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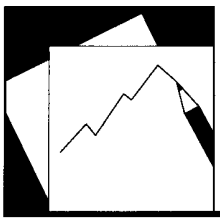

IMF Working Paper

Effects of Culture on Firm Risk-Taking: A Cross-Country and Cross-Industry Analysis

Roxana Mihet

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Research Department

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Prepared by Roxana Mihet*

Authorized for distribution by Stijn Claessens

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Abstract

This paper investigates the effects of national culture on firm risk-taking, using a comprehensive dataset covering 50,000 firms in 400 industries in 51 countries. Risk-taking is found to be higher for domestic firms in countries with low uncertainty aversion, low tolerance for hierarchical relationships, and high individualism. Domestic firms in such countries tend to take substantially more risk in industries which are more informationally opaque (e.g. finance, mining, IT). Risk-taking by foreign firms is best explained by the cultural norms of their country of origin. These cultural norms do not proxy for legal constraints, insurance safety nets, or economic development.

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Keywords: National culture, corporate risk-taking, industry opacity

Author's E-Mail Address: rmihet@imf.org, or roxana.mihet@economics.ox.ac.uk

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I. INTRODUCTION

Understanding whether national culture affects a society's likelihood to generate risk-seeking firms is important for effective policy-making and for improving corporate governance. It can enrich discussions on government policies that encourage entrepreneurship and innovation. A grasp of the impact of cultural influences on corporate risk-taking would allow policy-makers to better customize their policies for firms with different risk appetites, thus promoting more competitive business environments. Understanding the impact of culture on corporate risk-taking decisions is also important to the internal conduct of multinational firms. Internal decisions in multinational firms, such as the decision to pursue a risky R&D project, require well-orchestrated responses from executives with diverse cultural backgrounds. Even in firms with standardized operating procedures, the interpretation of various financial decisions can vary among executives from different societies as a result of their cultural differences (Tse et al. 1988). Accounting for the impact of cultural influences on decision-making allows the firms themselves to accommodate and adapt to such differences, hence diminishing "noisy" interactions among executives and errors in decision-making.

This study employs four dimensions of national culture identified by Hofstede (2001) and an international sample of 50,000 firms spread across 400 industries in 51 countries to analyze the effects of cultural differences on corporate risk-taking. More specifically, it tries to identify the *channels* through which cultural values can influence corporate risk-taking. Culture can affect the institutional and economic development at the macro level, the industrial diversification and industry concentration at the market structure level, as well as the corporate and individual decision-making at the micro level, all of which may in turn influence firm risk-taking decisions.

Previous literature has shown that national culture does in fact predict cross-country differences in the degree of institutional and economic development. Culture has been linked with creditor rights and investor protection (Stulz and Williamson 2003), with judicial efficiency (Radenbaugh et al. 2006), with corporate governance (Doidge et al. 2007), with bankruptcy protection and insolvency management (Beraho and Elisu 2010) and with overall levels of transparency and corruption (Husted 1999). Research has further established that national culture has an impact on the composition and leadership structure of boards of directors (Li and Harrison 2008) and also on individual decision-making at the micro level (Hilary and Hui 2009; Halek and Eisenhauer 2001; and Graham et al. 2009). On the other hand, attitudes towards risk are likely to be indirectly affected by culture through many of the factors listed above, as well as directly by national cultural norms, which may encourage or deter risk-taking.

This paper is not the first to study the impact of cultural values on corporate risk-taking. The extant literature has briefly studied the relation between culture and risk-taking, but has mostly focused on firms in the banking and the financial sectors (Houston et al. 2010; Kanagaretnam et al. 2011; Lehnert et al. 2011; Li and Zahra 2012). For example, Kanagaretnam et al. (2011) show that aggressive risk-taking activities by banks are more likely in societies with low uncertainty avoidance and high individualism. They show that cultural differences between societies have a profound influence on the level of bank risk-taking, and the ability to explain bank financial troubles during the recent financial crisis. On the other hand, Griffin et al. (2012) show that uncertainty avoidance is negatively and individualism is positively associated with firm-level riskiness in the non-financial sector (in the manufacturing sector).

This paper innovated in at least four ways. First, this paper takes a more holistic approach to the study of cultural influences on corporate risk-taking by studying not only the banking and the financial sectors, but all industries in a market economy. We take this approach in order to capture cross-industrial differences in risk-taking. The influence of cultural factors, such as national uncertainty aversion, may be of greater importance for firms in more informationally opaque industries such as information technologies, financial services, oil extraction, and chemicals, where information uncertainty is higher relative to manufacturing and industrial firms, because of the greater complexity of operations and the difficulty of assessing and managing risk. Thus, we test whether corporate risk-taking in informationally more opaque industries is more sensitive to a country's national cultural norms. Second, we differentiate between the direct and indirect effects of national culture on firm risk-taking. We specifically test whether cultural norms remain important in determining corporate risk-taking behaviors even after taking into account their impact on the institutional, economic and industrial environments. Third, unlike previous research which has used standard ordinary least squares analyses, we model both the direct and indirect effects of culture on risk-taking by employing a hierarchical linear mixed model. The hierarchical linear mixed model allows testing multi-level theories, simultaneously modeling variables at the firm, industry and country level without having to recourse to data aggregation or disaggregation as previous cultural economics studies have had to do. Fourth, by using a hierarchical linear model in explaining firm-level risk-taking, we can model not only the firm, industry and country-level influences on risk-taking, but also their cross-level interactions.

This paper finds that:

- Culture impacts corporate risk-taking *directly* and not merely though indirect channels such as the legal and regulatory frameworks.
- Corporate risk-taking is higher in societies with low uncertainty avoidance, low tolerance for hierarchical relationships and in societies which value individualism over collectivism, with these effects even more accentuated in societies with better formal institutions.
- Additionally, firms in countries ranking high in uncertainty-aversion and low in individualism take significantly less risk in industrial sectors which are more informationally opaque (e.g. finance, IT, oil refinery and mining), compared to firms in countries lower in uncertainty-aversion and higher in individualism.
- Risk-taking by foreign firms is best explained by the cultural norms of their country of origin.
- These cultural dimensions are not proxying for legal constraints, economic development, bankruptcy costs, insurance safety nets, or many other factors.

The results of this study inform both theory and policy in several ways. First, these findings strengthen the argument that the same institutional rules can produce different economic outcomes in culturally-different societies. Second, they imply that policy-makers should take into account cross-cultural values and norms when drafting policies that promote competitive business environments. Third, they enrich governmental discussions on policies that address risk-taking in informationally opaque sectors.

The remainder of the paper is organized as follows. Related literature is reviewed in section II. Section III details the data and its limitations. Section IV describes the hypotheses under analysis. Section V presents the empirical methodology, while Section VI discusses and interprets the results. Sections VII and VIII conduct additional identification analyses on accentuating/mitigating factors and distinguish between foreign and domestic firms. Section IX concludes.

II. LITERATURE REVIEW

Several research studies in the financial, accounting, and management literatures have explored the importance of cultural values in decision-making. These studies find that culture can explain the institutional, legal and economic environments of a country at the macro level which can influence corporate risk-taking decisions, and offer evidence of the impact of culture on financial decision-making by individuals at the micro level beyond traditional economic arguments.

At the micro level, culture has (unsurprisingly) been shown to affect individual risk-taking behaviors. Breuer et al. (2011) find that individualism is linked to overconfidence and overoptimism and has a significantly positive effect on individual financial risk-taking and the decision to own stocks. Tse et al. (1988) show that home culture has predictable, significant effects on the decision-making of executives. Two decades later, Graham et al. (2010), using survey data in the U.S., also show that CEOs are not immune to the effects of culture. They find that CEOs' decision-making is strongly influenced by cultural values such as uncertainty-aversion.

At the macro level, cultural heritage has been linked to corporate governance, investor protection, creditor rights, bankruptcy protection, judicial efficiency, accounting transparency, and corruption. Doidge et al. (2007) find that cross-cultural differences explain much more of the variance in corporate governance than observable firm characteristics. Hope (2003a) shows evidence that both legal origin and culture (as proxied by Hofstede's cultural dimensions) are important in explaining firms' disclosure practices and investor protection. In fact, he finds that although legal origin is a key determinant of disclosure levels, its importance decreases with the richness of a firm's information environment, while culture still remains a significant determinant. Licht et al. (2005) find that social norms of governance correlate strongly and systematically with high individualism and low power distance. Stulz et al. (2003) find that cultural heritage, proxied by religion and language, predicts the cross-sectional variation in creditor rights better than a country's trade openness, economic development, legal origin, or language. Other studies find that culture predicts judicial efficiency and the transparency of accounting systems. Radenbaugh et al. (2006) find that countries in the Anglo cluster have an accounting system which is more transparent and less conservative than either the Germanic or the Latin accounting systems. Beraho et al. (2010) show that cross-cultural variables have a direct influence on the propensity to file for bankruptcy and on insolvency laws. Lastly, both Getz and Volkema (2001) and Robertson and Watson (2004) link cultural differences to corruption levels.

Furthermore, recent research has also linked cultural variables to economic and market development, although the evidence is mixed. Guiso et al. (2006) find that national culture impacts economic outcomes, by influencing national savings rates and income redistributions. Kwok and Tadesse (2006) find that culture explains cross-country variations in financial systems, with higher uncertainty-avoidance countries dominated by bank-based financial systems, rather than by stock-markets. Kirca et al. (2009) show that national culture impacts the implementation of market-oriented practices (i.e., generation, dissemination, and utilization of market intelligence) and the internalization of market-oriented values and norms (i.e., innovativeness, flexibility, openness of internal communication, speed, quality emphasis, competence emphasis, inter-functional cooperation, and responsibility). Lee and Peterson (2000) show that only countries with specific cultural tendencies (i.e., countries which emphasize individualism) tend to engender a strong entrepreneurial orientation, hence experiencing more entrepreneurship and global competitiveness. On the other hand, Pryor (2005) argues that cultural variables do not seem related to the level of

economic development and are not useful in understanding economic growth or differences in levels of economic performance across countries. Additionally, Herger et al. (2008) also argue that cultural beliefs do not seem to support or impede financial development. This mixed evidence points to the idea that national culture might only indirectly influence economic and market development through its effects on the legal and institutional contexts.

The institutional and economic environments have been shown to affect corporate risk-taking decisions. There is a small strand of literature which has explored corporate risk-taking around the world which reflects countries' institutional and economic environments. For example, Laeven and Levine (2009) show that risk-taking by banks varies positively with the comparative power of shareholders within each bank. Moreover, they show that the relations between bank risk-taking and capital regulation, deposit insurance mechanisms, and bank activities restrictiveness, depend critically on the bank's ownership structure. Claessens et al. (2000) show that corporations in common law countries and market-based financial systems have less risky financing patterns, and that the stronger protection of equity and creditor rights is also associated with less financial risk. Overall, while the literature is relatively small, national culture has been indirectly linked with corporate risk-taking decisions in formal studies, although most of them only analyze the banking sector.

Culture has also been directly linked with corporate risk-taking, although again, most studies have focused on either the financial or the manufacturing sectors separately. Kanagaretnam et al. (2011) show that banks in high uncertainty avoidance societies tend to take less risk, whereas banks in high individualism societies take more risk. However, they do not control for institutional variables such as corporate governance, bankruptcy protection, judicial efficiency, transparency, and corruption, which have shown to be affected by national cultural norms and which could at their turn affect corporate risk-taking. Griffin et al. (2012) study the impact of culture on firms in the manufacturing sector in the period 1997-2006. To the best of our knowledge, they are the only ones who use a hierarchical linear mixed model to analyze the impact of culture on corporate risk-taking. They show that individualism has positive and significant direct effects, while uncertainty avoidance has negative and significant direct effects on corporate risk-taking.

This paper contributes to the literature on the impact of culture on firm risk-taking in several ways. While previous studies have studied either the direct or the indirect effects of culture on risk-taking, this paper tries to reconcile the two strands of literature and assess them simultaneously by using a hierarchical linear mixed model. This allow to test whether cultural norms remain important in determining corporate risk-taking behaviors even after taking into account their impact on the institutional, economic and industrial environments. Moreover, this paper extends the analyses of Griffin et al. (2012) and Kanagaretnam et al. (2011) to capture cross-industrial differences in risk-taking. Given the importance to national and global economies of the highly leveraged sector of finance, or the highly innovative sector of IT, or the highly risky commodity industries[1], and given that firms in these industries are markedly different from manufacturing firms and have been more adversely affected by the recent global economic crisis, it is very important to understand the role of culture on cross-industrial variation in corporate risk-taking.

[1] In general, commodity industries (biofuels, metal products, non-ferrous metals) are riskier and more opaque than other industries because they adopt more complicated production methods and organization structures and incur more intensive R&D expenditures which may cost more than the end benefits (Huang 2008).

III. DATA

This section details the data, describes the cross-cultural variables, the cross-firm risk-taking measures and the country-level, industry-level, and firm-level control instruments. We also discuss limitations of the cultural dimensions and offer guidance about how they could bias the results.

A. Measuring National Culture

The national cultural dimensions employed in the analysis are derived from a psychological survey into national and organizational culture conducted by the Dutch sociologist Geert Hofstede[2]. The analysis makes use of four dimensions of national culture that distinguish 66 countries from one another: (1) tolerance of uncertainty; (2) the degree of group integration; (3) immobility between social classes; and (4) division of roles between genders. The dimensions come from a very large sample of employee values scores[3] collected by IBM between 1967 and 1973 in 66 countries: 31 advanced economies and 35 emerging markets. Subsequent studies[4] over the following decades have validated and extended these results on occupationally different populations: school teachers, airplane pilots, high school students, etc.

The first index explored is *national uncertainty aversion (UAI)* which deals with a society's tolerance for uncertain, unknown, or unstructured situations. UAI is defined as "feeling uncomfortable with uncertainty and ambiguity, and therefore valuing beliefs and institutions that provide certainty and conformity (Hofstede 2001)." People in uncertainty avoidant cultures favor an orderly structure in their organizations, institutions and personal relations and prefer well-anticipated events. Emerging economies tend to be more uncertainty-averse than developed economies. A simple mean-comparison t-test at the 5 percent level shows that, on a scale from 1 to 100, the average UAI score for low income countries is 70, six points higher than the average UAI score for high income countries (see Figure A1 in Appendix A for more details). This observation is consistent with the idea that growth has an inherent risk component to it, and suggests that the lower a country's ambiguity aversion, the more business ventures it will pursue and thus, the higher its economic development. In fact, this hypothesis is verified by the modeling work of Giordani and Zamparelli (2011), who show that the lower the ambiguity aversion, the higher the R&D efforts, and ceteris paribus, the higher the economic performance. Our sense is that firms in countries low is uncertainty-aversion will benefit from the upside risky effects of their risky financial actions in periods of economic upswing and rapid development, whereas in periods of economic downturn they are likely to run into problems when confronted with the downside risky consequences of their actions.

The second dimension used is *individualism (IDV).* It describes the relationship between the individual and the greater society. Hofstede defines it as "a society in which the ties between individuals are loose. Everyone is expected to look after himself and his immediate family only. Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for

[2] Appendix A details the survey questions used by Hofstede (2001) to calculate the national cultural values.
[3] 117,000 IBM local employees of marketing and customer service positions from 66 countries around the world.
[4] Studies such as Hoppe (1990), Schwartz (1992, 1994), the European Media and Marketing Survey (1995, 1997 and 1999), the Helmreich and Merritt Study (1998), and Hofstede et al. (2010) have all replicated the initial results of the Hofstede study.

unquestioning loyalty (Hofstede 2001)." Developed countries tend to be, on average, more individualistic than emerging economies. In fact, there is a 27 point mean-difference between the mean IDV score of high income countries (57) and the mean IDV score of low income countries (25), significant at the 5 percent level. Whether wealthier countries are more individualistic because there is less need to be reliant on other people, or whether economic development is facilitated by individualism (the invisible hand and the ardent pursuit of self-interests) are two hypotheses which are worth investigation. Our sense is that collectivism has many advantages at one stage of economic development, after which it becomes a burden on growth. In an underdeveloped economy, collectivism can be advantageous because it provides some kind of informal insurance against hazards and potential risks. However, once a society becomes more economically developed, collectivism can prove disadvantageous because it can interfere with the functioning of the economy by contributing to corruption and by providing a disincentive to investing and accumulating wealth, both because one is expected to share with the larger in-groups and because one can rely on free-riding on others for economic support (Ball 2001). To account for these effects, we will control for overall corruption at the country level, and we will have an interaction variable between individualism and the stage of economic development to account for the hypothesized nonlinear effects of collectivism / individualism on growth and risk-taking.

The third dimension we employ for analysis is *power distance (PDI)*, which measures "the extent to which less powerful members of a society accept and expect that power is distributed unequally (Hofstede 2001)." A high PDI index means that national elites hold relatively authoritarian views, and that authority is based on tradition rather than on secular arguments. It also characterizes highly stratified societies that value conformity more than independence. Low income countries (67) tend to have, on average, higher power distance scores than high income countries (48) and the 19 point mean-difference is significant at the 5 percent level (see Figure A1 of Appendix A for more details). National wealth can itself be interpreted as both a cause and a consequence of small power distance scores. We believe that wealth is negatively correlated with power distance because development goes together with the growth of the middle classes in a society, which forms a bridge between the powerful and the powerless. On the other hand, high power distance societies are also highly authoritarian and authoritarian political systems which tend to not innovate as much, thus growing poorer in the long-run.

The fourth dimension analyzed is *masculinity (MAS).* It is defined by Hofstede as referring "to the dominant gender role patterns: the patterns of male assertiveness and female nurturance" (Hofstede 2001). 'Masculinity' stands for societies where social gender roles are clearly defined: men are supposed to be assertive, tough and focused on advancement and earnings; women are supposed to be more modest, nurturing, and concerned with the quality of life. 'Femininity' stands for societies where the gender roles overlap: both genders are supposed to be modest, tender and concerned with the standard of living (Hofstede 2001). While the choice of naming this index "masculinity" is an unfortunate one because it implies gender-role stereotypes which might not be necessarily true, the index still points to important cross-country differences. High income economies tend to have a slightly larger MAS score of 51, compared to low income countries which have a mean score of 42, but the 9 point difference is not statistically significant at the 5 percent level.

In Hofstede's terms, these four dimensions are independent of each other, operate along a continuum between two extremities, and can be combined in different ways. Table 1 shows the pair-wise correlations between the four cultural dimensions discussed in this paper. While all the other variables are uncorrelated at the 1 percent level, individualism is negatively correlated (-

0.66*) with immobility between social classes (power distance). This is due to the fact that both low power distance and high individualism correlate with economic development. Once economic development is statistically controlled for, the correlation disappears (-0.27). These results point to the idea that the four cultural dimensions capture dissimilar values and societal norms which will be useful in analyzing corporate risk-taking decisions.

Table 1. Correlation Matrix of Hofstede's National Cultural Dimensions

	Uncertainty Aversion	*Individualism*	*Power Distance*	*Masculinity*
Uncertainty Aversion	1			
Individualism	-0.21 (-0.30)	1		
Power Distance	0.15 (0.16)	-0.66* (-0.27)	1	
Masculinity	0.05 (0.05)	0.09 (0.14)	0.07 (0.09)	1

Notes: Pair-wise correlations of national cultural variables. Partial correlations controlling for the level of economic development in parentheses. The star (*) represents significance at the 1 percent level.
Source: Hofstede 2001.

Even if a fair share of differences in cultural values can be attributed to personal, individually-characteristic factors, much more is related to the society in which an individual has been brought up. Societies share a system of societal norms which consist of the value systems shared by major groups in the population. These societal norms have allowed the development and preservation of institutions with fairly persistent structures and ways of functioning such as: the family, the school, the political system and the legislation. These institutions tend to reinforce the societal value system in such a way that a member of a society will get rejected if he does not follow the value system ("the mental software") of the society he belongs to (Hofstede 2001). By analyzing matched samples of local IBM employees of marketing and customer service positions in 66 countries, a homogenous group of people with similar backgrounds, similar education levels, type of work and personality, Hofstede manages to eliminate idiosyncratic preferences and to obtain relative cross-country indices which reflect national cultural differences.

It is important to understand that these dimensions of culture are relative – societies are compared to other societies. As Hofstede suggests, they should only be used as a framework for understanding cultural differences between countries and not as laws set in stone. In other words, without making a comparison, a country score is meaningless.

B. Limitations of Cultural Variables

Linking cultural norms with economic phenomena is difficult because of the very nature of culture, which is extensive and all-encompassing. In order to claim a causal relationship between culture and economic behavior, one needs to restrict the definition of culture to only those beliefs and values that get transmitted across generations fairly unchanged. National uncertainty aversion, power distance, and individualism are cultural characteristics which seem to have this quality: they do not change significantly over time. The high correlations between various cross-country sociological studies in three consecutive decades (Hofstede 1984, 2001; Hoppe 1990; European Media and Marketing Survey 1995, 1997, 1999; and Hofstede et al. 2010) indicate that a country's tolerance for uncertainty, class mobility or emphasis on individual achievement stay fairly constant across time. This suggests that these cultural variables are, similar to religion, some of those dimensions of culture that are inherited by an individual from previous generations, rather than voluntarily accumulated. The same pattern is observed for the masculinity dimension as well. While

culture change basic enough to invalidate the country dimension index scores is a possible scenario (especially in the contemporary period of globalization and of 'country convergence[5]'), such a drastic cultural revolution would require a much longer period, or extremely dramatic exogenous events such as military conquests or deportation. Differences between national cultures in the areas studied in this paper were already recognizable in the years 1800s, if not earlier.

Hofstede's national cultural variables have been fairly stable over the last decades, at least relatively to each other. While cultures do change, they tend to do it simultaneously in response to the same global factors, leaving the relative positions in place. While we believe that the cultural variables that we use for analysis have stayed fairly constant within a nation across the last decades (Hofstede, 2001), any changes which would have happened since the survey answers were collected would weaken any relationship between national culture and corporate risk-taking.

In addition, if the sample population from which these national cultural variables were extracted does not reflect the values of the entire nation (e.g., the IBM employees surveyed do not share the same cultural values as their corporate managers, or as their fellow citizens), this would also render the results feebler. For a good critique of the validity and flaws of Hofstede's cultural dimensions, see McSweeney (2000). While the five dimensions of culture were derived from responses of mid-level IBM employees with lower levels of formal education than those of typical managers and R&D professionals, we have strong reasons to believe that their values stand for the values of the greater society they belong from. This conjecture is supported by Hoppe (2007) and by Søndergaard (1994) who found that Hofstede's cultural dimensions are equally valid for highly educated respondents.

Moreover, if different cultures have different definitions for what risk is, our measures of risk-taking might not be the purest proxy for risk-taking across nations. While theoretically the risk-taking instruments constructed in this paper might not capture the quintessence of risk-taking across societies, these are empirically robust and consistent instruments. We use the same definition of corporate risk-taking across firms, across industries and across countries, and thus measure the same concept across firms in different countries. Obtaining robust effects of national cultural variables on risk-taking would strengthen the hypothesis that cultural values are enduring norms, transmitted from one generation to the next, that are widely shared by citizens of the same nation.

C. Measuring Firm Risk-Taking

The firm-level data comes entirely from the Corporate Vulnerability Utility (CVU), developed by the IMF's Macro-Financial Linkages Unit, and based on Worldscope and Datastream data. The CVU database contains annual indicators from 2000 to 2012 at the firm level. It provides good coverage of about 50,000 publicly traded firms across more than 400 SIC industries in 51 countries for which we also have national culture data.

We measure corporate risk-taking using three indicators: (1) the z-score of each firm, which indicates insolvency risk and is a commonly used measure of risk-taking in previous academic research (Laeven and Levine 2009; Kanagaretnam et al. 2011) and (2), the σ (ROA), which

[5] The 'comparative management' literature argues in favor of the 'convergence hypothesis', which implies that management philosophies and practices around the world would eventually become more and more alike as societies tend to become more exposed to the same products and ideas (see Kerr et al. 1960; and Lomax and Berkowitz 1972).

measures the degree of risk taking in a firm's operations based on the volatility of corporate earnings, and (3) R&D expenditures to market capitalization, which is commonly used as a measure of risky corporate policies.

The Z-score is a measure of firm distress and distance from insolvency. It consists of accounting measures of profitability, leverage and volatility. More specifically, $Z = (ROA + CAR) / \sigma(ROA)$, where ROA is earnings before taxes and loan loss provision divided by assets, CAR is the capital-asset ratio, and $\sigma(ROA)$ is the standard deviation of the ROA over the entire sample period. The Z statistic indicates the number of standard deviations that a firm's losses (negative profits) can increase to deplete equity, making the firm insolvent (De Nicolò 2000). Thus, the higher the Z-score, the more stable and the more financially healthy the firm.

Although the Z-score has been frequently used in the financial literature, it is not fully precise because of variations in accounting standards across countries and it also suffers from a skewness bias (De Nicolò 2000). To ameliorate the latter caveat, we use the natural logarithm of the Z-score, which tends to be normally distributed. From now on we will denote this measure as the "z-score" in referring to the natural logarithm of the Z-score.

Two additional measures of firm risk-taking are employed to validate our findings. We use the standard deviation of ROA, which measures a firm's operational risk-taking. ROA is defined as the ratio of earnings before interests and taxes (EBIT) to the firm's total assets. The variability of ROA provides a comprehensive measure that reflects not only leverage risk, but any kind of risk (such as interest rate risk or liquidity risk) that is realized in a firm's earnings. For each firm with earnings and total assets available for at least eight years over the period 1999-2012, we compute the deviation of the firm's ROA from the industry average for the corresponding year in the corresponding country. Then, we calculate the standard deviation of this measure for each firm in the sample. Doing this allows us to eliminate the influence of the home country's and the industry's economic cycle and obtain a purer measure of corporate risk-taking.

Lastly, the third measure of corporate risk-taking proxy is an index of R&D expenditures, which is calculated as the ratio of research and development expenditures to market capitalization. Research and development expenditures are risky because they have a low probability of eventual technical success, high uncertainty about the costs and the length of time involved and a distant and uncertain financial outcome (Cox 2007). Brandenburg (1964) emphasizes that the very nature of an R&D project makes its outcome less certain than the outcome of projects in other functional departments of a firm. Other studies, such as Joglekar and Paterson (1986) or Cooper (1981) find dismal rates of cost recovery and commercial success for R&D projects.

D. Measuring Industry Informational Opacity

The high scale of divergence between bond raters implies that financial, insurance, oil and gas mining, and IT firms are inherently more opaque than other types of firms. Bond rating agencies such as Moody's and S&P split more often over these types of firms (Morgan 2000). Uncertainty over the financial firms comes from certain assets, loans and trading assets which are particularly difficult to monitor or price. Uncertainty over the oil and gas mining firms stems from the fact that outsiders have a hard time in determining the market value of their primary assets: their oil and gas reserves.

This paper follows Huang (2008) in developing for each industry an index measuring the amount of private information available, or inversely, the informational opacity of each industry. Huang (2008) uses Durnev et al. (2004) and Rajan and Zingales's (1998) indicator of "relative firm-specific stock return variation", which measures stock price informativeness at the industry level. The technical details on how to construct such an index for a wide array of industries can be found in the appendix, but the rationale is the following. Using high-frequency firm-level data, stock returns can be decomposed into market-related, industry-related and firm-specific components. When there is little firm-specific information available, stock prices become less informative, and most of the variation in stock price returns can be explained by industry or market related factors.

Following Huang (2008), the stock price informativeness of U.S. firms is calculated and used as a proxy for intrinsically given information availability at the industry level.[6] This is justifiable because: 1) the U.S. market is the market with the most efficient information environment, where new information is rapidly (and efficiently) incorporated into stock returns, and 2) using the stock price informativeness of U.S. firms avoids any risks of endogeneity. The opacity indicator is constructed based on weekly stock returns of all U.S. public-listed firms, from 2000 to 2005. A five-year window was chosen to measure stock price informativeness because it is small enough to capture cross-industrial differences, yet long enough to represent more than a transient trend in stock price informativeness. Appendix B describes the technical details in creating the indicator and lists both the industry informativeness and its' inverse, the industry informational opacity.

Table 2. Industry Informational Opacity

Industry	*R-squared*	*Informativeness Index*	*Opacity Index*
Finance, Insurance, And Real Estate	0.0034	0.9966	5.684
Wholesale Trade	0.0039	0.9961	5.550
Mining	0.0042	0.9958	5.477
Transportation, Communications, Electric, Gas	0.0059	0.9941	5.123
Retail Trade	0.0060	0.9940	5.111
Services	0.0066	0.9934	5.019
Agriculture, Forestry, And Fishing	0.0068	0.9932	4.986
Construction	0.0072	0.9928	4.931
Manufacturing	0.0085	0.9915	4.756

Notes: R-squared represents the R^2 of regressing firm specific return variations on industry-wide and market-wide returns. The informativeness index is calculated as one minus average R^2 of the regressions using each firm in an industry. The more information contained in the stock prices of individual firms, the lower the R^2 will be. The informativeness index is highly skewed and mildly leptokurtic, therefore to normalize it we calculate the $\ln(1/R^2)$-$\ln(R^2)$. The result of this calculation is the informational opacity index. All variables are mean-collapsed at the industry level. U.S. data only.
Sources: Datastream; author's calculations.

Table 2 ranks the main industries in terms of informational opacity and the results look quite intuitive. Table B in Appendix B provides a much grainer distinction of the measurements, reporting the informational opacity for more than 140 industries and in the course of the analysis the finer breakdowns are used. The pattern is that stock prices of newer industries, such as finance or the computer industry are more informationally opaque, whereas stock prices of the "old

[6] Accordingly, the United States is excluded from cross-country regressions.

economy" industries, such as manufacturing, construction or public administration reveal more firm-specific information. A casual inspection also suggests that low opacity industries are also the ones using simpler production and organization technologies, compared to the highly opaque industries (chemicals, petroleum refinery, and finance).

E. Control Variables

We control for numerous firm level, industry-level and country-level characteristics.

Country level controls

At the country level, we control for (1) economic development, measured as the ratio of credit to GDP, (2) the policy rate, (3) aggregate economic volatility, measured b the standard deviation of annual GDP growth, (4) rule of law, (5) regulatory quality, (6) government effectiveness, (7) voice and accountability, (8) control of corruption, (9) political stability, (10) efficiency of debt enforcement, (11) creditor rights, (12) shareholder protection, and (13) bankruptcy costs. For a more detailed description, definitions and sources of these variables, please see Appendix D.

This set of country-controls includes factors known to explain the cross-section of earnings volatility, leverage, or R&D investments. For example, Acemoglu and Zilibotti (1997) argue that economic underdevelopment may slow the adoption of more productive, but risky, technology. To control for economic development we use the ratio of credit to GDP. Other studies, such as Rajan (2005) and Altunbas et al. (2010) assert that monetary policy easing can induce greated risk taking through its effects on leverage and asset prices. However, De Nicolò et al. (2010) have found that the relationship between risk-taking and monetary policy is more complex, depending on the level of firm capitalization in non-linear ways. Therefore, we will have an interaction variable between the level of capitalization and the monetary policy rate to control for the case when well-capitalized firms will increase their risk-taking when the policy rate is low, while poorly capitalized firms will do the opposite.

We also attempt to control for variables most of the previous literature on the influence of culture on corporate risk-taking has ignored. When thinking about culture, one needs to disentangle those internal norms and beliefs specific to a particular society (e.g. Norwegians are inherently uncertainty averse, therefore they take less risk) from the institutional setting that can affect risk-taking (e.g. Norwegians are as uncertainty-averse as Americans, but the institutional setting is such as to make them take less risk). To disentangle these two effects, we attempt to control for a multitude of institutional variables, some of which, but not all, have been identified to increase risk-taking: rule of law, efficiency of debt enforcement, regulatory quality, government effectiveness, voice and accountability, political stability, shareholder protection, creditor rights, bankruptcy costs, and the overall corruption level. Because six of these governance measures tend to be very highly correlated with each other (pair-wise correlation >75%), we create an index of these institutional dimensions as a measure of a society's overall quality of formal institutions. We use a principal components analysis (PCA) to develop a composite index which we name "Formal Institutions Index" calculated as Rule of Law* 0.41+ Efficiency of Debt Enforcement* 0.34+ Control of Corruption* 0.40+ Regulatory Quality* 0.39+ Government Effectiveness* 0.40+ Voice and Accountability* 0.36+ Political Stability* 0.31. The weights are obtained through PCA. Table E4 in Appendix E gives more details regarding the procedure, showing both the principal components and the principle factors. The rest of the country level variables (financial

development, policy rate, aggregate economic volatility, creditor rights, shareholder protection, and bankruptcy costs) are used as independent controls because they do not display as high levels of multicollinearity.

Industry level controls

At the industry level, we control for the industry's (1) competition/concentration index, and (2) informational opacity. For the industry's competition measure we use the Herfindahl index, which is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. It is calculated as the sum of the squares of the market shares of the 50 largest firms (or summed over all the firms if there are less than 50) within the industry, where the market shares are expressed as percentages. The result is proportional to the average market share, weighted by market share. As such, an industry's competition measure ranges from 0 to 1.0, with a smaller Herfindahl index suggesting a highly competitive industry with no dominant players, and a larger Herfindahl index suggesting high concentration. We also control for the industry's level of informational opacity, calculated as described in a previous section.

Firm level controls

At the firm level, we control for (1) firm size, measured by the log of total assets, where total assets is the sum of fixes and current assets, (2) leverage, which is defined as the ratio of total liabilities (current and noncurrent liabilities) to total assets, (3) profitability, measured as the firm's return on assets (ROA) and calculated as the ratio of earnings (EBIT) to total assets, (4) sales growth, calculated as the annual logarithmic growth of sales, and (5) dependence on external finance, proxied by the Rajan-Zingales index (Rajan and Zingales, 1998). This data comes entirely from the CVU database.

We control for the firm's return on assets because we want to eliminate variation in management quality over time. A high ROA volatility, for example, can stem from poor management, rather than higher risk-taking, and so we try to account for this by controling for the level of ROA through time. We reduce the impact of firm accounting data outliers on our analysis by winsorizing all the firm-level controls at the 1% level in both tails, while we additionally winsorize sales growth and leverage at the top 5% of the distribution. We end up with 50,000 firms across 400 industries in 51 countries.

IV. HYPOTHESES DEVELOPMENT

The main concern of this paper is whether national culture still influences corporate risk-taking decisions, even after taking into account its effects on the institutional, economic and industrial environments. The second concern is whether any of these environments can accentuate or curb the influence of national culture on firm risk-taking.

A. DIRECT EFFECTS OF CULTURE

Ambiguous situations are novel, unknown, surprising and different from usual. Uncertainty avoiding cultures avoid ambiguous situations, but paradoxically might prefer risky situations to uncertain ones. The main difference between low UAI and high UAI countries is that high UAI countries might take risks, but these are limited to known risks, while low UAI countries in general

take *both* known and unknown risks and are more tolerant of both. This translates into high UAI countries having "a fear of failure", while low UAI countries have a "hope of success".

We suggest that employees in low UAI countries will take more risk because they hope to succeed no matter what, while being less stressed about downside scenarios and more willing to change jobs in case of failure, while employees in high UAI countries will take fewer risk because they are afraid of lack of success and the consequences that could arise in case they fail. Thus, we hypothesize

H1: Uncertainty aversion will directly <u>negatively</u> influence firm risk-taking.

Individualism has been consistently linked in the psychological literature with overconfidence and overoptimism. In more individualistic societies, decisions are the product of an individual rather than the group, and these decisions are more likely to be driven by overconfidence and overoptimism (Chui et al. 2010). Pan and Statman (2009) find that highly overconfident individuals tend to be more risk-tolerant than less overconfident people, exaggerating their ability to control outcomes and overestimating their knowledge. When individuals are too confident in their abilities, they tend to overestimate the accuracy of their predictions and to be excessively secure in their estimates of parameters, such as the future return of a stock (Van der Steen 2004; Grinblatt and Keloharju 2009).

We predict that individualism, which is correlated with overconfidence and overoptimism, will have a significant positive effect on risk-taking. On the other hand, individualism could also have the opposite effect because of the cushion hypothesis. In collectivist countries everyone takes responsibility to help out in case of a large and possibly catastrophic loss as a result of a risky option, whereas in individualistic countries, each is responsible and will bear the consequences of his own actions. Collectivism therefore acts as a cushion against possible losses (Hsee and Weber 1999). To account for this discrepancy, our model will take into account and control for creditor and shareholder protection mechanisms, as well as for bankruptcy costs. To summarize, the second hypothesis is

H2: Individualism will directly <u>positively</u> influence firm risk-taking.

A high PDI index means that national elites hold relatively authoritarian views, and that authority is based on tradition rather than on secular arguments. High PDI scores also characterize highly stratified societies that value conformity more than independence. While we cannot establish causality, we believe that high power distance tends to negatively affect national economic performance because it impedes mobility, innovation, entrepreneurship and proactivness, while emphasizing conformity. PDI might also be negatively correlated to wealth because wealth goes together with the growth of the middle classes, which connects the powerful with the powerless.

Power distance deals with issues of equality, and ultimately with trust. In high PDI countries, superiors and subordinates are differentiated in other-than-hierarchical ways and powerholders are entitled to privileges denied to the powerless. Because of these frictions, high power distance countries exhibit latent conflicts between the powerful and the powerless, and the later are seen as a threat to one's power and should rarely be trusted (Hofstede 2001). On the other hand, in low power distance countries there is a latent harmony between the powerful and the powerless: people at various power levels feel less threatened and are more prepared to trust each other.

We suggest that people in low power distance countries will take on more risk because they are more trusting. Indeed, a long strand of psychological research has found a strong connection between trust and risk-taking. The more trusting an individual is, the more risks he will take (Growiec and Growiec 2011; and Das and Teng 2004). We postulate that the same will hold true at the firm level and that firms in low PDI countries will be more trusting and will consequently take on more risk. Thus, our third hypothesis is

H3: Power distance will directly negatively influence corporate risk-taking.

We also predict that countries scoring higher in the masculinity index will take more risk. Because Hofstede's typical masculine society emphasizes achievements and competitiveness, a money and assets orientation (to have, to own, and to do well) and sympathy for the strong and the successful achiever, it might also encourage a higher risk-taking behavior. Our fourth hypothesis is

H4: Masculinity will directly positively influence firm risk-taking.

B. INDIRECT EFFECTS OF CULTURE

As mentioned previously, national cultural differences may also indirectly affect corporate risk-taking decisions, through their effects on the institutional, economic and industrial environments in which a firm finds itself in. Formal institutions and informal national cultural norms are strongly interconnected. More specifically, formal institutions can be the product of cultural norms because the political, contractual and economic rules are all linked to the society's perception of how things ought to work. These institutions, once established, tend to reinforce the societal values that led to their establishment. Formal institutions such as rule of law, regulatory quality, government effectiveness, control of corruption, investor protection, creditor rights, bankruptcy costs, financial development, market competition, and industry diversification can all be shaped by national cultural values including uncertainty aversion, individualism, power distance or masculinity.

Country Effects

Societies differ in the quality of institutions that regulate or encourage corporate risk-taking, such as regulatory institutions, governmental and administrative institutions, or judiciary institutions. National cultural variables affect the quality of these institutions, which at their turn have been shown to affect corporate risk-taking.

Table 3. Correlation Matrix between National Culture and National Governance Indicators

	Rule of Law	*Control of Corruption*	*Regulatory Quality*	*Govt. Effectiv.*	*Voice and Account.*	*Political Stability*	*Formal Institution Index*
Uncertainty Aversion	-0.17*	-0.20*	-0.14*	-0.21*	0.00	-0.05	-0.14
Individualism	0.71*	0.68*	0.60*	0.68*	0.64*	0.53*	0.69*
Power Distance	-0.64*	-0.65*	-0.56*	-0.60*	-0.64*	-0.48*	-0.64*
Masculinity	-0.07	-0.11*	-0.01	-0.04	-0.04	-0.07	-0.06

Notes: The formal institution index is a measure of institutional development (higher values mean better institutions) and is calculated as an average index of the other six governance indicators. The stars (*) represent significance at the 1 percent level.
Sources: Governance indicators from WGI World Bank; cultural variables from Hofstede 2001.

Table 3 explores the Pearson's correlations between national cultural values and governance indicators and shows that there is indeed a strongly significant positive relationship between individualism and governance, and a strongly significant negative relationship between power distance and good governance. In fact, the higher a country's level of individualism, the better its rule-of-law, the better its' government effectiveness, its' control of corruption and its' regulatory quality. Similarly, the lower a country's level of power distance (the more egalitarian the society), the better its formal institutions. There is no strong correlation relationship between governance and uncertainty aversion, or masculinity. Thus, we believe that individualism and power distance are the two most important cultural variables that affect institutional development.

Because individualistic cultures emphasize self-interested competition, freedom and well-established individual rights and obligations, they also require a rule-of-law state that provides people with a comprehensive set of protection rights (e.g. property, contract rights, etc) and that effectively enforces them (Licht et al. 2005). Such a rule-of-law state protects the rights of competing parties against opportunistic behavior and gives everyone a fair chance to pursue their ambitions. On the other hand, more collectivist countries may give less emphasis to enforcing laws intended to shield personal rights and property from violations. At the same time, better institutional governance has been shown to encourage greater firm risk-taking (Houston et al. 2010; Li and Zahra 2012; Laeven et al. 2009). Thus, we hypothesize that individualism will positively and indirectly affect risk-taking through its effects on institutional development.

Furthermore, cultures with a low power distance, that have a low tolerance for hierarchical relationships, also tend to be more egalitarian. Such cultures have better rule-of-law systems which treat citizens equally and which do not disfavor ones against the others, giving them the same rewards or punishments for their actions. Egalitarian societies, by encouraging societal members to treat one another equally, will also promote a rule-of-law norm that entitles all to equal protection under the law. We predict that power distance will be negatively associated with institutional development, which in turn will negatively affect corporate risk-taking. To summarize the fifth hypothesis,

H5: The higher the level of individualism, the stronger the positive relationship between the level of formal institutional development and the level of corporate risk-taking. The higher the level of power distance, the weaker the positive relationship between formal institutional development and corporate risk-taking.

Countries also vary extensively in the protection mechanisms they offer to creditors and shareholders, and in their bankruptcy rules. As previous literature has found, differences in protection rules, contract enforceability and bankruptcy costs all affect risk-taking decisions.

Countries high in individualism tend to have good shareholder and creditor protection mechanisms and a strong enforceability of deals. Such societies tend to clarify the framework and purpose of people's entitlements, allowing them to better plan their independent (and sometimes selfish) actions (Raz 1979). On the other hand, societies high on collectivism, by assigning priority to the group in the detriment of the individual, tend to give less importance to protecting individuals' interests or to satisfying their preferences (Licht et al. 2005). Creditor and shareholder rights have been shown to affect risk-taking decisions in opposite ways. Stronger creditor rights in bankruptcy tend to reduce corporate risk-taking (Acharya et al. 2010), while stronger shareholder rights tend to increase firm risk-taking (John et al. 2008; Paligorova 2010). This is consistent with the conflict of

interest between shareholders and creditors, with the creditors receiving only fixed payoffs and being rather risk-averse to risky projects, while the shareholders have an interest in pursuing risky projects because they are only subject to the upside consequences of risky decisions. Therefore we expect that individualism will indirectly affect corporate risk-taking through its distinct effects on creditor and shareholder protection, on the one hand encouraging firm risk-taking and on the other hand discouraging it.

Table 4. Correlation Matrix between National Culture and Protection Mechanisms

	Credit rights	*Property rights*	*Legal protect. of shareholders*	*Efficiency of debt enforce.*	*Enforce. of contracts*	*Bankruptcy costs*	*Propensity to file for bankruptcy*
Uncertainty Aversion	-0.30	-0.20	-0.46*	-0.32	-0.35	0.04	-0.02
Individualism	0.11	0.68*	0.08	0.51*	0.76*	-0.31*	0.32*
Power Distance	-0.05	-0.62*	-0.05	-0.52*	-0.73*	0.37*	-0.26*
Masculinity	-0.05	-0.04	-0.03	-0.06	-0.10	0.20	0.04

Notes: The indices are: creditor rights, property rights, the anti-self-dealing index, disclosure requirements, case-A efficiency, bankruptcy costs and propensity to file for bankruptcy. The stars (*) represent significance at the 5 percent level.
Sources: Djankov et al. 2003, 2006, 2007; The Heritage Foundation; La Porta et al. 2006; Hofstede 2001.

Table 4 explores the correlations between national cultural variables and creditor/shareholder protection mechanisms. Uncertainty aversion is negatively correlated with shareholder protection. This implies that highly uncertainty-averse countries tend to be associated with a lower protection of shareholders' rights. This is not surprising given the fact that usually, highly uncertainty-averse countries tend to be less supportive of market-based financial practices, usually being dominated by bank-based financial systems, rather than by stock-markets (Kirca et al. 2009; Kwok et al. 2006). Since they are not inclined to encourage market-based financial practices, we could also expect that they will give less importance to creditor and shareholder protection, which in turn will discourage corporate risk-taking. Individualism is, as expected, highly positively correlated with strong property rights, and with a good efficiency of debt enforcements and contracts. Power distance is negatively correlated with property rights, efficiency of debt enforcement and enforceability of contracts.

It also appears that the propensity to file for bankruptcy is influenced by national culture. The correlation analysis shows that individualism is positively and power distance is negatively linked to the propensity to file for bankruptcy. Cultures which are more individualistic might be more inclined to offer individuals "a fresh start" providing the financially troubled entity with an opportunity take responsibility for the financial failure and to obtain relief and properly position itself to re-join the economy as a productive member of society (Efrat 2002). Thus, more individualistic societies might render it easier to file for bankruptcy, while at the same time encouraging greater risk-taking because bankruptcy costs are not that high. More egalitarian societies (lower power distance countries) also seem to make it easier to file for bankruptcy. Thus, we hypothesize that both individualism and power distance will indirectly affect corporate risk-taking through their effects on a society's bankruptcy rules. To summarize, the sixth hypothesis is

H6: The higher the level of individualism, the stronger the positive link between the level of bankruptcy protection and risk-taking. The lower the level of uncertainty aversion, the stronger the relationship between shareholders' rights and corporate risk-taking. The higher the level of power distance, the lower the link between protection mechanism indicators and corporate risk-taking.

Industry Effects

Culture has an important impact upon economic development and upon the pattern of industrial relations found in a given country. National cultural values can dictate the types of industries economic activity is concentrated in, besides more obvious reasons such as resource availability or financial development (Whyte 1963).

Table 5. Correlation Matrix between National Culture and Industry Indicators

	Industrial diversification	*Industry concentration*	*Concentration in highly opaque industries*	*Concentration in less opaque industries*	*Economic development*
Uncertainty Aversion	-0.31*	0.06*	0.12*	0.05*	-0.54*
Individualism	0.69*	-0.09*	-0.25*	-0.06*	0.65*
Power Distance	-0.41*	-0.01*	0.08*	-0.02*	-0.51*
Masculinity	0.24*	-0.28*	-0.35*	-0.27*	0.08

Notes: Industrial diversification is an index which measures the diversity of industrial activities (higher values correspond to a spreading of employment and investment over a wider range of industries). The industry concentration represents the amount of competition among firms within an industry and is calculated as the Herfindahl index (the higher the index, the lower the competition). Opaque industries represent any industry whose stock price informational opacity is higher than 3.5. Economic development is the log of GDP per capita. The stars (*) represent significance at the 5 percent level.
Sources: CVU; Worldscope; Bankscope; Datastream.

Table 5 explores the correlations between national cultural variables and industry diversification, industry competition and economic development. It shows that more individualistic countries tend to have economic activity spread into a larger palette of industries. Also, the lower the level of uncertainty aversion and the lower the level of power distance, the higher the diversification of the country's industries. There are also significant correlations between cultural norms and industry competition. Countries ranking high in masculinity and in individualism tend to have, on average, more competitive industries. On the other hand, countries ranking high in uncertainty aversion tend to have more concentrated industries with few players. The results are especially strong for industries which are more informationally opaque (finance, IT, petroleum refining, and mining). There is also a strong relationship between national cultural values and the level of economic development. Countries ranking high in individualism tend to be strongly associated with a higher level of economic development, while countries high in power distance (less egalitarian) and high in uncertainty aversion tend to be strongly negatively correlated with economic development.

Because individualism and masculinity are more negatively correlated with concentration in the highly opaque industries, as compared to the more transparent industries, we hypothesize that firms in these industries will take on more risk. Excessive competition among firms within highly opaque industries can encourage them to pursue riskier policies in an attempt to maintain their former profits. To summarize the seventh hypothesis

H7: The higher the level of uncertainty aversion, the less the risk in industrial sectors which are more informationally opaque. The higher the levels of individualism and masculinity, the higher the risk-taking behavior of firms in more informationally opaque industries.

Firm Effects

National cultural variables can influence the way a firm chooses its compensation practices and ownership structure. Equity-based compensation is usually awarded to managers to overcome managerial risk aversion and induce optimal risk-taking behavior (Smith and Stulz 1985; Guay 1999). Nash et al. (2012) have shown that individualism is positively, while uncertainty avoidance is negatively related to firm level equity-based compensation practices. At the same time, several studies have proven that corporate risk-taking behavior depends on compensation practices and ownership structure. Low (2009), among many others, has proved that equity-based compensation affects managers' risk-taking behavior. Laeven et al. (2009) have shown that risk-taking also varies positively with the comparative power of shareholders within the corporate governance structure.

We postulate that both individualism, which accentuates self-interests and individual autonomy, and uncertainty aversion will indirectly influence corporate risk-taking through their effects on compensation practices and ownership structure. Since firm-level equity-based compensation is more frequent in highly individualistic and low uncertainty-avoidant countries, we predict that firms in such countries will be more risk-seeking. These suggestions only reinforce the previous hypotheses, suggesting that uncertainty aversion will be negatively, and individualism will be positively related to firm risk-taking decisions.

V. EMPIRICAL MODEL

Because the dataset analyzed is a hierarchical model, consisting of 50, 000 firms, nested across 400 industries in 51 countries, all analyses are performed using a linear mixed model procedure in Stata MP/11.2, controlling for firm, industry and country-level characteristics. From an econometric perspective, observations at the firm level are clustered under higher entities (e.g. firms grouped within industries within countries) and analyzing the data through ordinary least squares (OLS) or general linear models (GLS) could lead to a multitude of problems such as obtaining correlated errors, biased estimates of coefficient standard errors, and wrongfully interpreting the results and significance of the predictor variables (Garson 2012).

While previous literature has studied the effects of culture on risk-taking through OLS (Kanagaretnam et al. 2011) or through GLS methods (Li and Zahra 2011), we make full use of a more recently developed modeling technique, hierarchical linear mixed models (HLM), which can process multilevel data where observations are not independent. That is, linear mixed models are not only needed, but required in this case, since the OLS and GLS regression assumption of independent errors is violated: the data is clustered by a higher order grouping variable and by repeated time measures. Compared to OLS and GLS regressions, hierarchical linear mixed models correctly compute coefficient estimates and standard errors even when observations display intraclass correlation – that is, individual-level observations from the same upper level group will not be independent, but rather more similar due to factors such as shared group history and group selection processes.

There are several advantages of using a multilevel hierarchical model. First, we can statistically test multi-level theories, simultaneously modeling variables at the firm, industry and country level without having to recourse to data aggregation or disaggregation as previous cultural economics literature has had to do. Second, the multilevel hierarchical model has the ability to handle unbalanced data where sample size varies across higher levels, as in our case where the number of

firms varies widely across industries across countries. Third, in explaining corporate risk-taking, the linear mixed model focuses on differences between groups (e.g. industries, countries) in relation to differences within groups (e.g. among firms within industries within countries), making it possible to model not only individual firm, industry and country-level characteristics, but also their cross-level interactions.

Before specifying the hierarchical linear mixed model, we mean center the independent variables by their grand mean. This is a customary procedure which improves the interpretability of coefficients and reduces multicollinearity (Garson 2012). Then, we create grand-mean adjusted independent variables averaged within an industry and a country which we will denote as ending with the suffix "_indus_ctry_mean". Thus, for each industry within a country we will have grand-mean adjusted independent variables which do not change across firms, but only across industries within countries. Lastly, we create an additional set of variables of within-country variability, ending with the suffix "_firm_var", defined as the grand mean-adjusted independent variables in step 1 minus the grand-mean adjusted independent variable averaged within an industry and a country in step 2. These variables are practically deviations of firm-level variables from their corresponding industry and country-level means and inform our analysis by taking into account and separating the covariances within- and between industries in a given country.

The basic model we fit is specified as follows:

$$Risk-Taking_{ijk} = \alpha + \sum_1^4 \beta_j * Culture_j + \sum_1^7 \varphi_j * Country\_Controls_j + \sum_1^2 \theta_k * Industry\_Controls_k +$$
$$+ \sum_1^5 \sigma_i * Firm\_Controls\_Firm\_Var_i + \sum_1^5 \lambda_i * Firm\_Controls\_Indus\_Ctry\_Mean_i + \varepsilon_{ijk} \qquad (1)$$

where $Risk-Taking_{ijk}$ can be either the z-score, or the standard deviation of ROA, or the R&D index of firm *i* in country *j* in industry *k*.

$Culture_j$ is a vector composed of four national cultural variables: uncertainty aversion, individualism, power distance and masculinity as defined at the beginning of this section. $Country\_Controls_j$ is a vector of country-level variables such as economic development, the policy rate, and aggregate economic volatility. At the country level, we also control for variables such shareholder protection, creditor rights, and bankruptcy costs, besides controlling for a country's overall quality of formal institutions, which is an index of seven institutional measures calculated through principle component analysis. $Industry\_Controls_k$ is a vector of industry-level variables such as industry competition and industry informational opacity. Similar to Griffin et al. (2012), we decompose the firm-level controls into firm-level deviations and industry/ country-level means to understand the differential firm and industry/country-level effects. More specifically, $Firm\_Controls\_Firm\_Var_i$ is a vector comprising of firm size, leverage, profitability, sales growth, and dependence on external finance. $Firm\_Controls\_Indus\_Ctry\_Mean_i$ is an additional set of controls which will help us understand the differential industry/country-level effects.

VI. RESULTS AND DISCUSSION

Clearly, national cultural differences play a very important role in corporate risk-taking decisions. Table 6 on the following page presents the results of the empirical model. In Appendix C, we present more detailed HLM and OLS regression results for each measure of corporate risk-taking.

Models (2), (4) and (6) present the estimated coefficients for the direct and indirect effects of individual cultural variables, uncertainty aversion, individualism, power distance and masculinity respectively, on corporate risk-taking after controlling for country, industry and firm-level characteristics. Models (1), (3) and (5) present the coefficients obtained through OLS estimation, which we include for comparison purposes.

A. Direct Effects of Culture

Consistent with our predictions, national cultural differences are significant in directly explaining corporate risk-taking decisions, even after taking into consideration their effects on the institutional, economic and industrial environments. Two of the four cultural variables considered: uncertainty aversion and individualism are significant, robust and with the predicted signs across all model estimations. Power distance is significant and with the predicted sign when considering its effects on the z-score and on the R&D index, but it loses explanatory power in the σ(ROA) specification. The masculinity index is not significant in any of the HLM specifications.

These results indicate that firms take less risk in societies where uncertainty aversion is high, individualism is low and power distance is high, confirming hypotheses H1, H2 and H3. We reject hypothesis H4, that masculinity is positively related to risk-taking because we do not find robust and consistent evidence across the models analyzed.

The economic significance of the direct impact of national cultural variables on corporate risk-taking is noteworthy. A one standard deviation change in uncertainty aversion (21.7) is associated with a change in the z-score of 0.1085 (0.005*21.7), where the mean z-score is 0.019 and the standard deviation is 1.12. Similarly, it is associated with a change in the standard deviation of ROA of 4.1447 (0.191*21.7), where the mean σ(ROA) is 23.367 and its standard deviation is 51.18, and with a change in the R&D index of .2387 (0.011*21.7), where the mean R&D index is 0.02 with a standard deviation of 0.04. Additionally, a one standard deviation change in individualism (28.9) is associated with a change in the z-score of 0.2312 (0.008*28.9), with a change in the σ(ROA) of 6.5314 (0.226*28.9), and with a change in the R&D index of 9.9127 (0.343*28.9). Lastly, a one standard deviation change in power distance (18.7) causes a 0.0187 (0.001*18.7) change in the z-score and a 2.6741 (0.143*18.7) change in the R&D index.

These results suggest that the economic significance of each of these three national cultural norms is nontrivial, and rather remarkable, especially since each estimation model controls for several institutional and industrial variables which at their turn are influenced by national culture. Overall, the evidence suggests that national cultural values play a direct and important role in influencing corporate risk-taking decisions.

With regards to the firm-level controls, we find that firm profitability and sales growth are significant and negative across all model specifications. These results suggests that the more profitable the firm and the higher its sales, the less risk the firm takes. Firm size and leverage do not

seem to be robust across specifications. In fact, firm size seems to be negatively related to the inverse of the z-score, but positively related to the standard deviation of return on assets, while insignificant in the R&D model.

Table 6. Effects of National Culture on Corporate Risk-Taking

		Dependent variable: Risk-Taking					
	Explanatory variables	Inverse of The z-Score		Standard Deviation of Return on Assets		Research & Development Index	
	↓	(1)	(2)	(3)	(4)	(5)	(6)
		OLS	HLM	OLS	HLM	OLS	HLM
Culture	Uncertainty Aversion (UAI)	**-0.005*** **	**-0.005*** **	**-0.568*** **	**-0.191** **	**-0.568*** **	**-0.011** **
		[0.001]	[0.003]	[0.013]	[0.086]	[0.027]	[0.006]
	Individualism (IDV)	**0.003*** **	**0.008*** **	**0.726*** **	**0.226** **	**0.242***	**0.343** **
		[0.001]	[0.003]	[0.015]	[0.103]	[0.147]	[0.160]
	Power Distance (PDI)	**-0.006*** **	**-0.001** **	**-0.415*** **	-0.053	**-0.210*** **	**-0.143*** **
		[0.001]	[0.001]	[0.019]	[0.102]	[0.064]	[0.058]
	Masculinity (MAS)	0.001	0.001	**0.194*** **	0.043	**0.077*** **	0.131
		[0.001]	[0.001]	[0.015]	[0.072]	[0.015]	[0.126]
Country	Financial Development	0.003***	0.004	0.002	-0.411*	0.029	0.116
		[0.001]	[0.006]	[0.022]	[0.236]	[0.156]	[0.348]
	Central Bank Policy Rate	-0.007***	-0.008	-1.076***	0.323	-0.682***	-0.950
		[0.001]	[0.016]	[0.026]	[0.555]	[0.237]	[0.944]
	Shareholders' Rights Index	0.047	0.085	54.129***	17.687**	8.596	15.744
		[0.068]	[0.260]	[1.627]	[7.840]	[5.623]	[14.059]
	Creditor Rights	0.012	-0.020	-17.687***	-3.525**	0.761	-1.592
		[0.011]	[0.055]	[0.359]	[1.654]	[2.219]	[2.762]
	Cost Of Bankruptcy	-0.006***	-0.002	-0.318***	0.026	-0.029	0.106
		[0.002]	[0.007]	[0.034]	[0.224]	[0.077]	[0.414]
	Formal Institutions Index	1.025***	1.053*	28.067**	30.940**	2.268**	4.524**
		[0.255]	[0.622]	[11.196]	[15.559]	[1.136]	[2.198]
	Aggregate Econ Volatility	3.181**	4.247	575.432***	-117.931	249.115*	310.907
		[1.494]	[5.486]	[32.444]	[181.592]	[136.537]	[337.379]
Industry	Industry Opacity	-0.035***	-0.038***	-0.433*	0.136	-2.081**	-2.852**
		[0.008]	[0.007]	[0.224]	[0.209]	[1.007]	[1.307]
	Industry Competition	0.091***	0.216*	8.005***	9.391***	6.475***	2.697*
		[0.034]	[0.124]	[1.377]	[2.603]	[1.881]	[1.492]
Firm	Firm Size	-0.121***	-0.082***	2.331***	2.216***	-0.733	-1.233
		[0.004]	[0.004]	[0.089]	[0.121]	[0.554]	[0.751]
	Firm Leverage	0.001	-0.003***	-0.010	-0.098***	-0.022	-0.054
		[0.000]	[0.000]	[0.015]	[0.007]	[0.040]	[0.044]
	Firm Profitability	-0.115***	-0.029***	0.016***	0.701***	-0.248**	-0.173***
		[0.001]	[0.000]	[0.002]	[0.008]	[0.109]	[0.046]
	Firm Sales Growth	-0.047***	-0.289***	-0.495***	0.809	-2.939**	-7.465**
		[0.008]	[0.022]	[0.078]	[0.501]	[1.232]	[3.032]
	Firm Depend. Extern Finance	0.000**	-0.003***	0.000	0.018***	-0.016	-0.050
		[0.000]	[0.000]	[0.001]	[0.007]	[0.013]	[0.041]
	Observations	94997		132571		132755	
	Number of firms	20055	20055	24197	24197	24328	24328
	R-square overall	0.207		0.504		0.060	

Notes: Hierarchical linear mixed model estimation, with observations clustered at the industry- and country-levels. All regressions control for country-specific variables (financial development; policy rate; shareholder rights; creditor rights; bankruptcy costs; an index of the quality of formal institutions comprising of rule of law, regulatory quality, government effectiveness, efficiency of debt enforecement, control of corruption, voice and accountability and political stability; and aggreagate economic volatility), industry-specific variables (industry opacity; industry competition), and firm-specific variables (size; leverage; profitability; sales growth; and dependence on external finance). The estimation period is 2000-2012 and includes 50,000 firms, from 50 countries. OLS coefficients presented for comparison purposes. OLS regressions employ robust standard errors clustering at the country level with industry fixed effects not reported in this table. All regressions exclude U.S. firms. Robust standard errors in parentheses. Stars ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

B. Indirect Effects of Culture

So far, this paper has discussed the direct effects of culture by studying the impact of four cultural dimensions on corporate risk-taking and finding that three of them: uncertainty aversion, individualism and power distance have a direct, significant impact on corporate risk-taking. We are also interested in examining the indirect effects of national culture on the level of firm risk-taking. Table 6 simultaneously captures the indirect effects of culture by examining several country and industry-level controls which as previously discussed, are influenced by national cultural norms. Tables C1, C2 and C3 in Appendix C present more detailed HLM and OLS regression results for each measure of corporate risk-taking.

The overall formal institution index, which is calculated as a weighted index of the quality of seven formal institutions is significant and positive across all models. This suggests that the better a country's formal institutions, the more risk-seeking the firms in that country will be. Variables which make up this index, such as regulatory quality, rule of law, efficiency of debt enforcement, political stability and government effectiveness, encourage firms to take on more risk because they provide a framework which protects property rights and enforces contracts. A better contracting environment encourages greater risk-taking because it guarantees that the risk-taker keeps the fruit of risk-taking. The coefficients on shareholders' rights are strongly positive and strongly significant in both the OLS and the HLM specifications (17.687**) for the stdev (ROA) model. This suggests that the better the shareholders' protection, the more risk a firm will take. The opposite can be said for creditors' rights. Higher creditors' rights are associated with lower corporate risk-taking and with a lower volatility of return on assets (-3.525**).

As for the industry controls, we find that industry competition is significantly and positively, while industry informational opacity is negatively associated with corporate risk-taking. It is unsurprising that industry structure has a strong impact on the rules of the competitive market game, as well as on the risk-taking strategies that a company might pursue. Our analysis suggests that firms which belong to industries which are more competitive and less concentrated tend, on average, to take on more risk. They will increase their level of R&D expenditures and pursue riskier projects in order to get ahead of their competitors. Thus the level of industrial competition increases a firm's risk-taking behavior in that particular industry compared to the other industries. However, it seems that the more informationally opaque the industry in which a firm operates in, the lower the firm's risk-taking behavior.

VII. ACCENTUATING/ MODERATING FACTORS

Table 7 - and the more detailed Table C4 in Appendix C - present the accentuating/moderating factors that increase/decrease corporate risk-taking. They show that culture interacts with the various institutional, political and economic forces to produce very different and specific outcomes.

The columns numbered (1) in Table 7 show that the effects of national governance indicators depend on the level of informal national cultural values. These columns examine the interaction effects between various cultural variables and an index of the overall quality of institutions within a country (rule of law, control of corruption, regulatory quality, political stability, etc). The results verify hypothesis H5, showing that the higher the level of individualism, the stronger the positive relationship between formal institutions and corporate risk-taking. This implies that the higher a country's individualism and the better its formal institutions, the more risk firms in those countries will take. On the other hand, the coefficient on the interaction variable between power distance and formal institutions is not significant. Individually, power distance is negatively, while the formal institutions index is positively and significantly directly related to corporate risk-taking. The fact that their interaction is not significant suggests that the higher societies' level of power distance, the weaker the positive relationship between formal institutional development and corporate risk-taking. The results are robust across all three specifications: for the inverse of the z-score, the σ(ROA) and the R&D index.

The columns numbered (2) in Table 7 present the interactions between national cultural values and bankruptcy rights. The analysis shows no consistent pattern, and therefore we reject our hypothesis H6. We do mention that for the inverse of the z-score, which is a proxy for corporate risk-taking, stronger shareholders rights tend to increase the level of firm risk-taking in highly individualistic societies. Stronger creditors' rights in highly individualistic societies tend to slightly decrease risk-taking as shown by the negative and significant coefficient (-0.009***), while worse debt enforcement in high power distance countries tends to also decrease corporate risk-taking (-0.118*).

The columns numbered (3) in Table 7 show that corporate risk-taking in informationally opaque industries is strongly moderated by national cultural values. The interaction between uncertainty aversion and industry informational opacity is negative and significant across all model specifications (-0.001* for the inverse of the z-score, -0.006* for the stdev(ROA) and -0.058* for the R&D index). This suggests that firms tend to take even *less* risk in industries which are high in informational opacity if they are also located in a society which is high in uncertainty aversion. Such firms will be even more cautious in pursuing risky projects. Surprisingly, the coefficient on the interaction variable between individualism and industry opacity is highly positive and significant across all models (1.185* for the inverse of the z-score, 27.323** for the stdev(ROA) and 94.36* for the R&D index). This implies that in highly informationally opaque industries, such as finance, IT, mining or oil refinery, firms tend to take even *more* risk if they are located in a highly individualistic society. This result is very surprising because the general expectation is that a firm in an opaque industry takes less risk. However, this is not the case in a highly individualistic society. This puzzling result might be the consequence of highly opaque industries being more competitive in highly individualistic societies compared to the less opaque industries, and also compared to the more collectivistic societies. Neither masculinity, nor power distance seem to moderate risk-taking in highly opaque industries and the coefficients on these two interaction variables are not significant. Overall, these results partly confirm hypothesis H7.

Table 7. Accentuating/Moderating Factors

		Dependent variable: Risk-Taking								
	Explanatory variables ↓	Inverse of the z-score			Stdev(Return on assets)			Research & Development		
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Culture	UAI	**-0.005*** **	**-0.007** **	**-0.004***	**-0.297*** **	**-0.339** **	**-0.360*** **	**-0.010** **	**-0.089** **	**-0.038** **
		[0.003]	[0.003]	[0.003]	[0.096]	[0.170]	[0.097]	[0.004]	[0.49]	[0.184]
	IDV	**0.013***	**0.004** **	**0.015*** **	**0.538*** **	**0.381***	**0.444*** **	**0.113***	0.267	**0.297** **
		[0.006]	[0.002]	[0.004]	[0.183]	[0.199]	[0.098]	[0.060]	[0.437]	[0.132]
	PDI	**-0.001** **	-0.004	**-0.008***	-0.097	**-0.493** **	**-0.242** **	**-0.001** **	**-0.411***	**-0.695** **
		[0.001]	[0.006]	[0.004]	[0.139]	[0.199]	[0.103]	[0.001]	[0.242]	[0.339]
	MAS	0.001	0.003	0.004	0.094	0.060	0.098	0.095	0.278	0.151
		[0.001]	[0.003]	[0.003]	[0.080]	[0.096]	[0.090]	[0.088]	[0.180]	[0.161]
H5	IDV x F. Institutions	**0.006** **			**0.155***			**0.259***		
		[0.003]			[0.083]			[0.141]		
	PDI x F. Institutions	1.306			25.691			0.009		
		[2.703]			[104.102]			[0.245]		
H6	UAI X Creditors' Rights		-0.002			-0.022			-0.008	
			[0.002]			[0.081]			[0.094]	
	1/UAI X Shareholders' Rights		4.566			4.691			-231.375	
			[3.876]			[151.232]			[142.655]	
	IDV X Creditors' Rights		**-0.009*** **			-0.031			-0.076	
			[0.002]			[0.089]			[0.129]	
	IDV X Shareholders' Rights		**0.037*** **			0.264			0.555	
			[0.010]			[0.423]			[0.678]	
	IDV X Eff. of Debt Enforcement		0.000			0.004			**0.013***	
			[0.000]			[0.004]			[0.007]	
	PDI X 1/Eff. of Debt Enforcement		**-0.118***			-1.121			-2.995	
			[0.068]			[2.198]			[4.670]	
	IDV X 1/Cost of Bankruptcy		0.005			-0.002			0.237	
			[0.004]			[0.156]			[0.272]	
	PDI X Cost of Bankruptcy		0.000			-0.001			-0.001	
			[0.000]			[0.012]			[0.018]	
H7	UAI x Industry Opacity			**-0.001***			**-0.006** **			**-0.058***
				[0.000]			[0.003]			[0.034]
	IDV x Industry Opacity			**1.185***			**27.323** **			**94.36***
				[0.659]			[12.298]			[50.038]
	PDI x Industry Opacity			0.001			0.019			0.107
				[0.001]			[0.020]			[0.065]
	MAS x Industry Opacity			0.167			-3.189			0.031
				[0.244]			[6.314]			[19.579]
	Number of firms	20055								

Notes: Notes: Hierarchical linear mixed model estimation, with observations clustered at the industry- and country- levels. All regressions control for country-specific variables (financial development; policy rate; shareholder rights; creditor rights; bankruptcy costs; an index of formal institutions; and aggreagate economic volatility), industry-specific variables (industry opacity; industry competition), and firm-specific variables (size; leverage; profitability; sales growth; and dependence on external finance). The estimation period is 2000-2012 and includes 50,000 firms, from 50 countries. OLS coefficients presented for comparison purposes. OLS regressions employ robust SE clustering at the country level with industry fixed effects not reported. All regressions exclude U.S. firms. Robust standard errors in parentheses. Stars ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

VIII. FURTHER IDENTIFICATION TEST: FOREIGN VERSUS DOMESTIC FIRMS

By this stage, we have shown that on average national cultural values influence firm risk-taking both directly and indirectly, subsequent to the quality of formal institutions and the industry a firm operates in. In this section, we further study whether domestic firms and foreign firms respond to cultural norms in the same way. To test this, we divide our sample into domestic versus foreign firms and re-estimate regression (1) for each sample separately. For the foreign firms, we use as explanatory variables both the host country's and the origin country's cultural values and macro-economic indicators separately. Before we present the results, we draw attention to the fact that the sample of foreign firms used in the analysis is very limited (only 500 foreign firms).

Regressing corporate risk-taking on cultural, legal, firm-specific and country-specific economic controls for the large subsample of domestic firms strengthens the initial results and renders some coefficients even more significant. We do not report them here since they are very similar to Table 6, and likely driving the previous results. Table 8 presents the regression results for foreign subsidiaries. It shows that (with the exception of power distance) a host country's cultural values do *not* explain the corporate risk-taking behavior of foreign firms, while the parent country's cultural values do. This is a strong identification test which takes care of the potential omitted variable bias which might influence the previous results. In other words, it is less about the economy in which a firm operates, and more about the culture of its country of origin.

Thus, for a firm belonging to country A (with headquarters in country A) but operating in country B, most of country B's cultural norms will not impact the risk-taking appetite of that firm. However, country A's cultural values will be significant with the predicted sign in explaining corporate risk-taking decisions. This result is somewhat surprising. As an example, it implies that the risk-taking behavior of a Japanese[7] branch operating in the U.S. is less determined by American cultural values, but rather by Japanese values. As another example, the risk-taking behavior of a German firm operating in highly uncertainty-averse Greece will not be determined by Greek cultural norms as much as by German values.

These results suggest that even if a firm moves its business to another country, it takes a while for it to adopt new cultural norms, and that it will continue to behave according to the cultural norms of the society it originated in. Domestic regulatory laws will have different effects and produce different outcomes for domestic versus foreign firms. Foreign firms will most likely exhibit the same behavior as domestic firms in the country of origin. Thus, a firm coming from a society which values individualism, but operating in a collectivist society will take on more risk than a domestic firm in the collectivist society. More broadly, this suggests that the same regulatory structures can produce very different outcomes for culturally different firms (domestic versus foreign firms).

These surprising results also open up the question as to whether globalization can affect the stability of sovereigns. If the risk-taking behavior of a foreign branch is not determined by the host country's values in as much as by the parent country's values, we are left with the question of whether separate regulatory frameworks should be applied to foreign versus domestic firms. While a worthwhile topic, this idea should constitute the subject of further in-depth research. A caveat of the

[7] Japan is a highly uncertainty averse country, whereas the U.S. scores low in uncertainty aversion.

results presented in this section is that the sample of foreign firms is very limited (only 500 foreign firms) compared to the sample of domestic firms (about 20 000 entities) and more research is needed in order to draw reasonable conclusions. A further limitation of these results is that the analysis does not take into account the length of time a foreign firm has operated in a country, nor the cultural diversity of the management board, two additional caveats which might strengthen or weaken certain conclusions.

Table 8. Foreign Firms' Risk-Taking Behavior and Culture

		Dependent variable: Risk-Taking					
	Explanatory variables ↓	Inverse of The z-Score		Standard Deviation of Return on Assets		Research & Development Index	
		(1) Host Country	(2) Origin Country	(3) Host Country	(4) Origin Country	(5) Host Country	(6) Origin Country
Culture	Uncertainty Aversion	-0.001	**-0.013***	-0.299	**-0.314***	0.048	**-0.010***
		[0.006]	[0.008]	[0.182]	[0.177]	[0.049]	[0.005]
	Individualism	0.005	**0.031*****	0.213	**0.554*****	0.056	**0.086***
		[0.006]	[0.010]	[0.211]	[0.203]	[0.040]	[0.048]
	Power Distance	**-0.014***	**-0.031*****	**-0.527****	**-0.778****	**-0.156*****	**-0.231*****
		[0.008]	[0.010]	[0.218]	[0.316]	[0.053]	[0.064]
	Masculinity	0.004	0.002	-0.123	0.043	-0.038	-0.061
		[0.005]	[0.006]	[0.147]	[0.072]	[0.039]	[0.050]
Country	Financial Development	-0.016	-0.048***	-1.453***	-1.340***	-0.123	-0.329***
		[0.013]	[0.016]	[0.345]	[0.335]	[0.094]	[0.089]
	Central Bank Policy Rate	0.065	-0.082	-0.739	0.244	-0.048	-0.479
		[0.043]	[0.068]	[1.379]	[1.342]	[0.324]	[0.455]
	Shareholders' Rights	1.204**	-1.173*	43.282**	26.477*	9.989***	16.078***
		[0.514]	[0.641]	[16.929]	[15.624]	[3.519]	[4.977]
	Creditor Rights	-0.103	-0.071	-7.054**	-8.128***	-0.497	-0.373
		[0.105]	[0.127]	[2.890]	[2.829]	[0.812]	[0.900]
	Cost Of Bankruptcy	-0.004	-0.029	-1.331**	-1.372**	0.128	-0.033
		[0.022]	[0.029]	[0.636]	[0.613]	[0.161]	[0.222]
	Formal Institutions Index	0.374	-0.358	22.548	52.519***	2.901	3.572
		[0.265]	[0.772]	[16.075]	[20.219]	[1.956]	[4.780]
	Aggregate Econ	42.260**	39.522**	-1,122.111***	-1,059.191***	143.569	-248.645**
		[18.494]	[18.125]	[309.063]	[298.680]	[178.317]	[98.337]
Industry	Industry Opacity	0.006	0.035	0.930	-4.753	-0.425	-0.307
		[0.052]	[0.051]	[1.040]	[3.728]	[0.449]	[0.473]
	Industry Competition	0.831	0.779	22.624	24.305*	4.04	2.436
		[0.607]	[0.546]	[14.011]	[13.591]	[4.948]	[5.247]
Firm	Firm Size	-0.341***	-0.145***	2.979***	2.886***	-0.266	-0.231
		[0.084]	[0.035]	[0.683]	[0.681]	[0.297]	[0.302]
	Firm Leverage	-0.040***	-0.382***	-8.158***	-8.202***	-3.826***	-2.934***
		[0.004]	[0.085]	[1.586]	[1.539]	[0.699]	[0.606]
	Firm Profitability	-0.419**	-0.041***	0.707***	0.706***	-0.172***	-0.160***
		[0.177]	[0.004]	[0.057]	[0.056]	[0.026]	[0.026]
	Firm Sales Growth	-0.001	-0.395**	-5.721*	-6.140*	-1.075	-0.271
		[0.002]	[0.177]	[3.185]	[3.163]	[1.448]	[1.471]
	Firm Depend. Ext. Fin.	0.001	0.001	0.142***	0.141***	0.043***	0.042***
		[0.002]	[0.002]	[0.034]	[0.034]	[0.015]	[0.015]
	Number of firms	500	500	491	491	499	499

Notes: Hierarchical linear mixed model estimation, with observations clustered at the industry- and country-levels. Columns (1), (3) and (5) present the results from regressing corporate risk-taking on cultural and macroeconomic variables belonging to the host country a firm operates in. Columns (2), (4) and (5) present the results from regressing risk-taking indicators on cultural and macroeconomic variables belonging to the origin country a firm comes from. All regressions exclude U.S. firms. Robust standard errors in parentheses. Stars ***, **, and * denote significance at the 1, 5, and 10 percent levels respectively.

IX. CONCLUDING REMARKS

Because firm practices, institutional/political systems, economic development and social mores are intertwined with the national culture from which they derive, studying corporate risk-taking decisions under a cultural umbrella seems appropriate. This paper has taken a different approach to the empirical study of the impact of culture on corporate risk-taking. Whereas prior literature has focused mostly on the behavior of firms in the financial or in the manufacturing industry separately, this paper has considered firms in each industry in a market-economy simultaneously, trying to infer whether there are differences between the effects of culture on corporate risk-taking behaviors of firms not only across countries, but also across industries. Furthermore, whereas prior work has largely studied the impact of culture on firm risk-taking through ordinary least squares or generalized least squares estimation techniques, this paper has used hierarchical linear mixed models to identify both the direct and indirect effects of national cultural values on corporate risk-taking.

The evidence indicates that culture remains an important determinant of corporate risk-taking decisions, even after taking into account its indirect effects on the institutional, economic and industrial environments in which a firm operates in. Firms in societies which are highly uncertainty-averse, low in individualism and high in power distance will tend to take on less risk. This pattern is especially strong for firms operating in industrial sectors which are more informationally opaque. The evidence also suggests that the effects of formal institutions, such as shareholders' protection or creditors' rights, depend on the level of informal national cultural values such as individualism. Culture interacts with the various social, political and economic forces to produce very different and specific outcomes.

The evidence also indicates that these results hold only for domestic firms. The behavior of foreign firms is most likely determined by the cultural norms of the society they originated in.

In designing this study, we had to make some tradeoffs in examining the effects of both formal and informal institutions on corporate risk-taking behaviors. Firstly, the cross-cultural comparison of firm risk-taking is constrained by data availability. In the contemporary globalized world, it is more likely than not that firms are managed by executives with diverse cultural backgrounds. Future research would benefit from a more detailed analysis which also examines the cultural distribution of a firm's board of directors and individual-level cultural traits. Secondly, the definitions of formal and informal institutions are complex and multi-faceted and require more in-depth analysis. Whether the national cultural dimensions can be considered as de facto practices ("as is") or as general values ("as should be") is important for conceptualizing their effects on corporate risk-taking and further research is clearly warranted. Thirdly, corporate risk-taking practices may vary across regions and organizations within the same country. Future research would benefit from analyzing the influence of regional and organizational differences on the heterogeneity of firm-level risk-taking behaviors within countries. And lastly, future research would also benefit from a better decomposition of risk-taking into the active decisions that a firm's managers take versus those institutional/regulatory constraints on risk-taking. For example, further research could look at cross-industrial differences in the regulatory environments and how regulation of different industries affects corporate risk-taking.

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APPENDIX

Appendix A: Measuring National Culture

The **uncertainty aversion index** for each country is constructed on the basis of the country mean scores for the following three questions:

a) Rule orientation: agreement with the statement "Company rules should not be broken, even when it is in the company's best interest."
b) Employment stability: employees' statement that they intend to remain employed at IBM for a certain number of years.
c) Stress: the mean answer to the question "How often do you feel nervous or tense at work?"

The **individualism index** for each country is similarly constructed from the following three items:

a) Importance attached to having enough personal/family time.
b) Importance attached to having good physical working conditions and a secure employment.
c) Importance attached to having a challenging, adventurous job.

The **power distance index** is similarly constructed from the following three items:

a) Perceptions of subordinates' fear of disagreeing with superiors;
b) Subordinates' perception that their boss takes decisions in an autocratic/paternalistic way;
c) Subordinates' preference for an autocratic, a persuasive/paternalistic, or a democratic/ consultative style of decision-making.

The **masculinity index** is similarly constructed from the following six items:

a) Job content and learning: how important is to have a job on which there is a great deal of day-to-day learning.
b) Rewards: how important it is to have opportunity for high earnings/career advancement.
c) Interpersonal relations: how important is to work with people who are team-workers.
d) Security: how important is to have job security of not being transferred to a less desirable job.
e) Comfort: how important is to have good physical working conditions.
f) Company: how important is to work in a company that is successful and modern.

Figure A1. National Culture by Income Group

Income Group	UAI	IDV	PDI	MAS
High Income	64.00	57	48	51
Middle Income	68.00	27	71	50
Low income	70.00	25	67	42
Correlation with income	-0.99*	0.98*	-0.92*	0.77*

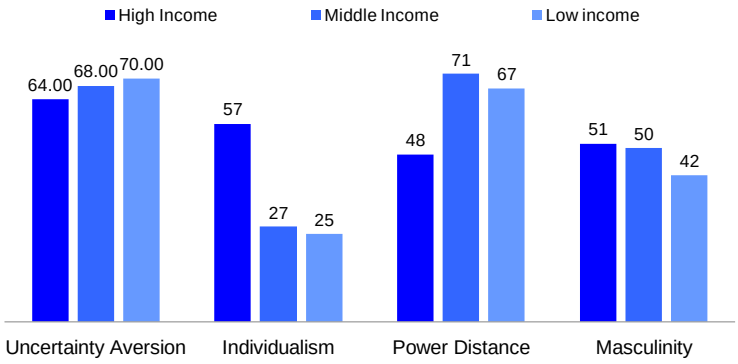


Figure A2. Heat Map of Uncertainty Aversion Index

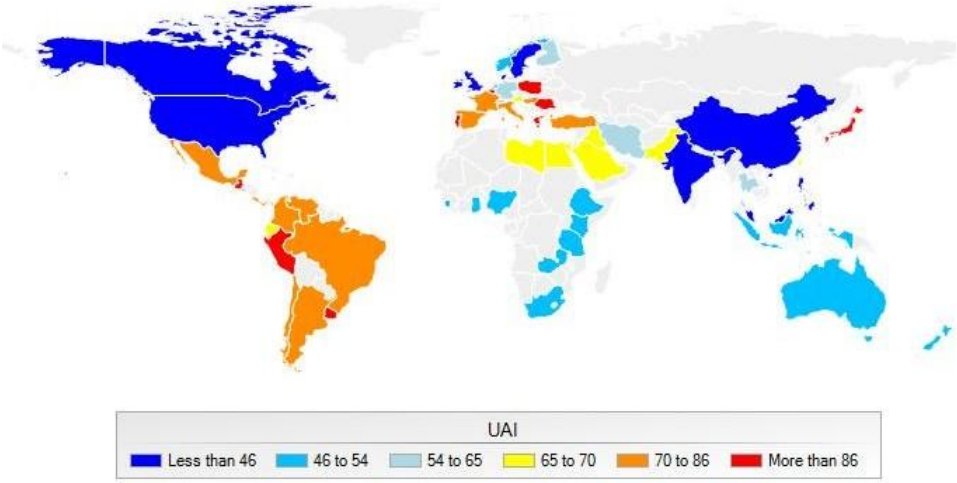


Figure A3. Heat Map of Individualism Index

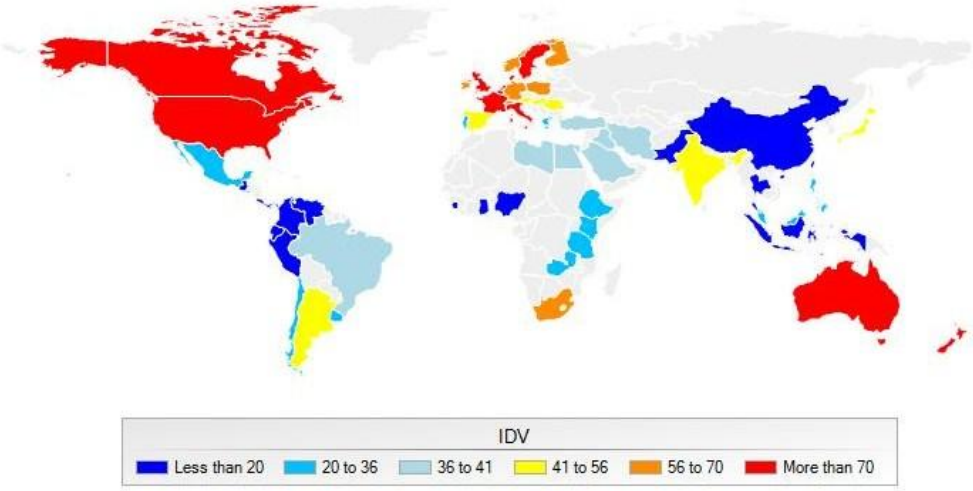


Figure A4. Heat Map of Power Distance Index

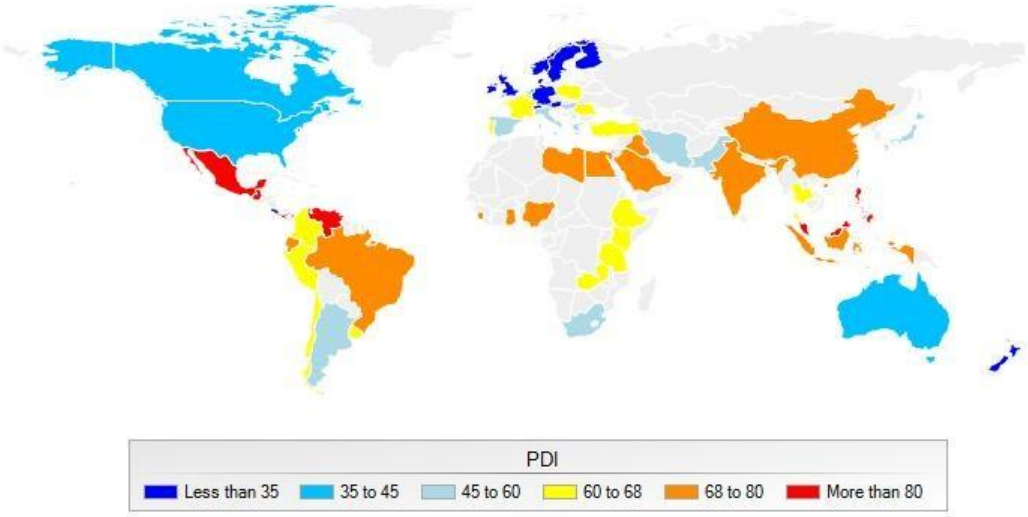
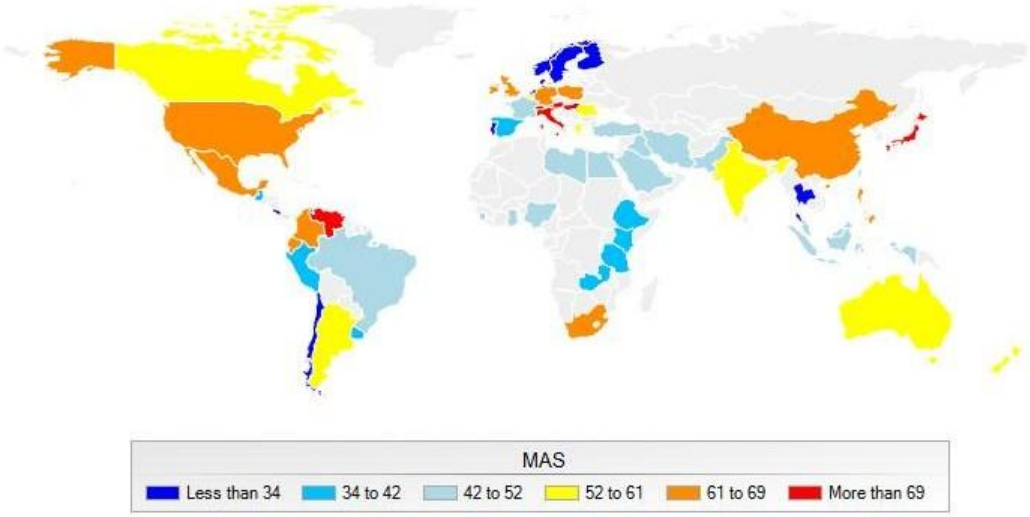


Figure A4. Heat Map of Masculinity Index



Appendix B: Measuring Industry Informational Opacity

First, we calculate firm *f*'s stock price returns as the weekly logarithmic growth of stock prices.

$$r_{f,t} = \ln (price_t/price_{t-1}) \quad (1)$$

Second, to measure the stock price informativeness in an industrial sector, we follow Huang (2008) and Durnev et al. (2004) who modify Roll's (1988) statistical R^2 to gauge firm-specific stock price return variations in industry *i*, by regressing firm *f*'s returns $r_{i,f,t}$ on industry-specific returns $r_{i,t}$ and market-specific returns $r_{m,t}$ simultaneously:

$$r_{i,f,t} = \alpha_{f,0} + \beta_{f,i} * r_{i,t} + \varphi_{f,m} * r_{m,t} + \varepsilon_{i,f,t} \quad (2)$$

The industry returns are the returns on a market capital-weighted portfolios of all firms in industry *i* excluding firm *f*. The weighting is done according to the firm *f*' share of market capital in industry *i*. The market returns are returns on a market capital-weighted portfolio including all NYSE, AMEX and NASDAQ listed stocks. This weighting is done according to the firm *f*'s share of market capital in market *m*. The exclusion of firm *f* prevents spurious correlations between firm and industry returns in industries that contain a limited number of firms.

One minus average R^2 of the regression using each firm in an industry measures the stock price informativeness of that industry. The more informative stock prices are, the lower the R^2 will be.

$$\text{Stock price informativeness} = 1 - R^2 \quad (3)$$

Because the distribution of $1 - R^2$ is negatively skewed, mildly leptokurtic and bounded within the unit interval, we follow Huang (2008) and Durvev et al. (2004) by applying a logistic transformation of the $1 - R^2$ to arrive at an industry opacity index defined as:

$$\text{Industry opacity} = \ln (1 - R^2 / R^2) = \ln (\text{Stock price informativeness} / R^2) \quad (4)$$

The industry opacity index will be, as a result of this manipulation, less skewed and less leptokurtic than $1 - R^2$. The higher the industry opacity, the less informative the stock prices in that industry.

The table below shows the industry opacity index for 140 industries.

Table B. Informational Opacity Index by Industry

SIC Code	Industry	R-squared	Informativeness index	Opacity Index
616	Mortgage Bankers & Loan Correspondents	0.0010	0.9990	6.903
614	Personal Credit Institutions	0.0014	0.9986	6.573
651	Real Estate Operators (No Developers) & Lessors	0.0015	0.9985	6.511
615	Short-Term Business Credit Institutions	0.0015	0.9985	6.489
358	Refrigeration & Service Industry Machinery	0.0017	0.9983	6.399
291	Petroleum Refining	0.0017	0.9983	6.396
351	Engines & Turbines	0.0018	0.9982	6.307
336	Nonferrous Foundries (Castings)	0.0019	0.9981	6.245
808	Services-Home Health Care Services	0.0020	0.9980	6.213
308	Miscellaneous Plastics Products	0.0022	0.9978	6.113
354	Metalworkg Machinery & Equipment	0.0023	0.9977	6.087
581	Retail-Eating & Drinking Places	0.0028	0.9972	5.877
209	Miscellaneous Food Preparations & Kindred Products	0.0028	0.9972	5.865
339	Miscellaneous Primary Metal Products	0.0031	0.9970	5.789
653	Real Estate Agents & Managers (For Others)	0.0032	0.9968	5.752
286	Industrial Organic Chemicals	0.0033	0.9967	5.721
508	Wholesale-Machinery, Equipment & Supplies	0.0033	0.9967	5.698
104	Gold and Silver Ores	0.0034	0.9966	5.690
299	Miscellaneous Products of Petroleum & Coal	0.0035	0.9966	5.665
306	Fabricated Rubber Products, NEC	0.0035	0.9965	5.652
484	Cable & Other Pay Television Services	0.0036	0.9965	5.638
359	Misc Industrial & Commercial Machinery & Equipment	0.0037	0.9963	5.588
514	Wholesale-Groceries & Related Products	0.0038	0.9963	5.583
204	Grain Mill Products	0.0042	0.9958	5.469
365	Household Audio & Video Equipment	0.0043	0.9957	5.436
349	Miscellaneous Fabricated Metal Products	0.0043	0.9957	5.435
809	Services-Misc Health & Allied Services, NEC	0.0044	0.9957	5.433
871	Services-Engineering Services	0.0044	0.9956	5.419
334	Secondary Smelting & Refining of Nonferrous Metals	0.0046	0.9954	5.374
509	Wholesale-Misc Durable Goods	0.0047	0.9953	5.349
347	Coating, Engraving & Allied Services	0.0049	0.9951	5.312
131	Crude Petroleum & Natural Gas	0.0049	0.9951	5.306
344	Fabricated Structural Metal Products	0.0053	0.9947	5.242
738	Services-Miscellaneous Business Services	0.0053	0.9947	5.227
603	Savings Institution, Federally Chartered	0.0059	0.9941	5.133
801	Services-Offices & Clinics of Doctors of Medicine	0.0064	0.9936	5.043
573	Retail-Radio, TV & Consumer Electronics Stores	0.0064	0.9936	5.042
379	Miscellaneous Transportation Equipment	0.0064	0.9936	5.041
473	Arrangement of Transportation of Freight & Cargo	0.0069	0.9932	4.977
489	Communications Services, NEC	0.0069	0.9931	4.974
631	Life Insurance	0.0069	0.9931	4.965
287	Agricultural Chemicals	0.0070	0.9930	4.961
591	Retail-Drug Stores and Proprietary Stores	0.0070	0.9930	4.953
731	Services-Advertising	0.0072	0.9929	4.933
807	Services-Medical Laboratories	0.0077	0.9923	4.862
521	Retail-Lumber & Other Building Materials Dealers	0.0077	0.9923	4.856
289	Miscellaneous Chemical Products	0.0078	0.9923	4.852
373	Ship & Boat Building & Repairing	0.0082	0.9918	4.794
109	Miscellaneous Metal Ores	0.0085	0.9915	4.755
483	Radio Broadcasting Stations	0.0087	0.9913	4.738
371	Motor Vehicles & Passenger Car Bodies	0.0091	0.9909	4.687
874	Services-Management Services	0.0093	0.9907	4.666
254	Partitions, Shelvg, Lockers, & office & Store Fixtures	0.0098	0.9903	4.620
138	Drilling Oil & Gas Wells	0.0098	0.9902	4.611
503	Wholesale-Lumber & Other Construction Materials	0.0102	0.9899	4.580
806	Services-Hospitals	0.0102	0.9898	4.572
372	Aircraft & Parts	0.0105	0.9895	4.546
628	Investment Advice	0.0106	0.9895	4.541
679	Oil Royalty Traders	0.0106	0.9894	4.538
345	Screw Machine Products	0.0106	0.9894	4.532
491	Electric Services	0.0113	0.9887	4.476
272	Periodicals: Publishing or Publishing & Printing	0.0139	0.9861	4.260

Table B. (Cont.) Informational Opacity Index by Industry

SIC Code	Industry	R-squared	Informativeness index	Opacity Index
357	Computer & office Equipment	0.0144	0.9856	4.225
811	Services-Legal Services	0.0146	0.9854	4.210
362	Electrical Industrial Apparatus	0.0152	0.9848	4.173
342	Cutlery, Handtools & General Hardware	0.0156	0.9844	4.144
361	Power, Distribution & Specialty Transformers	0.0162	0.9838	4.108
382	Laboratory Apparatus & Furniture	0.0164	0.9836	4.094
251	Household Furniture	0.0165	0.9835	4.088
458	Airports, Flying Fields & Airport Terminal Services	0.0165	0.9835	4.087
353	Construction, Mining & Materials Handling Machinery	0.0169	0.9831	4.063
346	Metal Forgings & Stampings	0.0171	0.9829	4.049
531	Retail-Department Stores	0.0172	0.9829	4.049
122	Bituminous Coal & Lignite Mining	0.0174	0.9826	4.034
517	Wholesale-Petroleum Bulk Stations & Terminals	0.0175	0.9825	4.028
323	Glass Products, Made of Purchased Glass	0.0181	0.9819	3.991
366	Telephone & Telegraph Apparatus	0.0186	0.9814	3.964
594	Retail-Miscellaneous Shopping Goods Stores	0.0191	0.9809	3.940
314	Footwear, (No Rubber)	0.0193	0.9807	3.929
245	Mobile Homes	0.0194	0.9806	3.923
363	Household Appliances	0.0197	0.9804	3.910
553	Retail-Auto & Home Supply Stores	0.0198	0.9802	3.900
386	Photographic Equipment & Supplies	0.0199	0.9801	3.897
324	Cement, Hydraulic	0.0205	0.9795	3.867
506	Wholesale-Electrical Apparatus & Equipment	0.0212	0.9788	3.833
596	Retail-Nonstore Retailers	0.0215	0.9785	3.819
505	Wholesale-Metals & Minerals (No Petroleum)	0.0221	0.9779	3.791
873	Services-Commercial Physical & Biological Research	0.0234	0.9766	3.730
391	Jewelry, Silverware & Plated Ware	0.0251	0.9749	3.660
265	Paperboard Containers & Boxes	0.0272	0.9728	3.578
516	Wholesale-Chemicals & Allied Products	0.0279	0.9721	3.552
327	Concrete, Gypsum & Plaster Products	0.0283	0.9717	3.535
452	Air Transportation, Nonscheduled	0.0304	0.9696	3.463
835	Services-Child Day Care Services	0.0325	0.9675	3.393
493	Electric & Other Services Combined	0.0333	0.9667	3.368
451	Air Transportation, Scheduled	0.0334	0.9666	3.365
783	Services-Motion Picture Theaters	0.0350	0.9650	3.316
511	Wholesale-Paper & Paper Products	0.0358	0.9642	3.292
502	Wholesale-Furniture & Home Furnishings	0.0378	0.9622	3.238
332	Iron & Steel Foundries	0.0389	0.9612	3.208
301	Tires & Inner Tubes	0.0399	0.9601	3.181
295	Asphalt Paving & Roofing Materials	0.0440	0.9560	3.079
609	Functions Related To Depository Banking, NEC	0.0516	0.9484	2.911
367	Electronic Components & Accessories	0.0532	0.9468	2.878
482	Telegraph & Other Message Communications	0.0551	0.9449	2.842
396	Costume Jewelry & Novelties	0.0592	0.9408	2.766
341	Metal Cans	0.0675	0.9325	2.626
276	Manifold Business Forms	0.0720	0.9280	2.557
565	Retail-Family Clothing Stores	0.0777	0.9223	2.475
387	Watches, Clocks, Clockwork Operated Devices/Parts	0.0796	0.9204	2.448
221	Broadwoven Fabric Mills, Cotton	0.0818	0.9182	2.419
322	Glass & Glassware, Pressed or Blown	0.0858	0.9142	2.366
395	Pens, Pencils & Other Artists' Materials	0.0905	0.9095	2.308
401	Railroads, Line-Haul Operating	0.0907	0.9093	2.305
211	Cigarettes	0.1011	0.8989	2.185
461	Pipe Lines (No Natural Gas)	0.1068	0.8932	2.124
422	Public Warehousing & Storage	0.1174	0.8826	2.018
227	Carpets & Rugs	0.1219	0.8782	1.975
328	Cut Stone & Stone Products	0.1240	0.8760	1.955
326	Pottery & Related Products	0.1275	0.8725	1.923
207	Fats & Oils	0.1606	0.8394	1.653
374	Railroad Equipment	0.1672	0.8328	1.606
278	Blankbooks, Looseleaf Binders & Bookbinding	0.4246	0.5754	0.304
279	Service Industries For The Printing Trade	0.4775	0.5225	0.090

Appendix C: Regression Results

Table C1. Explaining Corporate Risk-Taking Through the Inverse of the Z-Score

Dependent variable: Risk-Taking (Inverse of the z-score)

	Explanatory variable ↓	(1) Basic OLS case	(2) Basic HLM case	(3) Medium OLS case	(4) Medium HLM case	(5) Complex OLS case	(6) Complex HLM case	(7) Very complex OLS case	(8) Very complex HLM case
Culture	Uncertainty Aversion	**-0.001*** **	**-0.002*** **	**-0.004*** **	**-0.003*** **	**-0.005*** **	**-0.005***	**-0.005*** **	**-0.005*** **
		[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.003]	[0.001]	[0.003]
	Individualism	**0.005*** **	**0.007***	**0.002*** **	**0.008*** **	**0.002*** **	**0.007***	**0.003*** **	**0.008*** **
		[0.000]	[0.003]	[0.000]	[0.003]	[0.000]	[0.003]	[0.001]	[0.003]
	Power Distance	**-0.009*** **	**-0.003***	**-0.006*** **	**-0.003*** **	**-0.006*** **	**-0.003*** **	**-0.006*** **	**-0.001***
		[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
	Masculinity	0.000	0.002	0.001	0.002	**0.001*** **	0.001	0.001	0.001
		[0.000]	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]	[0.001]
Country	Financial Development	-0.001	0.013*	0.002**	0.015**	0.002***	0.007	0.003***	0.004
		[0.001]	[0.007]	[0.001]	[0.007]	[0.001]	[0.007]	[0.001]	[0.006]
	Central Bank Policy Rate	-0.010***	-0.026*	-0.006***	-0.023	-0.006***	-0.018**	-0.007***	-0.008
		[0.001]	[0.014]	[0.001]	[0.014]	[0.001]	[0.009]	[0.001]	[0.016]
	Shareholders' Rights Index	0.359***	0.147	0.113*	0.055	0.062	0.154	0.047	0.085
		[0.053]	[0.291]	[0.058]	[0.288]	[0.063]	[0.279]	[0.068]	[0.260]
	Creditor Rights	-0.004	-0.031	-0.001	-0.027	0.01	-0.036	0.012	-0.02
		[0.010]	[0.064]	[0.011]	[0.064]	[0.011]	[0.059]	[0.011]	[0.055]
	Rule of Law	0.026**	-0.009	0.048***	-0.052				
		[0.012]	[0.108]	[0.016]	[0.116]				
	Cost Of Bankruptcy			-0.009***	-0.003	-0.009***	-0.006	-0.006***	-0.002
				[0.001]	[0.008]	[0.002]	[0.007]	[0.002]	[0.007]
	Formal Institutions Index					1.021***	1.043*	1.025***	1.053*
						[0.232]	[0.604]	[0.255]	[0.622]
	Aggregate Real Econ Volatility							3.181**	4.247
								[1.494]	[5.486]
Industry	Industry Opacity							-0.035***	-0.038***
								[0.008]	[0.007]
	Industry Competition							0.091***	0.216*
								[0.034]	[0.124]
Firm	Firm Size	-0.118***	-0.080***	-0.111***	-0.085***	-0.118***	-0.083***	-0.121***	-0.082***
		[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.004]	[0.004]
	Firm Leverage	0.001	-0.001***	0.001	-0.003***	0.001	-0.003***	0.001	-0.003***
		[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Firm Profitability	-0.112***	-0.027***	-0.114***	-0.030***	-0.114***	-0.030***	-0.115***	-0.029***
		[0.001]	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]
	Firm Sales Growth			-0.051***	-0.276***	-0.050***	-0.278***	-0.047***	-0.289***
				[0.007]	[0.021]	[0.007]	[0.021]	[0.008]	[0.022]
	Firm Dependence Extern Finance			0.000**	-0.002***	0.000**	-0.002***	0.000**	-0.003***
				[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Observations	131446		104886		104886		94997	
	Number of firms	26777	26777	22202	22202	22202	22202	20055	20055
	R-square overall	0.192		0.200		0.202		0.207	

Notes: Hierarchical linear mixed regressions on the inverse of the zscore, defined as the inverse of natural logarithm of the ZScore. The sample period is 2000-2012 and includes firms from all industries. The model specifies two levels across which firms are nested: industry and country. We also report OLS regressions coefficients, for comparison purposes. The OLS regressions employ robust standard errors clustering at the country level with industry fixed effects which are not reported in the table. Stars ***, **, and * denote significance at the 1, 5, and 10 percent level.

Table C2. Explaining Corporate Risk-Taking Through the Standard Deviation of ROA

Dependent variable: Risk-Taking (Standard Deviation of Return on Assets)

	Explanatory variable ↓	(1) Basic OLS case	(2) Basic HLM case	(3) Medium OLS case	(4) Medium HLM case	(5) Complex OLS case	(6) Complex HLM case	(7) Very complex OLS case	(8) Very complex HLM case
Culture	Uncertainty Aversion	**-0.400*** **	**-0.161** **	**-0.512*** **	**-0.200** **	**-0.577*** **	**-0.166* **	**-0.568*** **	**-0.191** **
		[0.011]	[0.075]	[0.013]	[0.084]	[0.012]	[0.086]	[0.013]	[0.086]
	Individualism	**0.453*** **	**0.215*** **	**0.621*** **	**0.263*** **	**0.572*** **	**0.269*** **	**0.726*** **	**0.226** **
		[0.011]	[0.075]	[0.014]	[0.090]	[0.013]	[0.091]	[0.015]	[0.103]
	Power Distance	**-0.104*** **	**-0.147* **	**-0.107*** **	**-0.179* **	**-0.453*** **	-0.018	**-0.415*** **	-0.053
		[0.014]	[0.086]	[0.018]	[0.097]	[0.018]	[0.104]	[0.019]	[0.102]
	Masculinity	**0.155*** **	0.096	**0.246*** **	0.027	**0.187*** **	0.038	**0.194*** **	0.043
		[0.010]	[0.067]	[0.013]	[0.072]	[0.013]	[0.073]	[0.015]	[0.072]
Country	Financial Development	0.149***	-0.438**	0.124***	-0.422*	-0.008	-0.394	0.002	-0.411*
		[0.015]	[0.217]	[0.020]	[0.237]	[0.020]	[0.242]	[0.022]	[0.236]
	Central Bank Policy Rate	-0.416***	0.096	-0.627***	0.010	-1.005***	0.089	-1.076***	0.323
		[0.021]	[0.420]	[0.025]	[0.468]	[0.025]	[0.557]	[0.026]	[0.555]
	Shareholders' Rights Index	45.436***	17.767**	48.692***	18.761**	54.309***	19.263**	54.129***	17.687**
		[1.158]	[7.183]	[1.424]	[7.529]	[1.501]	[8.071]	[1.627]	[7.840]
	Creditor Rights	-17.255***	-2.945*	-19.860***	-3.211*	-18.086***	-3.389**	-17.687***	-3.525**
		[0.313]	[1.558]	[0.340]	[1.669]	[0.333]	[1.697]	[0.359]	[1.654]
	Rule of Law	7.644***	0.253	10.576***	-1.221				
		[0.265]	[2.520]	[0.398]	[3.518]				
	Cost Of Bankruptcy			-0.703***	-0.04	-0.546***	0.074	-0.318***	0.026
				[0.033]	[0.198]	[0.032]	[0.225]	[0.034]	[0.224]
	Formal Institutions Index					30.125**	32.090**	28.067**	30.940**
						[11.196]	[15.559]	[11.196]	[15.559]
	Aggregate Real Econ Volatility							575.432***	-117.931
								[32.444]	[181.592]
Industry	Industry Opacity							-0.433*	0.136
								[0.224]	[0.209]
	Industry Competition							8.005***	9.391***
								[1.377]	[2.603]
Firm	Firm Size	2.228***	2.943***	3.152***	2.219***	2.340***	2.236***	2.331***	2.216***
		[0.063]	[0.095]	[0.090]	[0.114]	[0.085]	[0.115]	[0.089]	[0.121]
	Firm Leverage	0.001***	-0.042***	-0.004	-0.102***	-0.013	-0.102***	-0.01	-0.098***
		[0.001]	[0.003]	[0.018]	[0.007]	[0.017]	[0.007]	[0.015]	[0.007]
	Firm Profitability	0.001	0.718***	0.022***	0.700***	0.019***	0.700***	0.016***	0.701***
		[0.002]	[0.006]	[0.003]	[0.007]	[0.002]	[0.007]	[0.002]	[0.008]
	Firm Sales Growth			-0.905***	0.574	-0.540***	0.632	-0.495***	0.809
				[0.080]	[0.466]	[0.076]	[0.467]	[0.078]	[0.501]
	Firm Dependence Extern Finance			0.000	0.018***	0.000	0.019***	0.000	0.018***
				[0.001]	[0.006]	[0.001]	[0.006]	[0.001]	[0.007]
	Observations	227993		145469		145469		132571	
	Number of firms	38398	38398	26683	26683	26683	26683	24197	24197
	Rsquare overall	0.314		0.470		0.480		0.504	

Notes: Hierarchical linear mixed regressions on the standard deviation of a firm's return on assets. The sample period is 2000-2012 and includes firms from all industries. The model specifies two levels across which firms are nested: industry and country. We also report OLS regressions coefficients, for comparison purposes. The OLS regressions employ robust SE clustering at the country level with industry fixed effects which are not reported in the table. Stars ***, **, and * denote significance at the 1, 5, and 10 percent level.

Table C3. Explaining Corporate Risk-Taking Through R&D Expenditures

Dependent variable: Risk-Taking (Research & Development Index)

	Explanatory variable	(1) Basic OLS case	(2) Basic HLM case	(3) Medium OLS case	(4) Medium HLM case	(5) Complex OLS case	(6) Complex HLM case	(7) Very complex OLS case	(8) Very complex HLM case
Culture	Uncertainty Aversion	**-0.035*** **	**-0.015*** **	**-0.101*** **	**-0.080** **	**-0.050** **	**-0.074** **	**-0.050** **	**-0.011** **
		[0.012]	[0.0078]	[0.028]	[0.037]	[0.036]	[0.036]	[0.027]	[0.006]
	Individualism	**0.090***	**0.156** **	**0.093***	**0.153** **	**0.142*** **	**0.219** **	**0.242***	**0.343** **
		[0.046]	[0.074]	[0.052]	[0.068]	[0.046]	[0.088]	[0.147]	[0.160]
	Power Distance	**-0.126*** **	**-0.169** **	**-0.172*** **	**-0.184** **	**-0.214*** **	**-0.217***	**-0.210*** **	**-0.143*** **
		[0.031]	[0.079]	[0.054]	[0.086]	[0.053]	[0.116]	[0.064]	[0.058]
	Masculinity	0.022	0.046	0.014	0.049	0.023	0.117	**0.077*** **	0.131
		[0.023]	[0.065]	[0.027]	[0.073]	[0.034]	[0.099]	[0.015]	[0.126]
Country	Financial Development	0.237***	0.241*	0.336***	0.374*	0.249**	0.310	0.029	0.116
		[0.047]	[0.184]	[0.086]	[0.209]	[0.125]	[0.279]	[0.156]	[0.348]
	Central Bank Policy Rate	-0.722***	-0.240***	-0.526***	-0.358***	-0.437	-0.693	-0.682***	-0.950
		[0.144]	[0.150]	[0.093]	[0.062]	[0.279]	[0.695]	[0.237]	[0.944]
	Shareholders' Rights Index	4.703***	12.283*	3.547***	13.146*	4.410	22.474**	8.596	15.744
		[1.360]	[7.200]	[1.032]	[7.540]	[4.624]	[9.303]	[5.623]	[14.059]
	Creditor Rights	0.218	-2.558*	0.283	-2.369*	0.545	-4.196**	0.761	-1.592
		[1.733]	[1.455]	[1.961]	[1.283]	[1.321]	[2.137]	[2.219]	[2.762]
	Rule of Law	-1.729	0.273	-4.158	-1.45				
		[1.216]	[2.553]	[2.472]	[3.645]				
	Cost Of Bankruptcy			-0.123*	-0.161	-0.058	0.018	-0.029	0.106
				[0.064]	[0.244]	[0.142]	[0.316]	[0.077]	[0.414]
	Formal Institutions Index					1.758**	3.058**	2.268**	4.524**
						[1.213]	[2.265]	[1.136]	[2.198]
	Aggregate Real Econ Volatility							249.115*	310.907
								[136.537]	[337.379]
Industry	Industry Opacity							-2.081**	-2.852**
								[1.007]	[1.307]
	Industry Competition							6.475***	2.697*
								[1.881]	[1.492]
Firm	Firm Size	-0.416	-0.877*	-0.859**	-0.945*	-0.785	-0.993	-0.733	-1.233
		[0.332]	[0.465]	[0.379]	[0.494]	[0.797]	[0.633]	[0.554]	[0.751]
	Firm Leverage	-0.003**	-0.048	-0.005*	-0.015	-0.012	-0.015	-0.022	-0.054
		[0.001]	[0.032]	[0.003]	[0.017]	[0.012]	[0.021]	[0.040]	[0.044]
	Firm Profitability	-0.167***	-0.150***	-0.080**	-0.120***	-0.090***	-0.132***	-0.248**	-0.173***
		[0.060]	[0.029]	[0.035]	[0.025]	[0.034]	[0.035]	[0.109]	[0.046]
	Firm Sales Growth							-2.939**	-7.465**
								[1.232]	[3.032]
	Firm Dependence Extern Finance					-0.002	-0.039	-0.016	-0.05
						[0.020]	[0.031]	[0.013]	[0.041]
	Observations	229700		204118		151029		132755	
	Number of firms	39898	39898	35971	35971	28046	28046	24328	24328
	R-square overall	0.050		0.300		0.290		0.060	

Notes: Hierarchical linear mixed regressions on the research and development index, defined as the ratio of R&D expenditures to market capitalization. The sample period is 2000-2012 and includes firms from all industries. The model specifies two levels across which firms are nested: industry and country. We also report OLS regressions coefficients, for comparison purposes. The OLS regressions employ robust standard errors clustering at the country level with industry fixed effects which are not reported in the table. Stars ***, **, and * represent significance at the 1, 5, and 10 percent level.

Table C4. Explaining Corporate Risk-Taking (With Decomposed Institutional Variables)

	Dependent variable: Risk-Taking					
Explanatory variables ↓	Inverse of The z-Score		Standard Deviation of Return on Assets		Research & Development Index	
	(1) OLS	(2) HLM	(3) OLS	(4) HLM	(5) OLS	(6) HLM
Culture: Uncertainty Aversion	**-0.005*** **	**-0.005*** **	**-0.568*** **	**-0.191** **	**-0.568*** **	**-0.011** **
	[0.001]	[0.003]	[0.013]	[0.086]	[0.027]	[0.006]
Culture: Individualism	**0.003*** **	**0.008*** **	**0.726*** **	**0.226** **	**0.242** *	**0.343** **
	[0.001]	[0.003]	[0.015]	[0.103]	[0.147]	[0.160]
Culture: Power Distance	**-0.006*** **	**-0.001** **	**-0.415*** **	-0.053	**-0.210*** **	**-0.143*** **
	[0.001]	[0.001]	[0.019]	[0.102]	[0.064]	[0.058]
Culture: Masculinity	0.001	0.001	**0.194*** **	0.043	**0.077*** **	0.131
	[0.001]	[0.001]	[0.015]	[0.072]	[0.015]	[0.126]
Country: Financial Development	0.003***	0.004	0.002	-0.411*	0.029	0.116
	[0.001]	[0.006]	[0.022]	[0.236]	[0.156]	[0.348]
Country: Central Bank Policy Rate	-0.007***	-0.008	-1.076***	0.323	-0.682***	-0.950
	[0.001]	[0.016]	[0.026]	[0.555]	[0.237]	[0.944]
Country: Rule of Law	0.042**	0.243	14.979***	-2.66	13.350*	25.460*
	[0.020]	[0.151]	[0.408]	[4.062]	[8.071]	[13.089]
Country: Shareholders' Rights Index	0.047	0.085	54.129***	17.687**	8.596	15.744
	[0.068]	[0.260]	[1.627]	[7.840]	[5.623]	[14.059]
Country: Creditor Rights	0.012	-0.02	-17.687***	-3.525**	0.761	-1.592
	[0.011]	[0.055]	[0.359]	[1.654]	[2.219]	[2.762]
Country: Cost Of Bankruptcy	-0.006***	-0.002	-0.318***	0.026	-0.029	0.106
	[0.002]	[0.007]	[0.034]	[0.224]	[0.077]	[0.414]
Country: Efficiency of Debt Enforcement	0.004***	-0.002	-0.243***	0.016	-0.031	-0.067
	[0.001]	[0.003]	[0.014]	[0.099]	[0.050]	[0.176]
Country: Control of Corruption	-0.079***	-0.135	-17.531***	3.106	7.917*	19.183*
	[0.012]	[0.099]	[0.228]	[2.608]	[4.655]	[10.555]
Country: Aggregate Real Econ Volatility	3.181**	4.247	575.432***	-117.931	249.115*	310.907
	[1.494]	[5.486]	[32.444]	[181.592]	[136.537]	[337.379]
Industry: Industry Opacity	-0.035***	-0.038***	-0.433*	0.136	-2.081**	-2.852**
	[0.008]	[0.007]	[0.224]	[0.209]	[1.007]	[1.307]
Industry: Industry Competition	0.091***	0.216*	8.005***	9.391***	6.475***	2.697*
	[0.034]	[0.124]	[1.377]	[2.603]	[1.881]	[1.492]
Firm: Firm Size	-0.121***	-0.082***	2.331***	2.216***	-0.733	-1.233
	[0.004]	[0.004]	[0.089]	[0.121]	[0.554]	[0.751]
Firm: Firm Leverage	0.001	-0.003***	-0.010	-0.098***	-0.022	-0.054
	[0.000]	[0.000]	[0.015]	[0.007]	[0.040]	[0.044]
Firm: Firm Profitability	-0.115***	-0.029***	0.016***	0.701***	-0.248**	-0.173***
	[0.001]	[0.000]	[0.002]	[0.008]	[0.109]	[0.046]
Firm: Firm Sales Growth	-0.047***	-0.289***	-0.495***	0.809	-2.939**	-7.465**
	[0.008]	[0.022]	[0.078]	[0.501]	[1.232]	[3.032]
Firm: Firm Dependence Extern Finance	0.000**	-0.003***	0.000	0.018***	-0.016	-0.05
	[0.000]	[0.000]	[0.001]	[0.007]	[0.013]	[0.041]
Observations	94997		132571		132755	
Number of firms	20055	20055	24197	24197	24328	24328
R-square overall	0.207		0.504		0.060	

Notes: Hierarchical linear mixed model estimation, with observations clustered at the industry- and country- levels. All regressions control for country-specific variables (financial development; policy rate; shareholder rights; creditor rights; bankruptcy costs; rule of law, regulatory quality, government effectiveness, efficiency of debt enforecement, control of corruption, voice and accountability and political stability; and aggreagate economic volatility), industry-specific variables (industry opacity; industry competition), and firm-specific variables (size; leverage; profitability; sales growth; and dependence on external finance). The estimation period is 2000-2012 and includes 50,000 firms, from 50 countries. OLS coefficients presented for comparison purposes. OLS regressions employ robust standard errors clustering at the country level with industry fixed effects not reported in this table. All regressions exclude U.S. firms. Robust standard errors in parentheses. Stars ***, **, and * denote significance at the 1, 5, and 10 percent level.

Table C5. Accentuating/Moderating Effects

Dependent variable: Risk-Taking

	Explanatory variables	Inverse of the z-score			σ(Return on assets)			Research & Development		
	↓	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Culture	Uncertainty Aversion	**-0.005*** **	**-0.007** **	**-0.004***	**-0.297*** **	**-0.339** **	**-0.360*** **	**-0.010** **	**-0.089** **	**-0.038** **
		[0.003]	[0.003]	[0.003]	[0.096]	[0.170]	[0.097]	[0.004]	[0.49]	[0.184]
	Individualism	**0.013***	**0.004** **	**0.015*** **	**0.538*** **	**0.381***	**0.444*** **	**0.113***	0.267	**0.297** **
		[0.006]	[0.002]	[0.004]	[0.183]	[0.199]	[0.098]	[0.060]	[0.437]	[0.132]
	Power Distance	**-0.001** **	-0.004	**-0.008***	-0.097	**-0.493** **	**-0.242** **	**-0.001** **	**-0.411***	**-0.695** **
		[0.001]	[0.006]	[0.004]	[0.139]	[0.199]	[0.103]	[0.001]	[0.242]	[0.339]
	Masculinity	0.001	0.003	0.004	0.094	0.060	0.098	0.095	0.278	0.151
		[0.001]	[0.003]	[0.003]	[0.080]	[0.096]	[0.090]	[0.088]	[0.180]	[0.161]
Country	Financial Development	0.005	0.003	0.005	-0.713***	-0.748***	-0.612***	-0.266	-0.333	-0.131
		[0.006]	[0.007]	[0.006]	[0.203]	[0.213]	[0.203]	[0.340]	[0.322]	[0.316]
	Central Bank Policy Rate	-0.008	-0.004	-0.006	1.009	0.876	1.395***	-0.324	-0.217	-0.293
		[0.016]	[0.016]	[0.016]	[1.979]	[0.572]	[0.474]	[0.890]	[1.438]	[0.879]
	Rule of Law	0.500**	0.639***	0.635***	-0.411	-4.684	-1.278	-18.886*	-17.523	-17.385
		[0.219]	[0.199]	[0.202]	[6.325]	[6.700]	[5.815]	[9.505]	[19.682]	[15.767]
	Shareholders' Rights Index	0.071	0.014	0.119	20.544**	18.231*	14.891*	14.623	22.422*	11.400
		[0.283]	[0.300]	[0.269]	[9.223]	[10.600]	[8.972]	[15.206]	[13.397]	[13.421]
	Creditor Rights	0.027	-0.016	-0.005	-2.645	-2.236	-2.584	-1.258	-2.623	-1.601
		[0.057]	[0.058]	[0.055]	[1.886]	[4.737]	[1.879]	[2.543]	[2.297]	[2.378]
	Cost Of Bankruptcy	0.001	-0.001	-0.003	-0.033	0.043	-0.023	0.212	-0.717	0.103
		[0.008]	[0.008]	[0.007]	[0.242]	[0.879]	[0.236]	[0.396]	[0.998]	[0.355]
	Formal Institutions Index	0.711**	0.665**	0.945***	28.067**	44.302***	38.348***	5.172*	9.364	6.95**
		[0.357]	[0.324]	[0.335]	[11.196]	[10.059]	[8.898]	[2.757]	[24.876]	[3.139]
	Aggregate Real Econ Volatility	3.733	2.481	8.918	4.869	-260.748	-215.213	382.512	281.779	216.736
		[6.009]	[6.131]	[5.628]	[203.403]	[252.970]	[189.913]	[321.410]	[286.176]	[280.742]
H5	Individualism X Formal Institutions	**0.006** **			**0.155***			**0.259***		
		[0.003]			[0.083]			[0.141]		
	Power Distance X Formal Institutions	1.306			25.691			0.009		
		[2.703]			[104.102]			[0.245]		
H6	Uncertainty Aversion X Creditors' Rights		-0.002			-0.022			-0.008	
			[0.002]			[0.081]			[0.094]	
	1/Uncertainty Aversion X Shareholders' Rights		4.566			4.691			-231.375	
			[3.876]			[151.232]			[142.655]	
	Individualism X Creditors' Rights		**-0.009*** **			-0.031			-0.076	
			[0.002]			[0.089]			[0.129]	
	Individualism X Shareholders' Rights		**0.037*** **			0.264			0.555	
			[0.010]			[0.423]			[0.678]	
	Individualism X Eff. of Debt Enforcement		0.000			0.004			**0.013***	
			[0.000]			[0.004]			[0.007]	
	Power Distance X 1/Eff. of Debt Enforcement		**-0.118***			-1.121			-2.995	
			[0.068]			[2.198]			[4.670]	
	Individualism X 1/Cost of Bankruptcy		0.005			-0.002			0.237	
			[0.004]			[0.156]			[0.272]	
	Power Distance X Cost of Bankruptcy		0.000			-0.001			-0.001	
			[0.000]			[0.012]			[0.018]	
H7	Uncertainty Aversion X Industry Opacity			**-0.001***			**-0.006** **			**-0.058***
				[0.000]			[0.003]			[0.034]
	Individualism X Industry Opacity			**1.185***			**27.323** **			**94.36***
				[0.659]			[12.298]			[50.038]
	Power Distance X Industry Opacity			0.001			0.019			0.107
				[0.001]			[0.020]			[0.065]
	Masculinity X Industry Opacity			0.167			-3.189			0.031
				[0.244]			[6.314]			[19.579]
Industry	Industry Opacity	-0.037***	-0.037***	-0.048***	-0.179	-0.177*	-0.806**	-2.979**	-2.951**	-6.304*
		[0.007]	[0.007]	[0.013]	[0.201]	[0.081]	[0.348]	[1.305]	[1.304]	[3.343]
	Industry Competition	0.206*	0.216*	0.203*	14.284***	15.048***	13.857***	12.808	14.837*	10.901
		[0.124]	[0.124]	[0.123]	[4.844]	[4.855]	[4.838]	[14.861]	[7.566]	[14.545]
Firm	Firm Size	-0.082***	-0.082***	-0.082***	2.789***	2.788***	2.787***	-1.235*	-1.241*	-1.257*
		[0.004]	[0.004]	[0.004]	[0.116]	[0.116]	[0.116]	[0.748]	[0.748]	[0.748]
	Firm Leverage	-0.003***	-0.003***	-0.003***	-0.094***	-0.094***	-0.094***	-0.055	-0.055	-0.055
		[0.000]	[0.000]	[0.000]	[0.007]	[0.007]	[0.007]	[0.044]	[0.044]	[0.044]
	Firm Profitability	-0.029***	-0.029***	-0.029***	0.728***	0.728***	0.728***	-0.175***	-0.176***	-0.177***
		[0.000]	[0.000]	[0.000]	[0.007]	[0.007]	[0.007]	[0.046]	[0.046]	[0.046]
	Firm Sales Growth	-0.290***	-0.029***	-0.290***	0.398	0.392	0.386	-7.570**	-7.616**	-7.646**
		[0.022]	[0.022]	[0.022]	[0.468]	[0.468]	[0.468]	[3.046]	[3.045]	[3.045]
	Firm Dependence Extern Finance	-0.003***	-0.003***	-0.003***	0.026***	0.026***	0.026***	-0.049	-0.05	-0.050
		[0.000]	[0.000]	[0.000]	[0.006]	[0.006]	[0.006]	[0.041]	[0.041]	[0.041]
	Number of firms	20055	20055	20055	20055	20055	20055	20055	20055	20055

Notes: Notes: Hierarchical linear mixed model estimation, with observations clustered at the industry- and country- levels. All regressions control for country-specific variables (financial development; policy rate; shareholder rights; creditor rights; bankruptcy costs; formal institutions - an index made of rule of law, regulatory quality, government effectiveness, efficiency of debt enforecement, control of corruption, voice and accountability and political stability; and aggreagate economic volatility), industry-specific variables (industry opacity; industry competition), and firm-specific variables (size; leverage; profitability; sales growth; and dependence on external finance). The estimation period is 2000-2012 and includes 50,000 firms, from 50 countries. OLS coefficients presented for comparison purposes. OLS regressions employ robust standard errors clustering at the country level with industry fixed effects not reported. All regressions exclude U.S. firms. Robust standard errors in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent level respectively.

Appendix D: Data Sources and Definitions

Variable	*Description*	*Sources*
	Country-specific data	
Uncertainty aversion	Uncertainty aversion indicator - UAI. Higher values reflect higher national uncertainty aversion.	Hofstede (2001)
Individualism	Individualism indicator - IDV. Higher values reflect higher national individualism.	Hofstede (2001)
Power distance	Power distance -PDI. Higher values reflect higher national power distance.	Hofstede (2001)
Masculinity	Masculinity - MAS. Higher values reflect higher national masculinity.	Hofstede (2001)
Religion	Religion	Gene Shackman, 2009, "The Global Social Change Research Project", Available at: http://gsociology.icaap.org
Legal origin	Legal origin variable separating countries into: French, German, Scandinavian, Socialist, and British legal origin.	Shleifer et al. (1999)
Rule of law	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Worldwide Governance Indicators, World Bank
Control of corruption	Captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Worldwide Governance Indicators, World Bank
Corruption	Alternative measure of the corruption level.	Transparency International
Regulatory quality	Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Worldwide Governance Indicators, World Bank
Government effectiveness	Captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Worldwide Governance Indicators, World Bank
Voice and accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	Worldwide Governance Indicators, World Bank
Political stability	Captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.	Worldwide Governance Indicators, World Bank
Formal institution index	Index of quality of formal institutions, calculated by the formula: Formal institutions = [Rule of law*0.4248 + Government effectiveness*0.4198 + Control of corruption*0.4187 + Regulatory quality*0.4093 + Political stability*0.3954 + Accountability*0.3797]	Li and Zahra (2012); Author's calculations.
Creditor rights	An index aggregating creditor rights, following La Porta et al. (1998). The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights).	La Porta et al. (1998)
Property rights	Index of property rights in 2004.	The Heritage Foundation, http://www.heritage.org/Index/

Legal protect. of minority shareholders (shareholder rights)	An index measuring the legal protection of minority shareholders against expropriation by corporate insiders. Named the anti-self-dealing index in Djankov et al. (2006).	Djankov et al. (2006)
Disclosure requirements index	Variable "disclose", from La Porta et al. (1998).	La Porta et al. (1998)
Efficiency of debt enforcement	Variable "Case A Efficiency".	Djankov et al. (2006)
Enforceability of contracts	Index measuring enforceability of contracts.	Djankov et al. (2003)
Bankruptcy costs	Assessment of the efficiency of bankruptcy law. Scale from 0 to 6, where higher scores indicate higher compliance.	World Economic Forum Global Competitiveness Report (2005).
Propensity to file for bankruptcy	Index calculated as the inverse of bankruptcy costs.	Author's calculations.
Economic development	GDP per capita.	International Finance Statistics
	Industry-level data	
SIC Classification	2, 3, and 4 letter standard industrial classification.	US Department of Labor
Stock price informativeness	$1\text{-}R^2$ of regressing firm's returns on industry-specific returns and market-specific returns simultaneously.	Author's calculations.
Industry opacity	ln (1- R2/ R2)	Author's calculations.
Industry diversification	Index that measures the diversity of industrial activities.	Author's calculations.
Industry concentration	Herfindahl index which measures the amount of competition among firms within an industry.	Author's calculations.
Industry competition	The inverse of industry concentration.	Author's calculations.
Concentration in highly opaque industries	Herfindahl index which measures the amount of competition among firms within opaque industries (industries whose informational opacity is higher than 3.5).	Author's calculations.
Concentration in less opaque industries	Herfindahl index which measures the amount of competition among firms in less opaque industries (industries whose informational opacity is lower than 3.5).	Author's calculations.
	Firm-level data	
All firm level data	All firm level data	CVU Database constructed by the Macro-Finance Research Unit at the IMF (original data from Datastream, Worldscope, Bankscope)
Z-score	(Return on Assets + Capital Asset Ratio) / Standard deviation of Return on Assets	Author's calculations.
z-score	ln(Z-score).	Author's calculations.
σ(ROA)	Standard deviation of return on assets.	Author's calculations.
R&D expenditures	Expenditures on research and development divided by total firm market share.	CVU
Firm size	Log of total assets, where total assets is the sum of fixes and current assets.	CVU
Firm leverage	Leverage, which is defined as the ratio of total liabilities (current and noncurrent liabilities) to total assets.	CVU
Profitability	Profitability, measured as the firm's return on assets (ROA) and calculated as the ratio of earnings (EBIT) to total assets.	CVU
Sales growth	Sales growth, calculated as the annual logarithmic growth of sales	CVU
Dependence on external finance	Dependence on external finance, proxied by the Rajan-Zingales index (Rajan and Zingales, 1998).	CVU

Appendix E: Summary Statistics Tables

Table E1. Summary Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Firm	471820 (unique 50702)	n.a.	n.a.	n.a.	n.a.
Year	471820 (unique 13)	2005	5	2000	2012
Country	471820 (unique 51)	n.a.	n.a.	n.a.	n.a.
z-score	209161	0.01	1.12	-11	12
Return on Assets (ROA)	310279	-7.42	62.75	-999	992
Capital-Asset Ratio (CAR)	274928	-1.43	89.61	-26513	43
Standard deviation of ROA	413159	18.35	44.32	0	1081
Research & Development Index	324142	0.02	0.07	0.00	1.00
Uncertainty aversion	471820	56.20	21.70	8	112
Individualism	471820	58.82	28.99	12	91
Power distance	471820	53.18	18.78	11	104
Masculinity	471820	59.46	17.18	5	95
Long-term orientation	381871	53.24	29.94	16	118
Financial development alternative	371479	9.67	8.66	0	53
Stock market development	463118	104.53	63.41	1	561
Equity development	471820	1.09	1.30	0	21
Central Bank Rate	444704	3.68	4.54	0	60
Aggregate economic volatility	471820	0.03	0.02	0.02	0.16
Aggregate real economic volatility	471820	0.02	0.01	0.01	0.08
Rule of law	471820	1.06	0.75	-1.64	2.01
Formal institutions index	471820	2.24	1.77	-3.18	4.87
Religion	471820	2.01	0.97	1.00	5.00
Shareholder rights	448254	0.63	0.20	0.09	1.00
Creditor rights	451908	1.98	1.04	0.00	4.00
Creditor rights alternative	421074	1.98	1.07	0.00	4.00
Cost of bankruptcy	421074	9.49	7.19	1	38
Control of corruption	471820	1.06	0.92	-1.31	2.59
Corruption index	471820	1.14	0.93	-1.08	2.39
Industry dummy (SIC-4 letter)	471820 (unique 10)	5.70	2.31	1	10
SIC Industry (3 letters)	471820 (unique 405)	465.25	212.00	10	999
Industry informational opacity	471820	4.65	1.03	0	8
Industry competition	471820	0.10	0.14	0	1
FIRE industry	87248	1	0.00	1	1
Non-FIRE industry	384572	1	0.00	1	1
Firm size	325540	13.53	3.51	0	27
Firm leverage	471820	2.32082	110.04	0	28646
Firm current leverage	274467	5.37	230.34	0	56792
Firm profitability	310279	-5.82	40.06	-274	38
Firm sales growth	262297	0.07	0.60	-12	11
Firm dependence on external finance	220259	3.99	46.02	-151	326

Table E2. List of Countries Analyzed

Country		
Argentina	India	Philippines
Australia	Indonesia	Poland
Austria	Ireland	Portugal
Belgium	Israel	Saudi Arabia
Brazil	Italy	Singapore
Chile	Japan	South Africa
China	Kenya	South Korea
Colombia	Kuwait	Spain
Czech Republic	Lebanon	Sweden
Denmark	Malaysia	Switzerland
Egypt	Mexico	Taiwan
Finland	Netherlands	Thailand
France	New Zealand	Turkey
Germany	Nigeria	United Arab Emirates
Greece	Norway	United Kingdom
Hong Kong	Pakistan	United States*
Hungary	Peru	Venezuela

* United States excluded from regressions in order to avoid econometric biases.

Table E3. Correlation Matrix Between Risk-Taking Measures

	z-score	***Return on Assets (ROA)***	***Capital-Asset Ratio (CAR)***	***σ(ROA)***	***R&D Index***
z-score	1				
Return on Assets (ROA)	0.16*	1			
Capital-Asset Ratio (CAR)	0.02*	0.07*	1		
σ(ROA)	-0.25*	-0.55*	-0.06*	1	
R&D Index	-0.07*	-0.21*	0.00	0.18*	1

Notes: The stars (*) represent significance at the 1% level. The z-score is negatively proxying for risk-taking. The standard deviation of return on assets and the research and development index are positively proxying for firm risk-taking.

Table E4. Principle Component Analysis of Governance Indicators

Variable	***PCA1***	***PCF1***
Rule of Law	0.41	0.17
Regulatory Quality	0.39	0.16
Government Effectiveness	0.40	0.16
Voice and Accountability	0.36	0.15
Control of Corruption	0.40	0.16
Political Stability	0.31	0.13
Efficiency of Debt Enforcement	0.34	0.14

Notes: PCA components are obtained through principle component analysis. PCF components are obtained through principle factor analysis. We use PCA1 coefficients, but alternatively PCF1 could also be used since the correlation between PCA1 and PCF1 is 100%.