultural heritage works as an informal institutional force that guides enterprises toward strategic decisions, which in turn affects economic outcomes.

The rest of the paper is organized as follows: Section 2 presents the theoretical framework and hypothesis development. Section 3 discusses the sample and variables. Section 4 presents the baseline findings. Section 5 discusses the heterogeneity tests. Section 6 presents the mechanisms on innovation. Section 7 contains alternative explanations and robustness tests. Finally, Section 8 concludes the findings.

## 2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

### 2.1 Theoretical Framework

The study of the relationship between culture and economic outcomes can be traced back to Max Weber's pioneering work "The Protestant Ethic and the Spirit of Capitalism" (1905/2013). Weber argued that Protestant values and ethics played a crucial role in shaping economic behaviors and the development of Western capitalism, laying the foundation for subsequent research on how culture influences economic behavior and outcomes. However, it was not until the 1970s when

Geert Hofstede began systematically studying the impact of culture on organizational behavior that the relationship between culture and economic outcomes became more well recognized (Hofstede, 1984). A variety of methods are currently employed to measure cultural factors. Some of the more widely used measures are as follows: Hofstede's cultural dimensions theory, Schwartz's cultural value orientations theory, the GLOBE Project, and the World Values Survey.

When Hofstede first introduced his cultural dimensions theory in 1980 (Hofstede,1984), he proposed four dimensions initially: Power Distance, Individualism vs. Collectivism, Masculinity vs. Femininity, and Uncertainty Avoidance. In 1991, Hofstede added a fifth dimension, Long-Term Orientation vs. Short-Term Orientation (Hofstede and Hofstede, 1991). The sixth and final dimension, Indulgence vs. Restraint, was added in 2010 (Hofstede, Hofstede, and Minkov, 2010). These dimensions were initially based on surveys of IBM employees from 40 countries between 1967 and 1973, but updates from various other sources have subsequently been incorporated, including from the World Values Survey, which currently presents data for over 100 countries[2].

Schwart's theory of cultural value orientations was conceptualized in 1994 (Schwart, 1994) and fully developed by 1999 (Schwart, 1999). He presented a complete and detailed exposition of the seven dimensions: Harmony, Embeddedness, Hierarchy, Mastery, Affective Autonomy, Intellectual Autonomy, and Egalitarianism. His works in 2004 and 2006 further elaborated on these dimensions, significantly advancing the theory through methodological refinements and empirical validation (Schwart, 2004, 2006). These cultural value orientations were initially derived from surveys

[2] For more details, refer to https://geerthofstede.com/research-and-vsm/dimension-data-matrix/.

conducted with teachers and students. Subsequent validation and extension of these dimensions were achieved through data from larger, more representative international surveys such as the World Values Survey, European Social Survey, and International Social Survey Program, including data from 80 countries[3].

The World Values Survey is a global research project that examines people's attitudes, values, and beliefs across cultures and over time (Inglehart and Baker, 2000). It was established in 1981 by Ronald Inglehart, initially covering 10 Western industrialized countries but quickly expanded to become a worldwide survey (Inglehar, Basanez, Diez-Medrano, Halman, and Luijkx, 2000). This survey has been conducted in waves, with each typically lasting about five years. It explores a wide range of social, economic, religious, political, and cultural values, including measures of trust, happiness, political participation, and attitudes toward democracy and gender equality. To date, seven waves have been completed, with the most recent one conducted from 2017 to 2022. The WVS has cumulatively covered nearly 100 countries, representing about 90% of the world's population[4].

The GLOBE (Global Leadership and Organizational Behavior Effectiveness) Project is an extensive cross-cultural study aimed at exploring the interrelationships between societal culture, organizational culture, and organizational leadership. It was initiated in 1991 by Robert J. House and involved collecting data from over 17,000 middle managers in 62 societies (House, Hanges, Javidan, Dorfman, and Gupta, 2004). This project introduced nine cultural dimensions: Power

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[3] For more details, refer to Schwartz's cultural value orientation (https://www.researchgate.net/publication/304715744_The_7_Schwartz_cultural_value_orientation_scores_for_80_countries).
[4] For more details, refer to the World Values Survey (https://www.worldvaluessurvey.org).

Distance, Uncertainty Avoidance, Humane Orientation, Institutional Collectivism, In-Group Collectivism, Assertiveness, Gender Egalitarianism, Future Orientation, and Performance Orientation. The GLOBE Project has conducted multi-stage data collection and analysis, with the latest update completed in 2020 called Globe 2020, covering 150 countries[5].

These cultural measures have been widely utilized in research investigating the impact of culture on various economic outcomes. For instance, by using 16 cultural values from these four measurement measures, Nguyen, Hagendorff, and Eshraghi (2018) demonstrate that the influence of cultural heritage extends beyond individual choices, impacting entire organizations through its effect on various firm-level policies. Boubakri, Chkir, Saadi, and Zhu (2021) utilize Hofstede's six cultural dimensions and discover that culture significantly impacts innovation by shaping individuals' attitudes and beliefs toward novelty, risk, and personal initiative. Siege, Licht, and Schwartz (2011) employed Schwartz's Egalitarianism cultural value orientation and found a significant impact of the disparity in egalitarianism on the international movement of bond and equity issuances, syndicated loans, as well as mergers and acquisitions. Guiso, Sapienza, and Zingales (2003) employed World Values Survey data to examine the impact of the intensity of religious beliefs on economic attitudes, showing that Christian religions tend to be more positively correlated with attitudes that foster economic growth. Meanwhile, the GLOBE project's cultural dimensions have been used by Kabasakal, Dastmalchian, Karacay, and Bayraktar (2012) to explore the relationship between culture and leadership in the Middle East and North Africa. Their findings

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[5] For more details, refer to the Globe Project (https://globeproject.com/).

reveal that the distinctive characteristics of exceptional leadership in this area are fundamentally shaped by cultural practices and values. These studies highlight the profound impact of cultural factors in shaping economic behaviors and outcomes across countries and underscore the value of these cultural measures in economic research.

Folklore-based measures (Michalopoulos and Xue, 2021) introduce a fresh perspective to cultural measurement methodologies, serving as a valuable complement to conventional survey-based data collection. It contains 2,564 folklore motifs from 958 societies worldwide and employs natural language processing techniques to perform text analysis. This approach helps to identify and extract key themes and patterns that reflect core cultural values and beliefs. Folklore-based measures address several limitations of traditional cultural measurement methods. It offers longer historical perspectives and broader geographical coverage to include societies that may be underrepresented in contemporary surveys. To the best of our knowledge, it is the only cultural factor that encompasses the largest number of countries to date covering 199 countries[6]. It also captures deep-rooted cultural traits that might not be easily accessible through direct questioning and reduces potential biases associated with modern survey techniques, such as social desirability bias or interviewer effects. By using folklore as a proxy for cultural values and beliefs, this measure opens new avenues for understanding how culture shapes economic and social outcomes over extended periods.

## 2.2 Hypothesis Development

[6] For more details, refer to Folklore (https://doi.org/10.7910/DVN/IXOHKB).

Folklore-based measures present an opportunity to explore economic outcomes through a new cultural perspective. In particular, this method offers a unique angle for examining the relationship between CEOs' folklore-based risk-taking and innovation, two factors that are crucial for economic development. The focus on risk-taking and innovation is motivated by several key considerations. Innovation is a critical enabler of sustainable corporate growth and competitive advantage (Porter, 1992; Tian and Wang, 2014). Innovation is a risky and uncertain long-term process that demands adventurous spirit, patience, and persistence (He and Tian,2020). Key decision-makers, especially the Chief Executive Officer (CEO), play an important role. Their willingness to take risks has a significant impact on a company's ability to innovate and adapt to a constantly changing market (Hambrick and Mason,1984; He and Tian, 2018).

Prior literature has examined the impact of CEO characteristics, compensation incentives, and cultural factors on firm innovation. For instance, Galasso and Simcoe (2011) found that overconfident CEOs invest more in innovation and obtain more patents and citations. Hirshleifer et al. (2012) found that overconfident CEOs with higher risk-taking behavior, are more likely to initiate innovative projects and pursue riskier innovation strategies. Sunder et al. (2017) find that firms led by pilot CEOs produce more patents and achieve better innovation outcomes by improving efficiency and pursuing diverse, original projects. Regarding compensation structure, Mao and Zhang (2018) investigate the relationship between managerial risk-taking incentives and corporate innovation and find that the reduction in risk-taking incentives following FAS 123R implementation is associated with a significant decrease in innovation output. The findings suggest that when managers experience a reduction in risk-taking incentives, they tend to adopt diversified innovation portfolios and reducing exploratory inventions as a strategy to mitigate business risk. In terms of cultural factors, Gorodnichenko and Roland (2017) used Hofstede's individualism index to study the effect of culture on long-run growth, finding that individualism has a strong effect on innovation and economic development. Adhikari & Agrawal (2016) show that firms in areas with a preference for gambling are more innovative, investing more in R&D, and achieve more and higher quality patents.

Building on these insights, we can explore the relationship between CEOs' folklore-based risk-taking and innovation. Similar to overconfident CEOs, those with a higher folklore-based risk-taking propensity may be more inclined to pursue uncertain yet potentially groundbreaking innovation projects. This tendency aligns with the effects of compensation structure, as risk-taking CEOs may foster corporate innovation. Moreover, like the influence of individualism, folklore culture that embraces risk-taking may enhance the positive impact of a CEO's risk propensity on innovative outcomes. Therefore, we suggest the following hypotheses:

H1. CEOs' folklore-based risk-taking is linked to better firm innovation performance.

H2. CEOs' folklore-based risk-taking tends to favor breakthrough innovation over incremental innovation.

## 3. SAMPLE AND DATA

Our sample consists of 6,120 unique CEOs in 2,918 unique firms from 1992 to 2022. We begin with the list of CEOs from the ExecuComp database, which provides first and last names, ages, gender, and other relevant information, covering S&P 1500 firms in the United States. We exclude companies with missing data on independent variables and controls from the Center for Research in Security Prices (CRSP)/Compustat database, as well as observations with CEO tenures of less than one year since these CEOs have little impact on a company's strategic decisions. Patent data are sourced from the Kogan, Papanikolaou, Seru, and Stoffman (KPSS, 2017) patent dataset[7]. Additionally, we omit financial (SIC codes 6000 to 6799) and utilities firms (SIC codes 4900 to 4949).

### 3.1 CEOs' cultural heritage

To determine CEOs' country of origin, we employ a name-based ethnicity classification approach following interdisciplinary literature (see, for example, Mateos, 2007). Specifically, we collect data from passenger records of ships arriving at the Port of New York from international ports between 1820 and 1957. These data, available on Ancestry.com, include each passenger's first and last name, arrival date, and ethnicity or nationality. Using historical passenger records and ethnic last names, we may determine the ancestral origins of CEOs in our sample. As a country of immigrants, the United States has significant family-level variance in cultural heritage, allowing us to investigate the transmission of CEOs' cultural heritage, including their culturally determined risk-taking propensity. For each family name in our initial CEO sample, we search available passenger records for people with the same name and no missing ethnicity or nationality information. Approximately 3% of CEOs' countries of origin could not be determined, resulting in a sample of 9,073 CEOs with 6,023 distinct family names. After meeting the selection criteria and dropping for missing variables, our final sample consists of 6,120 unique CEOs from 2,918

[7] We source the data on patents from https://github.com/KPSS2017.

publicly traded U.S. corporations. Furthermore, we match each CEO's nationality and ethnicity data to the nations indicated by Michalopoulos and Xue (2021). We have 101 possible nations of origin from the 199 indicated in their work. We aggregate nationality and ethnicity data at the country level and calculate their frequency distribution across all countries of origin.

**Table 1** lists the top ten most common countries of origin. The United Kingdom, the United States, Germany, Ireland, and Italy are the top five countries of origin in our sample. Approximately 17% of travelers are returning U.S. citizens whom we will remove from future consideration. Excluding returning U.S. citizens helps to reduce potential confounding effects from individuals who might have ancestral roots elsewhere but have been primarily shaped by U.S. culture. This exclusion allows us to focus on individuals who are more likely to have been directly influenced by their ancestral culture. Our approach to defining a CEO's country of origin is consistent with the methodology employed by Pan et al. (2017, 2020) to determine CEOs' cultural heritage, and our findings are comparable[8].

< Insert Table 1 Here>

### 3.2 CEOs' folklore-based risk-taking

To measure how CEOs' risk-taking propensity are shaped by their cultural heritage derived from folklore, we use the risk-taking index developed by Michalopoulos and Xue (2021). Their study examines oral traditions from 199 countries, focusing on recurring motifs of challenges and

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[8] We matched countries based on the 199 nations indicated by Michalopoulos and Xue (2021). We excluded data that could not be directly attributed to a specific country, such as entries labeled Scandinavian, Asian, European, African, Latin, or ambiguous racial categories like Black, White, Yellow, and Brown. For better classification, we classify Jewish as Israel. The United Kingdom comprises four geographic and historical parts: England, Scotland, Wales, and Northern Ireland.

competitions. They found that keywords related to competition in folklore strongly predict higher risk-taking behaviors across different countries today. On average, about 6% of a country's folklore themes involve challenges and competitions. The risk-taking index is defined as the proportion of motifs related to challenges and competitions relative to the total motifs. Their findings suggest that countries with a higher proportion of these themes in their folklore are generally more risk tolerant.

**Figure 1** shows the spatial distribution of folklore-based risk-taking across countries. The average value of folklore-based risk-taking for all 199 countries is 0.0597. The highest values are observed in Western Sahara (0.12468), Mauritania (0.11397), and Uganda (0.11360), while the lowest values are found in Burundi (0), Djibouti (0.00024), and Eswatini (0.00062). The variation in folklore-based risk-taking provides an ideal setting to explore the relationship between CEOs' folklore-based risk-taking propensity and innovation.

< Insert Figure 1 Here>

We calculate a weighted average of the risk-taking index linked with their countries of origin for each CEO in our sample. We exclude any countries of origin that cannot be classified or not included in their list of 199 countries. The weighted average risk-taking value for a given CEO is determined by combining the frequency weight of all represented countries of origin based on their last name. That is: $Risk\ taking_i = \sum W_{i\,c} * Risk\ taking_c$, where $W_{i\,c}$ represents the rescaled frequency of the last name $i$ with regard to the nation $c$. On average, CEOs exhibit folklore-based risk-taking of 0.073, with a standard deviation of 0.013, ranging from a minimum of 0.047 to a maximum of 0.089.

### 3.3 Firm innovation performance and style

To measure a firm's innovation performance, we separate it into two aspects: quantity and quality (Gao et al., 2023). For the quantity of innovation, we use the number of patents as a proxy. *Patents* refer to the natural logarithm of one plus the total number of patent applications filed by a company in a year. We evaluate two factors when assessing the quality of innovation: the number of citations received and the market value of patents. *Citations* refer to the natural logarithm of one plus the total number of citations per patent application filed by a company in a year. *Patent Value* indicates the natural logarithm of one plus the dollar value of patent applications filed by a company in a year.

To measure a firm's innovation style, we employ the self-citation method to distinguish between breakthrough and incremental innovation (Byun, Oh, and Xia, 2021). Breakthrough innovations involve exploring new knowledge areas, challenging existing technologies, and providing fundamentally different products or services from what is currently available in the market. In contrast, incremental innovations build on a company's existing knowledge and skills to improve or modify existing products or services. We defined a patent as a breakthrough innovation if less than half of its citations refer to other patents held by the same company; otherwise, it is classified as an incremental innovation. *Breakthrough* represents the natural logarithm of one plus the number of breakthrough innovations for a firm in a year, while *Incremental* represents the natural logarithm of one plus the number of incremental innovations.

All patent-related variables can be obtained from the KPSS patent dataset, which includes yearly information on patent quantities, citations received by each patent, estimated market values of patents, application dates, and grant dates (Kogan, Papanikolaou, Seru, and Stoffman, 2017). Consistent with prior studies (Griliches, Pakes, and Hall, 1987; Sunder et al., 2017; Bradley, Kim, and Tian, 2017), we date each patent based on its application year.

### 3.4 Control variables

To measure control variables, we follow Gao et al. (2023) and Do, Tan, and Wu, (2022) to include firm and CEO characteristics that may affect firm innovation. The control variables are as follows: *Capex Assets*, is the total capital expenditure scaled by the book value of the firm's total assets; *Cash Assets*, is the cash scaled by the book value of the firm's total assets; *PPE Assets*, is the property, plant & equipment scaled by the book value of firm's total assets; *R&D Assets*, is the research and development expenditure scaled by the book value of firm's total assets; *OMRD*, is a binary variable equal to 1 if the firm did not report R&D expenses in a given year, and 0 otherwise; *Size*, is the natural logarithm of the book value of firm's total assets; *Leverage*, is the book value of debt scaled by the book value of the firm's total assets; *ROA*, is the net income scaled by the book value of the firm's total assets; *Firm Age*, is the natural logarithm of the number of years since the firm first appeared in Compustat; *Tobin's Q*, is the firm's market value of assets scaled by the book value of the firm's total assets; *CEO Age*, is the CEO's age in years; *CEO Tenure*, is the number of years since the CEO became the company's CEO. Industries are based on the 2-digit Standard Industrial Classification (SIC) codes. These control variables account for various firm-level and CEO-level factors that may influence a firm's innovation performance, as well as industry-specific effects. **Appendix A 1** provides the definitions and data sources of all the variables. To mitigate the effect of outliers, all continuous variables are winsorized at the top and bottom 5% of their respective distributions by each year.

### 3.5 Summary statistics

**Table 2** presents the descriptive statistics for our key variables. The independent variable, *Risk-taking*, has a mean of 0.073, with a standard deviation of 0.013. For dependent variables, $Patents_{t+1}$ has a mean of 0.928 with a standard deviation of 1.476, while $Citations_{t+1}$ average at 1.454 with a standard deviation of 2.381, and the mean of $Patent\ Value_{t+1}$ is 1.616 with a standard deviation of 2.502, indicating significant variation in innovation output across firms. Moving on, the mean CEO age is 56.13 years (standard deviation of 6.62 years), and the average CEO tenure is 7.692 years (standard deviation of 6.469 years), suggesting diverse managerial backgrounds and varied durations within our dataset. *R&D Assets,* a crucial input for innovation, average 3% of assets (standard deviation 4.7%), indicating significant cross-sectional variation in research investment. The mean for *Size* is 7.389, and a median of 7.294 with a standard deviation of 1.531, implying the presence of both large and small firms in our sample. These statistics are comparable to those reported in previous research on U.S. public companies (e.g., Gao et al., 2023; Do et al., 2022). To address potential multicollinearity concerns, we examine the variance inflation factors (VIFs) for our variables. The VIF scores range from 1.027 to 2.340, well below the commonly accepted threshold of 10, suggesting that multicollinearity is not a significant issue in our analyses.

< Insert Table 2 Here>

## 4. BASELINE RESULTS

### 4.1 Firm innovation performance and CEOs' folklore-based risk-taking

To test the association between firm innovation performance and CEOs' folklore-based risk-taking, we conducted the following ordinary least squares (OLS) regressions:

$$Patents_{i,t+1\ or\ t+1\ to\ t+3}\ or\ Citations_{i,t+1\ or\ t+1\ to\ t+3}\ or\ Patent\ Value_{i,t+1\ or\ t+1\ to\ t+3}$$

$$= \alpha + \beta_1 Risk\ taking_{i,t} + \sum \lambda Controls_{i,t} + Industry\ FE_{i,t} + Year\ FE_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where the indices $i$ and $t$ indicate firms and years, respectively. The dependent variables are the natural logarithm of one plus the number of patents, citations, or market value of patents for all patent measures from years $t+1$ or $t+1$ to $t+3$. The independent variable, *Risk-taking*, is the CEO's risk-taking score related to their cultural heritage derived from folklore, calculated as the weighted average for risk-taking across all possible origins connected with the CEO's last name. All control variables are described in the previous section and measured in year $t$. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year.

The OLS regression results are reported in **Table 3**. Columns (1) and (2) show that the estimated coefficients between the number of patents and folklore-based risk-taking are positive and statistically significant. Economically, the *Risk-taking* coefficients of 0.0193 and 0.0166 indicate that a one-standard-deviation increase in *Risk-taking* based on a CEO's country of origin is associated with approximately a 2% standard-deviation increase in patent output in the subsequent one to three years. Columns (3) and (4) show that a one-standard-deviation increase in folklore-based risk-taking is associated with about a 2.5% standard-deviation increase in the number of citations in the subsequent years. Columns (5) and (6) indicate that a one-standard-deviation increase in folklore-based risk-taking is associated with approximately a 1.8% standard-deviation increase in the market value of patents in the subsequent years. Overall, our regression results in **Table 3** suggest that folklore-based risk-taking is associated with better subsequent innovation output, which supports **H1**. This finding indicates that the presence of CEOs from more risk-taking cultures can promote firm innovation performance.

< Insert Table 3 Here>

**4.2 CEO turnover analyses**

To mitigate concerns that the observed relationship between CEOs' folklore-based risk-taking and corporate innovation performance might be driven by unobservable firm-specific factors unrelated to the CEO, we conduct analyses focusing on CEO turnover events. We classify CEO turnovers due to death, illness, or retirement as exogenous events and gather data on these events from Gentry et al.'s CEO turnover dataset (2021)[9]. We exclude endogenous turnover events, as they are more likely influenced by the firm's selection process (Gao et al., 2023; Islam and Zein, 2020). For each turnover, we include data from three years before to three years after the CEO's turnover year, resulting in six years of observations. We use a Difference-in-Differences (DID) approach to estimate the effect of CEO turnover, employing a dummy variable to define the CEO turnover period and a categorical variable to capture the variation in shocks to CEO risk-taking caused by exogenous turnover events.

To investigate the association with innovation performance, we use the following OLS regression.

[9] We source the data on CEO turnover events from https://zenodo.org/records/4543893.

$$Patents_{i,t+1\ or\ t+1\ to\ t+3}\ \ or\ \ Citations_{i,t+1\ or\ t+1\ to\ t+3}\ \ or\ \ Patent\ Value_{i,t+1\ or\ t+1\ to\ t+3}$$

$$= \alpha + \beta_1 CEO\ Turnover_{i,t} * Dif\ Risk_{i,t} + \beta_2 CEO\ Turnover_{i,t}$$

$$+ \sum \lambda Controls_{i,t} + Firm\ FE_{i,t} + + YearFE_{i,t} + \varepsilon_{i,t} \tag{2}$$

Dependent variables are measured with the same proxies specified in Equation (1). *CEO Turnover* is a dummy variable that takes the value of zero before the CEO turnover year and one otherwise; *Diff Risk* indicates the change in the CEO's risk-taking background, measured as 1 if the difference between the risk-taking score of the incoming CEO and the departing CEO is greater than 0, measured as -1 if the risk difference is less than 0, as 0 if the risk difference is equal to 0. To account for the potential influence of unobservable firm-level features, we include firm characteristic control variables. The regressions include firm-fixed and year-fixed effects, with standard errors clustered by industry and year.

The results are reported in **Table 4**. The key variable of interest is the interaction between *CEO Turnover* and *Diff Risk*. We can find that this interaction variable is positive and statistically significant for all three innovation performance measures. This finding shows that firms undergoing an exogenous CEO turnover, which results in the appointment of a leader with a higher folklore-based risk-taking score exhibit superior innovation performance. The results indicate a more robust relationship between CEOs' folklore-based risk-taking and firm innovation performance.

< Insert Table 4 Here>

### 4.3 Firm innovation style and CEOs' folklore-based risk-taking

To examine the association between firm innovation style and CEOs' risk-taking propensity based on their cultural heritage derived from folklore, we conduct the following ordinary least squares (OLS) regressions:

$$Breakthrough_{i,t+1\ or\ t+1\ to\ t+3}\ \ or\ \ Incremental_{i,t+1\ or\ t+1\ to\ t+3}$$
$$= \alpha + \beta_1 Risk\ taking_{i,t} + \sum \lambda Controls_{i,t} + Industry\ FE_{i,t} + \ YearFE_{i,t} + \varepsilon_{i,t} \quad (3)$$

where the indices $i$ and $t$ indicate firms and years, respectively. The dependent variables are the natural logarithm of one plus the number of breakthrough or incremental innovations. The independent variable, *Risk-taking*, and all control variables are described as before. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year.

**Table 5** documents the OLS regression results. We find that the coefficients of *Risk-taking* are only statistically significant for regressions using *Breakthrough* as the dependent variable. This result is consistent with **H2**, and indicates that CEOs' folklore-based risk-taking tends to favor breakthrough innovation over incremental innovation.

< Insert Table 5 Here>

## 5. HETEROGENEITY TESTS ON CREATIVE DESTRUCTION AND PRODUCT MARKET COMPETITION

In this part, we aim to explore whether the positive relationship between a CEO's folklore-based risk-taking and corporate innovation output is amplified when firms operate in environments with more creative destruction pressures or increased product market competition, following Do et al. (2022). Cornaggia, Mao, Tian, and Wolfe (2015) propose the important role of banking competition in shaping innovation outcomes at the firm level. Companies in rapidly advancing technological and highly competitive markets face significant uncertainty and volatility. The constant evolution in technology and market dynamics can swiftly render the reallocation of resources, as highlighted by Kogan et al. (2017). Additionally, fierce competition demands continuous adaptation and creative problem-solving. In these turbulent settings, a CEO's willingness to embrace risk becomes pivotal for fostering innovation. Leaders who are open to taking risks can better navigate ambiguity and inspire the inventive thinking necessary to achieve groundbreaking results. We propose that a CEO's folklore-based risk-taking background is more conducive to corporate innovation when firms face higher levels of creative destruction pressures or intense product market competition.

### 5.1 High vs. Low Creative Destruction

To test whether a CEO's folklore-based risk-taking is more positively related to corporate innovation when firms confront more creative destruction pressures, we divide our sample into two groups: companies experiencing high creative destruction and those experiencing low creative destruction. We measure the creative destruction pressures of firm $i$ as the weighted average of the innovative output of its competitors within the same 3-digit SIC industry as firm $i$ (Kogan et al., 2017). Companies in the top tercile of annual creative destruction rankings are classified as facing high creative destruction, while those in the lower two terciles are classified as facing low creative destruction.

We perform regression analysis using Equation (1) separately for the high and low creative destruction groups. By comparing the results from these two samples, we aim to observe differences in the relationship between folklore-based risk-taking and innovation under varying levels of creative destruction. Panel A of **Table 6** represents the high creative destruction group, while Panel B of **Table 6** represents the low creative destruction group. We observe that all the innovation measures in Panel A are positive and significant. In contrast, although the results in Panel B are also positive, only the citation results are significant, and the coefficients are much smaller compared to those in Panel A. This indicates that the CEO's folklore-based risk-taking is more effective when the company faces high creative destruction pressures.

< Insert Table 6 Here>

### 5.2 High vs. Low Product Market Competition

To test whether a CEO's folklore-based risk-taking is more positively related to corporate innovation when firms confront more product market competition, we divide our sample into two groups: companies experiencing high product market competition and those experiencing low product market competition. Product market competition is measured using the Herfindahl index, constructed based on sales within the same 3-digit SIC industry (Do et al., 2022). A lower Herfindahl index indicates a more competitive market. Companies in the bottom tercile of the annual Herfindahl index distribution are classified as facing high product market competition, while those in the upper two terciles are classified as facing low product market competition.

We perform regression analysis using Equation (1) separately for the high and low product market competition groups. By comparing the results from these two samples, we aim to observe differences in the relationship between folklore-based risk-taking and innovation under varying levels of product market competition. Panel C of **Table 6** represents the high product market competition group, while Panel D of **Table 6** represents the low product market competition group.

We observe that all innovation measures in Panel C are positive and significant. In contrast, although the results in Panel D are also positive, only the citation result at time $t+1$ is significant, and the coefficients are much smaller compared to those in Panel C. This indicates that a CEO's folklore-based risk-taking is more effective when the company faces high product market competition.

## 6. MECHANISMS ON INNOVATION

Our result has established a positive association between CEOs' folklore-based risk-taking propensity and corporate innovation. Building on this finding, we seek to further explore the mechanisms through which these CEOs drive enhanced innovation outcomes. To this end, we investigate two potential pathways: increased R&D input and improved innovation efficiency. This analysis aims to identify the primary factors that drive the observed boost in innovation under the leadership of folklore-based risk-taking CEOs.

### 6.1 R&D spending

To understand the mechanisms through which CEOs contribute to a firm's innovation, following Sunder et al. (2017) and Mao and Zhang (2018), we begin by examining whether they achieve higher levels of innovation outcomes through increased innovation input. Specifically, we investigate whether CEOs with a higher propensity for folklore-based risk-taking tend to allocate more resources to innovation projects. This propensity for risk-taking is reflected in the firm's R&D spending, which we use as a proxy for innovation input. R&D expenditure is calculated as the firm's research and development expenditure scaled by the book value of total assets (*R&D Assets*).

To examine the mechanism, we conduct the following ordinary least squares (OLS) regressions:

$$R\&D\ Assets_{i,t} = \alpha + \beta_1 Risk\ taking_{i,t} + \sum \lambda Controls_{i,t} + FE_{i,t} + \varepsilon_{i,t} \tag{4}$$

Panel A of **Table 7** documents the regression results. Our findings did not reveal a significant relationship between the CEOs' folklore-based risk-taking and R&D spending. These results suggest that the positive impact of the CEOs' folklore-based risk-taking on innovation observed in our main analysis is not primarily driven by increased R&D spending.

### 6.2 Innovation efficiency

Further, we investigate whether CEOs with a higher propensity for folklore-based risk-taking achieve greater innovation outcomes through enhanced innovation efficiency. Hirshleifer, Hsu, and Li (2013) show that a firm is considered more efficient in generating innovation output if it achieves a higher patent count with the same level of R&D investment. Consequently, by scaling innovation output with past cumulative R&D investment, we can assess innovation efficiency (Do et al., 2022). In this test, we use patent efficiency (*Patents IE*), citation efficiency (*Citations IE*), and patent value efficiency (*Patent Value IE*) to measure innovation efficiency.

To examine the mechanism, we conduct the following ordinary least squares (OLS) regressions:

$$Patents\ IE_{i,t+1\ or\ t+1\ to\ t+3}\ \ or\ \ Citations\ IE_{i,t+1\ or\ t+1\ to\ t+3}\ \ or\ \ Patent\ Value\ IE_{i,t+1\ or\ t+1\ to\ t+3}$$

$$= \alpha + \beta_1 Risk\ taking_{i,t} + \sum \lambda Controls_{i,t} + Industry\ FE_{i,t} + Year\ FE_{i,t} + \varepsilon_{i,t} \tag{5}$$

We construct *Patents IE* as the ratio of the total number of patent applications to cumulative R&D investments over the past five years, *Citations IE* as the ratio of the total number of citations per patent application to cumulative R&D investment over the past five years, and *Patent Value IE* as the ratio of the dollar value of patent applications to cumulative R&D investment over the past five years. Consistent with Chan, Lakonishok, and Sougiannis (2001) and Do et al. (2022), we apply a 20% annual amortization rate to all R&D expenditures. The independent variable is the folklore-based risk-taking score in year t. Control variables and fixed effects are the same as those in the baseline regression.

< Insert Table 7 Here>

Panel B of **Table 7** documents the regression results for innovation efficiency. We find a significant and positive association between the folklore-based risk-taking score and firm innovation efficiency across all measures. The results indicate that high folklore-based risk-taking CEOs can generate more innovation outcomes through enhanced innovation efficiency.

## 7. ALTERNATIVE EXPLANATIONS AND ROBUSTNESS TESTS

### 7.1 Compensation Structure

Mao and Zhang (2018) find that managerial risk-taking incentives significantly impact firms' innovation. To address potential concerns that CEOs' risk-taking behavior might be influenced by their compensation structure rather than cultural factors, we incorporate *Vega* and *Delta* as control variables. *Vega* and *Delta* are financial measures that quantify CEOs' risk-taking behavior based on their compensation structure, where *Vega* assesses the sensitivity of stock options to volatility and *Delta* evaluates the sensitivity of the CEO's wealth to changes in the firm's stock price (Coles, Daniel, and Naveen, 2006; Core and Guay, 2002). In contrast, using folklore as a cultural factor to assess CEO risk-taking involves examining the influence of societal values, beliefs, and historical narratives on the CEO's decision-making. While *Vega* and *Delta* focus on the direct financial impact on the CEO, thus motivating behavior through personal financial gain or loss, folklore-based assessment considers broader cultural influences on the CEOs' attitudes and behaviors towards risk.

We re-estimate Equation (1), adding *Vega* and *Delta* as additional explanatory variables[10]. This approach allows us to isolate the effect of cultural factors on risk-taking and innovation by controlling for the possible impact of CEOs' compensation incentives. The results are presented in Panel A of **Table 8**. As shown, the inclusion of *Vega* and *Delta* does not significantly alter the positive relationship between folklore-based risk-taking and innovation. This finding suggests that the observed effect of folklore-based risk-taking on innovation is robust and not driven by compensation-related incentives.

### 7.2 Additional Cultural Factors

We incorporate other cultural factors identified in the literature. Specifically, we reference the article by Li et al. (2013), which highlights three key cultural risk-taking variables that may influence corporate behavior. These cultural values, developed by Hofstede (1984, 2001) and Schwartz (1994, 2004), include individualism (versus collectivism), uncertainty avoidance, and harmony (versus mastery). We add these three cultural risk-taking variables to our main model specification in Equation (1). This additional analysis allows us to verify that the observed relationship between CEOs' folklore-based risk-taking and innovation is not confounded by other cultural influences on risk-taking.

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[10] We source the data on *Vega* and *Delta* from https://sites.templ e.edu/lnaveen/data/.

The results are presented in Panel B of **Table 8**. The results show that even after accounting for the additional cultural risk-taking variables, the positive impact of folklore-based risk-taking on innovation remains significant. This indicates that our main findings are robust to the inclusion of other cultural risk-taking influences.

### 7.3 Alternative Definition of Risk-Taking

In the baseline analysis, the folklore-based risk-taking measure is defined as the proportion of motifs in a culture's folklore that relate to challenges and competitions. This includes motifs depicting characters who are successful, unsuccessful, or neither successful nor unsuccessful, as well as those where no explicit challenges are present. To further validate our findings, we conduct robustness checks using an alternative definition of risk-taking. We redefine risk-taking by considering only the motifs where the character is successful[11]. This narrower definition focuses specifically on the positive outcomes of risk-taking behavior. We then re-estimate our baseline model using this alternative definition of risk-taking.

The results are presented in Panel C of **Table 8**. The findings show that the positive relationship between folklore-based risk-taking and innovation remains significant when considering only the motifs where the character is successful. This evidence confirms that the observed impact of folklore-based risk-taking on innovation is not sensitive to the broader or narrower definitions of risk-taking. The results suggest that even when focusing solely on successful outcomes, the CEO's folklore-based risk-taking continues to play a crucial role in fostering innovation.

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[11] This data is also based on the folklore-based measurement developed by Michalopoulos and Xue (2021).

### 7.4 Inclusion of returning U.S. citizens

In our baseline analysis, we define a CEO's country of origin by excluding travelers who are returning U.S. citizens. To ensure the robustness of our findings, we conduct an additional analysis where we include these records. By recalculating the weighted average risk-taking value for each CEO based on their last name and incorporating these returning U.S. citizens, we re-estimate our baseline model. This step is crucial to verify that our results are not skewed or biased by the initial exclusion of these individuals.

The results of this robustness check are presented in Panel D of **Table 8**. The findings indicate that the inclusion of returning U.S. citizens does not significantly alter the positive impact of folklore-based risk-taking on innovation. This consistency suggests that our original results are robust and reliable and that the influence of folklore-based risk-taking on innovation is not contingent on the exclusion of any particular subgroup of CEOs.

### 7.5 Excluding Female CEOs

In the United States, most married women adopt their husbands' last names after marriage (Gooding and Kreider, 2010; Robnett, Wertheimer, and Tenenbaum, 2018). This naming tradition could compromise the accuracy of using CEOs' ethnic last names to proxy for their cultural heritage. To address this potential misclassification in our name-based analysis, we conducted a test excluding female CEOs from our sample to control for potential last name changes. This reduces the sample size by 5%. The results are presented in Panel E of **Table 8**. By comparing results with and without female CEOs, we ensure the robustness of our analysis, confirming that the influence of CEO folklore-based risk-taking on corporate innovation remains unchanged.

### 7.6 Alternative model

A sizable portion of firms in patent datasets often report zero patents. These numerous zero observations are particularly common in patent and citation counts. Cohn, Liu, and Wardlaw (2022) note that applying natural logarithms on dependent variables that contain a significant number of zeros potentially leads to biased or inconsistent estimates. To ensure the robustness of our findings across different econometric estimation techniques, we re-estimate our baseline model using the Tobit regression model, as in Lai, Yang, Wang, and Anderson (2023) and Gao et al. (2023). The Tobit model simultaneously accounts for zero and non-zero values, offering a more accurate analysis of variables with many zero observations (Amemiya,1984). We employ alternative innovation performance measures by substituting the dependent variables with the total number of patents, the total number of patent citations, and the total value of patents. The results in Panel F of **Table 8** reveal that the coefficients for folklore-based risk-taking remain significantly positive. This consistency with our baseline results reinforces the conclusion that the CEOs' folklore-based risk-taking positively influences innovation outcomes, irrespective of the econometric methods used.

< Insert Table 8 Here>

## 8. DISCUSSION AND CONCLUSION

Our study provides empirical evidence to demonstrate the practical value of folklore as a cultural measure in economic outcomes. Specifically, we investigate how CEOs' cultural heritage, inferred from their last names, shapes their risk-taking attitudes and its impact on corporate innovation. Utilizing a novel folklore-based measure developed by Michalopoulos and Xue (2021), we analyze the risk-taking propensity embedded in the ancestral folklore traditions of CEOs in U.S. publicly traded companies. Our findings suggest that companies led by CEOs with a higher level of folklore-based risk-taking have better innovation performance and promote breakthrough innovation. We also conduct CEO turnover analyses to demonstrate that the observed association is not influenced by unobservable firm characteristics unrelated to the CEO. Additionally, heterogeneity tests reveal that a CEO's folklore-based risk-taking propensity is more impactful when the company faces intense creative destruction pressures and heightened product market competition. Furthermore, our analysis finds that CEOs with high folklore-based risk-taking propensity primarily enhance corporate innovation through improved efficiency, rather than increased R&D expenditure. To ensure the robustness of our results, we implement several additional analyses. First, we incorporate *Vega* and *Delta* into our analysis to account for compensation incentives. We also control for other cultural factors like individualism, uncertainty avoidance, and harmony. Moreover, we use an alternative definition of risk-taking and conduct an additional analysis by recalculating the weighted average risk-taking value based on folklore. We also conducted a test excluding female CEOs to control for potential last name changes. Finally, we conduct Tobit regression to confirm that the results are robust across different econometric estimation techniques. These comprehensive robustness checks collectively reinforce our central conclusion - that folklore, as a deep-rooted cultural factor, significantly influences CEOs' risk-taking behavior, which in turn substantially impacts corporate innovation.

Our study contributes to multiple literature strands. Firstly, our paper makes a significant contribution by validating the use of folklore as a novel cultural measure in economic studies. We provide empirical evidence demonstrating how the cultural heritage derived from folklore influences CEO risk-taking behavior and its subsequent impact on corporate innovation. Secondly, it extends research on the relationship between the traits and backgrounds of CEOs and firm innovation, specifically investigating the role of CEOs' risk-taking derived from their ancestral folklore. Thirdly, it contributes to the research on how informal institutions such as cultural norms influence firm strategies and outcomes, emphasizing the deep impact of a society's engrained cultural traditions on firm-level innovation through the CEOs' risk propensity. Future research could explore additional mechanisms through which cultural heritage impacts firm policies and performance.

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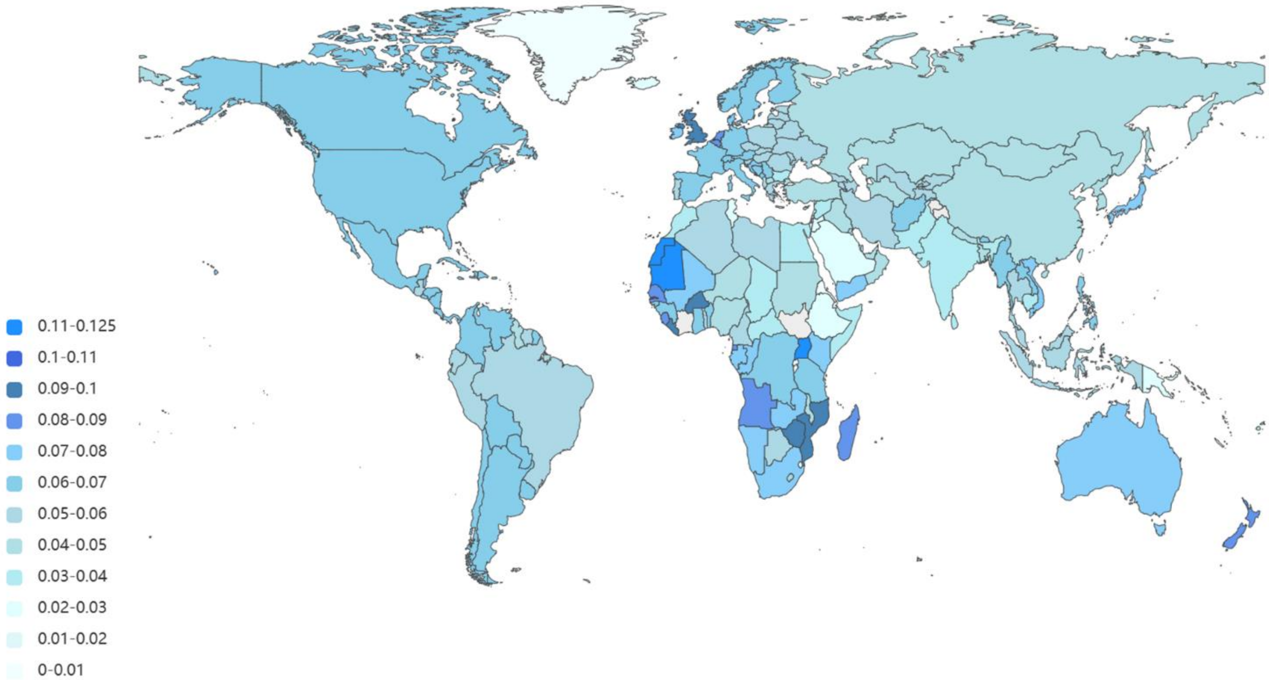
**Figure 1. Folklore-based risk-taking for countries**




This figure shows the variation in folklore-based risk-taking across countries. Folklore-based risk-taking is defined as the proportion of motifs related to challenges and competitions out of the total motifs in folklore for each country. Darker blue shades indicate counties with higher folklore-based risk-taking, while lighter blue shades represent lower folklore-based risk-taking.

## Table 1. Distribution of countries of origin

| | Country of origin | Percentage（%） |
|---|---|---|
| 1 | United Kingdom | 31.372 |
| 2 | United States | 17.031 |
| 3 | Germany | 10.971 |
| 4 | Ireland | 10.307 |
| 5 | Italy | 5.951 |
| 6 | Israel | 2.133 |
| 7 | France | 1.816 |
| 8 | Spain | 1.710 |
| 9 | Netherlands | 1.317 |
| 10 | China | 1.120 |

This table reports the ten most common countries of origin in our sample.

## Table 2. Summary statistics

| | count | mean | std | min | 0.250 | 0.500 | 0.750 | max |
|---|---|---|---|---|---|---|---|---|
| **Dependent Variable** | | | | | | | | |
| $Patents_{t+1}$ | 35113 | 0.928 | 1.476 | 0.000 | 0.000 | 0.000 | 1.609 | 5.024 |
| $Patents_{t+1\ to\ t+3}$ | 35113 | 1.286 | 1.872 | 0.000 | 0.000 | 0.000 | 2.398 | 6.052 |
| $Citations_{t+1}$ | 35113 | 1.454 | 2.381 | 0.000 | 0.000 | 0.000 | 2.708 | 8.427 |
| $Citations_{t+1\ to\ t+3}$ | 35113 | 1.853 | 2.767 | 0.000 | 0.000 | 0.000 | 3.761 | 9.598 |
| $Patent\ Value_{t+1}$ | 35113 | 1.616 | 2.502 | 0.000 | 0.000 | 0.000 | 3.091 | 8.448 |
| $Patent\ Value_{t+1\ to\ t+3}$ | 35113 | 2.074 | 2.920 | 0.000 | 0.000 | 0.000 | 4.166 | 9.512 |
| $Breakthrough_{t+1}$ | 12884 | 2.260 | 1.475 | 0.000 | 1.099 | 1.946 | 3.258 | 5.572 |
| $Breakthrough_{t+1\ to\ t+3}$ | 14624 | 2.797 | 1.743 | 0.000 | 1.386 | 2.565 | 4.060 | 6.558 |
| $Incremental_{t+1}$ | 12884 | 1.068 | 1.304 | 0.000 | 0.000 | 0.693 | 1.792 | 4.533 |
| $Incremental_{t+1\ to\ t+3}$ | 14624 | 1.437 | 1.612 | 0.000 | 0.000 | 0.693 | 2.485 | 5.468 |
| $Patents\ IE_{t+1}$ | 35113 | 0.045 | 0.112 | 0.000 | 0.000 | 0.000 | 0.026 | 1.250 |
| $Patents\ IE_{t+1to\ t+3}$ | 35113 | 0.136 | 0.346 | 0.000 | 0.000 | 0.000 | 0.076 | 4.507 |
| $Citations\ IE_{t+1}$ | 35113 | 0.794 | 3.223 | 0.000 | 0.000 | 0.000 | 0.035 | 41.609 |
| $Citations\ IE_{t+1\ to\ t+3}$ | 35113 | 2.358 | 10.322 | 0.000 | 0.000 | 0.000 | 0.146 | 160.071 |
| $Patent\ Value\ IE_{t+1}$ | 35113 | 0.405 | 1.217 | 0.000 | 0.000 | 0.000 | 0.136 | 12.972 |
| $Patent\ Value\ IE_{t+1\ to\ t+3}$ | 35113 | 1.282 | 4.190 | 0.000 | 0.000 | 0.000 | 0.388 | 55.029 |
| **Independent Variable** | | | | | | | | |
| *Risk-taking* | 35113 | 0.073 | 0.013 | 0.047 | 0.063 | 0.076 | 0.085 | 0.089 |
| **Control Variable** | | | | | | | | |
| *Capex Assets* | 35113 | 0.050 | 0.042 | 0.004 | 0.019 | 0.036 | 0.066 | 0.207 |
| *Cash Assets* | 35113 | 0.150 | 0.155 | 0.002 | 0.029 | 0.091 | 0.221 | 0.613 |
| *PPE Assets* | 35113 | 0.270 | 0.213 | 0.020 | 0.099 | 0.204 | 0.391 | 0.814 |
| *R&D Assets* | 35113 | 0.030 | 0.047 | 0.000 | 0.000 | 0.002 | 0.041 | 0.189 |
| *OMRD* | 35113 | 0.481 | 0.500 | 0.000 | 0.000 | 0.000 | 1.000 | 1.000 |
| *Size* | 35113 | 7.389 | 1.531 | 4.124 | 6.222 | 7.294 | 8.462 | 11.142 |
| *Leverage* | 35113 | 0.236 | 0.183 | 0.000 | 0.070 | 0.224 | 0.360 | 0.772 |
| *ROA* | 35113 | 0.134 | 0.082 | -0.150 | 0.086 | 0.131 | 0.183 | 0.332 |
| *Firm Age* | 35113 | 3.071 | 0.712 | 1.386 | 2.565 | 3.135 | 3.664 | 4.304 |
| *Tobin Q* | 35113 | 2.024 | 1.207 | 0.657 | 1.213 | 1.626 | 2.408 | 9.548 |
| *CEO Age* | 35113 | 56.130 | 6.620 | 42.000 | 51.000 | 56.000 | 61.000 | 71.000 |
| *CEO Tenure* | 35113 | 7.692 | 6.469 | 1.000 | 3.000 | 6.000 | 11.000 | 26.000 |

This table presents the summary statistics for the sample.

## Table 3. CEO's Folklore-based Risk-taking and Corporate Innovation Performance

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0193** | 0.0166* | 0.0257*** | 0.0236*** | 0.0186** | 0.0156** |
| | (2.2574) | (1.9209) | (4.0569) | (3.6598) | (2.4503) | (2.1384) |
| *Capex Assets* | 0.027 | 0.019 | 0.015 | 0.008 | 0.024 | 0.017 |
| | (1.6175) | (1.1564) | (0.7104) | (0.3806) | (1.3086) | (0.9908) |
| *Cash Assets* | 0.0588*** | 0.0655*** | 0.0587*** | 0.0658*** | 0.0564*** | 0.0607*** |
| | (3.1706) | (3.8182) | (3.2423) | (3.9807) | (3.4433) | (4.0935) |
| *PPE Assets* | -0.006 | 0.001 | 0.016 | 0.020 | -0.015 | -0.008 |
| | (-0.1637) | (0.0278) | (0.481) | (0.6323) | (-0.4927) | (-0.2851) |
| *R&D Assets* | 0.2229*** | 0.2138*** | 0.2031*** | 0.1964*** | 0.1930*** | 0.1878*** |
| | (9.1446) | (11.309) | (11.092) | (12.985) | (10.358) | (10.958) |
| *OMRD* | -0.4128*** | -0.4392*** | -0.3971*** | -0.4112*** | -0.4132*** | -0.4285*** |
| | (-5.6595) | (-6.2168) | (-5.4289) | (-5.8950) | (-6.1243) | (-6.7234) |
| *size* | 0.4260*** | 0.4017*** | 0.3600*** | 0.3417*** | 0.4953*** | 0.4790*** |
| | (8.1986) | (8.9755) | (7.7735) | (8.377) | (9.8722) | (10.933) |
| *leverage* | -0.0271*** | -0.0261** | -0.0286*** | -0.0288*** | -0.0267** | -0.0262** |
| | (-2.6784) | (-2.5244) | (-2.8290) | (-2.6172) | (-2.5045) | (-2.2344) |
| *ROA* | 0.0577*** | 0.0572*** | 0.0444*** | 0.0476*** | 0.0585*** | 0.0588*** |
| | (5.4656) | (5.2364) | (3.3308) | (3.2765) | (6.3706) | (5.2161) |
| *Firm age* | 0.0655*** | 0.0660*** | 0.0363** | 0.0366** | 0.0675*** | 0.0696*** |
| | (3.5287) | (3.5886) | (2.3423) | (2.3597) | (3.7922) | (3.8946) |
| *Tobin Q* | 0.0322** | 0.0363** | 0.0399** | 0.0391** | 0.0869*** | 0.0874*** |
| | (2.2969) | (2.4799) | (2.0376) | (2.0441) | (4.6578) | (4.6033) |
| *CEO AGE* | -0.004 | -0.006 | 0.003 | -0.001 | -0.009 | -0.010 |
| | (-0.3496) | (-0.5220) | -0.276 | (-0.0929) | (-0.7917) | (-0.9151) |
| *CEO Tenure* | -0.014 | -0.013 | -0.013 | -0.011 | -0.011 | -0.011 |
| | (-1.0243) | (-0.9109) | (-0.9911) | (-0.7803) | (-0.9268) | (-0.8626) |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2958 | 0.29 | 0.2338 | 0.2328 | 0.3501 | 0.347 |
| Observations | 35113 | 35113 | 35113 | 35113 | 35113 | 35113 |

This table presents the OLS regression results of the association between the CEO's folklore-based risk-taking and corporate innovation performance. The sample period is from 1992 to 2022. *Patents* are the natural logarithm of one plus the total number of patent applications filed by a company in a year. *Citations* are the natural logarithm of one plus the total number of citations per patent application filed by a company in a year. *Patent Value* is the natural logarithm of one plus the dollar value of patent applications filed by a company in a year. *Risk-taking* is the CEO's risk-taking score related to their cultural heritage derived from folklore. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Table 4. CEO turnover analysis

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Diff Risk*CEO Turnover* | 0.0174* | 0.0194* | 0.0333*** | 0.0341*** | 0.0147* | 0.0176* |
| | (1.7314) | (1.7082) | (3.7542) | (3.3398) | (1.7178) | (1.7643) |
| *CEO Turnover* | -0.0099 | -0.0170** | -0.0179 | -0.0215* | -0.0183 | -0.0156 |
| | (-1.2259) | (-2.1463) | (-1.2885) | (-1.7880) | (-1.5100) | (-1.6118) |
| *Capex Assets* | -0.0181*** | -0.0177** | -0.0209** | -0.0250** | -0.0202** | -0.0195* |
| | (-2.8527) | (-2.1741) | (-2.0403) | (-2.5069) | (-2.1410) | (-1.8376) |
| *Cash Assets* | 0.0214** | 0.0208* | 5.32E-05 | 0.0057 | 0.0045 | 0.0097 |
| | (2.3544) | (1.8922) | (0.0046) | (0.3778) | (0.3789) | (0.6815) |
| *PPE Assets* | 0.0916*** | 0.0854*** | 0.1450*** | 0.1232*** | 0.0679* | 0.0659 |
| | (3.4387) | (2.9631) | (4.5739) | (3.2466) | (1.9339) | (1.5622) |
| *R&D Assets* | 0.0829*** | 0.0795*** | 0.1379*** | 0.1312*** | 0.0509** | 0.0463** |
| | (3.5856) | (4.5416) | (6.0459) | (4.79) | (2.1367) | (2.2043) |
| *OMRD* | 0.0593 | 0.0904 | 0.1387 | 0.1479 | 0.0293 | 0.0542 |
| | (0.7975) | (0.9586) | (1.1147) | (1.1113) | (0.4096) | (0.6548) |
| *size* | 0.2005*** | 0.1643*** | 0.1638*** | 0.1352*** | 0.2117*** | 0.1735*** |
| | (3.4214) | (2.9941) | (3.402) | (2.6833) | (3.7992) | (3.1856) |
| *leverage* | -0.0196 | -0.0148 | 0.0031 | 0.0013 | -0.0129 | -0.0216 |
| | (-1.0480) | (-0.8341) | (0.1852) | (0.0741) | (-0.7188) | (-1.1760) |
| *ROA* | 0.0271** | 0.0276*** | 0.0216* | 0.0246** | 0.0291** | 0.0362*** |
| | (2.5091) | (2.8154) | (1.6781) | (1.9715) | (2.4098) | (2.8986) |
| *Firm age* | 0.1566** | 0.1482** | 0.2925*** | 0.2740** | 0.0988 | 0.0725 |
| | (2.0947) | (2.2711) | (2.6941) | (2.3278) | (1.5838) | (1.0606) |
| *Tobin Q* | -0.0019 | 0.0005 | 0.0253 | 0.023 | 0.0249* | 0.022 |
| | (-0.1715) | (0.0442) | (1.3576) | (1.3084) | (1.7328) | (1.4762) |
| Firm Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.0405 | 0.0424 | 0.0489 | 0.0526 | 0.0303 | 0.0317 |
| Observations | 7783 | 7783 | 7783 | 7783 | 7783 | 7783 |

This table presents the OLS regression results of the CEO turnover analysis. The sample period is from 1992 to 2022. *Patents* are the natural logarithm of one plus the total number of patent applications filed by a company in a year. *Citations* are the natural logarithm of one plus the total number of citations per patent application filed by a company in a year. *Patent Value* is the natural logarithm of one plus the dollar value of patent applications filed by a company in a year. *CEO Turnover* is a dummy variable that takes the value of zero before the CEO turnover year and one otherwise; *Diff Risk* indicates the change in the CEO's risk-taking background, measured as 1 if the difference between the risk-taking score of the incoming CEO and the departing CEO is greater than 0, measured as -1 if the risk difference is less than 0, as 0 if the risk difference is equal to 0. The regressions include firm-fixed and year-fixed effects, with standard errors clustered by industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Table 5. CEO's Folklore-based Risk-taking and corporate innovation style

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dep. Var. | $Breakthrough_{t+1}$ | $Breakthrough_{t+1\ to\ t+3}$ | $Incremental_{t+1}$ | $Incremental_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0315** | 0.0249* | 0.0215 | 0.0174 |
| | (2.2391) | (1.662) | (1.4945) | (1.2802) |
| *Capex Assets* | 0.0763*** | 0.0705*** | 0.0442** | 0.0582*** |
| | (4.718) | (4.1932) | (2.3061) | (3.614) |
| *Cash Assets* | 0.0775*** | 0.0812*** | 0.0985*** | 0.0933*** |
| | (4.6661) | (5.2771) | (3.6733) | (3.9116) |
| *PPE Assets* | -0.0185 | -0.0331 | 0.0354 | 0.0073 |
| | (-0.3127) | (-0.5499) | (0.573) | (0.1191) |
| *R&D Assets* | 0.2147*** | 0.1993*** | 0.1857*** | 0.1978*** |
| | (4.3408) | (4.7454) | (10.928) | (10.476) |
| *OMRD* | -0.4247*** | -0.4892*** | -0.3931*** | -0.4363*** |
| | (-3.3620) | (-4.0172) | (-3.6601) | (-4.3256) |
| *size* | 0.7549*** | 0.7008*** | 0.6454*** | 0.6312*** |
| | (17.46) | (20.42) | (16.831) | (17.261) |
| *leverage* | -0.0542*** | -0.0476*** | -0.0544** | -0.0451* |
| | (-3.9915) | (-4.2051) | (-1.9992) | (-1.8540) |
| *ROA* | 0.0565*** | 0.0650*** | 0.0404* | 0.0460** |
| | (3.0381) | (4.0207) | (1.947) | (2.1798) |
| *Firm age* | -0.0114 | -0.0046 | 0.1283*** | 0.1120*** |
| | (-0.5554) | (-0.2429) | (5.6668) | (4.3666) |
| *Tobin Q* | 0.0360*** | 0.0463*** | 0.0699*** | 0.0731*** |
| | (3.9974) | (4.5681) | (2.7064) | (3.0206) |
| *AGE* | 0.0021 | -0.0066 | 0.0118 | 0.0081 |
| | (0.111) | (-0.3367) | (0.7527) | (0.5335) |
| *CEO Tenure* | -0.0052 | -0.002 | 0.0179 | 0.0198 |
| | (-0.4030) | (-0.1353) | (1.2288) | (1.408) |
| Industry Effect | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes |
| R-squared | 0.4654 | 0.4459 | 0.3843 | 0.388 |
| Observations | 12884 | 14624 | 12884 | 14624 |

This table presents the OLS regression results of the association between the CEO's Risk-taking background and corporate innovation style. The sample period is from 1992 to 2022. *Breakthrough* is the natural logarithm of one plus the number of breakthrough innovations for a firm in a year. *Incremental* is the natural logarithm of one plus the number of incremental innovations for a firm in a year. *Risk-taking* is the CEO's risk-taking score related to their cultural heritage derived from folklore. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Table 6. Heterogeneity Tests on Creative Destruction and Product Market Competition

| Creative Destruction | | | | | | |
|---|---|---|---|---|---|---|
| Panel A: High Creative Destruction Sample | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0212** | 0.0184* | 0.0275*** | 0.0253*** | 0.0251** | 0.0225** |
| | (2.5158) | (1.7142) | (3.4209) | (2.5942) | (2.5098) | (2.0185) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.3998 | 0.3819 | 0.3186 | 0.3117 | 0.4627 | 0.4457 |
| Observations | 11654 | 11654 | 11654 | 11654 | 11654 | 11654 |
| Panel B: Low Creative Destruction Sample | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0141 | 0.0116 | 0.0165* | 0.0152* | 0.0071 | 0.0049 |
| | (1.3462) | (1.234) | (1.9365) | (1.839) | (0.7413) | (0.5639) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2637 | 0.2639 | 0.2174 | 0.2161 | 0.2969 | 0.3027 |
| Observations | 23459 | 23459 | 23459 | 23459 | 23459 | 23459 |

| Product Market Competition | | | | | | |
|---|---|---|---|---|---|---|
| Panel C: High Product Market Competition Sample | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0265** | 0.0241** | 0.0344*** | 0.0344*** | 0.0248** | 0.0223** |
| | (2.4575) | (2.1509) | (3.1221) | (3.044) | (2.4121) | (2.3134) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.3554 | 0.3504 | 0.2896 | 0.2919 | 0.4151 | 0.4105 |
| Observations | 11652 | 11652 | 11652 | 11652 | 11652 | 11652 |

Panel D: Low Product Market Competition Sample

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.013 | 0.0101 | 0.0172* | 0.0139 | 0.0111 | 0.0083 |
| | (1.1939) | (0.9174) | (1.8375) | (1.4902) | (0.9888) | (0.719) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2652 | 0.2583 | 0.2085 | 0.2053 | 0.3145 | 0.3124 |
| Observations | 23461 | 23461 | 23461 | 23461 | 23461 | 23461 |

This table presents the OLS regression results of heterogeneity tests on creative destruction and product market competition. The sample period is from 1992 to 2022. *Patents* are the natural logarithm of one plus the total number of patent applications filed by a company in a year. *Citations* are the natural logarithm of one plus the total number of citations per patent application filed by a company in a year. *Patent Value* is the natural logarithm of one plus the dollar value of patent applications filed by a company in a year. *Risk-taking* is the CEO's risk-taking score related to their cultural heritage derived from folklore. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Table 7. Mechanisms on Innovation

| Panel A: R&D spending | | |
|---|---|---|
| | (1) | (2) |
| Dep. Var. | R&D Assets | R&D Assets |
| *Risk-taking* | -0.0099 | -0.0055 |
| | (-0.8893) | (-0.8169) |
| Controls | Yes | Yes |
| Industry Effect | Yes | No |
| Firm Effect | No | Yes |
| Year Effect | Yes | Yes |
| R-squared | 0.3662 | 0.101 |
| Observations | 35113 | 35113 |

| Panel B: Innovation Efficiency | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dep. Var. | $Patents\ IE_{t+1}$ | $Patents\ IE_{t+1\ to\ t+3}$ | $Citations\ IE_{t+1}$ | $Citations\ IE_{t+1\ to\ t+3}$ | $Patent\ Value\ IE_{t+1}$ | $Patent\ Value\ IE_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0166** | 0.0178** | 0.0273** | 0.0274** | 0.0194** | 0.0212** |
| | (2.2207) | (2.145) | (2.2283) | (2.1248) | (2.4135) | (2.5157) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.0673 | 0.0655 | 0.0318 | 0.0291 | 0.1228 | 0.0996 |
| Observations | 35113 | 35113 | 35113 | 35113 | 35113 | 35113 |

This table presents the OLS regression results of CEO Innovation Mechanisms. The sample period is from 1992 to 2022. In panel A, *R&D Assets* are calculated as the firm's research and development expenditure scaled by the book value of total assets. The regressions include industry-fixed or firm-fixed and year-fixed effects. In panel B, *Patents IE* is the ratio of the total number of patent applications to cumulative R&D investments over the past five years, *Citations IE* is the ratio of the total number of citations per patent application to cumulative R&D investment over the past five years, and *Patent Value IE* is the ratio of the dollar value of patent applications to cumulative R&D investment over the past five years. All R&D investments are subject to a 20% annual amortization rate. The regressions include year-fixed and industry-fixed effects. *Risk-taking* is the CEO's risk-taking score related to their cultural heritage derived from folklore. Standard errors are clustered within industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Table 8. Alternative Explanations and Robustness Tests

Panel A: Compensation Structure

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0219*** | 0.0200*** | 0.0277*** | 0.0267*** | 0.0196*** | 0.0176** |
| | (2.8367) | (2.5823) | (4.6522) | (4.5424) | (2.6396) | (2.4875) |
| *Ln(1+vega)* | 0.0214 | 0.0249* | 0.0242* | 0.0271** | 0.0242** | 0.0292*** |
| | (1.4811) | (1.808) | (1.7598) | (2.1655) | (2.1426) | (2.7083) |
| *Ln(1+delta)* | -0.0167* | -0.0126 | -0.0193* | -0.0211* | -0.0023 | 0.003 |
| | (-1.7980) | (-1.1746) | (-1.6904) | (-1.6904) | (-0.2118) | (0.2426) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.3382 | 0.3335 | 0.2843 | 0.2841 | 0.4042 | 0.4017 |
| Observations | 26669 | 26669 | 26669 | 26669 | 26669 | 26669 |

Panel B: Additional Cultural Factors

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0377** | 0.0318** | 0.0463*** | 0.0412** | 0.0352** | 0.0236 |
| | (2.4253) | (2.0214) | (2.9511) | (2.4412) | (2.3392) | (1.4207) |
| *UAI* | 0.0119 | 0.0061 | 0.0183 | 0.0135 | 0.0097 | -0.0015 |
| | (0.7123) | (0.344) | (1.1733) | (0.8365) | (0.6593) | (-0.0958) |
| *Individualism* | -0.0078 | -0.0087 | -0.0032 | -0.0034 | -0.0096 | -0.009 |
| | (-0.3207) | (-0.3544) | (-0.1293) | (-0.1347) | (-0.4884) | (-0.4327) |
| *Harmony* | 0.0005 | 0.0022 | 0.0029 | 0.0048 | -0.0052 | -0.0029 |
| | (0.0367) | (0.1717) | (0.2354) | (0.4081) | (-0.4166) | (-0.2379) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2975 | 0.2918 | 0.2355 | 0.2346 | 0.3512 | 0.3482 |
| Observations | 34721 | 34721 | 34721 | 34721 | 34721 | 34721 |

Panel C: Alternative Definition of Risk-taking

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Challenge Succes* | 0.0176** | 0.0156** | 0.0227*** | 0.0212*** | 0.0173** | 0.0150** |
| | (2.2914) | (2.0555) | (3.9629) | (3.7575) | (2.5626) | (2.3805) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2957 | 0.2899 | 0.2336 | 0.2327 | 0.35 | 0.347 |
| Observations | 35113 | 35113 | 35113 | 35113 | 35113 | 35113 |

Panel D: Inclusion of returning U.S. citizens

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 1.7993** | 1.5516* | 2.3842*** | 2.1856*** | 1.5895** | 1.3185* |
| | (2.3018) | (1.9557) | (3.9903) | (3.5026) | (2.1943) | (1.8568) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2958 | 0.29 | 0.2339 | 0.2329 | 0.3501 | 0.347 |
| Observations | 35113 | 35113 | 35113 | 35113 | 35113 | 35113 |

Panel E: Excluding Female CEOs

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0192** | 0.0166* | 0.0259*** | 0.0241*** | 0.0187** | 0.0158** |
| | (2.2643) | (1.9364) | (4.0835) | (3.7382) | (2.4607) | (2.1774) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.2955 | 0.29 | 0.2346 | 0.234 | 0.3498 | 0.3467 |
| Observations | 33957 | 33957 | 33957 | 33957 | 33957 | 33957 |

Panel F: Alternative model: Tobit

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dep. Var. | $Patents_{t+1}$ | $Patents_{t+1\ to\ t+3}$ | $Citations_{t+1}$ | $Citations_{t+1\ to\ t+3}$ | $Patent\ Value_{t+1}$ | $Patent\ Value_{t+1\ to\ t+3}$ |
| *Risk-taking* | 0.0324*** | 0.0335*** | 0.033*** | 0.0345*** | 0.03*** | 0.0329*** |
| | (3.546) | (3.926) | (3.006) | (3.16) | (2.711) | (2.919) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 35113 | 35113 | 35113 | 35113 | 35113 | 35113 |

This table presents the OLS regression results of alternative explanations and robustness tests. The sample period is from 1992 to 2022. *Patents* are the natural logarithm of one plus the total number of patent applications filed by a company in a year. *Citations* are the natural logarithm of one plus the total number of citations per patent application filed by a company in a year. *Patent Value* is the natural logarithm of one plus the dollar value of patent applications filed by a company in a year. *Risk-taking* is the CEO's risk-taking score related to their cultural heritage derived from folklore. In panel A, *Ln(1+vega)* is the natural logarithm of one plus the dollar change in the wealth of the

CEO associated with a 1% change in the standard deviation of the firm's returns. *Ln(1+delta)* is the natural logarithm of one plus the dollar change in wealth of the CEO associated with a 1% change in the firm's stock price. In panel B, *UAI* is Hofstede's cultural index of uncertainty avoidance, *Individualism* is Hofstede's cultural index of individualism, and *Harmony* is Schwartz's cultural index of harmony. In panel C, *Challenge Success* is the risk-taking index, defined as the proportion of motifs related to challenges and competitions out of the outcomes of motifs where the character is successful. In panel D, *Risk-taking* is the weighted average risk-taking value for each CEO based on their last name and incorporating the returning U.S. citizens. In panel E, *Patents* are the total number of patent applications filed by a company in a year. *Citations* are the total number of citations per patent application filed by a company in a year. *Patent Value* is the dollar value of patent applications filed by a company in a year. The regressions include industry-fixed and year-fixed effects, with standard errors clustered by industry and year. R-squared is the adjusted $R^2$ in the regression. Observations are the total number of firm-year observations. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

## Appendix A 1. Variable Definition

| Variable | Definition | Source |
|---|---|---|
| Dependent variables | | |
| $Patents_{t+1}$ | The natural logarithm of one plus the total number of patent applications in year t + 1. | KPSS (2017) |
| $Patents_{t+1\ to\ t+3}$ | The natural logarithm of one plus the total number of patent applications in year t + 1 to t+3. | KPSS (2017) |
| $Citations_{t+1}$ | The natural logarithm of one plus the total number of citations per patent application in year t + 1 | KPSS (2017) |
| $Citations_{t+1\ to\ t+3}$ | The natural logarithm of one plus the total number of citations per patent application in year t + 1 to t+3. | KPSS (2017) |
| $Patent\ Value_{t+1}$ | The natural logarithm of one plus the dollar value of patent applications in year t + 1. | KPSS (2017) |
| $Patent\ Value_{t+1\ to\ t+3}$ | The natural logarithm of one plus the dollar value of patent applications in year t + 1 to t+3. | KPSS (2017) |
| $Breakthrough_{t+1}$ | The natural logarithm of one plus the number of breakthrough innovations for a firm in year t + 1. | KPSS (2017) |
| $Breakthrough_{t+1\ to\ t+3}$ | The natural logarithm of one plus the number of breakthrough innovations for a firm in years t + 1 to t+3. | KPSS (2017) |
| $Incremental_{t+1}$ | The natural logarithm of one plus the number of incremental innovations for a firm in year t + 1. | KPSS (2017) |
| $Incremental_{t+1\ to\ t+3}$ | The natural logarithm of one plus the number of incremental innovations for a firm in years t + 1 to t+3. | KPSS (2017) |
| $Patents\ IE_{t+1}$ | The ratio of the total number of patent applications in year t + 1 to cumulative R&D investments over the past five years with a 20% depreciation rate. | KPSS (2017), Compustat |
| $Patents\ IE_{t+1to\ t+3}$ | The ratio of the total number of patent applications in year t + 1 to t+3 to cumulative R&D investment over the past five years with a 20% depreciation rate. | KPSS (2017), Compustat |
| $Citations\ IE_{t+1}$ | The ratio of the total number of citations per patent application in year t + 1 to cumulative R&D investments over the past 5 years with a 20% depreciation rate. | KPSS (2017), Compustat |
| $Citations\ IE_{t+1\ to\ t+3}$ | The ratio of the total number of citations per patent application in year t + 1 to t+3 to cumulative R&D investments over the past 5 years with a 20% depreciation rate. | KPSS (2017), Compustat |
| $Patent\ Value\ IE_{t+1}$ | The ratio of the dollar value of patent applications in year t+1 to cumulative R&D investment over the past five years with a 20% depreciation rate. | KPSS (2017), Compustat |
| $Patent\ Value\ IE_{t+1\ to\ t+3}$ | The ratio of the dollar value of patent applications in year t+1 to t+3 to cumulative R&D investments over the past five years with a 20% depreciation rate. | KPSS (2017), Compustat |

| | | |
|---|---|---|
| Independent variables | | |
| *Risk-taking* | Folklore-based risk-taking, a weighted average of the risk-taking index linked with their countries of origin for each CEO based on their last name. The risk-taking index is defined as the proportion of motifs related to challenges and competitions out of the total motifs in folklore. | Michalopoulos and Xue (2021), Ancestry.com |
| *Capex Assets* | The total capital expenditure scaled by the book value of the firm's total assets, set to 0 if missing. | Compustat |
| *Cash Assets* | The cash scaled by the book value of the firm's total assets, set to 0 if missing. | Compustat |
| *PPE Asset* | The property, plant & equipment scaled by the book value of the firm's total assets. | Compustat |
| *R&D Assets* | The research and development expenditure scaled by the book value of the firm's total assets, set to 0 if missing. | Compustat |
| *OMRD* | A binary variable equal to 1 if the firm did not report R&D expenses in a given year, and 0 otherwise. | Compustat |
| *Size* | The natural logarithm of the book value of firm's total assets | Compustat |
| *Leverage* | The book value of debt scaled by the book value of the firm's total assets. | Compustat |
| *ROA* | The net income scaled by the book value of the firm's total assets | Compustat |
| *Firm Age* | The natural logarithm of the number of years since the firm first appeared in Compustat | Compustat |
| *Tobin Q* | The firm's market value of assets scaled by the book value of the firm's total assets | Compustat |
| *CEO Age* | The CEO's age in years. | ExecuComp |
| *CEO Tenure* | The number of years since the CEO became the company's CEO. | ExecuComp |
| *Ln(1+vega)* | The natural logarithm of one plus the dollar change in the wealth of the CEO associated with a 1% change in the standard deviation of the firm's returns. | Coles et al. (2006) |
| *Ln(1+delta)* | The natural logarithm of one plus the dollar change in wealth of the CEO associated with a 1% change in the firm's stock price. | Coles et al. (2006) |
| *UAI* | Hofstede's cultural index of uncertainty avoidance | Hofstede (1984, 2001) |
| *Individualism* | Hofstede's cultural index of individualism. | Hofstede (1984, 2001) |
| *Harmony* | Schwartz's cultural index of harmony | Schwartz (1994, 2004) |
| *Challenge Succes* | Folklore-based risk-taking, a weighted average of the risk-taking index linked with their countries of origin for each CEO based on their last name. The risk-taking index is defined as the proportion of motifs related to challenges and competitions out of the outcomes of motifs in folklore where the character is successful. | Michalopoulos and Xue (2021), Ancestry.com |