Intra-household Dynamics and CEO Corporate Risk-taking

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Abstract

We examine whether intra-household dynamics in the distance of one Hofstede's cultural dimension, that is, the attitude toward uncertainty, between CEOs and CEO spouses affect corporate risk-taking. We document that the high uncertainty avoidance of CEO spouses will influence CEOs' personal uncertainty avoidance, and then lead to less corporate risk-taking, reflected in standard deviation of return on assets and Research and Development (R&D) expenditure. We extend intra-household dynamics beyond household settings into corporate finance settings. Our study contributes to the research on how culture heritage and cultural transmission affect financial outcomes.

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1. Introduction

Household finance literature suggests that intra-household dynamics between couples can affect their household financial decisions (e.g. Addoum, 2017; Da, 2018). Risk-sharing between husband and wife jointly decide their savings and stock investment choices. Does the effect of household dynamics extend beyond household settings? Do the household dynamics in inherited cultural distance between CEOs and CEO spouses affect CEOs' decision-making?

Married persons are usually more risk-averse than single person because of housing and children issues (Love, 2009; Roussanov and Savor, 2014). Women are usually more risk-averse than men because women usually have longer lifespan but less income than men (Arano, Parker and Terry, 2010; Addoum, Kung and Morales, 2016). During marriage life, married couples have convergence in personalities, preferences and attitudes (Gonzaga, Campos and Bradbury, 2007; Rammstedt and Schupp, 2008). In a recent study, Serra-Garcia (2019) find that risk attitudes converge within stable households over time. These studies document the interaction between husband and wife affect their risk attitude. Meanwhile, culture partly decide personal lifestyles, preferences, and even risk attitude (Guiso, Sapienza and Zingales, 2006). Cultural distance in personalities, lifestyles, and beliefs affects couples' personal concept imperceptible through cultural transmission (Kenkel, 1961; Remennick, 2009). A growing literature documents how cultural heritage of chief executive officers (CEOs) shapes firm performance and how other family members affect CEOs' corporate decisions, especially firm risk (Roussanov and Savor, 2014; Cronqvist and Yu, 2017; Pan, Siegel and Wang, 2017; Nguyen, Hagendorff and Eshraghi, 2017). However, this literature faces challenge when it neglects the household dynamics in cultural transmission between couples. In this study, we examine whether intra-household dynamics in cultural distance and cultural transmission between CEOs and CEO spouses influences CEO corporate risk-taking.

To identify the cultural heritage of CEOs and CEO spouses, we hand-collect a novel data set to track ancestry information of CEOs in S&P 500 firms from 2000 to 2015 and their corresponding spouses. We obtain CEOs' names from ExecuComp and CEO spouses' names from a set of various data sources. We use Ancestry.com to trace each person's ancestry immigrant information following Nguyen, Hagendorff and Eshraghi (2017). We then use each person's name to infer his or her cultural heritage distribution based on immigrant records if we cannot find exact information of this person's ancestors, following Pan, Siegel and Wang (2017). With the distribution of culture origin, we employ Hofstede's (2001) six country level cultural dimensions to capture culture values. Specifically, we focus on uncertain avoidance index (UAI) which reflects attitudes toward risk and uncertainty for unfamiliar situations in a society. We obtain UAI proxy for both CEOs and CEO spouses in the form of weighted-average UAI using the distribution of countries of origin. The cultural distance is measured by UAI of spouse minus UAI of CEO then scaled by UAI of CEO. Our hypothesis is that the UAI distance between CEO spouses and CEOs should be negatively associated with firm risk. We conjecture that high uncertainty avoidance of CEO spouses will influence CEOs' personal uncertainty avoidance, and then lead to less corporate risk-taking.

We primarily measure firm risk with the quarterly standard deviation of firm operation return from industry average return, i.e. $\sigma(ROA)$, following John, Litov, and Yeung (2008) and Leaven and Levine (2009). To distinguish the effect of culture, our models control CEO personal characteristics, firm characteristics, corporate governance, industry fixed effect and time fixed effect. Our baseline results show that UAI distance has negative and statistically significant coefficient for firm operation risk. In economic terms, one standard deviation increase in UAI distance is associated with 0.11% decrease in $\sigma(ROA)$, which is corresponding to approximately 5% of one standard deviation of the $\sigma(ROA)$.

Our second measure is R&D investments, which is a typical measure of risky corporate policies because of its uncertain benefits (Bhagat and Welch, 1995; Bargeron et al., 2010). We construct R&D investments with R&D expenditure over total assets for each quarter[1]. We find UAI distance also has an economically sizable and statistically significant association with R&D expenditures. One standard deviation increase in UAI distance is associated with 10%, i.e. 8% of one standard deviation, decrease in R&D investments. Our results are robust when we use industry adjusted R&D investments.

We implement additional subsample tests to identify the effect of cultural distance for different CEOs. Our first subsample test is how education level deviate the effect of cultural distance because CEOs with high education level may be more cautious and less impacted by culture. We split our sample by whether CEOs have Master or higher degree, or not. We find UAI distance has stronger effect on corporate risk-taking if CEO has lower education level. Our second subsample test is whether CEO individualism culture, which is another Hofstede's culture dimension indicating the degree of people overvalue themselves in a society. We conjecture that people from high individualism culture may undervalue suggestions from others. We split our sample by whether the CEO individualism culture value is higher than the mean or not. UAI distance shows significant effect in low individualism sample. Cultural transmission between family members require contagion but also low individualism.

We examine changes of CEO and changes of corporate risk-taking with firm fixed effect to identify a casual effect in time-series variation. Besides, we also check the endogenous CEO-firm matching that is firms with high risk seeks a CEO with high uncertainty avoidance. We find we do not have reverse causality concerns. To solve the endogeneity concern of CEO choosing spouses, we also employ CEO fixed effect specification and a placebo test with

[1] We treat firm-quarter observations with missing R&D expenditures as having zero expenditure.

randomly matched CEOs and CEO spouses. In our robustness check, we employ propensity score matching and Heckman two-stage model to address selection bias concerns, and our results of UAI distance still hold for corporate risk-taking and R&D investments. Our results are not driven by children in family, economic development, and institutional quality.

We provide a novel explanation of how marriage and intra-household dynamics affect risk-taking behavior of CEOs. To our best knowledge, this is the first paper to extend household dynamics beyond household finance settings into corporate finance settings. Previous literature documents the marital statues and household dynamics directly impact preferences toward risk in married males, reflected in financial outcomes (e.g. Bertaut, 1998; Agnew, Balduzzi and Sunden, 2003; Bertocchi, Brunetti and Torricelli, 2011; Roussanov and Savor, 2014; Addoum, 2017; Da, 2018). To distinguish with different channels through which household dynamics can alter risk-tolerance of high-wealth individuals, we focus on the cultural transmission between married couples. Consistent with the sociology culture arguments that culture transmission affects personal traits, our findings suggest that personal risk avoidance increased when his or her spouse has lower risk-tolerance in cultural heritage.

Second, our study contributes to the growing literature of impact of CEO on corporate outcomes. Various studies document the manager's physiology, life experiences, family members, or career experience explain heterogeneity of managerial styles among CEOs, which play a key role in a range of policy choices (Bertrand and Schoar, 2003; Custódio and Metzger, 2013; Adams, Keloharju, and Knupfer 2016; Bernile, Bhagwat, and Rau, 2017; Cronqvist and Yu, 2017). Our findings add to this literature, suggesting that cultural heritage across family members, especially the CEO's spouse, also shape CEO's managerial risk-taking styles. Most of CEOs got married before they became CEO and cultural heritage of CEO spouses is not a choice variable for the executive, which means that our results shed less endogeneity concerns.

Last but not least, our study shed new light on the relation between culture and financial outcomes. Emerging literature documents how personal cultural heritage affect priory beliefs, economic preferences, and political preferences (Guiso, Sapienza and Zingales, 2006). Cultural distance is related to trading volume (Chui, Titman, and Wei, 2010), bank loans (Giannetti and Yafeh, 2012), cross-border mergers (Ahern, Daminelli, and Fracassi, 2015), analyst forecast errors (Du, Yu and Yu, 2017), and corporate corruption (Liu, 2016). The findings of Nguyen, Hagendorff and Eshraghi (2017) imply that cultural heritage effects go beyond personal decisions to entire organization policies. Corporate leaders' personal cultural heritage cultivate corporate cultural heritage toward risk (Pan, Siegel and Wang, 2017). We extend these findings by indicating that not only CEO personal cultural heritage is related to corporate risk, cultural transmission between family members also shapes CEO preferences toward firm risk. Moreover, our findings include CEOs who are high generation immigrants, which contributes to the literature of persistence of individual cultural preferences and cultural transmission effect (e.g. Bisin and Verdier, 2000; Chen, 2013; Robalino and Robson, 2013).

The rest of paper is organized as follows. Section 2 discusses literature review in more detail and develop our hypothesis, section 3 describes the data and methodology, section 4 presents the results, section 5 shows robustness check, and section 6 concludes.

2. Literature review and hypothesis development

Culture is human nature and all people have a capacity to classify experiences, encode classifications symbolically, and teach such abstractions to others. Cultural variation among humans includes contemporary human cultures, their beliefs, myths, values, practices, technologies, economies and other domains of social and cognitive organization. Culture is the ways of thinking and describing, the ways of acting, and the material objects that together shape

a people's way of life. Cultural proximity contributes to the formation of social ties and network (Pachucki and Breiger, 2010).

The improvement of techniques and increasing available data makes it possible to identify the differences in people's beliefs and to relate them to culture heritage, which introduce testable cultural explanations into economics (Guiso, Sapienza and Zingales, 2006). Some dimensions of culture, e.g. ethnic and religious, are inherited by an individual from previous generations affecting people's beliefs, values or preferences over several subsequent generations (Guiso, Sapienza and Zingales, 2006; Fernandez and Fogli, 2006, 2009; Giavazzi, Petkov and Schiantarelli, 2014). "Because of the difficulty of changing culture and its low depreciation rate, culture is largely a 'given' to individuals throughout their lifetimes." (Becker, 1996). This identifies a causal effect from culture to economic outcomes and no need to worry about the reverse causality. Even though some religious practices respond to economic conditions, obvious modification occur over centuries or even millennia (Botticini and Eckstein, 2005).

2.1 Culture and economic outcomes

The emerging literature has documented the significant impact of culture heritage on various economic exchanges and financial outcomes. In the survey of Guiso, Sapienza and Zingales (2006), culture heritage affect economic outcomes through three channels—prior beliefs, economic preferences, and political preferences. Guiso, Sapienza and Zingales (2003) using the World Values Survey look at the effect of religion on trust across individuals, finding that religious increases the trust of others especially for Catholic and Protestant. They also use General Social Survey to examine the effect of the ethnic origin on beliefs of people about trust in US, showing a significant different trusts across ethnic origins. Then Guiso, Sapienza and

Zingales (2004 and 2009) find that bilateral trust between two countries matters for all trade in goods, financial assets, and direct foreign investment, i.e. trust more, engage more. Culture potentially affects economically relevant preferences, e.g. living arrangements (Giuliano, 2004), work and fertility choices (Fernández, Fogli and Olivetti, 2004), and shirking one the job (Ichino and Maggi, 2000), thriftiness and national saving rate (Guiso, Sapienza and Zingales, 2003, 2006). Finally, Guiso, Sapienza and Zingales (2006) find the underlying cultural determinants of preferences for redistribution seem to affect the amount of redistribution that occurs.

2.2 Cultural and Financial outcomes

Besides economic outcomes, recent research shows that cultural also impact financial outcomes. Chui, Titman, and Wei (2010) find cross-country cultural differences measured by individualism index (Hofstede, 2001) is related to overconfidence and self-attribution bias, which is positively associated with trading volume and momentum profits. Giannetti and Yafeh (2012) investigate cultural differences between professional decision makers in international syndicated bank loans, i.e. more cultural distant lead banks offer smaller loans, higher interest rate, and requirement of third-party guarantees. Ahern, Daminelli, and Fracassi (2015) find strong evidence that cross-country cultural distance in trust and individualism leads to less cross-border mergers and lower combined announcement returns. Du, Yu and Yu (2017) examine how cultural proximity affects information asymmetry in financial markets, documenting that Chinese analysts issue more accurate forecasts on Chinese firms than non-Chinese analysts.

Bisin and Verdier (2000) document the intergenerational transmission of ethnic and religious traits through marriage and socialization which influences preferences of next

generation. Culture plays key role in the formation and persistence of an individual's characteristics, economic preferences, and risk attitude (Chen, 2013; Robalino and Robson, 2013; Becker, Dohmen, Enke, and Falk, 2015). The cultural heritage of CEO shapes corporate culture. Nguyen, Hagendorff and Eshraghi (2017) exploit the cultural heritage of US bank CEOs who are second- or third-generation immigrants are associated with higher profitability during competition intensifies but lower performance during stable environment because these CEOs emphasize safe, cost-efficiency and cautions acquisitions. The culture of a CEO's ancestors influence CEO's decision-making in the present time. Liu (2016) use cultural background of company insiders to measure the corporate corruption culture toward opportunistic behavior, e.g. earnings management, accounting fraud, option backdating. Most corporate investment decisions, e.g. R&D and M&A, are made under uncertainty (Dixit and Pindyck, 1994; Garlappi, Giammarino, and Lazrak, 2017). Pan, Siegel and Wang (2017) combine CEO cultural heritage and corporate risk culture documenting that the preferences toward risk and uncertainty by a firm's leaders' cultural heritage, which is measured by country-level UAL (Hofstede, 2001) has persistent effect on corporate risk culture, investment policies, and selection of leaders.

2.3 Hypothesis development

Scholars have argued that marriage and intra-household relationships can have a profound influence on the lives of individuals and their economic incentives. Married couples share a common future and offspring, and thus their interests tend to be well aligned (Luo and Klohnen, 2005). Besides initial similarity, married couples become more similar, which means convergence, in personality of conscientiousness, agreeableness, and openness, in emotions of confident, hopeful, and fear, in preferences of habits (Gonzaga, Campos and Bradbury, 2007;

Rammstedt and Schupp, 2008; Gonzaga, Carter and Buckwalter, 2010). Furthermore, marriage is also related to risk attitudes. Serra-Garcia (2019) documents a strong convergence in risk aversion, especially among newly-established household. Marital status may have a direct biological effect on preferences by leading to lower testosterone levels in married males correlated with less risk taking (Burnham, 2007; Guiso and Rustichini, 2011). Roussanov and Savor (2014) find that single CEOs prefer more aggressive corporate policies in capital expenditures, R&D, advertising, and acquisitions than married CEOs.

Household dynamics in risk preferences and barging power between the husband and wife decides their financial activities, e.g. consumption, savings, retirement plan and portfolio choice (Addoum, Kung and Morales, 2016; Addoum, 2017; Da, 2018). Joint choices made by couples typically are more risk averse than those made by individuals (Bateman and Munro, 2005). Under risk sharing between the couple, individual could adjust risk preferences (Mazzocco, 2004). However, previous literature of household dynamics only limited in household settings. There is a research gap of household dynamics in corporate finance settings, that is, whether the household dynamics in CEOs' family affect their decision making and what is the channel through which marital status and household dynamics can alter risk tolerance of CEOs.

Based on above discussion, we argue CEO cultural heritage, CEOs' spouse cultural heritage, and their cultural heritage distance jointly affect CEO risk-taking and corporate outcomes. Cultural sociology researchers believe culture changes with environment, inventions, and contacting with other cultures (Griswold, 2012). In social psychology studies, husband-wife interaction potentially change couples personality, perception, lifestyle and affect their decisions making (Kenkel, 1961). Cultural transmission through cross-cultural marriages have strong effect on personal traits and preferences, especially when families of origin differ greatly in their values and rituals (Falicov, 1995; McFadden, 2001; Remennick, 2009). Ex-ante, we

should not expect CEO spouse to have direct influence on corporate outcomes because CEO spouses usually are outsider. However, the cultural transmission provide a channel for CEO spouses to potentially and indirectly affect corporate outcomes. Therefore, we conjecture that CEO's spouse cultural heritage could potentially affect CEO's personalities and preferences. Our hypothesis is higher cultural distance in uncertain avoidance between CEO and CEO spouse is correlated with corporate risk-taking.

3. Data and methodology

In this section, we describe the data source of CEOs and CEO spouses and how we identify their cultural heritage. Then, we explain the methodology of empirically examining the effect of CEO couples cultural distance on corporate risk-taking.

3.1 Data source on CEOs and CEO spouses

This paper studies how cultural heritage distance of CEOs and CEO spouses interactively shapes company strategies. Cultural heritage distance persists between individuals of different origins, even though their families might have been in the U.S. for several generations (Fernandez and Fogli (2006), (2009), Giavazzi et al. (2014)).

Our sample consists of Standard & Poor (S&P) 500 firms, i.e. the largest public firms in the U.S., from 2000 to 2015. We collect S&P 500 constituents from Compustat – Capital IQ and S&P ExecuComp database during the 16-years period. There are 849 firms have been in S&P 500 between 2000 and 2015. We exclude utility (Stadard Industrial Classification (SIC) codes 4900-4999) firms and financial (SIC codes 6000-6999) firms, following Cronqvist and Yu (2017), because of regulatory requirements of some firm characteristics in these industries. Then we collect individual CEO characteristics of the remaining 646 firms, especially first and

last name, from S&P ExecuComp database. For those firms always persist in S&P 500, we keep all CEOs during the sample period. For those firms left S&P 500, we only keep CEOs when their firms belong to S&P 500. This yield a sample of 1,465 CEOs.

However, there is no database with information related to CEO spouses. So, we manually collect data of CEO spouses' information, especially first and last name, from various public sources. We start by using The Complete *Marquis Who's Who* Biographies online resource through LexisNexis, which is the most comprehensive source of personal biographical information. We also use Notable Names Database, Wikipedia, Google search, interviews or news about CEO couples, YouTube, and Ancestry.com, to obtain CEO couples' names and additional information as much as possible. We need their year of marriage, how many children they have, divorce time if they do to make sure the firm level observations occurs after their marriage and before their divorce. If we cannot find exact marriage date of a couple, we will use the age of their oldest child plus one to estimate the year of their marriage. This yield a sample of 1,128 couples whom we can obtain name of both.

3.2 Identification: ancestry information of CEOs and CEO spouses.

People's surnames are widely used in identifying the ethnicity or country of ancestry. Kumar, Niessen-Ruenzi and Spalt (2015) find that US mutual fund managers with foreign-sounding name experience lower annual fund flows and lower appreciation. Liu (2016) use surnames to identify insiders' country of ancestry based on US Census records from 1850 to 1940. She matched the each unique surname from the Census records to its most frequently associated country of birth or father's country of birth. Nguyen, Hagendorff, and Eshraghi (2017) also use the Census records to check the immigrant generations of US banks' CEO, i.e. whether a CEO's father or grandfather immigrate from other country. Pan, Siegel and Wang

(2017) use CEOs' name together with passenger lists of ships arriving in New York City from foreign ports between 1820 and 1957 through Ancestry.com. They assign each surname to the largest origin across 121 countries. Du, Yu and Yu (2017) pick the Chinese analysts out by searching the surnames of analysts.

To obtain data on the ancestry of CEO couples, we use the following steps. Firstly, we check the database in section 2.1, i.e. *Marquis Who's Who*, Notable Names Database, Wikipedia, Google search, interviews or news, YouTube, and Ancestry.com, to search direct immigrant information of the CEO couples and their families, especially those foreign born CEOs or CEO spouses. There are 176 foreign-born CEOs and 136 foreign-born CEO spouses in our sample. Second step, following Nguyen, Hagendorff and Eshraghi (2017), we use the Census Bureau records accessed via Ancestry.com, which is the largest genealogy database in the world, to trace the exact country level origin of U.S. born CEOs or CEO spouses' ancestors[2]. The latest publicly available Census Bureau records are 1940 census, we can obtain ancestry information for those born before 1940. Census records contain demographic information of household members, e.g. birth years, birth places, parents' birth places. We map out their family tree and locate their country level origin. If someone are born after 1940 and we can find their parents' names, birth place, and other necessary information through data collection, we will search their parents' Census records. Then we map out their parents' ancestry. We identify personal cultural heritage mainly based on father's country of origin since the change of surname reduce the information accuracy of mother's ancestry. If their parents are also born in the U.S., we continue our search of their grandparents or earlier ancestors using earlier census records as far back as possible until we find their foreign born ancestors. We find 94 CEOs and 58 CEO spouses are second immigrant generations, while 98 CEOs and 49 CEO

[2] For women who change their surnames after marriage, we will search their maiden name first and then use their maiden name to trace ancestry.

spouses are third immigrant generations. 320 CEOs and 197 CEO spouses are forth or higher immigrant generations.

In third step, we will follow Nguyen, Hagendorff and Eshraghi (2017) approach to infer ancestry information of those CEOs or CEO spouses we cannot find enough information about their parents. We search the families with same surname as the CEO (spouse) and lived in the birth or adjacent county of CEO (spouse) around CEO (spouse) birth year. If all of these families emigrated from same country, we assume ancestors of this CEO or CEO spouse also emigrated from this country. For example, we search the ancestry of a CEO whose surname is Jandernoa born in 1950, Wayne County. We search the families with surname Jandernoa lived in Wayne County and adjacent county around 1950. We find there are two families with surname Jandernoa and both have German origin. So we can reasonably assume this CEO is of German ancestry. After above steps, we can obtain exact ancestry information for 691 CEOs and 444 CEO spouses. 319 couples have exact ancestry information of both. If the families with same surname and lived in the birth or adjacent county of CEO (spouse) come from different countries, we will calculate the frequency distribution across these countries of origin.

In the final step, for the rest persons who we cannot trace their ancestry information using their birthplace, we estimate the likelihood that an individual's ancestors emigrated from using the individual's surname and passenger lists, especially arriving in New York City between 1820 and 1957, following Pan, Siegel, and Wang (2017). The passenger lists are also available in Ancestry.com, which provides passengers' name, age, ethnicity, birth place, etc. Then we search the surname of this individual and use the ethnicity of passengers with this surname to calculate the frequency distribution across countries of origin. For example, among passengers with last name Deromedi, 51% have Italian origin, 33% come from Austrian origin, 11% have German origin and remaining 5% have Croatian origin. For some female CEO spouses who we cannot find their surname or maiden name because of changing surname after

marriage, we search their first name in the passenger lists. If this first name is popular in a few countries only, usually less than three, we also calculate the origin distribution based on it. Otherwise we drop them from our sample. We have ancestry distribution of 1,066 couples in our final sample[3], where 147 couples have exactly same ethnicity origin.

Table 1 shows descriptive statistics of CEOs' and CEO spouses' basic information, immigrant generations, and cultural backgrounds in our sample.

[Insert Table 1 here]

3.3 Cultural values: Hofstede six dimensions

The six country level cultural dimensions of Hofstede (1980, 2001, and 2010) has been widely applied across many disciplines. Some papers only focus on one dimension (e.g. Pan, Siegel and Wang (2017) only use UAI) while some papers use aggregate proxy (e.g. Aggarwal, Kearney and Lucey, 2012). In this paper we focus on the uncertainty avoidance index (UAI) which indicates to what extent members' tolerance for ambiguity and uncomfortable situations in a society. Hofstede (1980) constructed this index with surveys of IBM employees in 50 countries. Then this survey has been done several times with non-IBM participants in more countries. We calculate the value weighted UAI value for both CEOs and CEOs' spouses based on their ancestry distribution[4]. We use CEO spouses' UAI value minus CEO UAI value then scaled by CEO UAI value as the cultural distance between CEO couples, i.e. *UAI_DISTANCE*.

[3] The ancestry distribution of individuals with exact ancestry information is 100%.
[4] We group historical origins to their modern larger groups following Pan, Siegel and Wang (2017). For example we group all Arab countries under Arab and African countries under west Africa or east Africa because Hofstede cultural dimensions do not have data of specific countries under these countries group. We associate Jewish with data for Israel when necessary.

This proxy reflects the cultural distance between then couple relative to CEO personal cultural heritage.

3.4 Corporate risk-taking

Corporate risk-taking is essential to firm performance and survival. Literature document that corporate risk-taking is influenced by country-level factors (e.g. La Porta et al., 1997; John, Litov, and Yeung, 2008; Acharya, Amihud, and Litov, 2011; Li et al., 2013), firm-level factors (e.g. Jensen and Meckling, 1976; Tosi and Greckhamer, 2004; Bryan et al., 2012), and individual-level factors (e.g. Kreiser et al., 2010; Cain and McKeon 2016).

The primary measure of corporate risk-taking in firms' operations is the volatility of ROA, $\sigma(ROA)$, defined as the standard deviation of firm's EBITDA over total assets at the beginning of the quarter from industry average (two-digit SIC code) over 5 years (20 quarters) overlapping leading windows. It is a standard proxy for corporate risk in literature (e.g. John, Litov, and Yeung, 2008; Leaven and Levine, 2009; Faccio, Marchica, and Mura, 2011, 2016; Li et al., 2013). This variable captures risk to investment decisions.

Besides the volatility of asset returns, Research and Development expenditures (*R&D*) are investments under uncertainty because they have a low probability of success and uncertain benefits (Bargeron et al., 2010; Acharya, Amihud, and Litov, 2011; Pan, Siegel, and Wang, 2017). R&D expenditure is the quarterly R&D expense over total assets from Compustat.

To examine how cultural difference between CEO couples affect the corporate risk-taking, we run the following model:

$$Corporate\ risk_{\ it} = \beta_0 + \beta_1 \cdot UAI\ distance_{i,t-1} + \text{Controls} + \text{Fixed effects} + \varepsilon_{it} \quad (1)$$

where *i* is firm and *t* is quarter. The dependent variable is corporate risk-taking which is $\sigma(ROA)$ or R&D. The main explanatory variable is the UAI distance between CEO spouse and CEO.

3.5 Other controls

We include several factors from three dimensions that have been shown to influence corporate risk-taking following Cain and McKeon (2016) and Pan, Siegel, and Wang (2017), discussed below and variable definitions shown in Appendix A:

The first dimension is CEO characteristics. We control CEO age (*ln(1+AGE)*), CEO gender (*FEMALE*), CEO education (*EDUCATION*), CEO cultural background (*UAI_CEO*), how many years of marriage (*ln(1+MARRIAGE_YEAR*), whether the couple has different cultural heritage (*DIFF_CULTURE)*, and CEO tenure (*ln(1+TENURE)*) from *Marquis Who's Who*, Notable Names Database, Wikipedia, interviews or news about CEO couples through Google search and YouTube, Ancestry.com., and ExecuComp.

The second dimension is firm characteristics. We control firm size (*ln(ASSETS)*), market-to-book ratio (*MB*), whether it has loss (*LOSS*), and Tobin's Q (*Q*) from Compustat.

The last dimension is corporate governance. We control board size (*BOARD_SIZE*), board ownership (*BOARD_OWNERSHIP*), and board independence (*BOARD_INDEPENDENCE*) from Institutional Shareholder Services (ISS).

Table 2 shows descriptive statistics of our variables. Variable descriptive statistics of annual data is reported in Appendix Table A1.

[Insert Table 2 here]

4. Empirical results

In this section, we report empirical evidence on the relation between CEO couples' cultural distance and risk-taking in the firm that the CEO manages.

4.1 Cultural distance and firm risk-taking

Table 3 reports our baseline results of UAI distance between CEO and CEO spouse on firm risk-taking. The dependent variable is $\sigma(ROA) \times 100$, which presents operating risk of the firm managed by a specific CEO. Our key explanatory variable is the UAI index distance between CEO and this CEO's spouse. In Column (1) we only control CEO personal characteristics. In Column (2) we control firm characteristics and corporate governance. We put in all control variables in columns (3) to (6). Standard errors are double clustered at firm and quarter level. We control industry fixed effects (two-digit SIC code) in Column (3) only and control both industry and year-quarter fixed effects in columns (1), (2), and (5). In Column (4) we include industry-quarter fixed effect. The point estimate on UAI distance range from -0.172 to -0.206 and statistically significant at the 10%-level across all the model specifications. The estimate of UAI distance is higher when we only control CEO personality or firm-level observations. After incorporating all control variables, the estimate of UAI distance decreases. This estimate is consistent and the significant level dose not alleviates dramatically when we change controls. One standard deviation increase in UAI distance is associated with 9% (= -0.172 × 0.54) to 11.12% (= -0.206 × 0.54) decrease in $\sigma(ROA) \times 100$, which is corresponding to approximately 5% of one standard deviation of the $\sigma(ROA)$. There is less firm risk-taking when CEO spouse has higher uncertainty avoidance than CEO self.

In terms of control variables, firms run by female CEOs have less volatility in operating income than firms run by male CEOs. This result is consistent with findings in Faccio, Marchica, and Mura (2016). CEOs with longer tenure will take less risk, while larger size firms are also associated with less volatility. This finding correspond to Cain and Mckeon (2016). However, firms which have higher Tobin's Q or make a loss confront with more future volatility. It seems that CEOs with more cash payments will also take more risk. Corporate governance has little influence in our models.

[Insert Table 3 here]

4.2 Cultural distance and R&D expenditure

We show UAI distance has significant effect on firm operation risk in section 4.1. An alternative way to quantify firm risk is to consider risk-related corporate policy. We test whether CEOs whose spouses have higher UAI exhibit meaningful deviations in R&D expenditure. R&D investments are risky because their low probability of success and uncertainty benefits. We hypothesize that risk-tolerance CEO would like to adopt more R&D expenditure but high uncertainty avoidance of CEO spouse tend to intervene CEO's choice of R&D investments.

Estimates of UAI distance on corporate R&D expenditure are shown in Table 4. The dependent variable in column (1) to (5) is R&D expenditure over total asset. We use industry adjusted R&D expenditure in Column 6, which is the average R&D expenditure minus industry average R&D expenditure over next 20 quarters. The main explanatory variable is UAI distance between CEO spouse and CEO. Only CEO personality variables are included in Column (1). Only firm characteristics and corporate governance variables are included in Column (2). All control variables are included in Column (3) to (6). We find UAI distance still

has significant and negative coefficient in all columns, with estimates ranging from -0.172 to -0.192. One standard deviation increase in UAI distance leads to 9% (= -0.172 × 0.54) to 10.37% (= -0.206 × 0.54) decrease in R&D × 100, which is corresponding to approximately 6% of one standard deviation of the R&D. Thus, CEO may cut down expenditure on R&D investments if this CEO has a spouse with higher uncertainty avoidance culture.

We also find CEO with higher education degree prefer to increase R&D investments because they understand the importance of technic development. Firms with high Tobin's Q will also increase R&D expenditure.

[Insert Table 4 here]

4.3 Cultural distance, firm risk, and CEO education

CEO education which has effect on corporate R&D investments nay mitigate the influence of cultural distance in CEO families. CEOs with higher education could be more cogitative when making corporate policies, and they are less impacted by cultural distance. To examine whether cultural distance of UAI has weaker influence on firm risk and R&D investments for better educated CEO, we split our sample by CEO education, which is whether CEO has a Master or higher degree.

Results are shown in Table 5. In Panel A of Table 5, we report the OLS results of UAI distance on corporate risk taking in each sub-sample. UAI distance still has negative and significant coefficients in the sample of low education degree sample, and these coefficients are lower than those in our baseline model, -0.361 compared to -0.192. However, UAI distance shows weak effect in the sub-sample of high education degree. We also find the different coefficients between high education degree sample and low education degree sample are statistically significant at 10% level. Better educated CEOs are less influenced by UAI distance

while cultural distance in UAI has stronger effect on corporate risk-taking for CEOs who has lower education degree.

Results of UAI distance on R&D investments in each sub-sample are reported in Panel B. Different from corporate risk-taking, UAI distance shows no significant difference between high education degree sample and low education degree sample. The point estimates of UAI distance in each sub-sample are close to the results of our baseline model. CEO education level does deviate UAI distance effect on corporate risk-taking but not interplays for corporate R&D investments.

[Insert Table 5 here]

4.4 UAI distance, firm risk, and CEO Individualism culture

Individualism vs. Collectivism (IDV) is another cultural dimension of Hofstede's (2001) six cultural dimensions. It reflects the degree to which people in a society are integrated into groups. Higher IDV value means people in this society are expected to take care of only themselves and pursue their own interests. Managers from high individualism culture countries are more likely to make decisions by themselves and pay less attention on others' suggestions. We do not want to predict cultural distance in IDV and corporate risk-taking in this paper because the link between CEO spouse's individualism and corporate risk is not very clear. However, we are interested in clarifying CEO personal individualism and the influence of UAI distance. Managers with high individualism tend to neglect suggestions from others and they are less likely to be affected by other people. Therefore, we conjecture that UAI distance between CEO and CEO spouse is less effective for managers with high individualism culture.

We split our sample by the mean of CEO individualism culture heritage at 70. The dependent variable is $\sigma(ROA)$ × 100 in Panel A of Table 6 and R&D × 100 in Panel B of Table 6. The negative effect of UAI distance is significant in low individualism sample with IDV_CEO smaller than 70 but insignificant in high individualism sample with IDV_CEO larger than 70 for both corporate risk-taking and R&D investments. The difference of coefficients between the two samples are statistically significant at 1% level. The point estimates of UAI distance in low individualism sample are -0.964 for corporate risk-taking and -0.446 for R&D expenditure, much lower than estimates in baseline model. CEOs with low individualism culture are more likely to be affected by their spouses' uncertainty avoidance, which is reflected in less corporate risk-taking and less R&D investments.

[Insert Table 6 here]

4.5 Children, Economic Development and Institutional Quality

Focusing on S&P 500 firms allows us to hold similar economic and institutional factors that all CEOs face. However, there are two more potential concerns. First, CEOs who have children may become more risk-averse. Second, CEOs who married with those come from countries with weak institutions and economic states may be more risk-seeking. To rule this out, we collect data of children in a CEO's family from *Marquis Who's Who*, GDP per capita, market capitalization, and rule of law at a CEO spouse's ancestral country of origin from World Bank.

As shown in Table 7, our results of UAI distance remain robust to the inclusion of these controls. The number of children does not significantly lead less firm risk-taking. Better economic factors, capital market development, and legal quality in spouse's origin does not assure less risk-taking neither. Our results are unlikely to be driven by these factors.

[Insert Table 7 here]

4.6 CEO turnover and CEO appointment

We examine a causal effect of UAI distance on firm risk-taking, which is changes in UAI distance over time should be associated with changes in corporate risk-taking and R&D investments. However, it is challenging to identify exogenous shocks to UAI distance in the time-series dimension because culture is predetermined and changes slowly. But, the changes in UAI distance are associated with CEO turnovers. We employ a firm fixed effect specification in a sub-sample of firms with at least one CEO turnover. Firm fixed effect absorb the effect of unobservable firm-specific characteristics. It also reveals how much effect operates through time-varying changes in UAI distance. In Column (1) and Column (2) of Table 8, we redo our baseline model of UAI distance on corporate risk-taking and R&D investments but controlling firm fixed effect and industry-quarter fixed effect. We find the results still hold for $\sigma(ROA)$, even though weaker. This specification suggests that decreasing corporate risk-taking in a firm is associated with increasing in UAI distance in CEO family.

Furthermore, CEOs and firms do not match randomly. Our results could be biased by endogenous marching if CEO cultural backgrounds or CEO spouse cultural backgrounds are criterion of CEO appointment by the board. The board of a firm with high corporate risk in prior quarters may prefer to appoint a CEO who has high UAI distance in family. Column (3) and Column 4 in Table 8 reports results related to CEO-firm endogenous marching. We firstly identify all CEO turnover in our data set and regress the new CEO UAI distance on prior $\sigma(ROA) \times 100$ which is the standard deviation of abnormal ROA from 20 prior quarter to 1 prior quarter in Column (3). Then we regress new CEO UAI distance on R&D expenditure in prior quarter in Column (4). We find prior corporate risk-taking and R&D expenditure do not

significantly predict UAI distance in the new CEO's family. It is difficult to completely rule out endogenous marching scheme, so we conclude that there is no obvious reverse causality between UAI distance and corporate risk-taking at least.

[Insert Table 8 here]

4.7 Endogeneity choice of spouses

Another endogeneity concern is that marriages between CEOs and CEO spouses are not random. The choice of spouse depends on CEO-self. People usually would like to choose spouse with similar culture background. People who married with spouses from a specific culture may have some commonalities. The unobservable factors may drive CEO's decision of spouse and risk-taking. To control these unobservable factors, We employ a CEO fixed effect specification in a sub-sample of firms with at least one CEO get married or change spouses from different culture backgrounds during the service. CEO fixed effect absorb unobservable CEO personal characteristics. The coefficient of UAI distance reveals the effect on corporate risk-taking from change in spouses. We report these results in column (1) and column (2) of Table 9. After controlling CEO fixed effect, the negative coefficient of UAI distance is still significant but amplified huge, which indicates a strong effect of time-varying change of UAI distance.

In column (3) and column (4) of Table 9, we report results of a placebo test. We randomly match CEO and CEO spouses based on their age and marriage date. Our conject is that if it is unobservable characteristic of CEO drive the choice of spouse and risk-taking decisions, no matter who is the CEO's spouse, randomly matched sample may still reports significant result. If the culture heritage of actual CEO spouses indeed influence CEO risk-taking, the random matched sample should not indicate a significant effect. Actually, UAI

distance do not reveal significant effect in column (3) and column (4), which highlight the impact of household dynamics in cultural distance between CEO and actual CEO spouse.

[Insert Table 8 here]

5. Robustness check

One concern we may have is the accuracy of cultural backgrounds. We cannot find exact cultural background of some persons and we calculate the distribution of potential cultural backgrounds for them. The inaccurate cultural backgrounds may make our results biased. To alleviate this concern, we conduct a subsample test where we only keep CEO spouse with exact cultural backgrounds information in our sample. Results are reported in Column (1) and Column (2) in Table 10. We find UAI distance still has significant and negative effect on corporate risk-taking and R&D investments. Especially, the estimates decrease to -0.249 for R&D investments. The driving force of CEO spouse's uncertainty avoidance on CEO personal uncertainty avoidance of firm risk-taking is robust.

To further address potential sample selection bias, we report evidence from propensity score matching and Heckman two-stage test. First we match firm-quarter observation without exact data on CEO spouses to one for which we have exact data on CEO spouses, based on year, industry, and firm size. We require five matched neighbors. For each firm, we calculate the average ROA and R&D expenditure of marched firms. We re-estimate our baseline model on this matched data set in Column (3) and Column (4). The coefficient of *UAI_DISTANCE* for the matched sample is close to our baseline model results. Then we use Heckman two-stage test following Nguyen, Hagendorff and Eshraghi (2017). We conjecture that the individual surname length will affect the accuracy and availability of cultural heritage data because of less duplications. We report Heckman two-stage test results in Column (5) and Column (6), where

UAI distance has significant and negative coefficient. The Lambda of Heckman two-stage is significantly different from zero. The surname length, particularly spouse surname length indeed influences our sample inclusion.

[Insert Table 10 here]

6. Conclusion

This paper combines the intra-household dynamics in culture distance between family members, CEOs and CEO spouses, with corporate risk-taking and R&D investments. We focus on CEOs of large US firms (S&P 500) because US citizens has larger variation of immigrant backgrounds comparing to other countries. To reveal the culture heritage of couples, we collect the names and family ancestry backgrounds of CEOs and corresponding spouses. We identify cultural heritage distribution of a person through surname if we cannot find the exact immigrant information. To measure cultural distance between couples, we matched their cultural heritage with Hofstede's cultural dimensions value of uncertainty avoidance.

We find the cultural distance between CEOs and CEO spouses in uncertainty avoidance is negatively associated with firm operation risk and R&D investments. The higher uncertainty avoidance of CEO spouses drives CEOs individually more avoidance of firm future risk. The effect of uncertainty avoidance distance is stronger if CEO has lower education level and lower individualism cultural backgrounds.

The findings suggest an importance link between CEO household dynamics and career life. In this paper, we only focus on the relation between the couple's cultural distance and corporate risk-taking policies. Other corporate policies, such as CSR, may be considered in future research.

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Table 1: Descriptive Statistics of CEO and CEO spouse

Panel A: CEO's and CEO spouse's basic information

	N	Share of total CEOs
CEOs with more than one marriage	72	4.91%
Female CEO	40	2.73%
CEOs with exact ancestry	688	46.96%
CEO spouses with exact ancestry	440	30.03%
CEO couples both with exact ancestry	318	21.71%
CEO couples with same ancestry distribution	147	10.03%
CEO couples both with ancestry distribution	1,066	72.76%
Total CEO couples	1,128	76.70%
Total CEOs	1,465	100%

Panel B: CEO's and CEO spouse's immigrant generation

	N of CEO	Share of Total CEOs	N of CEO spouses	Share of Total CEO spouses
Gen 1	176	12.01%	136	12.76%
Gen 2	94	6.42%	58	5.44%
Gen 3	98	6.69%	49	4.60%
Gen 4+	320	21.84%	197	18.48%
Unknown	777	53.04%	626	58.72%
Total	1,465	100%	1,066	100%

Panel C: CEO's and CEO spouse's cultural backgrounds

Country	N of CEO	N of CEO spouse	Country	N of CEO	N of CEO spouse
Arab	5	4	Latvia	0	1(0.42)
Argentina	1	2(0.16)	Lebanon	3	1(0.5)
Armenia	(0.8)	0	Lithuania	2(0.53)	1
Australia	17(20)	9(0.09)	Macedonia	(0.13)	0
Austria	10(4.37)	6(2.21)	Malaysia	2	0
Bangladesh	1	1	Mexico	3	5(1.11)
Belgium	5(0.29)	4(0.73)	Monaco	1	1
Bosnia	0	1	Native American	12	14
Brazil	6(0.36)	5(0.55)	Netherlands	21(13.59)	9(4.44)
Bulgaria	(0.09)	0	Norway	12(3.17)	5(9.775)

Canada	31(6.7)	23(8.53)	Pakistan	2(0.125)	1
Chile	1	1	Philippines	0	2
China	4	8(0.31)	Poland	15(4.42)	11(5.28)
Colombia	(0.05)	1	Portugal	1(0.52)	4(0.5)
Costa Rica	1	0	Puerto Rico	1	1(0.215)
Croatia	4(0.94)	(0.71)	Romania	3(1.16)	0.5(0.5)
Cuba	4(1.82)	1(0.88)	Russia	11(12.66)	5(5)
Czech Republic	8(1.04)	6(0.29)	Serbia	2	0
Denmark	4(2.08)	5(4.17)	Singapore	0	1
Dominica	(0.19)	0	Slovak Republic	(1.82)	1(0.4)
Egypt	2	1	Slovenia	(1.44)	2(0.25)
Estonia	0	(0.075)	South Africa	3	1
Finland	2(0.15)	2(1.76)	Spain	18(3.03)	12(3.93)
France	27(16.69)	26(17.41)	Sri Lanka	1	0
Germany	104(91.39)	56(64.835)	Sweden	17(13.79)	15(13.33)
Greece	12(2.86)	6(1.42)	Switzerland	7(3.3)	3(4.75)
Hungary	6(5.99)	3(2)	Syria	2(0.44)	1
India	29	14	Taiwan	6	4
Iran	4	1	Turkey	4(0.615)	2
Ireland	54(145.73)	26(91.79)	UK	175 (267.19)	182(197.72)
Israel	5	3(0.25)	Ukraine	2	0
Italy	80(21.74)	41(22.665)	Venezuela	0	(0.11)
Japan	3	2	Yugoslavia	0	1
Jewish	80(7.39)	44(5.79)	Zambia	0	1

Panel A reports descriptive statistics of CEOs and CEO spouses ancestry information. Panel B classifies CEOs and CEO spouses as first immigrant generation (foreign-born), Gen 2 (parents are foreign-born), Gen 3 (grandparents are foreign-born), or Gen 4+ (forth or higher immigrant generations), and Unknown (without generation information). Panel C reports the number of CEOs and CEO spouses from each country-level cultural backgrounds. The number outside parentheses is the amount of CEOs or CEO spouses with this specific country ancestry exactly. The number inside parentheses is the sum of distribution of CEOs or CEO spouses with this specific country ancestry not exactly.

Table 2: Variable Descriptive Statistics

	N	Mean	Std. Dev	Q1	Median	Q3
Panel A: CEO Characteristics						
UAI_CEO	22,454	55.12	20.98	35.00	50.00	75.00
IDV_CEO	22,454	69.91	16.44	60.84	73.78	82.16
UAI_DISTANCE	22,134	0.06	0.54	-0.32	0.00	0.20
EDUCATION	22,537	1.67	0.74	1	2	2
FEMALE	22,537	0.03	0.18	0	0	0
ln(1+ MARRIAGE_YEAR)	22,537	3.24	0.54	3.09	3.37	3.58
ln(1+AGE)	22,537	4.04	0.13	3.97	4.04	4.13
DIFF_CULTURE	22,217	0.87	0.33	1	1	1
ln(1+TENURE)	22,537	1.76	0.86	1.10	1.79	2.40
Panel B: Firm Characteristics						
σ(ROA) × 100	12,578	2.23	2.03	1.06	1.62	2.62
R&D × 100	22,537	0.80	1.67	0.00	0.01	1.12
MB	22,501	3.97	5.27	1.82	2.90	4.60
ln(ASSETS)	22,523	9.00	1.33	8.05	8.91	9.90
Q	22,503	2.21	1.36	1.35	1.79	2.55
LOSS	22,537	0.13	0.34	0	0	0
Panel C: Corporate Governance						
BOARD_SIZE	18,999	10.37	2.14	9	10	12
BOARD_OWNERSHIP	18,909	0.04	0.07	0.01	0.01	0.04
BOARD_INDEPENDENCE	18,991	0.76	0.14	0.69	0.80	0.89

Panel A reports descriptive statistics for the variables of CEO characteristics. Panel B reports descriptive statistics of firm level variables, while Panel C shows corporate governance variables. All variables are defined in the Appendix A.

Table 3: Cultural Distance and Firm Risk

This table reports the panel regression results of CEO and CEO spouse risk cultural distance on firm risk. The dependent variable is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) σ(ROA)	(2) σ(ROA)	(3) σ(ROA)	(4) σ(ROA)	(5) σ(ROA)
UAI_DISTANCE	-0.172*	-0.185*	-0.191**	-0.206**	-0.192**
	(0.102)	(0.099)	(0.095)	(0.093)	(0.095)
Panel A: CEO Characteristics					
EDUCATION	0.168**		0.095	0.089	0.105
	(0.083)		(0.078)	(0.074)	(0.078)
FEMALE	-0.535***		-0.473**	-0.486***	-0.419**
	(0.188)		(0.193)	(0.169)	(0.191)
ln(1+ MARRIAGE_YEAR)	-0.261**		-0.108	-0.017	-0.118
	(0.116)		(0.091)	(0.093)	(0.089)
ln(1+AGE)	-0.331		-0.323	-0.267	-0.301
	(0.615)		(0.599)	(0.611)	(0.605)
DIFF_CULTURE	0.250		0.197	0.166	0.193
	(0.156)		(0.155)	(0.154)	(0.153)
ln(1+TENURE)	-0.114		-0.168**	-0.148**	-0.147**
	(0.071)		(0.067)	(0.068)	(0.067)
Panel B: Firm Characteristics					
MB		-0.013	-0.011	-0.018*	-0.012
		(0.009)	(0.008)	(0.010)	(0.008)
ln(ASSETS)		-0.133***	-0.135***	-0.130***	-0.122***
		(0.046)	(0.048)	(0.048)	(0.046)
Q		0.164*	0.199**	0.202**	0.158*
		(0.090)	(0.086)	(0.098)	(0.088)
LOSS		1.154***	1.094***	1.390***	1.096***
		(0.156)	(0.147)	(0.151)	(0.147)
Panel C: Corporate Governance					
BOARD_SIZE		-0.033	-0.027	-0.039	-0.034
		(0.026)	(0.028)	(0.027)	(0.027)
BOARD_OWNERSHIP		1.003	1.297*	1.358	1.282*
		(0.741)	(0.778)	(0.830)	(0.761)
BOARD_INDEPENDENCE		0.643	0.223	0.390	0.631
		(0.407)	(0.344)	(0.391)	(0.404)
Industry fixed effect	Yes	Yes	Yes	No	Yes
Year-Quarter fixed effect	Yes	Yes	No	No	Yes
Industry-quarter fixed effect	No	No	No	Yes	No
Observations	12,353	10,612	10,612	10,008	10,612
R-squared	0.273	0.333	0.323	0.404	0.341

Table 4: Cultural Distance and R&D Expenditure

This table reports the panel regression results of CEO and CEO spouse risk cultural distance on firm R&D expenditure. The dependent variable is R&D expenditure over assets ($R\&D \times 100$) in Column (1) to (5). In Column (6), the dependent variable is average industry adjusted R&D expenditure over assets in future 20 quarters. The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) R&D	(2) R&D	(3) R&D	(4) R&D	(5) R&D	(6) Adj. R&D
UAI_DISTANCE	-0.192**	-0.172**	-0.185**	-0.180**	-0.182**	-0.182**
	(0.080)	(0.076)	(0.073)	(0.075)	(0.073)	(0.072)
Panel A: CEO Characteristics						
EDUCATION	0.234***		0.206***	0.215***	0.209***	0.209***
	(0.070)		(0.065)	(0.066)	(0.065)	(0.061)
FEMALE	-0.073		-0.034	-0.041	-0.027	-0.053
	(0.223)		(0.257)	(0.276)	(0.261)	(0.229)
ln(1+ MARRIAGE_YEAR)	0.067		0.094	0.112	0.099	0.067
	(0.071)		(0.071)	(0.077)	(0.070)	(0.066)
ln(1+AGE)	-1.073***		-0.599	-0.484	-0.571	-0.471
	(0.412)		(0.371)	(0.382)	(0.378)	(0.364)
DIFF_CULTURE	0.045		0.112	0.096	0.108	0.090
	(0.115)		(0.102)	(0.110)	(0.103)	(0.100)
ln(1+TENURE)	0.099		0.059	0.068	0.061	0.047
	(0.067)		(0.061)	(0.064)	(0.060)	(0.056)
Panel B: Firm Characteristics						
MB		-0.003	-0.003	-0.003	-0.002	-0.006
		(0.006)	(0.006)	(0.008)	(0.006)	(0.005)
ln(ASSETS)		-0.066	-0.062	-0.070	-0.069	-0.082
		(0.057)	(0.050)	(0.056)	(0.055)	(0.052)
Q		0.340***	0.314***	0.369***	0.329***	0.304***
		(0.051)	(0.045)	(0.052)	(0.048)	(0.041)
LOSS		0.916***	0.894***	1.059***	0.887***	0.659***
		(0.190)	(0.173)	(0.213)	(0.180)	(0.153)
Panel C: Corporate Governance						
BOARD_SIZE		-0.031	-0.028	-0.025	-0.026	-0.023
		(0.020)	(0.019)	(0.021)	(0.020)	(0.018)
BOARD_OWNERSHIP		0.451	0.614	0.429	0.523	0.553
		(0.624)	(0.630)	(0.664)	(0.619)	(0.571)
BOARD_INDEPENDENCE		0.364	0.493**	0.354	0.317	0.388
		(0.252)	(0.217)	(0.269)	(0.250)	(0.241)
Industry fixed effect	Yes	Yes	Yes	No	Yes	Yes
Year-Quarter fixed effect	Yes	Yes	No	No	Yes	Yes
Industry-quarter fixed effect	No	No	No	Yes	No	No
Observations	22,134	18,559	18,559	17,757	18,559	18,492
R-squared	0.268	0.349	0.344	0.392	0.358	0.664

Table 5: Cultural Distance, Firm Risk, and CEO Education

This table reports the panel regression results of CEO and CEO spouse risk cultural distance on firm risk and R&D expenditure based on CEO education. The dependent variable in Panel A is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The dependent variable in Panel B is R&D expenditure over assets ($R\&D \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). Sample is split by CEO education level, which is whether CEO has a Master or higher degree (Edu ≥ 2) or not (Edu < 2). Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. Industry-quarter fixed effect is included in Column (1) and Column (2). All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Low	(2) High	(3) High - Low	(4) Low	(5) High	(6) High -
Panel A: Firm Risk						
UAI_DISTANCE	-0.314**	-0.123	0.191*	-0.361**	-0.183	0.178*
	(0.164)	(0.114)		(0.145)	(0.123)	
CEO characteristics	Yes	Yes		Yes	Yes	
Firm characteristics	Yes	Yes		Yes	Yes	
Corporate governance	Yes	Yes		Yes	Yes	
Industry fixed effect	Yes	Yes		No	No	
Year-Quarter fixed effect	Yes	Yes		No	No	
Industry-quarter fixed effect	No	No		Yes	Yes	
Observations	4,319	6,293		3,448	5,486	
R-squared	0.329	0.401		0.407	0.421	
Panel B: R&D Expenditure						
UAI_DISTANCE	-0.151	-0.143*	0.008	-0.137	-0.151*	-0.014
	(0.120)	(0.084)		(0.134)	(0.089)	
CEO characteristics	Yes	Yes		Yes	Yes	
Firm characteristics	Yes	Yes		Yes	Yes	
Corporate governance	Yes	Yes		Yes	Yes	
Industry fixed effect	Yes	Yes		No	No	
Year-Quarter fixed effect	Yes	Yes		No	No	
Industry-quarter fixed effect	No	No		Yes	Yes	
Observations	7,345	11,214		6,347	10,077	
R-squared	0.320	0.395		0.211	0.323	

Table 6: UAI Distance, Firm Risk, and CEO Individualism Culture

This table reports the panel regression results of CEO and CEO spouse risk cultural distance on firm risk and R&D expenditure based on CEO education. The dependent variable in Panel A is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The dependent variable in Panel B is R&D expenditure over assets ($R\&D \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). Sample is split by CEO education level, which is whether CEO individualism is higher than average (IDV_CEO > 70) or not (IDV_CEO ≤ 70). Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. Industry-quarter fixed effect is included in Column (1) and Column (2). All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) Low	(2) High	(3) High - Low	(4) Low	(5) High	(6) High -
Panel A: Firm Risk						
UAI_DISTANCE	-0.830***	-0.160*	0.670***	-0.964**	-0.061	0.903***
	(0.299)	(0.095)		(0.263)	(0.088)	
CEO characteristics	Yes	Yes		Yes	Yes	
Firm characteristics	Yes	Yes		Yes	Yes	
Corporate governance	Yes	Yes		Yes	Yes	
Industry fixed effect	Yes	Yes		No	No	
Year-Quarter fixed effect	Yes	Yes		No	No	
Industry-quarter fixed effect	No	No		Yes	Yes	
Observations	4,439	6,173		3,750	5,325	
R-squared	0.318	0.415		0.384	0.452	
Panel B: R&D Expenditure						
UAI_DISTANCE	-0.434**	-0.080	0.354**	-0.446*	-0.080	0.366**
	(0.217)	(0.082)		(0.233)	(0.081)	
CEO characteristics	Yes	Yes		Yes	Yes	
Firm characteristics	Yes	Yes		Yes	Yes	
Corporate governance	Yes	Yes		Yes	Yes	
Industry fixed effect	Yes	Yes		No	No	
Year-Quarter fixed effect	Yes	Yes		No	No	
Industry-quarter fixed effect	No	No		Yes	Yes	
Observations	7,973	10,586		7,100	9,570	
R-squared	0.394	0.359		0.290	0.278	

Table 7: Children, Economic Development and Institutional Quality

This table reports the panel regression results of CEO and CEO spouse risk cultural distance on firm risk and R&D expenditure. The dependent variable in Panel A is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The dependent variable in Panel B is R&D expenditure over assets ($R\&D \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). The additional control is number of children in the family, GDP per capita in spouse's origin, market capitalization in spouse's origin, and rule of law in spouse's origin, Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Panel A: Firm Risk					
UAI_DISTANCE	-0.261**	-0.249**	-0.233*	-0.175*	-0.211*
	(0.110)	(0.114)	(0.133)	(0.112)	(0.128)
Children	-0.045	-0.420	-0.058	-0.039	-0.047
	(0.046)	(0.045)	(0.051)	(0.043)	(0.046)
GDP per capita		0.037			-0.179
		(0.055)			(0.172)
Market capitalization			0.095*		0.207
			(0.049)		(0.142)
Rule of law				0.226	-0.020
				(0.124)	(0.175)
CEO characteristics	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes
Corporate governance	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Year-Quarter fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	8,746	8,621	6,871	8,094	6,350
R-squared	0.357	0.359	0.389	0.368	0.397
Panel B: R&D Expenditure					
UAI_DISTANCE	-0.188**	-0.179**	-0.257**	-0.232**	-0.278**
	(0.088)	(0.091)	(0.107)	(0.101)	(0.110)
Children	-0.018	-0.017	-0.016	-0.008	-0.019
	(0.033)	(0.033)	(0.040)	(0.032)	(0.043)
GDP per capita		-0.076			-0.086
		(0.048)			(0.152)
Market capitalization			-0.057*		0.024
			(0.034)		(0.105)
Rule of law				-0.142	-0.182
				(0.103)	(0.151)
CEO characteristics	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes
Corporate governance	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Year-Quarter fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	14,887	14,703	11,400	13,782	10,505
R-squared	0.373	0.376	0.365	0.371	0.361

Table 8: CEO Turnover and CEO Appointment

This table reports the panel regressions results of CEO turnover and CEO seeking. The dependent variable in Column (1) is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The dependent variable in Column (2) is R&D expenditure over assets ($R\&D \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*) in Column (1) and Column (2). The dependent variable in Column (3) and Column (4) are UAI distance between new CEO spouse and new CEO (*UAI_DISTANCE*). The main explanatory variable is $\sigma(ROA) \times 100$ in prior quarter $R\&D \times 100$ in prior quarter in Column (3) and Column (4). Definitions of the variables are provided in Appendix A. Firm fixed effect and industry-quarter fixed effect are included in column (1) and (2). Industry and quarter fixed effect are included in Column (3) and (4). All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) σ(ROA)	(2) R&D	(3) UAI_DIFF	(4) UAI_DIFF
UAI_DISTANCE	-0.293*	-0.026		
	(0.156)	(0.035)		
σ(ROA) in prior quarter			-2.251	
			(3.409)	
R&D in prior quarter				-0.040
				(0.033)
CEO characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Corporate governance	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	No	No
Industry fixed effect	No	No	Yes	Yes
Year-Quarter fixed effect	No	No	Yes	Yes
Industry-quarter fixed effect	Yes	Yes	No	No
Observations	9,991	17,754	229	320
R-squared	0.765	0.594	0.516	0.388

Table 9: Endogeneity Choice between CEOs and CEO Spouses

Column (1) and column (2) reports panel regressions results with CEO fixed effect. Column (3) and column (4) reports placebo test results, where we randomly match CEOs and CEO spouses based on their age and date of marriage. The dependent variable in Column (1) and Column (3) is the volatility of the firm's operating return on assets ($\sigma(ROA) \times 100$). The dependent variable in Column (2) and Column (4) is R&D expenditure over assets ($R\&D \times 100$). The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). CEO fixed effect and industry-quarter fixed effect are included in column (1) and (2). Definitions of the variables are provided in Appendix A. Industry and year-quarter fixed effect are included in Column (3) and (4). All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	σ(ROA)	R&D	σ(ROA)	R&D
UAI_DISTANCE	-4.837***	-0.064	-0.110	-0.079
	(0.988)	(0.218)	(0.100)	(0.069)
CEO characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Corporate governance	Yes	Yes	Yes	Yes
CEO fixed effect	Yes	Yes	No	No
Industry fixed effect	No	No	Yes	Yes
Year-Quarter fixed effect	No	No	Yes	Yes
Industry-quarter fixed effect	Yes	Yes	No	No
Observations	3,708	6,812	10,186	320
R-squared	0.881	0.719	0.345	0.388

Table 10: Robustness Check

This table reports the panel regressions results of robustness check. In Column 1 and Column 2, we require CEO spouses should have exact cultural backgrounds information. In Column 3 and Column 4, we use propensity score matching based on our year, industry, and other controls. We check selection bias in Column5 and Column 6 with Heckman two-stage test. The main explanatory variable is the UAI distance between CEO spouse and CEO (*UAI_DISTANCE*). Definitions of the variables are provided in Appendix A. Industry fixed effects are based on two-digit SIC codes. All regressions include a constant term. Standard errors are double clustered at firm and quarter level. *, **, and ***, indicate significant at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1) σ(ROA)	(2) R&D	(3) σ(ROA)	(4) R&D	(5) σ(ROA)	(6) R&D
Panel A: CEO and CEO spouse risk cultural distance						
UAI_DISTANCE	-0.181*	-0.249**	-0.217***	-0.134*	-0.206**	-0.139*
	(0.107)	(0.119)	(0.078)	(0.076)	(0.104)	(0.072)
Panel B: First-stage results of Heckman two-stage test						
CEO surname length					-0.071	-0.048*
					(0.050)	(0.029)
CEO spouse surname length					0.547***	0.509***
					(0.032)	(0.036)
Lambda					-0.313**	1.388***
					(0.159)	(0.159)
CEO characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Corporate governance	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,121	7,328	12,632	18,559	10,601	18,553
R-squared	0.319	0.391	0.245	0.228		

Appendix A: Variable Definitions

CEO Characteristics:

UAI_CEO: Uncertainty avoidance index for the CEO. *Source:* Hofstede et al. (2010).

IDV_CEO: Individualism vs. collectivism index for the CEO. *Source:* Hofstede et al. (2010).

UAI_DISTANCE: The difference between the CEO spouse's UAI and CEO's UAI scaled by CEO's UAI. *Source:* Hofstede et al. (2010).

EDUCATION: The level of the CEO's education. It is equal to 3 if the CEO holds a doctorate degree, equal to 2 if the highest degree is a master's degree, and equal to 1 if the highest degree is undergraduate, and 0 otherwise. *Source:* Marquis Who's Who, Notable Names Database, Wikipedia.

FEMALE: An indicator equal to 1 if the CEO is a female, and 0 otherwise. *Source:* Execucomp item GENDER.

ln(1+MARRIAGE_YEAR): Nature logarithm of years since the couple's wedding, updated annually. *Source:* Marquis Who's Who, Notable Names Database, Wikipedia, interviews or news about CEO couples through Google search and YouTube, and Ancestry.com. If we cannot find exact marriage date of a couple through these ways, we will use the age of their oldest child plus one as their marriage year.

ln(1+AGE): Nature logarithm of CEO's age plus one, updated annually. *Source:* Execucomp item AGE.

DIFF_CULTURE: An indicator variable equal to 1 the CEO has different cultural heritage with his or her spouse.

ln(1+TENURE): Nature logarithm of years of service as CEO at given firm. *Source:* Execucomp item YEAR minus BECAMECEO.

Firm Characteristics:

σ(ROA): For each firm with available earnings and total assets for at least 5 years (20 quarters) over the 2001 to 2015 period, the standard deviation of the firm's ROA from the industry average ROA for the corresponding year (John et al. (2008)). ROA=(NIQ+DPQ+TXTQ+XINTQ)/ ATQ_{t-1} in Compustat.

R&D: R&D expenditure. XRDQ/ATQ in Compustat.

MB: Market to Book ratio. (PRCC_Q × CSHOQ)/SEQQ in Compustat.

ln(ASSETS): Nature logarithm of total assets. ln(ATQ) in Compustat.

Q: Tobin's Q. [ATQ – SEQQ + (PRCC_Q × CSHOQ)]/ATQ in Compustat

LOSS: An indicator equal to 1 if negative net income (NIQ) in given year, and 0 otherwise. NIQ in Compustat.

Corporate Governance:

BOARD_SIZE: The number of directors sitting on the board. *Source:* BoardEx

BOARD_OWNERSHIP: The number of shares hold by board member over board member shares plus outstanding shares. NUM_OF_SHARE/(NUM_OF_SHARE + CSHO) *Source:* Institutional Shareholder Services (ISS) item NUM_OF_SHARE and Compustat item CSHO

BOARD_INDEPENDENCE: The fraction of independent directors on the board. *Source:* Institutional Shareholder Services (ISS) item CLASSIFICATION