The Effect of Board Directors from Countries with Different Genetic Diversity Levels on Corporate Performance

Manthos Delis and Chrysovalantis Gaganis and Iftekhar Hasan and Fotios Pasiouras

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Manthos D. Delis
Surrey Business School, University of Surrey, UK
E-mail: m.delis@surrey.ac.uk

Chrysovalantis Gaganis
Department of Economics, University of Crete, Greece
Email: c.gaganis@uoc.gr

Iftekhar Hasan
Fordham University, USA, and Bank of Finland
E-mail: ihasan@fordham.edu

Fotios Pasiouras
Surrey Business School, University of Surrey, UK, and
Financial Engineering Laboratory, School of Production Engineering & Management,
Technical University of Crete, Greece
E-mail: f.pasiouras@surrey.ac.uk

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Abstract

We link genetic diversity in the country of origin of firms' board members with corporate performance via board members' nationality. We hypothesize that our approach captures deep-rooted differences in cultural, institutional, social, psychological, physiological, and other traits that cannot be captured by other recently measured indices of diversity. Using a panel of firms listed in the North American and U.K. stock markets, we find that adding board directors from countries with different levels of genetic diversity (either higher or lower) increases firm performance. This effect prevails when we control for a number of cultural, institutional, firm-level, and board member characteristics, as well as for the nationality of the board of directors. To identify the relationship, we use as instrumental variables for our diversity indices the migratory distance from East Africa and the level of ultraviolet exposure in the directors' country of nationality.

Keywords: Genetic diversity; corporate performance; nationality of board members

I. Introduction

How does genetic diversity in the country of origin of a firm's board members affect the corporate performance of these firms? The answer has important implications for the optimal synthesis of corporate boards of directors as a means to enhance firms' profitability and value. Human genetic diversity captures deep-rooted social, cultural, psychological, physiological, and institutional characteristics that were shaped many years ago. Within-board differences in these characteristics—which modern relevant indices may fail to capture—can have a unique bearing on firm performance. In this study, we explore this question by bringing together data on the biological genetic variation of board members' country of origin along with simple measures of corporate performance.

We hypothesize that the diversity in the boardroom, in terms of genetic diversity within each director's country of origin, can affect a firm's performance. Although this article refers to genetic diversity in the total population of each board member's country of origin, for simplicity we use the term "genetic diversity of the board." To construct our diversity measure, we use information from BoardEx on the nationality of board members for a number of firms and attach country-specific genetic diversity values from Ashraf and Galor (2013) to each board member. Then, we calculate our measure of genetic diversity of boards as the standard deviation by firm-year of genetic diversity across the values given to each board member. We call this computation the "deviation effect" of genetic diversity.

With this measure, we aim to examine whether including directors from countries with different levels of genetic diversity affects firms' profitability and value. We are of course unaware about which genes these directors carry, and we do not claim to examine the direct effect of genomes on corporate performance. We also abstain from suggesting that a higher or a lower level of diversity in the country of origin is either beneficial or unfavorable for corporate performance. Thus, we do not relate corporate performance to the mean score of genetic diversity in the boardroom. What we do examine with the standard deviation is whether and to what extent deep-rooted differences in the directors' countries of origin affect firm performance, irrespective of whether these differences come from a genetically more robust (less diverse) country or less robust (more diverse) country. We contend that it is the diversity in these deep-rooted elements that also shapes firm performance in unique ways.

As an example, consider a U.K.-based firm with 10 directors, 8 of whom are British, 1 is Brazilian, and 1 Italian. The British directors are all assigned an equal score of B, the standard deviation of which is zero. Based on Ashraf and Galor (2013), the Brazilian director carries a score lower than B and the Italian a score higher than B. The presence of both the Brazilian and the Italian director increases the deviation of the board's diversity. We seek to examine whether and to what extent this increase affects corporate performance. We are not considering whether the fact that the Brazilian (Italian) director has a score lower (higher) than B affects corporate performance.

We test the impact of the deviation effect on firm performance, as measured by risk-adjusted returns and Tobin's q, using a panel of up to 1,085 firms based predominantly but not exclusively in the United States and the United Kingdom from 1999 through 2012. We overcome the potential endogeneity problem by using two instrumental variables. These variables are constructed using the mean of migratory distance from East Africa and the mean of ultraviolet exposure in the board members' country of origin, by firm and year. Our exploration of these variables is motivated by the implications of Ashraf and Galor (2013) as well as important findings in biology.

The results show that genetic diversity plays an important role in affecting corporate performance. These findings hold even if we control for other elements of diversity, such as gender, culture, and nationality, which have been shown to have an important bearing on the efficiency and performance of corporate boards and firms. In keeping with the results of Ashraf and Galor (2013) regarding the effect of genetic diversity on economic development, we suggest that deep-rooted elements of diversity exist that were determined thousands of years ago and now play an important role in the functioning and performance of corporate groups.

More specifically, we find that the deviation effect of genetic diversity is positive and statistically and economically significant. For a firm with an average risk-adjusted return, a one standard deviation increase in the deviation of diversity implies a 20.8% increase in risk-adjusted return. Also, an increase in the deviation of diversity by the same amount will increase Tobin's q by approximately 6.9% for a firm with an average Tobin's q in our sample. This positive effect on corporate performance is in line with an important strand of sociology and management literature, which posits that the performance of groups is enhanced only when the level of heterogeneity is considerable and irrespective of whether the country of origin has a higher or a lower score compared to the country in which the firm is headquartered. We view this as an important finding with specific implications for organizational science, management science, and financial economics.

In Section II, we bring together the literature on the effect of various forms of diversity and group performance with the literature on genetic diversity and macroeconomic development. In Section III, we discuss our data set, and in Section IV, we present our empirical findings and discuss our findings in relation to our theoretical background. In Section V, we conclude by summarizing our main findings and providing implications and direction for future research.

II. Theoretical Considerations and Motivation

The potential nexus between genetic diversity in the boardroom and corporate performance is rooted in two distinct literatures, one initiated by sociologists and management scientists and another by economists. The seeds of the relevant literature can be traced at least as far back as

Blau's (1960, 1977) work on social integration and heterogeneity in groups in the form of cultural, gender, and racial heterogeneity. These theories, further refined in the management science literature by Earley and Mosakowski (2000), among others, hypothesize that diversity can exert both positive and negative influences on the performance of groups of individuals.

The negative effects of increasing diversity (positive effects of homogeneity) emerge from the fact that communication in homogenous groups is facilitated by the group members' common backgrounds, shared ideas and perceptions, and ease of interaction. In contrast, moderate levels of diversity can yield a segmented working environment between a small number of groups (usually two), which can lead to social barriers within a race-, gender-, or culture-based group. In turn, these processes can hinder an organization's ability to function efficiently by increasing communication problems and reducing organizational fairness. This idea is recognized in a number of related studies under the specter of the social identity theory (Smith et al., 1994; Lau and Murnighan, 1998; Dumas, Phillips, and Rothbard, 2013).

The view of within-group diversity is, however, completely different in the sociology and management literature. Blau (1977) suggests that a high degree of group heterogeneity can effectively weaken social barriers as a result of more even diffusion of diversity within the groups. Under this diffusion mechanism, positive forces of diversity will surface that can be explained by the value-in-diversity hypothesis. In the words of Swann et al. (2004), combining the different ideas, knowledge, and skills of different cultures greatly enhances the potential for creative synthesis. In an interesting variation on this concept, Watson, Kumar, and Michaelsen (1993) suggest that these positive effects require some cooperative time before being realized, about four months.

These theories imply that organizational groups composed of members with several different nationalities will benefit from prosperous interactions, heightened cooperation, and improved outcomes. In contrast, in moderately diverse groups in which only a few nationalities are represented, the barriers to interaction and cooperation are expected to be high. We highlight here, however, that the elements of genetic diversity introduced in this study go beyond board members' cultural, racial, and gender characteristics to encompass other, more general traits. It is here that the economics literature comes into play.

Economics literature has examined the nexus between genetic diversity and performance-related outcomes from a macroeconomic perspective to analyze the historical sources of different countries' economic development. The novelty of this literature is that it refers for the first time to genetic diversity, as opposed to cultural, racial, and other types of human diversity. The main contribution comes from the work of Ashraf and Galor (2013) on the "out of Africa hypothesis," as well as from the "diffusion of development" hypothesis of Spolaore and Wacziarg (2009).

The underlying premise of these hypotheses is that variation of migratory distance from East Africa—the site of origin for modern humans—to global settlements around the world enhanced biological differences among people. In turn, these biological differences gave rise to differences in behavior among inhabitants of the new settlements, which have had a significant effect on economic development of nations above and beyond differences in culture, institutions, geography, fractionalizations, and the like. These collective genetic traits were determined not by the relatively recent cultural differences among peoples but rather tens of thousands of years ago. Geneticists use data on allelic frequencies to measure the expected heterozygosity, which is the probability that two individuals selected at random from the relevant population are genetically different from one another. It is precisely the different traits arising from this type of diversity that we aim to capture in this study.

Ashraf and Galor (2013) find a hump-shaped effect of genetic diversity on comparative economic development. In our context, it is crucial to consider the positive and negative forces of genetic diversity on economic development. The positive forces relate to the beneficial effect of heterogeneity of individuals in expanding the production possibility frontier. The genetic heterogeneity of individuals captures traits that are not *necessarily* related to cultural, institutional, or other sociological characteristics but rather relate to other, deeper-rooted elements of individuals' personality. The proposition is that it is precisely these differential elements that can bring new ideas and perspectives in the work environment, and they can also promote the synthesis of these ideas through individuals' complementary traits. In turn, these positive forces lead to firms' technological advancements and product innovation, improved operating efficiency, easier expansion abroad, and superior overall performance.

Increasing genetic diversity in the corporate environment comes with costs, however, similar to those highlighted by the sociology and management literature. Specifically, increasing genetic diversity in the corporate environment can increase confusion and mistrust, which can adversely affect the efficiency of decision-making and can increase organizational and operational risk. Higher diversity can, therefore, be linked to increased operating inefficiency, lower productivity, and inferior performance. These processes are well documented in the biology literature under the impulse of the Darwinian kin selection theory as refined by Hamilton (1987) for human social patterns. This theory posits that altruistic and cooperative acts manifest themselves better in situations where individuals share common traits, leading to shared developmental environments, familiarity, and social bonding. Inevitably, this relates to the "selfish gene" theory of evolution proposed by Dawkins (1976).

The sociology and management literature suggests that various forms of diversity can produce both positive and negative effects for corporate performance, while the economics literature introduces genetic diversity as a very important factor in shaping macroeconomic development. The extent to which genetic diversity in the origin countries of the board directors shapes corporate performance is the novel element we introduce into the intersection between diversity and corporate performance.

III. Data

Our data come from three different sources. The data used to construct our genetic diversity scores are from Ashraf and Galor (2013). The data on firms' corporate governance characteristics are from BoardEx, and the data on firms' financial characteristics are from Thomson Reuters' Worldscope and Datastream. We explicitly define all variables used in our study in Table 1 and provide summary statistics in Table 2. After cleaning up some data with missing observations for the main variables used in our analysis, we are left with a sample with a maximum of 4,198 observations from 1,085 firms during the period 1999 through 2012.[1] These firms are listed on either the London Stock Exchange or a North American stock exchange, and they are headquartered in one of 10 countries.[2]

[Inset Tables 1 and 2 about here]

We measure firm performance with a ratio of risk-adjusted returns (equivalent to the Sharpe ratio) and Tobin's q (see, e.g., Adams and Ferreira, 2009; Dushnitsky and Lenox, 2006). We view these two measures as complementary.[3] The first ratio measures firms' *ex post* performance and, relative to the simple return on assets, it includes the opportunity cost of the risk associated with holding the assets or generating the return. This adjustment is important because it scales the three-year average in the return on assets with the equivalent variance, providing a book-value equivalent to the Sharpe ratio. Tobin's q is a future-oriented and risk-

[1] All firms included are non-financial firms. We exclude financial firms from our sample because of the special features and special regulations imposed on these firms, which could bias the results.

[2] The vast majority of firms in our sample have headquarters in either the United Kingdom or the United States. For example, in the sample with Tobin's q as the dependent variable, 460 firms are headquartered in the United Kingdom and 605 are in the United States. The remaining firms are headquartered in Bermuda, Canada, the Isle of Man, Jersey, Netherlands, Ireland, South Africa, or Switzerland. Naturally, the majority of firms in our sample have directors who are mostly (if not entirely) from the country in which the firm is headquartered. The mean deviation of diversity is 0.011 in the case of the U.K. firms, 0.006 in the case of the U.S. firms, and 0.022 for the remaining firms.

[3] Dybvig and Warachka (2014) criticize Tobin's q on the basis that scale inefficiency resulting from underinvestment lowers firm performance but increases Tobin's q. This is a reason we more eclectically view our two measures of firm performance as complementary.

adjusted performance measure, reflecting the premium that the capital market will pay for a given level of firm assets. Given that we have a small difference in the number of observations between the risk-adjusted returns and Tobin's q, we report in Table 2 the descriptive statics for the two panels separately.

III.A. Measuring the Board's Genetic Diversity

To construct our board genetic diversity scores, we rely heavily on data from Ashraf and Galor (2013). In their study on the "out of Africa" hypothesis, the authors construct an index of country-specific genetic diversity scores based on data from the HGDP-CEPH Human Genome Diversity Cell Line Panel and the framework of Ramachandran et al. (2005). Ashraf and Galor (2013) offer a very diligent discussion about constructing this variable, and to avoid replicating this discussion here, we kindly refer the reader to their article.

Here we highlight the fact that population geneticists typically measure the extent of diversity in genetic material across individuals within a given population (such as an ethnic group) using an index called expected heterozygosity. This index reflects the probability that two individuals, selected at random from the relevant population, are genetically different from one another. The data used to construct the index of expected heterozygosity are based on allelic frequencies—that is, the frequency with which a gene variant or allele occurs in the population sample. Given allelic frequencies for a particular gene or DNA locus, geneticists compute the gene-specific heterozygosity statistic, which, when averaged over multiple genes or DNA loci, yields the overall expected heterozygosity for the relevant population.

Based on Ashraf and Galor's (2013) country-level data, we calculate the standard deviation by firm-year of genetic diversity across the country-specific values given to each board member in our dataset. More formally, we consider the following measure:

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(d_i - m)^2}, \quad (1)$$

where σ is the standard deviation of the genetic diversity score *d* attached to the *n* board directors of each firm. Each director's genetic diversity score is linked to the country of nationality *i* of that director, and *m* is the mean score of each board. We call the potential effect of this variable the deviation effect of genetic diversity on corporate performance.

The deviation of board diversity shows how diverse a board is with respect to the genetic diversity in the origin countries of its members. Consider for example a firm based in the United States that consists of 10 board directors, 8 of whom are American, 1 British, and 1 Argentinean. The American directors all carry a score approximately equal to 0.63, the British 0.73, and the Argentinean 0.57. The deviation of diversity for this board equals 0.037, whereas it would equal zero if this was an all-American board, 0.031 if there were no Argentinean director, and 0.019 if there were no British director.

We note three interrelated issues. First, we attach the scores to the directors' nationality, as obtained from the BoardEx database.[4] This implies that we do not examine per se the effect of the mix of directors' actual genes (for which we have no information) on corporate performance. Doing so would make this study a biological analysis, which is beyond our theoretical motivation in particular or the scope of this research in general. Instead, we stress the importance of genetic diversity in the director's country of origin as a means to identify and measure the all-too-many characteristics of the countries that shape human behavior and cannot be captured—or are very incompletely captured—by the cultural and institutional variables of existing databases. These characteristics are a number of sociological,

[4] A large number of previous studies use nationality from BoardEx to examine the effect of the nationality or the nationality mix of the board on corporate performance and executive pay (e.g., Fernandes et al., 2009). All of these studies inherently assume that there is a difference between nationality and citizenship. The former is referred as the informal membership or identification with a particular nation (not a country or state), with nations being understood as social categories, characterized by at least a common language, culture, and territory, and sometimes also by a common religious faith and a purportedly shared ancestry. Citizenship is a legal status in a political institution, such as a city or a state. The relationship between a citizen and the institution that confers this status is formal and, in contemporary liberal-democratic models, includes both a set of rights that the citizen possesses by virtue of this relationship and a set of obligations or duties that the citizen owes to that institution and his or her fellow citizens in return.

psychological, cultural, and physiological elements that are shaped by or correlate with the genetic diversity of the underlying population of the countries considered. It is precisely in this manner that we aim to use our genetic diversity indices.

Second, the deviation of diversity disregards whether genetic diversity in the origin country is high or low compared with that of the country where the firm is based, which is also the country most directors come from. This would be captured by the mean score of board diversity, which would then imply that the actual level of the genetic diversity score in a board member's country of origin (the relative homogeneity or heterogeneity of populations in that country) plays a role in determining corporate performance. This outcome is not what our theoretical motivation suggests, however. Indeed, there is no reason to assume in social sciences that board directors coming from genetically more homogeneous or more heterogeneous populations would either positively or negatively affect corporate performance.

Instead, the deviation of diversity considers only how board members differ systematically from each other with respect to genetic distance of populations in their country of origin and assigns positive values to the differences irrespective of whether "difference" means more homogeneous or more heterogeneous genes in the country of origin. By not examining the homogeneity or heterogeneity of genes and focusing on differences we are aligned with what our theoretical considerations suggest when defining diversity. In other words, what possibly matters for corporate performance is the inclusion of directors with different experiences in the boards, as well as the degree of the differences in these experiences. This heterogeneity can be created by adding a director who comes from either a country with higher genetic diversity or from a country with lower diversity (or even multiple directors from different countries). Thus, in our example, the 10-member board will be more "genetically diverse" if it has both a British and an Argentinean director.

III.B. Control Variables

To reduce the omitted-variable bias, we control for a number of variables that might affect corporate performance. The first and obvious group of control variables relates to firms' financial characteristics. More specifically, we control for a firm's sales growth (we also use this as dependent variable in some sensitivity tests) and cash flow (e.g., Brush, Bromiley, and Hendrickx, 2000), equity capital (Simerly and Li, 2000), liquidity (e.g., Miller and Triana, 2009), size (e.g., Dezso and Ross, 2012), and cost inefficiency (e.g., Corbett, Montes-Sancho, and Kirsch, 2005). We formally define these variables in Table 1.[5]

A rather important set of controls relates to firms' foreign expansion, which can be correlated with the inclusion of directors from the country or countries into which the firms expand internationally. To avoid falsely attributing the effect of the deviation of diversity to the performance of a firm's foreign subsidiaries, we include the growth in foreign sales or the share of foreign sales as a percentage of total sales as explanatory variables. Because we lose some observations when we include these variables, we decided to use them only in robustness checks.

The second group of variables relates to board attributes, which we discuss in some detail to note the differences between these variables and our genetic diversity variable. We experiment with many board characteristics available in the BoardEx database, but we resort to the ones most commonly used in the studies explaining corporate performance.

First, we include standard measures of board composition in terms of gender, nationality, independence of audit committee, and financial expertise. Adams and Funk (2012) mention that female directors are more benevolent and more universally concerned, less power

[5] Table A1 presents a correlation matrix that reveals the relationship between genetic diversity and the financial characteristics of the firms. The correlation coefficients show that our diversity score has a positive and significant correlation with Tobin's q, but an insignificant correlation with the risk-adjusted returns. The diversity score is also strongly positively correlated with firm size, indicating that larger firms, perhaps those with a foreign market orientation, have a more diverse board of directors.

oriented, less tradition and security oriented, and more risk-loving than their male counterparts. Unsurprisingly, therefore, other studies document an association between a board's gender composition and a firm's performance and value (e.g., Adams and Ferreira, 2009; Dezso and Ross, 2012; Hoogendoorn, Oosterbeek, and van Praag, 2013). To control for gender composition, we use the percentage of male directors on the board.

The literature also suggests that foreign directors can influence firm performance (e.g., Masulis, Wang, and Xie, 2012) and value (e.g., Oxelheim and Randoy, 2003). Thus, we control for the proportion of foreign directors on the board. Audit committee independence has been associated with firm value (Chan and Li, 2008) and lower debt financing costs (Anderson, Mansi, and Reeb, 2004). We therefore control for the proportion of independent non-executive directors on the audit committee. Financial experts on the board may provide stronger oversight and/or direction with regard to firm financial policies and strategies (Gore, Matsunaga, and Yeung, 2011), improve financial reporting monitoring (Kim, Mauldin, and Patro, 2014), and enhance external funding and decrease investment cash flow sensitivity (Guner, Malmendier, and Tate, 2008). Thus, we control for the proportion of independent non-executive directors with past roles on the board as chief financial officer or finance director.

We also control for five broad characteristics of the board, namely, size, network, CEO duality, age, and longevity. The impact of board size, measured by the number of directors, has been thoroughly investigated in the literature. On the one hand, from the perspective of the resource dependence theory, a large board could provide greater information and resources. On the other hand, larger boards could be less effective because of coordination problems or director free-riding (Lipton and Lorsch, 1992; Jensen, 1993).

Social networks and the connectedness of directors may improve access to information in terms of cost, quality, relevance, and timeliness (e.g., Adler and Kwon, 2002), subsequently enhancing firm performance (Horton, Millo and Serafeim, 2012). Hence, we control for the board's average number of outside linked directors.

The effect of CEO duality on performance and value has also attracted attention in the literature (Rechner and Dalton, 1991; Iyengar and Zampelli, 2009). On the one hand, duality violates the idea of separating decision making and control (Fama and Jensen, 1983; Jensen, 1993). On the other hand, duality may result in superior leadership in terms of strategy and formulation, enhancing stability, confidence in management, and communication among managers and directors (Stoeberl and Sherony, 1985; Iyengar and Zampelli, 2009). Therefore, we include a dummy variable indicating whether or not a firm's CEO is also the board chair.

The directors' ages may also influence corporate strategy (e.g., R&D spending) and performance because of differences in wisdom, energy, risk aversion, and conservatism (Wiersema and Bantel, 1992; Muth and Donaldson, 1998; Barker and Mueller, 2002). Therefore, we control for the average age of the board of directors. The last board characteristic that we consider is longevity, which measures the average time directors have spent in their current role. Long tenure and experience enhance a director's firm-specific skills, understanding of group dynamics, and corporate culture (Harris and Helfat, 1997; Cohen, Frazzini, and Malloy, 2012; Anderson et al., 2011). Yet more time on the board may also undermine independence and monitoring (Vafeas, 2003).

A final group of variables relates to additional characteristics of directors' origin countries. Excluding these characteristics from the regression equations can lead to falsely attributing the characteristics' effects to the board's genetic diversity. We construct these indicators using the same methodology as the genetic diversity variables (i.e., we attach the values of the respective variables based on the directors' nationality and take the standard deviation as in equation 1).

An increasing number of studies document an association between national culture and firm outcomes such as capital structure and risk-taking (Li et al., 2011, 2013), debt maturity choices (Zheng et al., 2012), and cash holdings (Chang and Noorbakhsh, 2009). To control for the effect of a director's cultural background on corporate performance, we use the principal component of Hofstede's five cultural indicators (power distance, individualism, masculinity, uncertainty avoidance, and long term orientation).[6] Additionally, we construct a board-specific indicator for law and order, which is an indicator widely used to capture the quality of legal institutions.[7]

Finally, we control for the directors' orientation in terms of social values (in particular trust) and economic, political, and constitutional characteristics.[8] For trust, we use information from the World Values Survey, and for the economic background, we use GDP per capita (in real U.S. dollars). For political and constitutional values in the directors' country of origin, we use data from the Polity IV database to control for political regime characteristics. We experiment with many other such variables from a number of data sources (e.g., freedom, institutional, and economic variables from the Fraser Institute), and our main results remain essentially unaffected.

[6] We also experiment with the five cultural indicators separately. The results remain unchanged.

[7] Law and order is perhaps the main institutional factor affecting the corporate environment. We also consider other institutional indicators, including bureaucratic quality, corruption, general socioeconomic conditions, and so on. These variables are highly correlated with each other, and so to avoid multicollinearity, we include only law and order in the regression equations. The legal system in a director's country of nationality may influence firm performance through direct or indirect channels, such as size and breadth of capital markets (La Porta et al., 1997), firm-level governance (Klapper and Love, 2004), firms' uses of external financing to fund growth (Demirguc-Kunt and Maksimovic, 1998), efficiency (Lensink, Meesters and Naaborg, 2008), and stability (Fang, Hasan, and Marton, 2014).

[8] The literature suggests that political rights and institutional structures are associated with firms' bond yield spreads (Qi, Roth, and Wald, 2010), firm growth (Boubakri, Ghoul, and Saffar, 2013), and risk-taking (Boubakri, Mansi, and Saffar, 2013). Also, recent studies show that people with different political orientations exhibit different preferences in terms of investments (Hong and Kostovetsky, 2012), corporate financial policies (Hutton, Jiang, and Kumar, 2014), and so on.

IV. Estimation and Empirical Results

IV.A. Empirical Identification

Our results come from a series of regressions on the causal effect of our two diversity measures on corporate performance. We begin by estimating the following model:

$$y_{it} = a_0 + a_1 D_{it} + a_2 X_{it} + u_{it}. \quad (2)$$

In equation (2), y is the corporate performance of firm i in year t, D is our diversity score, X is a vector of control variables, and u is the stochastic term. In all of our estimations, we separate the stochastic disturbance into a firm fixed effects component, which captures the time-invariant characteristics of firms, and the remainder disturbance. The fixed effects are eliminated through first differencing. All the estimations also include year fixed effects, which capture factors that vary over time in a way that is common to all firms.

We opt to identify the causal impact of the deviation of diversity on corporate performance. To this end, we are concerned with all three main sources of endogeneity problems: reverse causality, omitted variables, and measurement error. Reverse causality can arise in our regressions if poor performance leads to the decision to diversify the board by injecting directors with a different nationality. Further, and despite the use of numerous control variables and firm fixed effects, our genetic diversity indices may erroneously capture other unobserved elements of diversity, thus falsely attributing our findings to genetic diversity per se. Finally, given that our measures of diversity are constructed using estimated scores, some measurement error may be attached to them.[9]

A joint solution for all these problems is to use one or more instrumental variables (IVs) that satisfy the exclusion restriction; that is, we need to identify one or more variables that

[9] Ashraf and Galor (2013) recognize that their estimates of the regression of population density on predicted genetic diversity can result in biased estimates of the standard errors and, thus, inference due to measurement error. To this end, they use a bootstrapping algorithm to consistently estimate standard errors. In our case, we have more than one endogeneity problem to address, and thus we resort to an instrumental variable method, which inter alia corrects for measurement error in the case where the instrument is uncorrelated with the stochastic disturbance (Wooldridge, 2013).

affect genetic diversity but do not affect corporate performance directly. In this sense, an excellent proposition for a proper IV comes from Ashraf and Galor (2013), who use the migratory distance (in logs) from East Africa to predict the genetic diversity of countries. In our study, the endogenous dependent variable is the standard deviation of the diversity scores across board members and, thus, not the diversity score of Ashraf and Galor per se. Thus, we can use migratory distance as a means to mitigate both measurement error as well as reverse causality and omitted variables biases.

With this instrument alone, our equations will be exactly identified, which allows receiving under-identification and weak identification tests for the instrument's validity. To receive the results of an over-identification test for our estimated models, we complement migratory distance with a measure of ultraviolet (UV) exposure. We also construct this variable by firm and year on the basis of equation (1). The intuition in using this variable comes from the biology literature. In addition to the apparent and well-known effects of UV radiation on skin color, UV radiation can cause mutations of genes, thus affecting alleles (e.g., Sturm and Duffy, 2012; Kozmin et al., 2005). Further, differences in UV radiation affect the natural landscape with indirect but profound implications for the way humans change their lifestyles and form their societies. In turn, there is no reason to believe that UV radiation in the board of directors' origin country would directly affect firms' performance in the country where the firm is headquartered, given that our regressions include firm (and thus country) fixed effects. Note that we do confirm our main findings when we only use either one of the two instrumental variables separately.

Note that our IVs are constructed based on the directors' country of nationality. Thus, UV exposure conditions in those countries are unlikely to directly affect corporate performance in the countries where the firms are headquartered. Moreover, by using a model in first differences, we essentially difference out any such effects common across firms in a specific country. Given our estimation method and our control variables, our IVs are unlikely to affect corporate performance directly, but they are by definition likely to affect the genetic diversity of board members. Thus, these instruments should satisfy the exclusion restriction.

Another empirical issue is that corporate performance is persistent, and thus we need to estimate a dynamic model to avoid falsely attributing elements of persistence to the dynamics of performance. We find that including the first lag of our dependent variable in the regression equations is sufficient to accomplish this goal, because the second lag of our dependent variables is statistically insignificant. We experiment with both a limited information maximum likelihood (LIML) model in first differences, to eliminate the inconsistency arising from including fixed effects, and the standard generalized method of moments (GMM) methods of Arellano and Bond (1991) or Blundell and Bond (1998). We find that LIML outperforms GMM in all the identification tests and is the favored tool in the analysis that follows.[10]

IV.B. The Deviation Effect of Genetic Diversity

In Table 3, the results show that the effect of the diversity deviation on risk-adjusted returns and Tobin's q is both positive and statistically significant. In the first four models, the dependent variable is risk-adjusted returns, and in the latter four, it is Tobin's q. Models 1 and 5 include the baseline controls. In models 2 and 6, we examine additional characteristics of the directors' origin countries, and in models 3 and 7, we add the board characteristics of the firms. Finally, in models 4 and 8, which are our preferred specifications, we include only the characteristics of the origin countries and board characteristics that have some explanatory power in our regressions. All regressions include year fixed effects. We keep the number of

[10] Applying LIML to the model in differences is more rarely used but is a consistent estimator for dynamic panel data models (see Baltagi, 2005, pp.153–155), In fact, Alonso-Borrego and Arellano (1999) compare the GMM and LIML methods using simulations. Monte Carlo and empirical results show that the GMM can exhibit large biases when the instruments are poor, whereas LIML remains essentially unbiased.

observations constant for all four pairs of regressions to allow a better comparison of the coefficient estimates. In the lower part of the table, we report the under-identification, weak identification, and over-identification tests.

[Insert Table 3 about here]

In all cases, the coefficient on the deviation of diversity is positive and statistically significant at conventional levels. In both the regressions of risk-adjusted returns and Tobin's q, the economic significance strengthens somewhat as we include additional controls. The coefficient on the deviation of diversity in model 4 equals approximately 59 and shows that an increase in the deviation of diversity by 0.016 points (equal to a one standard deviation increase) yields an increase in risk-adjusted returns by approximately 0.94 points. For a firm with an average risk-adjusted return (equal to 4.52), this implies a 20.8% increase in risk-adjusted returns. The results for the effect of the deviation in diversity on Tobin's q are qualitatively similar. Specifically, an increase in the deviation of diversity by 0.016 points will increase Tobin's q by approximately 0.13 points, which is equivalent to 6.9% for a firm with an average Tobin's q in our sample (equal to 1.89).

For comparison, we also estimate equation (3) with OLS and OLS on the fixed effects model (see Table A2 in the Appendix). These models are robust under the assumption of no correlation between the deviation of diversity and the stochastic disturbance. For the simple OLS models, we include country dummies to capture any time-invariant country fixed effects. None of these models includes a lagged dependent variable because doing so would produce inconsistent estimates. The OLS results (models 1 and 3) show a negative and a positive effect of the deviation of diversity on the risk-adjusted returns and Tobin's q, respectively. Using firm fixed effects in model 2 changes the sign of the diversity deviation effect on the risk-adjusted returns to positive. Thus, the results in models 2 and 4 are in line with those of Table 3. In terms of the effect's economic significance, the coefficient estimates in Table A2 are somewhat (but not markedly) smaller. Given especially the issue of measurement error associated with the country-specific diversity estimates, we favor the results from the IV models.

With respect to the financial control variables, our findings are in line with our expectations detailed in Section III.B, as well as with the existing literature. Specifically, more capitalized and larger firms have higher risk-adjusted returns, and the equivalent effect of the rest of the financial variables is statistically insignificant. The results in Tobin’s q regressions are quite different.[11] Sales growth is positively linked with q, but size and inefficiency have a negative effect. For inefficiency, this finding is intuitive, but the discrepancy in the results for size between the risk-adjusted returns and Tobin’s q further adds to the ambiguity of the role of firm size in different aspects of corporate performance. Our results for returns-based variables are in line with Richard et al. (2004), while the results for Tobin’s q are in line with those of Dushnitsky and Lenox (2006) and Lang and Stulz (1994) in both the sign and magnitude of the coefficient.

Perhaps the most important set of control variables are the cultural and institutional variables that are constructed similarly to the deviation of diversity. These variables are important to avoid falsely attributing the effect of the cultural and institutional characteristics of the directors’ countries of nationality to genetic diversity. Given that most variables examined come out statistically insignificant, in the regression equations we include only five of these variables that are theoretically most important: diversity in law and order, political diversity, cultural diversity, economic development diversity, and trust diversity. We find that the only variable with a significant coefficient is diversity in law and order. In the models on risk-adjusted returns, this effect is negative and statistically significant at the 1% level, suggesting that adding directors from countries with different strength and impartiality of the

[11] We exclude the equity capital variable from the Tobin’s q regressions because equity capital is already a component of Tobin’s q.

legal system, as well as popular observance of the law, lowers firm value. Most importantly, however, adding these or other variables does not diminish the effect of genetic diversity, which remains quite strong.

In turn, the contribution of the board characteristics to corporate performance is relatively minor.[12] *Time in role* bears a statistically significant coefficient in the models on risk-adjusted returns, implying that the higher the average number of years a firm director has held his or her role, the higher the risk-adjusted returns. This result is consistent with Harris and Helfat (1997) and Anderson, Reeb, Upadhyay and Zhao (2011), who note that long tenure and experience enhance directors' firm-specific skills, their understanding of group dynamics, and corporate culture. In turn, the only marginally significant effect in the Tobin's q equations comes from the chairman's presence on the board and is negative. This effect is in line with the premise that duality violates the idea of the separation of decision making and control, and through this mechanism, duality lowers firm value (Fama and Jensen, 1983; Jensen, 1993).

In Table 4, we examine the sensitivity of our estimates when controlling for *foreign directors*, *foreign sales growth*, and *foreign sales* in alternative specifications. We do not include these variables in our baseline specifications of Table 3 because doing so results in a loss of observations. We find that only the effect of *foreign directors* in model 1 is statistically significant, and only at the 10% level. More importantly, the coefficients on the deviation of diversity remain statistically significant, and in fact, the coefficients on the models of risk-adjusted returns further gain in economic significance.

[Insert Table 4 about here]

In Table 5, we further inquire into the econometric robustness of our results. First, we add the squared term of the deviation of diversity to examine the potential existence of a bell-

[12] This finding comes as no surprise in light of recent corporate finance studies (e.g., Wintoki, Linck, and Netter, 2012), which posit that most board characteristics are not strong determinants of corporate performance.

shaped relationship with corporate performance. This test is in line with the discussion in Section II that diversity exerts both positive and negative forces on the operational efficiency of groups. The coefficients on the main and the squared term in model 1 are jointly statistically significant at the 10% level and statistically insignificant in model 2. If we add more control variables in model 1, there too the statistical significance diminishes. Thus, we cannot find robust evidence for the consistent existence of a bell-shaped relationship between the deviation of diversity and corporate performance.

[Insert Table 5 about here]

In models 3 and 4, we include only *migratory distance* as an IV, and in models 5 and 6, we include only *ultraviolet exposure*. The results remain essentially the same as the equivalent measures in Table 3; perhaps the only important difference is that in model 5, the coefficient estimate becomes larger. In models 7 and 8, we cluster the standard errors by both firm and year. Under this approach, the resulting standard errors are robust to arbitrary within-panel autocorrelation (clustering on firms) and to arbitrary contemporaneous cross-panel correlation (clustering on time). Again, we find that this approach does not affect the results. In models 9 and 10, we exclude all firms for which the boards are completely homogeneous. The results are essentially unchanged, which is intuitive given that our estimations are carried out in first differences.

In Table A3 in the appendix, we explore the possibility that the results are driven by characteristics endemic to one of the two main countries used in our sample, namely the United States or the United Kingdom. To this end, we introduce an interaction term between the deviation of diversity and a dummy variable that takes the value one if the firm is based in the United States and zero otherwise. If both the U.S. firms and the rest of the firms contribute to the positive overall effect of the deviation of diversity, we expect that both the main and the interactive components will have a positive and statistically significant coefficient. The results for both the risk-adjusted returns and the Tobin's q indicate that this result is indeed the case, although the coefficients have greater economic importance for the non-U.S. firms. Adding up the coefficients on the deviation of diversity and the interaction term gives coefficient estimates approximately equal to the equivalent ones presented in models 4 and 8 of Table 3.

As a final exercise, we examine whether the deviation of diversity affects measures of more operational outcomes of the firms. We first differentiate between the revenue and the cost side of the firms' profit function and test whether genetic diversity affects each one separately. In models 1 and 2 of Table 6, we report the results on *sales growth* and *operating expenses*, respectively. We find that the deviation of diversity has a positive effect on *sales growth*, while its effect on *operating expenses* is negative but statistically insignificant at conventional levels. These findings are in line with important theoretical literature, suggesting that diverse groups bring in more creativity and broader perspectives and are less likely to suffer from so-called "groupthink" (see, e.g., Watson, Kumar, and Michaelsen, 1993). Further, diverse boards of multinational companies are likely to benefit from superior knowledge of foreign markets, institutions, and cultural attributes. In turn, all of these elements relate more directly to the revenue side of firm performance rather than the cost side, which is more accounting- and process-based.[13]

[Insert Table 6 about here]

IV.C. Discussion

[13] We also use other response variables, such as elements of risk (e.g., profit volatility, the current ratio, or the probability of default from actual information on defaulting firms) and innovation as measured by expenses for research and development (R&D) to total assets or sales. We find some preliminary evidence that a higher deviation of diversity is associated with lower profit volatility, but we cannot generalize these effects to the other measures of risk used. Further, we do not find robust evidence that the deviation of diversity significantly explains the level of R&D expenses. Given that the relations between diversity on the one hand and risk and innovation on the other have their own theoretical channels that need to be exploited, we do not pursue more work in this direction. The preliminary results are available on request.

The results on the positive effect of the deviation of diversity on corporate performance suggest that the theoretical arguments behind the positive forces of board diversity are the dominant ones in our sample. The results from including the squared term of the deviation of diversity suggest that some ambiguity exists concerning a potential negative effect of genetic diversity on returns only for relatively high levels of diversity, but the results do not generalize in our sample for either a richer set of controls or for firm value.

Our estimations in differences reflect the effect of a firm simply adding one director from a country with a different genetic diversity score. By construction, this implies a higher score for the deviation of diversity irrespective of whether that director's country of origin has a lower or a higher score relative to the firm's average. Then, the additional director promotes the firm's genetic diversity, not by bringing in different genes but by bringing in a diverse skill set based on the fact that his or her country of origin has relatively higher or lower genetic diversity. Thus, we contend that either higher or lower genetic diversity relative to the firm's average is beneficial for firms' returns and value.

These findings are in line with the theoretical propositions of the sociology and management literature highlighted in Section II: A higher level of diversity improves value and performance (Blau, 1977; Watson, Kumar, and Michaelsen, 1993; Earley and Mosakowski, 2000). These findings are the first to relate elements of *genetic* diversity to corporate performance, and in this sense, our results partially corroborate at the microeconomic level those of Ashraf and Galor (2013) on the effects of genetic diversity on countries' economic development. In other words, we posit that the genetic characteristics of the countries of directors' origins play a special role in determining firm performance, and this nexus is above and beyond any cultural, gender, and institutional characteristics of the countries of origin. Thus, the diverse country traits, determined as early as the birth of humanity, can be held responsible for the beneficial effect of diversity in the boardroom on firm performance. Indeed, our main finding is that the coexistence and synthesis of a large number of these traits in the boardroom, associated with multiple directors from different countries, is an important determinant of corporate success.

V. Conclusions, Organizational Implications, and Directions for Future Research

We construct a measure of corporate boards' genetic diversity using the standard deviation by firm and year of the genetic diversity in each director's country of nationality. We establish a positive relationship between this measure of board diversity and both a firm's returns and value. We also establish that this type of diversity in the boardroom benefits firms in addition to any effect stemming from nationality and other institutional, constitutional, social, and behavioral characteristics of the board.

We link our findings to the established sociology and management literature on firm board diversity and to a flourishing economics literature on countries' genetic diversity. Specifically, the positive effect of the deviation of diversity on corporate performance is in line with the sociology and management literatures on the advantages of diversity in promoting successful outcomes and shows that increasing board genetic heterogeneity is a prerequisite for increasing both corporate returns and value.

Our study is not intended to examine the board genetic diversity based on specific board members' genes. Doing so would be a purely biological-financial analysis, which is beyond the scope of our study. Our premise is that deep-rooted effects shaped thousands of years ago are common to groups of people who moved away from the birthplace of humanity in East Africa and formed today's modern countries. These characteristics, and the associated information they bear, have become genetic in the sense that they cannot be captured (or measured) by simple country fixed effects or by other cultural and institutional characteristics, which formed in the more recent history of humanity. It is these common factors that we find to have an important effect on corporate performance.

In light of this focus, we do *not* argue that selection of board directors should be determined by analyzing potential directors' genetics. We merely suggest that the recently shaped cultural and institutional characteristics in directors' countries of origin are less important in explaining corporate performance than are the deep-rooted factors captured by our diversity variable. It is precisely these effects that provide a policy implication, suggesting that diversity in the boardroom is desirable. This result also opens up future paths of research in identifying which are the precise characteristics captured by our genetic diversity variable. Certainly, this avenue requires digging further into the genetic diversity scores and identifying their components. Because we have already covered a lot of ground herein, we leave this idea as a desideratum for future research.

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Table 1
Variable Definitions and Sources

Name	Description	Data source
Dependent variables		
Risk-adjusted returns	ROA/σ(ROA). ROA is the average return on assets over a three-year period, and σ(ROA) is calculated over the same three-year period.	Worldscope and own calculations
Tobin's q	(Equity market value + Liabilities book value)/(Equity book value + Liabilities book value)	Worldscope
Sales growth	Net sales/Revenues (1-year annuity)	Worldscope
Operating expenses	Total operating expenses/Total sales	Worldscope
Explanatory variables		
Deviation of diversity	$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(d_i - m)^2}$, where σ is the standard deviation of the genetic diversity score *d* from the mean value *m* of the diversity of the board of directors, attached to the *n* board directors of each firm, according to the diversity score of the country of nationality of each director.	Ashraf and Galor (2013) and own calculations
Cash flow	Cash flow/Total sales	Worldscope
Equity capital	Common equity/Total assets	Worldscope
Current ratio	Current assets/Current liabilities	Worldscope
Size	ln(Total assets)	Worldscope
Inefficiency	Cost of goods sold/Total sales	Worldscope
Diversity in law and order	The standard deviation of the law and order scores from the country of nationality of directors by firm and year, constructed in the same way as the deviation of diversity variable.	ICRG and own calculations
Political diversity	The standard deviation of the Polity IV index of democracy from the country of nationality of directors by firm and year, constructed in the same way as the deviation of diversity variable.	Polity IV and own calculations
Cultural diversity	The standard deviation of an overall cultural index from the five components of the Hofstede database, constructed in the same way as the deviation of diversity variable. A principal components analysis is used on the five sub-indices to derive a single index of cultural diversity.	Hofstede and own calculations
Diversity in trust	The standard deviation of a trust index from the country of nationality of directors by firm and year, constructed in the same way as the deviation of diversity variable. Average scores are calculated based on the samples of respondents from the World Values Survey.	World Values Survey and own calculations
Diversity in development	The standard deviation of GDP per capita (in constant U.S. prices) from the country of nationality of directors by firm and year, constructed in the same way as the deviation of diversity variable.	World Development Indicators and own calculations
Number of directors	Number of firm directors	BoardEx
Non-executive directors	Percentage of non-executive directors on the board	BoardEx
Gender	Percentage of male directors on board	BoardEx
Chairman on board	Dummy variable equal to one if the executive chairman is present on the board and zero otherwise	BoardEx
Age of board	Average age of the board of directors	BoardEx

Independent on audit	Percentage of independent non-executive directors on the audit committee	BoardEx
Director network	Average of board's network size, in terms of outside linked directors	BoardEx
Time in role	Average of the number of years of director in current role	BoardEx
Independent past roles	Percentage of independent non-executive directors with past CFO/FD role on board	BoardEx
Foreign directors	Percentage of foreign directors on board	BoardEx
Foreign sales growth	Annual growth in foreign sales (in logs)	Worldscope
Foreign sales	Foreign sales divided by total sales (%)	Worldscope
Instrumental Variables		
Migratory distance	ln(Migratory distance from East Africa)	Ashraf and Galor (2013) and own calculations
Ultraviolet exposure	The intensity of ultraviolet exposure	Ashraf and Galor (2013) and own calculations

Table 2
Summary Statistics

The table reports the number of observations as well as the mean, standard deviation, minimum, and maximum of the main variables used in the empirical analysis. The variables are defined in Table 1. The two panels correspond to the samples used to run regressions with risk-adjusted returns and Tobin's q as the dependent variables, respectively.

Variable	Observations	Mean	Std. dev.	Min.	Max.
Panel A. Sample with risk-adjusted returns as the dependent variable					
Risk-adjusted returns	4,083	4.52	6.75	-4.61	50.40
Deviation of diversity	4,083	0.01	0.02	0	0.08
Cash flow	4,083	10.38	32.29	-818.12	611.40
Equity capital	4,083	48.21	23.37	-67.68	132.22
Current ratio	4,083	2.20	2.13	0.28	31.34
Sales growth	4,083	13.31	28.45	-62.36	340.83
Size	4,083	13.37	2.10	5.68	19.60
Inefficiency	4,083	58.70	24.97	0.00	547.78
Diversity in law and order	4,083	0.10	0.24	0	2.26
Political diversity	4,083	0.11	0.80	0	27.51
Cultural diversity	4,083	0.09	1.76	-3.10	12.76
Diversity in development	4,083	0.07	0.23	0	2.31
Diversity in trust	4,083	2.70	5.62	0	39.58
Number of directors	4,083	7.98	2.55	2	20.00
Non-executive directors	4,083	59.20	21.43	0	100
Gender	4,083	92.82	9.36	33.33	100.00
Chairman on board	4,083	0.54	0.50	0	1
Age of board	4,083	57.79	5.21	38.17	77.75
Independent on audit	4,083	92.27	20.80	0	100
Director network	4,083	381.83	310.86	6.60	1,817.64
Time in role	4,083	6.31	3.39	0.16	23.30
Independent past roles	4,083	8.26	9.85	0	75
Foreign directors	4,061	7.35	15.48	0	100
Foreign sales growth	3,544	100.83	3,384.18	-100	157,789.8
Foreign sales	3,692	30.87	31.70	0	100
Migratory distance	4,083	2.47	0.51	1.53	3.13
Ultraviolet exposure	4,083	4.54	0.39	3.81	5.34
Panel B. Sample with Tobin's q as the dependent variable					
Tobin's q	4,198	1.89	1.17	0.56	10.15
Deviation of diversity	4,198	0.01	0.02	0.00	0.08
Cash flow	4,198	9.06	38.07	-818.12	611.40
Equity capital	4,198	48.14	23.08	-67.68	110.16
Current ratio	4,198	2.20	2.14	0.28	31.34
Sales growth	4,198	13.53	29.00	-62.61	340.83
Size	4,198	13.35	2.14	5.68	19.60
Inefficiency	4,198	58.76	24.95	0.00	547.78
Diversity in law and order	4,198	0.10	0.23	0	2.26
Political diversity	4,198	0.11	0.79	0	27.51
Cultural diversity	4,198	0.08	1.77	-3.10	12.76
Diversity in development	4,198	0.07	0.23	0	2.31
Diversity in trust	4,198	2.64	5.54	0	39.58
Number of directors	4,198	7.98	2.55	2	20.00
Non-executive directors	4,198	59.11	21.60	0	100
Gender	4,198	92.83	9.39	33.33	100
Chairman on board	4,198	0.54	0.50	0	1
Age of board	4,198	57.75	5.20	38.17	77.75
Independent on audit	4,198	92.12	21.11	0	100
Director network	4,198	383.57	312.33	6.60	1,817.64

Time in role	4,198	6.28	3.37	0.44	23.30
Independent past roles	4,198	8.24	9.81	0	75
Foreign directors	4,176	7.29	15.61	0	100
Foreign sales growth	3,638	100.13	3,340.67	-100	157,789.8
Foreign sales	3,783	30.70	31.76	0	100
Migratory distance	4,198	2.47	0.51	1.53	3.13
Ultraviolet exposure	4,198	4.54	0.39	3.81	5.34

Table 3

Deviation Effect of Genetic Diversity on Corporate Performance: Baseline Results

The table reports coefficient estimates and *t*-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. Estimation method is LIML in first differences with robust standard errors clustered by firm. All models include year fixed effects. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value (equal to 8.68 in these models) to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	Risk-adjusted returns				Tobin's q			
	1	2	3	4	5	6	7	8
Lagged dependent	-0.280***	-0.280***	-0.282***	-0.283***	-0.173***	-0.174***	-0.172***	-0.172***
	(-11.149)	(-11.160)	(-11.184)	(-11.187)	(-6.182)	(-6.216)	(-6.124)	(-6.164)
Deviation of diversity	43.912**	50.067**	49.825**	59.023***	6.794***	6.799**	7.160**	8.123***
	(2.169)	(2.342)	(2.283)	(2.683)	(2.711)	(2.325)	(2.392)	(2.841)
Cash flow	-0.000	-0.000	-0.000	-0.001	0.001	0.000	0.000	0,001
	(-0.228)	(-0.193)	(-0.201)	(-0.462)	(0.877)	(0.813)	(0.807)	(0.837)
Equity capital	0.0026***	0.025***	0.024***	0.026***				
	(2.999)	(2.869)	(2.796)	(2.914)				
Current ratio	0.104	0.106	0.109	0.106	-0.013	-0.013	(0.013)	-0,012
	(0.994)	(1.015)	(1.042)	(1.013)	(-1.167)	(-1.179)	(-1.189)	(-1.127)
Sales growth	-0.001	-0.001	-0.001	-0.001	0.002***	0.002***	0.002***	0.002***
	(-0.627)	(-0.566)	(-0.655)	(-0.503)	(3.252)	(3.270)	(3.277)	(3.274)
Size	0.944***	0.950***	0.918***	0.929***	-0.404***	-0.404***	-0.404***	-0.406***
	(3.567)	(3.626)	(3.512)	(3.543)	(-4.517)	(-4.512)	(-4.541)	(-4.523)
Inefficiency	-0.010	-0.011	-0.010	-0.011	-0.006**	-0.006**	-0.006**	-0.006**
	(1.249)	(-1.331)	(-1.294)	(-1.349)	(-2.230)	(-2.278)	(-2.232)	(-2.256)
Diversity in law and order		-3.542***	-3.598***	-3.031**		-0.220*	-0.209	-0.219*
		(-2.927)	(-2.942)	(-2.421)		(-1.681)	(-1.616)	(-1.840)
Political diversity		-0.069	-0.063			-0.015	-0.015	
		(-0.470)	(-0.444)			(-1.314)	(-1.316)	
Cultural diversity		0.312	0.288			0.037	0.038	
		(0.846)	(0.786)			(1.065)	(1.095)	
Diversity in development		1.540	1.367			-0.120	-0.127	
		(0.768)	(0.689)			(-1.049)	(-1.105)	
Diversity in trust		-0.047	-0.043			0.005	0.005	
		(-1.000)	(-0.931)			(0.962)	(0.913)	
Number of directors			0.181				-0.013	
			(1.609)				(-1.164)	
Non-executive directors			-0.012				-0.000	
			(-0.712)				(-0.080)	
Gender			0.010				0.003	
			(0.343)				(0.841)	
Chairman on board			0.177	0.172			-0.091*	-0.090
			(0.367)	(0.360)			(-1.620)	(-1.600)
Age of board			-0.073				-0.002	
			(-1.002)				(-0.161)	
Independent on audit			0.009				0.002	
			(1.000)				(1.332)	
Network size			0.001				-0.000	
			(0.761)				(-0.082)	
Time in role			0.164**	0.139*			0.004	0.004
			(2.124)	(1.888)			(0.385)	(0.458)
Independent past roles			-0.024				0.001	
			(-1.196)				(0.373)	
Observations	4,083	4,083	4,083	4,083	4,198	4,198	4,198	4,198
UIT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WIT	76.37	78.82	79.23	64.90	81.06	84.48	84.17	68.90
OIT	0.54	0.12	0.13	0.13	0.61	0.50	0.38	0.60

Table 4
Controlling for Foreign Sales and Foreign Directors

The table reports coefficient estimates and *t*-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. Estimation method is LIML in first differences with robust standard errors clustered by firm. All models include year fixed effects. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value (equal to 8.68 in these models) to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	1	2	3	4	5	6
Dependent variable:	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q
Lagged dependent	-0.283***	-0.173***	-0.287***	-0.182***	-0.274***	-0.175***
	(-11.160)	(-6.177)	(-10.298)	(-6.079)	(-9.768)	(-5.976)
Deviation of diversity	96.748**	12.896**	73.338***	6.213**	67.493***	7.272***
	(2.475)	(2.232)	(2.955)	(2.192)	(2.948)	(2.698)
Cash flow	-0.001	0.001	-0.001	0.001	-0.001	0.001
	(-0.469)	(0.853)	(-0.553)	(1.413)	(-0.556)	(0.882)
Equity capital	0.026***		0.028***		0.027***	
	(2.912)		(2.693)		(2.679)	
Current ratio	0.106	-0.012	0.153	-0.019	0.136	-0.018
	(1.008)	(-1.079)	(1.298)	(-1.576)	(1.183)	(-1.569)
Sales growth	-0.001	0.002***	-0.001	0.002**	-0.001	0.002***
	(-0.491)	(3.065)	(-0.536)	(2.475)	(-0.378)	(2.607)
Size	0.902***	-0.388***	0.884***	-0.417***	0.960***	-0.398***
	(3.380)	(-4.397)	(2.752)	(-3.972)	(3.318)	(-4.292)
Inefficiency	-0.010	-0.006**	-0.013	-0.006**	-0.012	-0.006**
	(-1.297)	(-2.225)	(-1.368)	(-2.344)	(-1.319)	(-2.352)
Foreign directors	-0.082*	-0.009				
	(-1.917)	(-1.313)				
Foreign sales growth			-0.000	0.000		
			(-1.404)	(0.303)		
Foreign sales					-0.012	-0.002
					(-1.155)	(-1.621)
Diversity in law and order	-2.480*	-0.182	-2.983**	-0.171	-3.040**	-0.193
	(-1.937)	(-1.484)	(-2.122)	(-1.393)	(-2.228)	(-1.610)
Chairman on board	0.123	-0.116**	-0.073	-0.107*	0.151	-0.110*
	(0.256)	(-2.160)	(-0.133)	(-1.675)	(0.277)	(-1.797)
Time in role	0.133*	0.004	0.134*	0.002	0.138*	0.005
	(1.794)	(0.445)	(1.675)	(0.266)	(1.792)	(0.555)
Observations	4,061	4,176	3,356	3,444	3,560	3,658
UIT	0.00	0.00	0.00	0.00	0.00	0.00
WIT	23.53	24.18	56.18	58.74	63.70	67.92
OIT	0.06	0.22	0.13	0.27	0.13	0.58

Table 5
Non-Linearity, Different Instrumental Variables and Two-Way Clustering of Standard Errors

The table reports coefficient estimates and t-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. Estimation method is LIML in first differences with robust standard errors clustered by firm in models 1 to 6 and by both firms and years in models 7 and 8. All models include year fixed effects. In models 3 and 4 the instrumental variable is only migratory distance and in models 5 and 6 only ultraviolet exposure. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value included in parentheses to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	1	2	3	4	5	6	7	8
Dependent variable:	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q
Lagged dependent	-0.282***	-0.172***	-0.283***	-0.172***	-0.282***	-0.172***	-0.283***	-0.172***
	(-11.013)	(-6.159)	(-11.189)	(-6.165)	(-11.167)	(-6.162)	(-9.882)	(-4.196)
Deviation of diversity	607.173	19.672	52.939**	7.980***	99.872***	9.013***	59.023***	8.123***
	(1.577)	(0.865)	(2.401)	(2.787)	(2.763)	(2.681)	(3.246)	(3.481)
Deviation of diversity squared	12,200.0	-258.8						
	(-1.425)	(-0.512)						
Cash flow	0.000	0.001	-0.001	0.001	-0.001	0.001	-0.001	0,001
	(-0.195)	(0.844)	(-0.446)	(0.838)	(-0.573)	(0.833)	(-0.515)	(1.215)
Equity capital	0.025***		0.026***		0.025***		0.026***	
	(2.846)		(2.917)		(2.893)		(3.742)	
Current ratio	0.089	-0.013	0.106	-0.012	0.104	-0.012	0.106	-0.012
	(0.833)	(-1.148)	(1.015)	(-1.127)	(0.999)	(-1.128)	(1.016)	(-1.356)
Sales growth	-0.001	0.002***	-0.001	0.002***	-0.001	0.002***	-0.001	0.002**
	(-0.491)	(3.261)	(-0.513)	(3.274)	(-0.436)	(3.2770	(-0.501)	(2.404)
Size	0.905***	0.405***	0.930***	-0.406***	0.922***	-0.406***	0.929**	-0.406***
	(3.262)	(-4.515)	(3.547)	(-4.523)	(3.507)	(-4.520)	(2.079)	(-2.922)
Inefficiency	-0.009	-0.006**	-0.011	-0.006**	-0.011	-0.006**	-0.011	-0.006***
	(-1.131)	(-2.241)	(-1.344)	(-2.256)	(-1.381)	(-2.255)	(-1.292)	(-2.850)
Diversity in law and order	-4.845***	-0.257*	-2.907**	-0.217*	-3.860***	-0.237*	-3.031**	-0.219
	(-3.034)	(-1.685)	(-2.284)	(-1.834)	(-3.117)	(-1.804)	(-2.499)	(-1.566)
Chairman on board	0.159	-0.090	0.172	-0.090	0.169	-0.090	0.172	-0.090***
	(0.331)	(-1.605)	(0.361)	(-1.600)	(0.355)	(-1.604)	(0.489)	(-2.784)
Time in role	0.181**	0.005	0.138*	0.004	0.146**	0.004	0.139**	0.004
	(2.267)	(0.549)	(1.873)	(0.455)	(1.982)	(0.476)	(2.029)	(0.408)
Observations	4,083	4,198	4,083	4,198	4,083	4,198	4,083	4,198
UIT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WIT	6.17	6.92	133.11	142.09	79.53	74.99	140.24	131.31
	(7.03)	(7.03)	(16.38)	(16.38)	(16.38)	(16.38)	(8.68)	(8.68)
OIT	-	-	-	-	-	-	-	-

Table 6
Operational Outcomes of the Deviation Effect of Genetic Diversity

The table reports coefficient estimates and *t*-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. Estimation method is LIML in first differences with robust standard errors clustered by firm. All models include year fixed effects. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value included in parentheses to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

	1	2
Dependent variable:	Sales growth	Operating expenses
Lagged dependent	-0.108***	-0.283
	(-4.819)	(-1.024)
Deviation of diversity	477.825**	-349.789
	(2.136)	(-1.081)
Cash flow	-0.008	0.142
	(-0.353)	(0.328)
Equity capital	-0.053	-0.301
	(-1.090)	(-0.936)
Current ratio	-0.693	-3.080
	(-0.906)	(-0.766)
Sales growth	-0.108***	-0.500
	(-4.819)	(-0.970)
Size	-80.737***	54.188
	(-19.832)	(0.860)
Inefficiency	0.079	-3.635
	(0.928)	(-0.991)
Observations	4,363	4,381
UIT	0.00	0.00
WIT	79.88	83.49
OIT	0.07	0.55

Table A1
Correlation matrix

This table reports correlation coefficients of the firm-level variables used in equations 1 and 5 of Table 3. All variables are defined in Table 1. The *** marks denote statistical significance at the 1% level.

	Risk-adjusted returns	Tobin's q	Deviation of diversity	Cash flow	Equity capital	Current ratio	Sales growth	Size	Inefficiency
Risk-adjusted returns	1.000								
Tobin's q	0.139***	1.000							
Deviation of diversity	-0.010	0.063***	1.000						
Cash flow	0.126***	0.012	0.059***	1.000					
Equity capital	0.000	0.152***	-0.071***	0.014	1.000				
Current ratio	-0.057***	0.171***	-0.025	-0.090***	0.547***	1.000			
Sales growth	0.009	0.137***	-0.002	0.085***	0.058***	0.005	1.000		
Size	0.230***	-0.030*	0.251***	0.193***	-0.358***	-0.291***	-0.061***	1.000	
Inefficiency	-0.041**	-0.290***	-0.016	-0.183***	-0.285***	-0.214***	-0.071***	0.190***	1.000

Table A2
OLS results

The table reports coefficient estimates and t-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. The estimation method is OLS with robust standard errors clustered by firm. All models include year fixed effects. Models 1 and 3 include country fixed effects, and models 2 and 4 include firm fixed effects. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value included in parentheses to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level. The ***, **, and * marks denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	Risk-adjusted returns		Tobin's q	
	1	2	3	4
Deviation of diversity	-23.879**	33.800*	5.770**	4.062**
	(-2.114)	(1.725)	(2.372)	(2.275)
Cash flow	0.016***	0.007*	-0.001	-0.001
	(3.513)	(1.697)	(-1.033)	(-1.128)
Equity capital	0.022***	0.029**		
	(2.742)	(2.345)		
Current ratio	-0.086	0.053	0.044**	-0.001
	(-1.042)	(0.468)	(2.206)	(-0.084)
Sales growth	0.004	0.006**	0.005***	0.002***
	(1.201)	(2.193)	(5.012)	(3.553)
Size	0.921***	0.486	-0.004	-0.068***
	(9.449)	(1.352)	(-0.201)	(-3.448)
Inefficiency	-0.017***	-0.018	-0.011***	-0.007***
	(-2.658)	(-1.361)	(-5.672)	(-6.054)
Diversity in law and order	-0.851	-2.357**	0.153	0.001
	(-1.219)	(-2.362)	(1.084)	(0.015)
Chairman on board	0.232	0.187	-0.075	-0.065
	(0.703)	(0.314)	(-1.093)	(-1.319)
Time in role	0.279***	0.088	0.006	0.01
	(5.319)	(0.977)	(0.642)	(1.305)
Firm fixed effects	No	Yes	No	Yes
Observations	4,083	4,083	4,198	4,198
R-squared	0.11	0.10	0.17	0.14

Table A3

Results for the United States and the United Kingdom

The table reports coefficient estimates and *t*-statistics (in parentheses) of regressions based on equation (2). The dependent variables are reported in the first line of the table. All variables are defined in Table 1. The estimation method is LIML in first differences with robust standard errors clustered by firm. UIT is the *p*-value of the under-identification LM test by Kleibergen and Paap, which requires a value lower than 0.05 to reject the null hypothesis at the 5% level. WIT is the Wald *F*-statistic of the weak identification test by Kleibergen and Paap, which must be higher than its critical value (equal to 8.68 in these models) to reject the null. OIT is the *p*-value of the over-identification test by Hansen, which requires a value higher than 0.05 to reject the null hypothesis at the 5% level.

	United States		United Kingdom	
	1	2	3	4
Dependent variable:	Risk-adjusted returns	Tobin's q	Risk-adjusted returns	Tobin's q
Lagged dependent	-0.253***	-0.166***	-0.324***	-0.131***
	(-7.643)	(-4.955)	(-8.760)	(-2.811)
Deviation of diversity	79.980**	7.909	21.201	4.277**
	(2.040)	(1.373)	(1.420)	(2.446)
Cash flow	-0.002	0.000	0.003	0.000
	(-0.679)	(0.700)	(1.561)	(0.482)
Equity capital	0.029**	-0.006**	0.020*	-0.005**
	(2.065)	(-2.163)	(1.865)	(-2.432)
Current ratio	0.083	-0.017	0.142	0.010
	(0.512)	(-1.065)	(1.143)	(0.852)
Sales growth	-0.009***	0.002**	0.003	0.002***
	(-3.536)	(2.209)	(1.087)	(2.872)
Size	2.155***	-0.580***	0.532*	-0.326***
	(4.658)	(-3.883)	(1.841)	(-4.175)
Inefficiency	-0.006	-0.008**	-0.018**	-0.001
	(-0.565)	(-2.148)	(-2.128)	(-0.647)
Observations	2,221	2,179	1,799	1,754
UIT	0.00	0.00	0.00	0.00
WIT	19.83	19.76	97.12	93.90
OIT	0.07	0.11	0.63	0.12