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Abstract

We proxy for board members' differences of opinions and values using directors' ancestral origins and show that diversity has costs and benefits, which lead to high performance volatility. Consistent with the idea that diverse groups experiment more, firms with diverse boards have more and more cited patents and their strategies conform less to those of the industry peers. However, firms with greater ancestral diversity also have more board meetings, higher director turnover unrelated to performance, and make less predictable decisions. These findings suggest that diversity may lead to inefficiencies in the decision-making process and conflicts in the boardroom. Our results do not appear to be driven by firms' risk-taking or complexity.

Keywords: Boards, Diversity, Culture, Genetics

JEL Classifications: Z1, G3, O4

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1. Introduction

The effects of diversity are studied in a variety of fields ranging from macroeconomics to social psychology (e.g., Alesina, Michalopoulos, and Papaioannou, 2016; Ashraf and Galor, 2013; Page, 2007). These studies typically conjecture that diversity may have costs and benefits. By widening the spectrum of individuals' abilities, cognitive approaches and preferences, diversity is expected to yield benefits in terms of more rapid knowledge accumulation, but it may also frustrate the decision-making process and decrease trust and interpersonal cooperation (Algan, Hemet, and Laitin, 2016). To date, there is little evidence on how diversity affects actual economic decisions.

This paper attempts to fill this gap using the board of directors as a laboratory. It starts by documenting that most of the variance in common measures of U.S. listed companies' board diversity is related to directors' ancestries. While a large fraction of the directors of U.S. listed companies has British origin, firms differ in the extent to which different ancestries are represented. Ancestry has been shown to affect the culture of immigrants even after several generations (Guiso, Sapienza and Zingales, 2006) not only because culture has a large component of intergenerational transmission, but also because genetic differences between individuals with different ancestries are known to be related to differences in their values and preferences (Desmet, Ortuño-Ortín, Wacziarg, 2017).[1]

Controlling for other commonly used measure of diversity, such as gender diversity and diversity in industry experience, we show that ancestral diversity has costs and benefits, which result in greater stock return and fundamental volatility for firms with more diverse boards. Put differently, ancestral diversity widens the distribution of firm

[1] See also Algan, and Cahuc (2010), Fernandez (2011), Dohmen, Falk, Huffman, and Sunde (2012), and Alesina, Giuliano, and Nunn (2013).

profits and the effects appear to be driven by cultural as well as genetic differences between the directors. Consistent with the idea that diverse groups are better at solving complex problems, we find that firms with diverse boards have more and more cited patents. The success in innovation of firms with diverse boards may result from more experimentation as we show that firms with diverse boards enact strategies that differ more from those of the industries peers and change them to a larger extent over time.

The downside of diverse preferences and perspectives is that diverse directors may disagree on what the pressing problems of the firm are and on which policies optimize the firm's objectives. To the extent that individual preferences fail to aggregate into collective preferences, as highlighted by Arrow (1951), individuals have incentives to misrepresent their preferences and manipulate the agenda. As a consequence, the voting results of rational individuals may be hard to predict and the decision-making process may be erratic. Also, conflict in the boardroom may arise.

Consistent with these conjectures, we find that director turnover is higher and unrelated to performance in firms with diverse boards. Firms with diverse boards also have more board meetings suggesting difficulties in the decision-making process. Finally, analysts make larger forecast errors in predicting the performance of firms with diverse boards suggesting that the diverse preferences of board members lead to hard to predict decisions.

It is typically hard to go beyond the association between board composition and firm strategies and performance because the characteristics of board members are chosen optimally. However, while directors' skills, such as industry experience, are likely to be optimally selected depending on a firm's challenges and investment opportunities, the

ancestral composition of the board tends to reflect the ancestral composition of the location where the firms' headquarters are located. This is because independent directors are largely selected locally and the headquarters' locations are chosen early on in firms' lifecycles (Knyazeva, Knyazeva, and Masulis (2013); Alam, Chen, Ciccotello, and Ryan (2014)). Thus, concentrating on ancestral diversity allows us to focus on a dimension of board composition that is less likely to be the primary driver of the decision to hire a director, but rather depends on the local supply of potential directors.

We also exploit ancestral diversity in the counties where firms are headquartered as an instrument for board ancestral diversity. Our results are robust when we exploit the arguably exogenous component of board diversity reflecting the geographical composition of the counties where firms are headquartered. This finding supports a causal interpretation of our findings under the identifying assumption that county characteristics are not associated with firm performance volatility after the inclusion of a host of firm level controls. This identifying assumption appears to be fully supported by other tests, in which we exploit orthogonal sources of variation in the data, and show that our results are robust to the inclusion of firm fixed effects (which fully control for the location of firms' headquarters). Thus, there is no evidence that our results may be driven by firms with diverse boards being different along some unobserved time-invariant dimension, such as the county in which they are headquartered.

To mitigate any lingering doubts about the interpretation of our findings, we consider firm performance following the announcements of mergers and acquisitions. Mergers and acquisitions are major corporate decisions, made by the board, that have a considerable impact on firm performance. Thus, an association between board diversity

and the outcome of (subsequent) merger and acquisitions cannot be driven by reverse causality. Higher variability in the announcement returns of mergers and acquisitions would be consistent with our interpretation that diverse boards make extremely good and extremely bad decisions. It is thus comforting that we find that acquisition announcement returns of firms with diverse board are more volatile.

We also show that our findings are unlikely to be driven by higher complexity or opacity of firms with diverse boards, as the dispersion of analyst forecasts does not depend on board ancestral diversity. Finally, we find no evidence that firms with diverse boards take more risk, as these firms do not have higher leverage and do not invest more.

Our paper is related to a body of research that explores how ancestral diversity affects cooperation and economic performance (Alesina and La Ferrara, 2005; Spolaore and Wacziarg, 2013). A number of influential papers show that genetic diversity, which depends on population ancestral origins, has a hump-shaped effect on macroeconomic performance (Ashraf and Galor, 2013; Ashraf, Galor and Klemp, 2015), a finding that we show to hold also at the firm level. Genetic differences across countries also prevent the diffusion of economic development (Spolaore and Wacziarg, 2009). Genes are also known to affect financial decisions (Cesarini et al, 2010; Cronqvist and Siegel, 2015).

By studying how boards with different ancestral diversity run companies, this paper aims to provide microeconomic evidence on how diversity related to individuals' ancestral origins affects high-stake economic decisions. Since the identity of directors and the performance of listed companies are easily observed, boards provide an ideal laboratory to understand how ancestral diversity affects economic outcomes.

Our paper also contributes to the literature on boards of directors. A growing literature explores the effects of directors' skills and board structure on performance (e.g., Guner, Malmendier, and Tate, 2008; Ahern and Dittmar, 2012; Field, Lowry, and Mkrtchyan, 2013; Kim, Mauldin, and Patro, 2014). The quality of a board's decision-making is likely to depend not only on the characteristics of the directors but also on the interaction between the directors, an aspect that has been largely neglected in previous literature and that we investigate in this paper.[2] We highlight that diversity in culture and values has an effect on the decision-making process, which goes beyond the effect of the distance associated with the location of directors on the board's ability to monitor (Masulis, Wang and Xie, 2012).

A number of papers have explored the effects of diversity on firm performance using composite indexes of directors' skills, including industry experience, tenure, and age (Anderson, Reeb and Zhao, 2011; Bernile, Bhagwat, and Yonker, 2016; Gompers, Mukharlyamovc, Xuan, 2016). These papers show mixed results on the effects of different aspects of diversity on firm performance and risk taking.[3] We focus on diversity in ancestral origins and explore its effects on the working of the board, while controlling for other aspects of board diversity. By capturing diversity in culture and values, ancestral diversity appears to affect the decision-making process and to increase firm performance volatility and makes performance less predictable, while other sources of diversity such as gender diversity appear to be associated with an increase in

[2] A notable exception is Schwartz-Ziv and Weisbach (2013) who analyze the minutes of boards of eleven Israeli companies.

[3] In contemporaneous work, Bernile, Bhagwat, and Yonker (2016) show that a composite index of board diversity has a negative effect on the volatility of daily returns. Our controls and especially the proxy for the diversity in industry experience also tend to have a negative effect on performance volatility albeit not always significant. We also note that our measures of volatility are based on monthly returns, which are less noisy.

transparency and make the stock price more informative (Gul, Srinidhi, and Ng 2011). This also highlight the necessity to distinguish between different types of diversity as opposed to relying on composite indexes.

Our work is also related to a strand of research exploring the effect of culture relying on executives and directors' ancestries, established using executives' surnames as we do. For instance, Ellahie, Tahoun, Tuna (2017) study how the ancestry of the CEO is related to the structure of pay. Pan, Siegel, and Wang (2014 and 2017) and Liu (2016), explore how cultural traits, such as risk tolerance, affect decision making. Instead of exploring cultural traits, we consider ancestral diversity, which as we show is related to cultural and genetic differences between directors, and how it affects the decision making process.

Finally, our paper helps to understand the determinants of stock idiosyncratic volatility. Idiosyncratic stock-return volatility is a large component of stock total volatility (Campbell, Lettau, and Xu, 2001), which may be affected by corporate policies and characteristics. Existing studies have stressed the role of competition and uncertainty about managerial characteristics (Irvine and Pontiff, 2006; Pan, Wang and Weisbach, 2015). We highlight the role of board decision-making.

2. Data and main Variables

2.1 Sample Construction

Our board data are from Risk Metrics. This database provides annual corporate governance information on S&P1,500 companies. From Risk Metrics, we extract data on directors' names, age, tenure, outside directorships, board size, board independence,

whether the CEO is also the chairman of the board, whether the director is an insider, and gender from 1996 to 2014. As is common practice, we exclude firms in the financial industry (SIC codes in the 6000s). Our final dataset covers an unbalanced panel of 2,947 firms for a total of 23,970 firm-year observations. At the director level, we have information on 31,956 unique directors for a total number of 234,616 director-year observations.

We complement Risk Metrics with information on stock prices and returns from CRSP and financial statements from COMPUSTAT. In some tests, we merge our main dataset with information on analyst forecasts from IBES, executive turnover from EXECUCOMP, and firms' patents from Kogan, Papanikolau, Seru and Stoffman (2015). Our merger data are from Thomson Reuters's SDC database. We also extract 8-K filings data from the SEC Analytics Suites. For part of the sample period (2001-2014), we obtain the number of board meetings from MSCI GMI Ratings (formerly, Board Analytics). Finally, we extract implied volatility data from Option Metrics.

2.2 Measuring Board Ancestral Diversity

Ancestry can be categorized using a practice, consolidated among demographers, geographers, geneticists and epidemiologists (Mateos, 2014), but also used by economists (e.g., Kerr, 2008; Liu, 2016; Pan, Siegel and Wang, 2017), of establishing ancestry through last names.[4]

[4] Research in demography, health, and genetics makes increasing use of names to classify populations and establish their hereditary characters and group identities. The U.S. government has been a key player in the use of this approach to population classification. It commissioned such an analysis in the first decade of the twentieth century to inform migration policies and later on to ascribe ethnicity in the resident populations. The Census Bureau has been involved in the development and validation of these techniques over several decades, lending official support to the use of this method.

We follow this practice and associate with each last name a country of origin using information from *Ancestry.com*. *Ancestry.com* provides information on the country of origin of passengers of ships arriving from foreign ports at the port of New York between 1820 and 1957. Since in a few instances the same last name may originate from several countries, in those cases, we associate each last name with equal probability to the top three most frequent countries of origin of the ship passengers, similarly to Pan, Siegel and Wang (2014).

While using last names for classifying individual ancestral origins involves noise, the approach we take has proved useful to study hereditary characters in a number of disciplines. Moreover, we do not see any reasons why misclassifications should exhibit a systematic correlation with firm performance volatility and other corporate outcomes. Any noise should increase the standard errors of our estimates, thus biasing the estimates against finding any result.

Table 1 describes the ten most frequent ancestral origins of the 31,956 directors in our sample. A majority of directors has British origin, followed by individuals of German ancestry and other predominantly Western European countries. We cannot identify the ancestral origin for 2.5% of the directors, which we exclude from the sample.

We follow existing literature (Alesina and La Ferrara, 2005) and define *Fractionalization*, a measure of board diversity capturing the probability that two randomly selected directors have different countries of origin, using a Herfindahl-based index as follows:

$$Fractionalization_{f,t} = 1 - \sum_{1}^{n} s_{i,f,t}^{2},$$

where $s_{i,f,t}$ is the share of board members of ancestry i among all board members of firm f at time t.

We also consider alternative measures of diversity, which as we show below help to explain the mechanisms through which the fractionalization of directors' ancestries matters. A higher fractionalization of the directors' ancestries may be associated with higher genetic diversity. Genetic diversity is expected to widen the spectrum of individuals' skills, abilities and cognitive approaches as well as cultural values and norms in a way that stimulates productivity. However, genetic diversity may also reflect low level of trust and interpersonal cooperation. For this reason, existing studies find a hump-shaped effect of genetic diversity on macroeconomic performance and country level productivity (Ashraf, Galor and Klemp, 2013 and 2015).

Following existing literature, we recognize that genetic diversity has two components. First, there are genetic differences between individuals of different ancestries, which we capture using the measure of genetic distance of Spolaore and Wacziarg (2009). As Spolaore and Wacziarg (2009 and 2013) argue, genetic distance is an excellent *summary statistic* capturing divergence in the whole set of implicit beliefs, customs, habits, biases, conventions, etc. that are transmitted across generations—biologically and/or culturally—with high persistence. We obtain a firm level measure of genetic distance (*Genetic Distance*) between the members of the board by averaging the genetic distance between the ancestries of each pair of board members.

Second, ancestry may matter because individuals within each ancestral group have different degrees of ancestral diversity. Population geneticists typically measure the extent of diversity in genetic material across individuals within a given population (such

as within a country) using an index called "expected heterozygosity." Like most other measures of diversity, this index may be interpreted simply as the probability that two individuals, selected at random from the relevant population, differ genetically from one another with respect to a given spectrum of traits. To proxy for genetic differences between individuals with a given ancestral origin, we use the country level measure of (within-country) genetic differences constructed by Ashraf and Galor (2013). We average this measure of genetic differences across all board members' ancestries to obtain an average of the genetic diversity of the board members; we refer to these average within-ancestry genetic differences as *Genetic Diversity*.

Our main measure of diversity may increase in within-group genetic diversity to the extent that diverse boards tend to have more individuals with ancestral origins that are associated with higher genetic differences. Since populations that are originally from areas closer to Africa are more genetically diverse, it is typically the case that directors with non-British ancestries originate from populations with high heterozygosity. Desmet, Ortuño-Ortín, and Wacziarg (2017) provide evidence that both between- and within-ancestry genetic differences, that is, *Genetic Diversity* and *Genetic Distance*, are related to differences in culture and trust.

Since cultural differences between individuals with different ancestries are not necessarily fully captured by genetic differences, we also consider a measure of *Cultural Differences*. This proxy for diversity exploits the World Value Survey, an attempt by social scientists to measure cultural values around the world. Inglehart (1997) shows that the salient features of a culture tend to cluster along two cultural values, survival and traditionalism. We thus use the Euclidean distance in cultural values between any two

pairs of directors of a company to measure cultural differences in heritage within the board.

Panel A of Table 2 summarizes the measures of board diversity. There appears to be large dispersion in the measures of diversity across the sample firms. This reflects that in some firms all directors have British origin while in others there are a number of directors with different ancestries.

2.3 Measuring firm volatility and other firm characteristics

We use several proxies to capture firm performance volatility, which are summarized in Panel B of Table 2. First, the total stock return volatility, defined as the standard deviation of monthly stock returns over 12 months starting from the most recent fiscal year end.

Since stock return volatility may reflect changes in both firms' expected cash flows and investors' discount rates, to focus on the volatility of cash flows, we define an alternative measure of fundamental volatility, which relies on earnings per share. Similarly to Irvine and Pontiff (2009), we measure the standard deviation of quarterly earnings shocks during months *t* to *t+12*. We assume that earnings follow a random walk, and measure an earnings shock as the difference between earnings per share in month *t* and month *t-12*. Measuring the shock over a one-year period controls for seasonality. If a firm reports its earnings on a quarterly basis, then the 12-months earnings volatility is the standard deviation of four earnings shocks. We use the natural logarithm of this volatility measure as dependent variable in the empirical analysis.

Finally, to capture that volatility arising from the effect of diversity on decision-making is more likely to arise from firm idiosyncratic factors rather than from exposure to systematic risk factors, we define a measure of idiosyncratic volatility. The 12-month idiosyncratic volatility is computed as the residual of a four-factor model including the three Fama and French (1993) factors and the momentum factor (Carhart, 1997) and estimated on monthly returns.

Not to rely only on measures of historical volatility, we compute common measures of implied volatility, which also allow us to decompose the total volatility in upside and downside volatility. We use the Optionmetrics option price database and calculate measures of upside and downside volatility for firms that have traded options. Downside volatility is measured as the yearly average daily-implied volatility of out-of-the-money puts that are closest to 30 days to expiration. We use 30 days to expiration to select the most liquid options. We use out-of-the-money puts and not in-the-money calls because the former are more liquid. Similarly, upside volatility is measured as the yearly average of the daily-implied volatility of out-of-the-money calls that are closest to 30 days to expiration.

Finally, we evaluate the volatility of the outcome for a major board decision, mergers and acquisitions (M&A). We extract all M&As made by U.S. public companies during the 1996–2014 period from the Securities Data Corporation's (SDC) U.S. Mergers and Acquisitions database. As is common in the literature, we require that (i) the acquisition is completed, (ii) the deal value disclosed in SDC is more than $1 million and is at least 1% of the acquirer's market value of total assets, measured at the fiscal year-end immediately before the acquisition announcement, (iii) the acquirer controls less than

50% of target shares prior to the announcement and owns more than 50% of target shares after the transaction. For each acquisition, we compute the announcement returns for the acquirer as the market adjusted abnormal return on the announcement date. Our results are robust if we use the cumulative abnormal returns over a window of one or two days before the merger announcement date to one or two days after the announcement date. The abnormal return is calculated by subtracting from the raw return the value weighted return of the market portfolio. We measure the volatility of the acquisition performance by using the absolute value of the announcement returns.

2.4 Other Firms Characteristics

Throughout the analysis, we control for a variety of firm characteristics including other measures of board diversity, unrelated to ancestral diversity, which have been used in the literature, as summarized in Panel A and C of Table 2. The other measures of board diversity include the percentage of female directors in a board, director age heterogeneity, proxied by the coefficient of variation of the directors' ages, and a similarly defined measure of directors' tenure heterogeneity. In addition, we proxy for the directors' diverse industry experience using the Herfindahl index of the number of directorships that a firm's directors hold in other two-digit SIC code industries.

Panel D lists the remaining firm level controls. All the variables' definitions of are provided in the Appendix.

3. Determinants of Board Diversity

To what extent is ancestral diversity a salient characteristic of board diversity? Do cross-sectional differences in other features of the boards, such as diversity in industry experience, trump the effects of board diversity? To answer these questions, we perform factor analysis for the different proxies for board diversity in our dataset. We find that three eigenvalues are larger than one, with the first largely dominating the other two, indicating that three factors capture the main dimensions of variation in board diversity. Panel A of Table 3 shows the factor loadings on the different diversity proxies associated with the three factors corresponding to the eigenvalues larger than one.

The first two factors (principal components) mostly load on the proxies for ancestral diversity as well as on the diversity of industry experience, while the third factor loads on diversity due to age and tenure. Overall, ancestral diversity seems to play an important role in accounting for variation in board diversity across firms. This supports our choice of concentrating on ancestral diversity. As explained in the introduction, ancestries are also less likely to reflect firms' demand for director skills. Consequently, our estimates of the effect of ancestral diversity on firm performance are less likely to be affected by endogeneity problems.

Panel B of Table 3 shows that average genetic differences, genetic distance and cultural differences between board members jointly contribute to explain ancestral fractionalization, our main firm-level measure of ancestral diversity in the board.

Panel C of Table 3 relates *Fractionalization* to predetermined firm characteristics and ancestral diversity in the county where a firm is headquartered. We proxy for county ancestral diversity using the 2000 U.S. Census Integrated Public Use Microdata Series (IPUMS) database at the University of Minnesota (Ruggles et al., 2010). The census

provides information on the respondents' self-reported ancestry. Over 74% of the respondents trace their roots to a particular foreign country. Importantly for our purposes, IPUM reports each respondent Public Use Microdata Area (PUMA), which generally follows the boundaries of a county. Using these data, we can construct the fractionalization of the ancestries of the individuals in a county (*County diversity*), as we do for the board level fractionalization.

It appears that the most important determinants of board diversity are the extent of ancestral diversity in the county where a firm is headquartered and board size. A one-standard-deviation increase in the county's ancestral diversity increases board diversity by over 5% of the standard deviation. This finding is consistent with previous literature indicating that directors, and independent directors in particular, are mostly selected locally and suggests a possible instrument for board diversity, capturing arguably exogenous variation in the supply of directors with different ancestries (Knyazeva, Knyazeva, and Masulis (2013); Alam, Chen, Ciccotello, and Ryan (2014); Giannetti, Liao, and Yu (2015)). In what follows, we provide evidence in support of the instrument's exclusion restriction.

Firm Tobin Q and, in column 2, the R&D to sales ratio appear to be associated with board ancestral diversity. This is consistent with the notion that diversity fosters creativity and particularly benefits innovative firms, which have to perform complex tasks. For this reason, in what follows, we include controls for these and other firm characteristics throughout the analysis. Our diversity proxy appears to be largely unrelated to other firm characteristics, such as firm size, captured by the logarithm of the

book value of assets, or the firm's leverage, mitigating concerns about selection problems.

4. Board Diversity and Firm Performance Volatility

In this section, we explore whether a diverse board may lead to unpredictable decisions and increase firm volatility. Table 4 relates alternative proxies for firm volatility to board diversity. Throughout the analysis, we control for a host of board and firm characteristics. The controls include proxies for board diversity other than ancestral diversity, such as diversity in industry experience, age, and tenure, and percentage of female directors; controls for other board characteristics, such as board size, percentage of independent directors, average number of the directors' outside directorships, a dummy for whether the CEO is the only insider who is a member of the board, and a dummy capturing whether the CEO is also the chairman of the board; and controls for firm characteristics, such as Tobin Q, R&D to sales ratio, the number of firm segments, which is a measure of firm diversification and complexity, leverage, investment, and age.[5] In addition, all specifications include year and either industry or firm fixed effects.

In Table 4, board diversity appears to be associated with higher firm performance volatility. The parameter estimate in column 1 of Panel A suggests a small, but not economically irrelevant effect: A one-standard-deviation increase in the measure of diversity leads to a 3% of a standard deviation increase in total return volatility. Importantly, this effect is present not only when we consider the total return volatility, but also if we concentrate on fundamental volatility (column 2) and we abstract from

[5] The results we present hereafter are equally robust if we control for diversity in the executive team.

possible differences in exposure to systematic risk factors by considering a firm's idiosyncratic volatility (column 3).

Importantly, the effect of ancestral origin fractionalization differs from the ones of other proxies for board diversity, such as diversity in industry experience, which have previously used in previous literature, and have been found to have a negative effect on the volatility of stock returns (Bernile, Bhagwat and Yonker, 2016).

The effects of fractionalization on the different proxies for firm performance volatility are similar, qualitatively and quantitatively, when we include firm fixed effects in columns 4 to 6 indicating that differences in time-invariant firm characteristics do not drive our findings. These results also demonstrate that our results cannot be driven by the fact that a firm's location is related to the firm's volatility as including firm fixed effects absorb location and any other time-invariant factors.

Therefore, to further mitigate any concerns about omitted factors driving the relation between volatility and fractionalization, we exploit cross-sectional differences in population fractionalization across counties. Since the fixed effects results demonstrate that county-specific factors do not drive our findings, an instrument based on county diversity is expected to satisfy the exclusion restriction. We thus instrument the fractionalization variable with the county's ancestral diversity. The Cragg-Donald Wald F statistics confirms that our instrument is highly relevant for explaining board diversity. Our instrument satisfies the exclusion restriction as long as a firm's location is not associated with the firm's volatility, an identifying assumption, which is supported by the robustness of our results to the inclusion of firm fixed effects. Thus, we can test whether board diversity continues to be associated with higher firm volatility once we use

ancestral diversity in the county in which a firm is headquartered as instrument. In this way, we abstract from firm-specific factors that may lead firms to choose more or less diverse boards.

Panel B shows that not only the direction of our estimates is invariant when we rely on two-stage least squares, but the magnitude of the estimates increases significantly. A one-standard-deviation increase in board diversity explains 50% of the standard deviation of the total volatility of a firm. The analogous effects for the firm's fundamental volatility and the firm's idiosyncratic volatility are 59% and 56%.

The large increase in the magnitude of the estimates may have two reasons. First, as explained before, there is measurement error in our measure of ancestral diversity deriving from the classification of last names. In this context, using instrumental variables reduces the attenuation bias due to the measurement error and leads to larger estimates.

Second, the instrumental variable estimates allow us to concentrate on the supply of directors. In counties where firms' choices are constrained by the supply of available directors, even the firms for which the costs of having a diverse board are highest may end up having directors with different ancestries. Furthermore, firms with headquarters in highly diverse geographical areas are subject to pressure to increase diversity in their board. They may thus increase board diversity even if this increases their performance volatility to a larger extent than for other firms.

Overall, it is comforting that our measure of board diversity continues to be associated with higher firm performance volatility when we exploit orthogonal sources of variation in the data (that is, within-firm variation in the firm fixed effects estimates and

cross-county variation in the instrumental variable estimates) thus suggesting that our findings are unlikely to be driven by endogeneity problems.

Table 5 reproduces our main results considering measures of implied volatility. Besides being forward looking, these measures allow us to decompose performance volatility in upside volatility and downside volatility. This in turn permits to highlight costs and benefits of directors' ancestral diversity. While the results are weak in the OLS estimates, the instrumental variable estimates clearly show that an increase in the fractionalization of the directors' ancestries leads to both higher upside and downside volatility.

Table 6 explores the cost and benefits of ancestral diversity in a different way. In columns 2 to 4, we present quintile regressions in which we relate a measure of firm profitability to our proxy for board fractionalization. Ancestral diversity decreases the bottom quartile of the distribution of a firm's average profitability in the following three years and it increases the top quartile of the distribution. We find no effect on the average firm (column 1) as well as on the median firm (column 3). This confirms that there are cost and benefits of ancestral diversity.

Consistent with the findings of Ashraf and Galor (2013), the effects of diversity appear to be non-monotonic as in column 5 ancestral diversity seems to have a positive effect on performance for low levels of diversity and then to decrease performance. Overall, it appears that ancestral diversity between corporate decision makers has a hump-shaped effect on performance as population diversity does on countries' macroeconomic performance. Furthermore, diversity is associated with higher performance volatility.

These results suggest that ancestral diversity has costs and benefits. While in macroeconomic studies it is hard to provide systematic evidence on how diversity benefits and hampers economic performance, in what follows we can provide detailed microeconomic evidence on the mechanisms through which ancestral diversity affects corporate boards.

5. Why Board Ancestries Affect Firm Performance Volatility?

5.1 Why Fractionalization Matters?

Table 7 explores why board ancestral fractionalization matters. In columns 1 to 3, we consider the effect of *Genetic Diversity* and *Genetic Distance*, which we have shown to be positively correlated with a firm's board ancestral fractionalization in Table 3. Both variables capture how unrelated the directors are and are associated with an increase in firm performance volatility. *Genetic Diversity* is based on the index of genetic diversity within a country, which Ashraf and Galor (2013) show to have a hump-shaped effect on income per capita in the country. In our context, the average genetic diversity of the directors of a firm captures dissimilarity between individuals with the same ancestry. *Genetic Distance* instead captures differences between individuals with different ancestries. Both *Genetic Diversity* and *Genetic Distance* have been found to be associated with more cultural fractionalization and are thought to results in intergenerationally transmitted traits that hinder interaction and communication (Desmet, Ortuño-Ortín, and Wacziarg, 2017). It is therefore fully consistent with our hypothesis that the lack of (genetic) relatedness of the individuals sitting on the board of a firm is associated with higher performance volatility.

Interestingly, in column 1, a one-standard-deviation change in *Genetic Diversity* explains almost 7% of the standard deviation of a firm's total return volatility, while an analogous change in *Genetic Distance* explains almost 3% of the standard deviation of the dependent variable. This result parallels well-known evidence in population genetics going back to Lewontin (1972), and new results in economics on within-group versus between-group genetic and cultural differentiation (Desmet, Ortuño-Ortín, and Wacziarg, 2017; Ashraf and Galor, 2017). In all these studies, within-group differences appear more important than between-group differences in explaining DNA variation, culture and macroeconomic outcomes. Thus, it is unsurprising that within-group differences have a larger effect on firm performance volatility.

Scientific literature on human evolution points out that a large part of the variance in intergenerationally transmitted traits among humans stems from cultural transmission, rather than genetic differences. For this reason, we also explore whether cultural differences between board members affects firm performance volatility. In columns 4 to 6, it is apparent that cultural differences between board members are associated with higher firm performance volatility. In column 4, a one-standard-deviation change in the *Cultural Differences* proxy explains 2% of the standard deviation of the firm's total return volatility.

Overall, these results indicate that ancestral diversity increases firm performance volatility by widening the distribution of firm profits. In what follows, by considering specific corporate policies and indicators of how the board works we try to shed light on how diversity is related to experimentation, innovation and coordination problems.

5.2 Fractionalization and Frictions in Decision Making

This section provides evidence on the mechanisms through which board diversity leads to higher volatility of firm performance by considering indicators of frictions in the decision-making process.

If the decision-making process is indeed more cumbersome in firms with higher board ancestral diversity, we would expect the board of directors to have to meet more often to reach agreement. In column 1 of Table 8, a one-standard-deviation change in board diversity explains 10% of the standard deviation of board meetings notwithstanding we control for a number of firm characteristics aiming to capture complexity in the decisions that directors have to take in different firms.

Difficulties in reaching decisions and the fact that, when individual preferences cannot be easily aggregated, some members may manipulate the outcomes of the decisions should increase disagreement between board members. This in turn may lead to higher board turnover in diverse boards. This is precisely what we find in columns 2 and 3 of Table 8, where we report the marginal effects of a probit model. A marginal increase in board ancestral diversity increases director turnover by almost 20%. Importantly, this effect is unrelated to the firm's performance, as measured by the firm's profitability (ROA), indicating that idiosyncratic factors related to an erratic decision process may matter.

The rest of the table provides direct evidence of the volatility of diverse boards' decisions. In column 4, the absolute value of the announcement returns of mergers is larger in firms with diverse boards. There is no evidence that the mean announcement returns are higher indicating that firms with diverse boards more frequently announce

both good and bad mergers. This result is fully consistent with our earlier findings on firm performance volatility.

If indeed, as we argue, board diversity is associated with greater performance volatility because difficulties in aggregating the diverse preferences of board members make the decision-making process more erratic, we should observe more changes in corporate strategies as different opinions prevail in different meetings. We consider several indicators of strategy changes. First, when firms experience material changes in financial conditions or operations, they need to file SEC Form 8-K to inform shareholders. These filings capture companies' events such as entry or termination of agreements, acquisitions or disposals of activities and assets, amendments to corporate bylaws and the code of ethics, and indicate material changes in strategy. It is therefore supportive of our hypothesis, and consistent with our previous results, that firms with diverse boards experience more often changes in financial conditions and operations and therefore file more frequently the SEC Form 8-K (column 5).

Second, we proxy for the (lack of) persistence of a firm's strategy using the sum of the (standardized) variance between *t* and *t+4* of each of the following indicators of corporate policies: (1) advertising intensity (advertising/sales), (2) research and development intensity (R&D/sales), (3) plant and equipment newness (net P&E/gross P&E), (4) nonproduction overhead (Selling, general and administrative expenses/sales), (5) inventory levels (inventories/sales), and (6) financial leverage (debt/equity). We standardize the variance of each indicator by subtracting the industry's mean of the indicator and dividing by its standard deviation. To have an indicator of strategy persistence (SP) we multiply this variable by minus one. The estimates in column 6

indicate that firms with diverse boards have less persistent strategies further supporting the idea that these firms have more erratic decision-making processes.

The coordination problems that lead to a more cumbersome and erratic decision process may also favor experimentation and more creative solution to the firms' problems. To start shedding light on this issue, in column 7, we consider how a firm's strategy conforms with the industry's strategy in year *t*. We first standardize each of the indicators of corporate policies, used to define strategy persistence, subtracting the industry mean and dividing by the industry standard deviation, and then take the absolute difference between a firm's value and the average value for all firms in the same two-digit SIC industry. We multiply the absolute differences by minus one to have an indicator of conformity. The results indicate that firms with more diverse boards pursue strategies that are more different from the ones of the industry peers. Together with the evidence that they have less persistent strategies, this result suggests that firms with diverse boards end up experimenting more. As we show in Subsection 5.3, this benefits their innovation output.

Our maintained hypothesis is that board ancestral diversity makes firms' decisions more erratic and unpredictable and for this reason increases firm performance volatility. Higher fundamental volatility in firms with diverse boards should imply that analysts find it more difficult to forecast firm performance (Dichev and Tang, 2009). This is precisely what we find in Table 9. Mean (median) earnings forecast errors are larger for firms with diverse boards. Importantly, in column 3, we find no evidence that the standard deviation of analyst forecast errors is larger when board diversity increases. This indicates that our results on forecast errors are not driven by the fact that analysts disagree on the prospects

of firms with diverse boards because for instance these firms are more complex. It rather appears that analysts make larger forecast errors because these firms make less predictable decisions and thus have higher earnings volatility.[6]

Firms with diverse boards could have more volatile performance because they take more risk. There is no evidence however that this is the case. Table 9 shows that firms with diverse boards do not invest more and have similar leverage to other firms suggesting that they do not take more risk. The higher performance volatility associated with firms with more diverse boards seem rather to arise from more frequent strategy changes and experimentation.

5.3 Fractionalization and Innovation

Diverse groups are expected to perform well when they need to solve complex, creative tasks. In this case, objectives may be imprecisely defined and discovered through experimentation. Erratic decision-making may become an advantage.

Radical innovation is an example of complex task with imprecisely defined objectives. In Table 10, we measure the quantity and quality of innovation of a firm using the number of patents and the average number of yearly citations of the firm's patents, respectively. Not only firms with diverse boards have more patents, but diverse boards are also associated with more patent citations indicating that in companies with diverse boards more original innovation takes place.

Thus, erratic decision-making and experimentation appear to lead to more significant innovations, proxied by highly cited patents. Through this channel, board

[6] In unreported results, we also find no evidence that analysts exhibit systematic upward or downward biases.

ancestral diversity may increase the profitability of the most successful firms (as is consistent with the results in column 4 of Table 6). To the extent that innovation has broad applications in society, ancestral diversity may create positive externalities further increasing the positive effects on economic performance.

6. Conclusions

We provide evidence on costs and benefits of board ancestral diversity. We conjecture that diversity may make the decision-making process more erratic not only because it increases communication costs but also because diverse preferences cannot be univocally aggregated. We take firm performance volatility as an indicator of erratic decision-making and provide evidence that board diversity increases firm idiosyncratic and fundamental volatility even though there is no evidence that firms with diverse boards take on more risk. Firms with diverse boards appear to have more board meetings and to experience higher director turnover unrelated to performance indicating frictions in the decision-making process. In addition, the strategies of firms with diverse boards are less persistent and deviate more from the ones of the industry peers.

Our results also imply that when objectives are imprecisely defined and discovered through experimentation, erratic decision-making may become an advantage. Thanks to less persistent and conforming strategies, firms with diverse boards experiment more. They thus end up innovating more and having more and more cited patents.

In summary, our evidence suggests that diverse groups have costs and benefits and that the development of decision rules aiming to make the decision process more efficient may improve the performance of diverse boards and diverse groups in general.

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Appendix

Variable	Definition and Data Source
Board Diversity	
Fractionalization	Herfindhal-based index of the ancestral countries of origin of a firm's directors. Countries of origin are based on the directors' last names. The index varies between 1 and 0. A value of the index closer to 1 indicates that directors' ancestries are less diverse. Source: Ancestry.com and RiskMetrics.
Genetic Distance	A firm level measure of genetic distance between the members of the board obtained by adding up the genetic distance between the ancestral countries of origin of each pair of board members. Countries of origin are based on directors' last names. Source: Spolaore and Wacziarg (2009 and 2013), ancestry.com, and RiskMetrics.
Genetic Diversity	The average of the genetic diversity in the ancestral country of origin of the directors based on Ashraf and Galor (2013). This measure captures the extent of diversity in genetic material across individuals within a given population (such as within a country) and it may be interpreted as the probability that two individuals, selected at random from the relevant population, differ genetically from one another with respect to a given spectrum of traits. Source: Ashraf and Galor (2013), ancestry.com, and RiskMetrics.
Cultural Differences	The Euclidean distance in cultural values between any two pairs of directors of a company. The cultural values are based on the World Value Survey. Source: World Value Survey, ancestry.com, and RiskMetrics.
Age Dissimilarity	The average distance of the age of each director in a firm from the mean age of the firm's directors, scaled by the mean age of the firm's directors. Source: RiskMetrics
Tenure Dissimilarity	The average distance of tenure of each director in a firm from the mean number of outside directorships of the firm's directors, scaled by the mean number of outside directorships of the firm's directors. Source: RiskMetrics
Industry Experience Diversity	The diversity in industry experience of a firm's directors, defined as 1-sum(*square of xk*), where *xk* is the fraction of board seats that the firm's directors hold in firms in 2-digit SIC industry *k*,

	and *k* is different from the industry of the current firm. The variable is scaled by the total number of the board seats held by the firm's directors. Source: Corporate Library's Board Analyst.
% of Female Directors	The percentage of female directors on a firm's board. Source: Corporate Library's Board Analyst.
Firm Volatility	
TotRetVol (12 mons)	The standard deviation of a firm's monthly stock returns over 12 months. Source: CRSP.
Log (EPS Vol) (12 mons)	The natural logarithm of the standard deviation of a firm's earnings per share shocks over 4 quarters. Earnings per share shocks are defined as in Irvine and Pontiff (2009). Source: CRSP and COMPUSTAT.
Idiovol (12 mons)	The standard deviation of the residuals of the regression of a firm's monthly returns on the four Fama French factors (including the Cahart's momentum factor) over a 12-month interval. Source: CRSP.
Implied Downside Vol	The yearly average of the daily implied volatility of out-of-the-money puts that are closest to 30 days to expiration. Source: Option Metrics.
Implied Upside Vol	The yearly average of the daily implied volatility of out-of-the-money calls that are closest to 30 days to expiration. Source: Option Metrics.
Strategy Persistence/Conformity	
Strategy Persistence (SP)	Persistence of a firm's strategy defined using the sum of the standardized variance between *t* and *t+4* of each of the following indicators of corporate policies: (1) advertising intensity (advertising/sales), (2) research and development intensity (R&D/sales), (3) plant and equipment newness (net P&E/gross P&E), (4) nonproduction overhead (Selling, general and administrative expenses/sales), (5) inventory levels (inventories/sales), and (6) financial leverage (debt/equity). The variance of each variable is standardized subtracting the mean and dividing by the standard deviation of the industry. We multiply this variable by minus one to have an indicator of strategy persistence. Source: COMPUSTAT.
Strategy Conformity (SC)	We standardize each of the indicators of corporate policies (listed in the definition of strategy persistence) by subtracting the industry mean and

	dividing by the industry standard deviation, and then take the absolute difference between a firm's value and the average value for all firms in the same two-digit SIC industry. We multiply the absolute differences by minus one to have an indicator of strategy conformity. Source: COMPUSTAT.
Board Meetings, 8-K Filings and Director Turnover	
Meetings	The natural logarithm of the number of board meetings. Source: Corporate Library's Board Analyst.
8-K filings	The natural logarithm of the number of 8-K filings. Source: SEC Analytics Suites.
Turnover	A dummy variable equal to one if at least one director departs the board in a given year. Source: RiskMetrics.
Mergers & Acquisitions	
Merger return volatility	The absolute value of the acquiring firm's abnormal stock market reaction on the merger announcement date. The abnormal stock return is the firm's stock return adjusted by the return of the value-weighted market index. Source: SDC and CRSP.
Analyst Forecast Errors	
Mean EPS Forecast Error (AFE_Mean)	Absolute value of the difference between mean analyst earnings per share forecasts and actual earnings per share, scaled by stock price. Source: IBES
Median EPS Forecast Error (AFE_Median)	Absolute value of the difference between median analyst earnings per share forecasts and actual earnings per share, scaled by stock price. Source: IBES
Stdev EPS Forecast Error (STD(AFE))	Standard deviation of the analyst earnings per share forecasts. Source: IBES
Patents	
Log(patapp)	The natural logarithm of 1 plus the number of patent applications during a year. Source: Kogan, Papanikolau, Seru and Stoffman (2015).
Log(patcited)	The natural logarithm of 1 plus the number of citations of each patent granted to a firm in a year. Source: Kogan, Papanikolau, Seru and Stoffman (2015).
Instruments	
County Diversity	Ancestral diversity of the county in which a firm's

	headquarters are located. It is the Herfindhal index of the dispersion of ancestral origins of the population of the county. Ancestral origins of the population in the county are based on the 2000 U.S. Census data, which provides information on the respondents' self-reported ancestry. Source: 2000 U.S. Census data.
Firm Level Controls	
% Independent Directors	The percentage of independent directors in a firm in a given year. Source: RiskMetrics.
ChairmanCEO	A dummy variable that takes a value of one if the CEO is also the chairman of the board. Source: RiskMetrics.
Only Insider	A dummy variable that takes a value of one if the CEO is the only insider on the board. Source: RiskMetrics.
DirBusyness	The natural logarithm of the average number of the directors' outside directorships. Source: RiskMetrics.
Log(BoardSize)	The natural logarithm of the number of board members. Source: RiskMetrics.
Log(#ofSegments)	The natural logarithm of a firm's number of business 3-digit SIC code segments. Source: COMPUSTAT.
Log (FirmAge)	The natural logarithm of a firm's age, defined as the number of years since IPO. Source: RiskMetrics.
Log(Assets)	The natural logarithm of a firm's book value of assets. Source: COMPUSTAT.
Leverage	A firm's ratio of long-term debt to total assets. Source: COMPUSTAT.
Capex/Assets	A firm's ratio of capital expenditures to total assets. Source: COMPUSTAT.
Log(q)	The natural logarithm of a firm's market-to-book ratio, defined as (price*shares outstanding+book value of assets-book value of equity)/book value of assets. Source: COMPUSTAT.
ROA	A firm's income before extraordinary items, divided by the firm's total assets. Source: COMPUSTAT.
R&D/Sales	A firm's research and development expenditures, divided by the firm's sales. Source: COMPUSTAT.

Table 1: Directors' Ancestral Origins (Top 10 origins)

This table reports the top 10 ancestral origins of the directors in our sample.

Origins	% of Sample Directors
United Kingdom	26.00%
Germany	11.89%
Ireland	7.79%
Italy	4.77%
Israel	2.42%
Spain	1.78%
Sweden	2.34%
France	2.31%
Netherlands	2.02%
Russian Federation	1.78%
United States	17.83%
Unidentified	2.55%
Total	31,956

Table 2: Summary statistics

This table reports summary statistics for different proxies for board diversity (Panel A), firm performance volatility (Panel B), board characteristics (Panel C), and firm characteristics (Panel D). The definitions of each variable are provided in the Appendix.

Panel A: Board Diversity	Mean	Median	SD	P25	P75	N
Fractionalization	0.725	0.739	0.075	0.685	0.779	24,050
Genetic Diversity	0.912	0.770	0.698	0.451	1.175	24,050
Genetic Distance	0.069	0.048	0.070	0.023	0.091	24,050
Culture Differences	0.754	0.720	0.300	0.532	0.936	24,073
% Female Directors	0.096	0.100	0.097	0.000	0.154	21,809
Tenure Dissimilarity	0.737	0.723	0.271	0.565	0.893	19,448
Age Dissimilarity	0.133	0.127	0.048	0.101	0.159	21,806
Industry Experience Diversity	0.398	0.417	0.252	0.204	0.603	24,077
County Diversity	0.983	0.984	0.004	0.983	0.985	30,034

Panel B: Performance Volatility	Mean	Median	SD	P25	P75	N
TotRetVol (12 mons)	0.113	0.095	0.074	0.068	0.136	21,758
Log (EPS Vol) (12 mons)	-9.541	-9.884	3.036	-11.605	-7.774	22,285
Idiovol (12 mons)	0.073	0.061	0.051	0.042	0.090	22,032
Implied Downside Vol	0.483	0.442	0.197	0.341	0.579	18,961
Implied Upside Vol	0.444	0.398	0.210	0.301	0.530	19,295

Panel C: Board Characteristics	Mean	Median	SD	P25	P75	N
Board Size	9.086	9.000	2.363	7.000	11.000	21,809
% Independent Directors	0.698	0.727	0.174	0.600	0.833	21,809
Chairman/CEO	0.673	1.000	0.469	0.000	1.000	21,809
CEO Only Insider	0.539	1.000	0.498	0.000	1.000	21,809
Busy Director	0.559	0.560	0.300	0.336	0.773	19,462
Director Age	60	60	5	58	63	21,809
Director Tenure	8.677	8.125	3.981	5.923	10.800	19,458
Director Turnover	0.636	1.0	0.481	0	1.0	20,621

Panel D: Firm Characteristics						
Assets	7382.091	1593.897	26813.190	606.286	4959.337	23,585
Log(q)	0.540	0.443	0.490	0.186	0.800	23,529
# of Segments	1.732	1.000	1.136	1.000	2.000	24,077
Firm Age	26.085	20.000	19.937	11.000	36.000	23,578
R&D/Sales	0.058	0.000	0.348	0.000	0.040	23,576
Capex/Assets	0.065	0.044	0.071	0.024	0.079	23,406
Leverage	0.199	0.187	0.172	0.040	0.304	23,495
ROA	0.035	0.049	0.169	0.020	0.086	23,577

Table 3: Board Diversity

Panel A. Factor Analysis

We perform factor analysis on the proxies for diversity listed in this table. A total of three eigenvalues are larger than one, with values 2.36, 1.36, and 1.07, respectively. We list below the eigenvectors associated with these eigenvalues.

	First Factor	Second Factor	Third Factor
Fractionalization	0.432	0.394	-0.221
Genetic Diversity	0.513	-0.145	0.236
Genetic Distance	0.492	0.067	0.150
Cultural Differences	0.287	0.567	-0.330
Industry Experience Diversity	0.353	-0.430	-0.026
Tenure Dissimilarity	0.092	0.099	0.716
Age Dissimilarity	-0.129	0.437	0.501
% Female Directors	0.276	-0.334	0.009

Panel B. Fractionalization and Other Measures of Ancestral Diversity

This panel relates our main measure of board diversity to the other diversity measures. Detailed variable definitions are provided in the Appendix. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

Dependent Variable	Fractionalization
Genetic Diversity	0.043***
	(17.58)
Genetic Distance	0.069***
	(4.05)
Cultural Differences	0.118***
	(33.09)
Constant	0.598***
	(164.74)
Observations	24,050
R-squared	0.34

Table 3: (Continued)

Panel C. Determinants of Board Ancestral Diversity

This table relates firm characteristics to our main measure of board diversity, fractionalization. Variable definitions are provided in the Appendix. We present ordinary least squares parameter estimates. We include industry and year fixed effects in all regressions whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Fractionalization	Fractionalization
County Diversity	1.248***	1.210***
	(3.63)	(3.53)
Log(Assets)	-0.001	-0.001
	(-0.67)	(-0.86)
Logq	0.001***	0.001***
	(3.09)	(3.06)
Debt/Assets	-0.003	-0.003
	(-0.35)	(-0.42)
Capex/Assets	-0.014	-0.014
	(-1.08)	(-1.05)
Log(FirmAge)	-0.002	-0.002
	(-0.83)	(-0.80)
Log(#ofSegments)	-0.004	-0.004
	(-1.60)	(-1.61)
Log(BoardSize)	0.124***	0.125***
	(19.31)	(19.02)
% Independent Directors	0.019**	0.015*
	(2.26)	(1.70)
Tenure Dissimilarity	0.002	0.003
	(0.48)	(0.69)
Age Dissimilarity	-0.029	-0.026
	(-1.06)	(-0.96)
Industry Experience Diversity	-0.009	-0.017**
	(-1.51)	(-2.26)
% of Female Directors	0.016	0.016
	(1.05)	(1.07)
ChairmanCEO		0.004*
		(1.71)
OnlyInsider		0.001
		(0.57)
DirBusyness		0.008
		(1.30)
Lag(ROA)		-0.003
		(-0.63)
Lag(R&D)		0.003*
		(1.73)
Constant	-0.782**	-0.758**
	(-2.30)	(-2.23)
Observations	18,150	18,148
R-squared	0.18	0.18

Table 4: Board Ancestral Diversity and Performance Volatility

This table relates several proxies for firm performance volatility to our main proxy for board ancestral diversity, fractionalization. The dependent variables are respectively the one-year total stock return volatility, the fundamental volatility and the idiosyncratic return volatility as indicated on top of each column. Variable definitions are provided in the Appendix. We present ordinary least squares parameter estimates in Panel A and instrumental variable estimates in Panel B. The instrumental variable for fractionalization is ancestral diversity in the county where the firm is headquartered and the first stage is presented in Panel C of Table 3. All models include fixed effects whose coefficients are not reported as indicated on the bottom of the table. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

Panel A. OLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	TotRetVol	Log(VolEPS)	Idiovol	TotRetVol	Log(VolEPS)	Idiovol
Fractionalization	0.029***	1.073**	0.021***	0.022*	1.152**	0.016*
	(2.84)	(2.34)	(3.28)	(1.67)	(1.99)	(1.85)
Log(Assets)	-0.006***	-0.181***	-0.006***	-0.010***	-0.411***	-0.009***
	(-8.89)	(-5.07)	(-11.12)	(-4.65)	(-4.90)	(-6.75)
Logq	-0.016***	-2.991***	-0.012***	-0.008***	-2.501***	-0.007***
	(-9.62)	(-42.39)	(-10.39)	(-3.50)	(-28.96)	(-4.77)
Debt/Assets	0.039***	2.140***	0.028***	0.047***	1.791***	0.033***
	(7.55)	(10.09)	(8.02)	(6.09)	(6.87)	(6.96)
Capex/Assets	0.080***	0.730	0.045***	0.029*	0.020	0.011
	(5.73)	(1.47)	(5.02)	(1.93)	(0.04)	(1.05)
R&D/Sale	0.018***	0.646***	0.011***	0.003	0.173*	0.002
	(7.07)	-5.81	(6.46)	(1.48)	(1.84)	(0.57)
Log(FirmAge)	-0.012***	-0.321***	-0.008***	-0.029***	-0.358**	-0.016***
	(-9.53)	(-5.58)	(-9.78)	(-6.57)	(-1.99)	(-5.63)
Log(#ofSegments)	-0.004***	-0.196***	-0.003***	0.001	0.126	0.001
	(-3.05)	(-2.63)	(-3.15)	(0.50)	(1.40)	(0.86)
Tenure Dissimilarity	0.012***	0.343***	0.007***	0.000	0.061	0.000
	(3.34)	(2.89)	(3.77)	(0.00)	(0.50)	(0.24)
Age Dissimilarity	0.017	1.549**	0.022**	-0.011	-0.289	0.003
	(1.09)	(2.09)	(1.99)	(-0.73)	(-0.32)	(0.28)
Industry Experience	-0.014***	-0.319	-0.011***	0.007	0.131	0.001
Diversity	(-2.99)	(-1.55)	(-3.60)	(1.27)	(0.63)	(0.38)
% of Female Directors	-0.009	0.469	-0.002	0.006	0.524	0.010
	(-1.25)	(1.24)	(-0.49)	(0.53)	(1.13)	(1.42)
Log(BoardSize)	-0.025***	-0.608***	-0.015***	-0.014***	-0.150	-0.009***
	(-6.40)	(-3.42)	(-5.47)	(-2.96)	(-0.78)	(-2.66)
ChairmanCEO	0.001	-0.080	0.001	0.002	0.077	0.001
	(0.70)	(-1.23)	(1.15)	(1.37)	(1.28)	(0.81)
OnlyInsider	0.001	0.175**	0.001	-0.002	0.051	-0.000
	(0.82)	(2.55)	(1.42)	(-0.98)	(0.79)	(-0.30)
DirBusyness	0.013***	0.841***	0.008***	-0.008**	0.366**	-0.004
	(3.52)	(5.25)	(3.21)	(-1.98)	(2.30)	(-1.44)
% Independent Directors	-0.004	0.148	-0.006	-0.005	-0.323	-0.006
	(-0.59)	(0.61)	(-1.61)	(-0.81)	(-1.34)	(-1.42)
Constant	0.181***	-6.645***	0.126***	0.294***	-4.762***	0.197***
	(10.97)	(-8.39)	(10.59)	(12.47)	(-5.10)	(13.12)
Industry Dummy	Yes	Yes	Yes	No	No	No
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Firm Dummy	No	No	No	Yes	Yes	Yes
Observations	17,674	18,148	17,936	17,674	18,148	17,936
R-squared	0.36	0.35	0.34	0.26	0.17	0.21

Table 4: Board Ancestral Diversity and Performance Volatility (Continued)

Panel B. Instrumental Variable Estimates

	(1)	(2)	(3)
	TotRetVol	Log(VolEPS)	Idiovol
Fractionalization	0.525***	25.478***	0.374***
	(2.93)	(2.58)	(2.96)
Log(Assets)	-0.006***	-0.164***	-0.005***
	(-6.03)	(-3.44)	(-7.38)
Logq	-0.020***	-3.167***	-0.014***
	(-8.10)	(-27.18)	(-8.38)
Debt/Assets	0.038***	2.127***	0.027***
	(5.76)	(7.50)	(6.05)
Capex/Assets	0.094***	1.274*	0.054***
	(5.37)	(1.80)	(4.72)
R&D/Sale	0.016***	0.552***	0.010***
	(6.79)	(4.69)	(5.50)
Log(FirmAge)	-0.011***	-0.271***	-0.007***
	(-6.31)	(-3.20)	(-5.76)
Log(#ofSegments)	-0.003	-0.112	-0.002
	(-1.37)	(-0.99)	(-1.38)
Tenure Dissimilarity	0.013***	0.319**	0.007***
	(2.79)	(2.01)	(2.83)
Age Dissimilarity	0.033	2.245**	0.033**
	(1.50)	(2.06)	(2.08)
Industry Experience	-0.004	0.172	-0.004
Diversity	(-0.54)	(0.53)	(-0.84)
% of Female Directors	-0.018	0.016	-0.009
	(-1.58)	(0.03)	(-1.20)
Log(BoardSize)	-0.087***	-3.660***	-0.059***
	(-3.84)	(-2.95)	(-3.66)
ChairmanCEO	-0.001	-0.190*	-0.000
	(-0.47)	(-1.92)	(-0.31)
OnlyInsider	0.000	0.132	0.001
	(0.22)	(1.39)	(0.63)
DirBusyness	0.009*	0.655***	0.005
	(1.72)	(2.81)	(1.42)
% Independent Directors	-0.012	-0.199	-0.012**
	(-1.42)	(-0.55)	(-2.15)
Constant	-0.034	-17.359***	-0.031
	(-0.41)	(-3.84)	(-0.53)
Cragg-Donald F-stat	30.13	28.51	28.09
Observations	16,939	17,397	17,192
R-squared	0.14	0.05	0.09

Table 5: Board Ancestral Diversity and Implied Volatility

This table relates fractionalization to firms' measures of implied volatility. The dependent variables are respectively implied downside and implied upside stock return volatility as indicated on top of each column. The implied volatility is based on option pricing data from OptionMetrics. Detailed descriptions of the variables are provided in the Appendix. The first two columns present OLS estimates, the last two columns present instrumental variable estimates in which we use county diversity as instrument for fractionalization. The first stage is presented in Panel C of Table 3. All regressions include year and industry fixed effects whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Implied Downside Vol	Implied Upside Vol	Implied Downside Vol	Implied Upside Vol
	OLS	OLS	IV	IV
Fractionalization	0.042	0.046*	1.353**	1.592***
	(1.49)	(1.66)	(2.26)	(2.59)
Log(Assets)	-0.029***	-0.037***	-0.028***	-0.035***
	(-13.69)	(-16.27)	(-9.73)	(-11.23)
Logq	-0.048***	-0.075***	-0.057***	-0.085***
	(-10.45)	(-16.28)	(-8.30)	(-11.64)
Debt/Assets	0.071***	0.077***	0.072***	0.080***
	(4.67)	(4.75)	(3.76)	(3.77)
Capex/Assets	0.064**	0.041	0.109***	0.095**
	(2.26)	(1.41)	(2.72)	(2.17)
R&D/Sale	0.057***	0.069***	0.052***	0.063***
	(8.18)	(8.31)	(7.71)	(8.28)
Log(FirmAge)	-0.034***	-0.035***	-0.033***	-0.033***
	(-9.90)	(-9.66)	(-6.50)	(-5.96)
Log(#ofSegments)	-0.009**	-0.011**	-0.004	-0.006
	(-2.05)	(-2.46)	(-0.65)	(-0.88)
Tenure Dissimilarity	0.038***	0.039***	0.039***	0.040***
	(5.32)	(5.32)	(4.06)	(3.85)
Age Dissimilarity	0.061	0.046	0.100*	0.090
	(1.47)	(1.12)	(1.65)	(1.40)
Industry Experience	-0.051***	-0.056***	-0.024	-0.023
Diversity	(-4.11)	(-4.42)	(-1.23)	(-1.12)
% of Female Directors	-0.052**	-0.030	-0.070**	-0.051
	(-2.38)	(-1.37)	(-2.21)	(-1.49)
Log(BoardSize)	-0.069***	-0.077***	-0.231***	-0.268***
	(-6.26)	(-6.94)	(-3.13)	(-3.51)
ChairmanCEO	0.003	0.004	-0.003	-0.002
	(0.81)	(1.13)	(-0.46)	(-0.40)
OnlyInsider	0.004	0.004	0.003	0.001
	(0.98)	(0.86)	(0.60)	(0.20)
DirBusyness	0.037***	0.049***	0.023	0.032**
	(4.08)	(5.16)	(1.64)	(2.12)
% Independent Directors	-0.017	-0.034**	-0.040*	-0.060**
	(-1.15)	(-2.10)	(-1.84)	(-2.46)
Constant	0.968***	0.852***	0.243	0.190
	(15.19)	(15.22)	(0.85)	(0.65)
Observations	16,357	16,571	15,596	15,801
R-squared	0.58	0.59	0.37	0.34

Table 6: Board Ancestral Diversity and Firm Performance

This table relates firm performance to our proxy for board diversity, fractionalization. Firm performance is measured as average ROAs between year t+1 and t+3. All variables are defined in the Appendix. In columns 2 to 4, we present quintile regressions. The relevant quintile is indicated on top of each column All regressions include year and 2-digit SIC code industry fixed effects whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
			ROA		
		Q=0.25	Q=0.50	Q=0.75	
Fractionalization	0.004	-0.021*	0.013	0.041***	0.464*
	(0.14)	(-1.84)	(1.43)	(3.79)	(1.75)
Fractionalization^2					-0.339*
					(-1.74)
Log(Assets)	0.008***	0.004***	0.001	-0.002**	0.009***
	(2.79)	(4.72)	(1.08)	(-2.17)	(2.82)
SalesGrowth	0.045***	0.032***	0.038***	0.037***	0.045***
	(3.24)	(8.90)	(13.09)	(10.70)	(3.23)
Debt/Assets	-0.042**	-0.008	-0.030***	-0.056***	-0.042**
	(-1.98)	(-1.57)	(-7.13)	(-11.09)	(-1.97)
Capex/Assets	-0.007	-0.006	0.007	0.046***	-0.008
	(-0.27)	(-0.40)	(0.61)	(3.36)	(-0.29)
Log(FirmAge)	0.008***	0.007***	0.003***	0.004***	0.008**
	(2.58)	(5.26)	(2.78)	(3.57)	(2.58)
Log(#ofSegments)	-0.007**	-0.004**	-0.008***	-0.014***	-0.008***
	(-2.53)	(-2.10)	(-5.61)	(-8.45)	(-2.60)
Tenure Dissimilarity	-0.005	-0.003	-0.003	-0.006**	-0.005
	(-0.69)	(-0.91)	(-1.02)	(-2.12)	(-0.71)
Age Dissimilarity	-0.009	-0.043**	0.006	0.037**	-0.005
	(-0.22)	(-2.23)	(0.39)	(2.03)	(-0.13)
Industry Experience	0.049***	0.023***	0.022***	0.043***	0.049***
Diversity	(3.79)	(3.97)	(4.74)	(7.88)	(3.78)
% of Female Directors	0.035*	0.026***	0.014*	0.010	0.035*
	(1.85)	(2.66)	(1.88)	(1.04)	(1.86)
Log(BoardSize)	0.015	0.027***	0.013***	-0.004	0.016
	(1.46)	(6.28)	(3.72)	(-1.08)	(1.56)
ChairmanCEO	-0.001	0.001	-0.003*	-0.001	-0.001
	(-0.23)	(0.40)	(-1.74)	(-0.64)	(-0.22)
OnlyInsider	-0.004	-0.002	-0.003**	-0.003*	-0.005
	(-1.33)	(-1.25)	(-2.11)	(-1.84)	(-1.39)
DirBusyness	-0.040***	-0.020***	-0.010***	-0.015***	-0.040***
	(-3.74)	(-4.50)	(-2.96)	(-3.64)	(-3.72)
% Independent Directors	0.004	-0.012*	0.001	0.001	0.004
	(0.27)	(-1.95)	(0.11)	(0.12)	(0.25)
Constant	-0.023	-0.012	0.061***	0.126***	-0.180*
	(-0.69)	(-0.50)	(3.17)	(5.47)	(-1.79)
Observations	13,863	13,863	13,863	13,863	13,863
R-squared	0.12	0.08	0.08	0.12	0.12

Table 7: Genetic Diversity, Genetic Distance, and Culture Differences

This table relates firm performance volatility to three alternative measures for board diversity, Genetic Diversity, Genetic Distance, and Culture Differences. The dependent variables are respectively the one-year total stock return volatility, the fundamental volatility and the idiosyncratic return volatility as indicated on top of each column. All variables are defined in the Appendix. All regressions include year and industry fixed effects whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	TotRetVol	Log(VolEPS)	Idiovol	TotRetVol	Log(VolEPS)	Idiovol
Genetic Diversity	0.007**	0.264*	0.005**			
	(2.00)	(1.77)	(1.98)			
Genetic Distance	0.029**	0.715	0.021**			
	(2.10)	(1.10)	(2.27)			
Culture Difference				0.005**	0.157	0.004***
				(2.30)	(1.43)	(2.59)
Log(Assets)	-0.007***	-0.186***	-0.006***	-0.006***	-0.183***	-0.006***
	(-9.09)	(-5.23)	(-11.33)	(-8.92)	(-5.12)	(-11.13)
Logq	-0.016***	-2.985***	-0.012***	-0.016***	-2.982***	-0.011***
	(-9.54)	(-42.27)	(-10.31)	(-9.52)	(-42.28)	(-10.28)
Debt/Assets	0.039***	2.158***	0.028***	0.039***	2.148***	0.028***
	(7.64)	(10.18)	(8.09)	(7.57)	(10.11)	(8.02)
Capex/Assets	0.079***	0.665	0.044***	0.080***	0.704	0.045***
	(5.63)	(1.34)	(4.91)	(5.72)	(1.42)	(5.00)
R&D/Sale	0.018***	0.646***	0.011***	0.018***	0.645***	0.011***
	(7.01)	(5.83)	(6.42)	(6.98)	(5.80)	(6.44)
Log(FirmAge)	-0.012***	-0.328***	-0.008***	-0.012***	-0.322***	-0.008***
	(-9.69)	(-5.71)	(-9.95)	(-9.51)	(-5.60)	(-9.75)
Log(#ofSegments)	-0.004***	-0.197***	-0.003***	-0.004***	-0.199***	-0.003***
	(-3.04)	(-2.65)	(-3.15)	(-3.07)	(-2.68)	(-3.17)
Tenure Dissimilarity	0.013***	0.351***	0.007***	0.012***	0.337***	0.007***
	(3.45)	(2.97)	(3.90)	(3.31)	(2.85)	(3.73)
Age Dissimilarity	0.016	1.527**	0.021*	0.016	1.521**	0.021**
	(1.05)	(2.06)	(1.96)	(1.05)	(2.06)	(1.97)
Industry Experience	-0.014***	-0.327	-0.011***	-0.014***	-0.333	-0.011***
Diversity	(-3.02)	(-1.58)	(-3.62)	(-3.04)	(-1.61)	(-3.64)
% of Female Directors	-0.008	0.541	-0.001	-0.010	0.479	-0.003
	(-1.02)	(1.42)	(-0.27)	(-1.25)	(1.26)	(-0.51)
Log(BoardSize)	-0.035***	-0.964***	-0.021***	-0.022***	-0.504***	-0.012***
	(-5.20)	(-3.37)	(-4.60)	(-5.81)	(-2.95)	(-4.78)
ChairmanCEO	0.001	-0.081	0.001	0.001	-0.077	0.001
	(0.66)	(-1.24)	(1.12)	(0.73)	(-1.19)	(1.20)
OnlyInsider	0.001	0.177***	0.001	0.001	0.176**	0.001
	(0.87)	(2.58)	(1.47)	(0.87)	(2.57)	(1.48)
DirBusyness	0.013***	0.836***	0.007***	0.013***	0.850***	0.008***
	(3.48)	(5.19)	(3.16)	(3.57)	(5.29)	(3.25)
% Independent Directors	-0.002	0.200	-0.005	-0.003	0.179	-0.005
	(-0.36)	(0.82)	(-1.34)	(-0.46)	(0.74)	(-1.45)
Constant	0.205***	-5.299***	0.152***	0.179***	-6.228***	0.134***
	(11.27)	(-6.07)	(11.40)	(11.26)	(-8.26)	(11.43)
Observations	17,694	18,167	17,956	17,692	18,165	17,954
R-squared	0.36	0.35	0.34	0.36	0.35	0.34

Table 8: Board Ancestral Diversity and the Decision-Making Process

This table relates board diversity to several corporate events, such as number of board meetings in a year (column 1), director turnover (columns 2 and 3), merger return volatility (column 4), number of extra-ordinary events from the 8-K filings (column 5), strategy persistence (SP) and strategy conformity (SC) in columns 6 and 7, respectively. We present OLS estimates in all columns but column 2 and 3 where we perform probit regressions and present marginal effects. All variables are defined in the Appendix. All regressions include year and 2-digit SIC code industry fixed effects, whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Meetings	Turnover	Turnover	Merger Return Volatility	8-K Filings	SP	SC
Fractionalization	0.114**	0.188**	0.170**	0.017***	0.236**	-2.051***	-1.075**
	(2.34)	(2.51)	(2.21)	(2.99)	(2.00)	(-2.80)	(-2.38)
Diversity*ROA			0.450				
			(0.98)				
Log(Assets)	0.034***	0.025***	0.025***	-0.003***	0.082***	0.242***	0.124***
	(10.45)	(4.57)	(4.56)	(-7.09)	(8.81)	(3.68)	(3.07)
ROA	-0.280***	0.019	-0.304	-0.027***	-0.180***	2.362***	1.347***
	(-5.94)	(0.56)	(-0.93)	(-4.55)	(-4.25)	(4.46)	(5.11)
Logq	-0.073***	-0.006	-0.007	-0.002	-0.019	0.002	-0.139
	(-7.64)	(-0.53)	(-0.56)	(-1.47)	(-0.84)	(0.01)	(-1.54)
Debt/Assets	0.145***	-0.048	-0.049	0.001	0.191***	-2.352***	-2.458***
	(5.66)	(-1.34)	(-1.37)	(0.19)	(2.66)	(-4.58)	(-8.76)
Capex/Assets	-0.052	0.097	0.098	0.028***	0.276*	-0.057	1.105
	(-0.77)	(1.09)	(1.10)	(2.98)	(1.95)	(-0.05)	(1.26)
R&D/Sale	0.042*	-0.003	-0.003	-0.001	0.034	-2.827***	-2.289***
	(1.86)	(-0.17)	(-0.17)	(-0.18)	(1.59)	(-3.13)	(-5.23)
Log(FirmAge)	-0.001	0.023***	0.023***	-0.001*	-0.039**	0.172*	0.171***
	(-0.23)	(2.66)	(2.66)	(-1.71)	(-2.48)	(1.80)	(2.97)
Log(#ofSegments)	0.010	0.037***	0.037***	-0.004***	0.037*	0.001	-0.074
	(1.47)	(3.17)	(3.18)	(-4.54)	(1.78)	(0.01)	(-0.90)
Tenure Dissimilarity	0.044***			0.002	-0.001	0.054	-0.018
	(2.83)			(1.17)	(-0.04)	(0.27)	(-0.14)
Age Dissimilarity	-0.017	0.227*	0.229*	0.022*	-0.196	-2.138*	-1.241
	(-0.18)	(1.70)	(1.72)	(1.87)	(-1.17)	(-1.71)	(-1.56)
Industry Experience	-0.078***	0.032	0.032	-0.001	-0.134**	0.554	-0.276
Diversity	(-3.19)	(0.86)	(0.86)	(-0.40)	(-2.50)	(1.42)	(-1.34)
% of Female Directors	0.019	0.066	0.066	0.006	0.001	0.130	-0.611
	(0.50)	(1.01)	(1.00)	(1.01)	(0.01)	(0.19)	(-1.48)
Log(BoardSize)	-0.056***	0.354***	0.355***	-0.010***	-0.021	0.921***	0.514***
	(-2.74)	(11.89)	(11.91)	(-4.47)	(-0.46)	(3.01)	(2.96)
ChairmanCEO	-0.077***	-0.009	-0.009	0.000	0.014	-0.073	-0.019
	(-10.28)	(-0.77)	(-0.77)	(0.34)	(0.88)	(-0.59)	(-0.28)
OnlyInsider	0.030***	-0.015	-0.015	0.000	-0.001	-0.135	0.075
	(3.60)	(-1.18)	(-1.17)	(0.02)	(-0.04)	(-1.17)	(1.10)
DirBusyness	0.026	0.021	0.021	0.003	0.149***	-0.514	0.032
	(1.27)	(0.72)	(0.73)	(1.25)	(3.52)	(-1.64)	(0.21)
%Independent Directors	0.226***	0.075*	0.075*	0.000	0.110*	-0.397	0.305
	(6.58)	(1.77)	(1.77)	(0.14)	(1.84)	(-1.06)	(1.33)
Constant	1.702***	-5.157***	-5.121***	0.078***	1.525***	0.892	-4.688***
	(19.42)	(12.96)	(12.91)	(12.10)	(9.88)	(1.08)	(-10.32)
Observations	9,870	15,425	15,425	7,584	19,481	9,877	14,486
R-squared	0.14	0.091	0.091	0.13	0.54	0.15	0.19

Table 9: Board Ancestral Diversity, Analyst forecast, and Firm Risk Taking

In columns 1 to 3, we relate analyst forecasts to our main proxy for board diversity, fractionalization. The dependent variables are respectively median (AFE_median), mean (AFE_mean) and standard deviation (STD(AFE)) of analysts' earnings forecast errors, computed using quarterly observations. In columns 4 and 5, the dependent variables are capital expenditures and leverage, respectively. Variable definitions are provided in the Appendix. In all regressions, we include year and 2-digit SIC code industry fixed effects whose coefficients are not reported. We present ordinary least squares estimates. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	AFE_Median	AFE_Mean	STD(AFE)	Capex	Leverage
Fractionalization	0.003***	0.003***	0.011	-0.004	0.002
	(2.96)	(2.89)	(1.39)	(-0.94)	(0.28)
Log(Assets)	-0.001***	-0.001***	0.002**	-0.002***	0.003***
	(-9.22)	(-9.17)	(2.23)	(-4.96)	(3.45)
Logq	-0.005***	-0.005***	-0.013***	0.014***	-0.003
	(-23.64)	(-23.70)	(-9.81)	(13.49)	(-1.52)
Debt/Assets	0.004***	0.004***	0.009*	-0.008***	0.840***
	(6.95)	(6.76)	(1.89)	(-2.93)	(96.78)
Capex/Assets	0.002	0.002	0.048***	0.603***	0.051***
	(1.22)	(1.04)	(3.52)	(29.96)	(3.27)
R&D/Sales	0.002***	0.002***	0.009***	-0.002	0.008**
	(4.57)	(4.56)	(3.03)	(-1.53)	(2.43)
Log(FirmAge)	-0.000	-0.000	-0.000	0.001*	-0.000
	(-1.22)	(-1.29)	(-0.09)	(1.80)	(-0.02)
Log(#ofSegments)	-0.000***	-0.001***	-0.001	0.000	0.003**
	(-3.04)	(-3.09)	(-0.86)	(0.57)	(2.04)
Tenure Dissimilarity	0.001*	0.001*	-0.003	-0.001	-0.005
	(1.75)	(1.83)	(-1.11)	(-0.42)	(-1.48)
Age Dissimilarity	0.003*	0.003*	0.031**	0.016*	0.045**
	(1.92)	(1.88)	(2.29)	(1.89)	(2.48)
Industry Experience	-0.000	-0.000	-0.006	0.002	-0.007
Diversity	(-0.36)	(-0.31)	(-1.55)	(0.67)	(-1.18)
% of Female Directors	-0.000	-0.000	-0.010	-0.004	0.003
	(-0.10)	(-0.17)	(-1.28)	(-0.99)	(0.31)
Log(BoardSize)	-0.001***	-0.001***	0.003	0.004*	-0.000
	(-2.79)	(-2.91)	(0.77)	(1.72)	(-0.05)
ChairmanCEO	0.000	0.000	0.002	0.000	-0.002
	(0.49)	(0.45)	(1.47)	(0.31)	(-1.16)
OnlyInsider	0.000	0.000	-0.000	-0.000	0.002
	(0.71)	(0.69)	(-0.24)	(-0.00)	(1.06)
DirBusyness	0.001***	0.001***	0.003	-0.002	0.008*
	(2.97)	(2.96)	(1.08)	(-0.89)	(1.91)
%Independent Directors	-0.001*	-0.001*	0.011**	0.004	0.006
	(-1.68)	(-1.81)	(2.18)	(1.23)	(0.89)
Constant	0.016***	0.016***	0.027***	0.008	0.016
	(5.25)	(5.12)	(2.66)	(1.13)	(0.82)
Observations	62,283	62,283	59,446	17,262	17,271
R-squared	0.12	0.12	0.17	0.65	0.75

Table 10: Board Ancestral Diversity and Innovation

This table reports tobit regressions in which the dependent variables are the log of one plus the number of patent applications of a firm in a year (column 1) and the log of one plus the number of patent citations per patent in a given year (columns 2). We set the number of citations to zero if a firm has no patents. All variables are defined in the Appendix. We present tobit regression results to take into account that the the dependent variables are truncated at zero. All regressions include 2-digit SIC code industry and year fixed effects whose coefficients are not reported. We report t-statistics in parenthesis with standard errors clustered at firm level and corrected for heteroscedasticity. ***, **, * denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Log(1+ patapp)	Log(1+patcited)
Fractionalization	0.288***	0.141***
	(4.79)	(3.94)
Log(Assets)	0.815***	0.282***
	(142.33)	(82.19)
Logq	0.830***	0.498***
	(26.80)	(27.63)
Debt/Assets	-1.314***	-0.656***
	(-13.00)	(-11.01)
Capex/Assets	-0.900***	-0.622***
	(-3.20)	(-3.80)
R&D/Sale	0.474***	0.267***
	(47.43)	(45.73)
Log(FirmAge)	0.077***	-0.008
	(5.65)	(-1.01)
Log(#ofSegments)	-0.166***	-0.069***
	(-5.60)	(-3.96)
Tenure Dissimilarity	0.116**	0.051*
	(2.44)	(1.81)
Age Dissimilarity	-1.345***	-0.726***
	(-4.94)	(-4.53)
Industry Experience	-0.059	-0.079*
Diversity	(-0.84)	(-1.89)
% of Female Directors	0.708***	0.120
	(3.56)	(1.01)
Log(BoardSize)	-0.141***	-0.064***
	(-6.95)	(-5.29)
ChairmanCEO	-0.033	-0.041*
	(-0.84)	(-1.76)
OnlyInsider	0.018	0.015
	(0.54)	(0.81)
DirBusyness	0.669***	0.461***
	(12.44)	(14.62)
% Independent Directors	1.416***	0.834***
	(23.44)	(23.26)
Constant	-24.381***	-13.769***
	(-550.46)	(-523.02)
Observations	14,750	14,750
Adj. R-squared	0.39	0.36

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