Board-Management Commonality, Firm Value, and Board Decision-Making

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Abstract

We examine the impact of commonality between boards and management ("board-management commonality") on board effectiveness and firm value. We measure this commonality by identifying overlapping individuals between the two groups across various dimensions, using the classification properties of the support vector machine (SVM). Supporting the view that commonality between these groups fosters communication and facilitates consensus building, we find that commonality is significantly associated with an increase in firm value. The positive impact is pronounced for firms facing industry and market-level uncertainties or operating in poor information environments. Furthermore, commonality enhances innovation outputs and efficiency and prompts timely investment adjustments.

Keywords: Board, management, commonality, support vector machine (SVM), board diversity, management diversity, decision-making

JEL Classification: G30, G34, G38, M14

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1. Introduction

The significance of board diversity has been extensively recognized in prior research and underscored by regulatory bodies and institutional investors (Bernile, Bhagwat, and Yonker, 2018; Kang, Kim, and Oh, 2022; Giannetti and Wang, 2023; Gormley et al., 2023). In response to mounting pressures from shareholders and societal demands, firms are increasingly diversifying not only their boards but also their management teams, albeit with less public scrutiny.[1] This shift profoundly impacts the interaction and communication dynamics between outside directors, executives, and senior managers. Given that non-board senior managers play a pivotal role in governance, where CEOs often serve as the sole insiders on boards, it is crucial to understand how more diverse boards and the increasing role of non-board senior managers influence these dynamics. Anecdotal evidence suggests that many firms prioritize effective communication and engagement between directors and management teams during the director nomination and selection process.[2] Surprisingly, little effort has been made to explore the interaction between boards and management teams and its effect on board decision-making processes. Examining these interactions is essential for filling this gap and understanding their implications for effective governance and firm performance.

In this study, we focus on "board-management commonality," which refers to the shared characteristics, values, experiences, or perspectives between boards and management teams. This commonality is closely tied to the interaction between boards and management teams, as it influences communication and mutual understanding, both of which are critical for effective decision-making. While previous research has extensively examined the impact of diversity

[1] At present, regulatory mandates pertaining to diversity, such as Regulation S-K enacted in 2009 and California Senate Bill 826 passed in 2018, predominantly address diversity within corporate boards rather than within management teams.

[2] For example, UnitedHealth Group Inc.'s 2015 proxy statement emphasizes the requirement for directors to 'work collegially and collaboratively with other directors and management. Similarly, Bristow Group Inc. underscores the importance of this trait in its 2016 proxy statement, stating that director nominees must possess 'the ability to engage management and each other in a constructive and collaborative fashion.' This highlights the crucial role of proficient communication and engagement for an effective board.

within groups, particularly in boardrooms (e.g., Bernile, Bhagwat, and Yonker, 2018; Kang, Kim, and Oh, 2022; Gormley et al., 2023), the impact of commonality on the intergroup dynamics between board members and management teams remains largely unexplored.

To address the empirical challenges of measuring commonality, we employ the inherent properties of the support vector machine (SVM), which identifies overlapping individuals by separating the two groups across various dimensions. Unlike standard SVM applications that focus on finding a universal classification rule for optimal group separation (e.g., Boudoukh et al., 2018; Chen, Wu, and Yang, 2019; Lerner and Seru, 2021; Fedyk and Hodson, 2023), our approach aims to identify 'misclassified' members within each firm in a given year. This method captures subtle overlaps between the board (non-executive directors) and the management team (executive directors and senior managers) based on multiple characteristics, offering novel insights into board-management commonality beyond mere diversity levels within groups.[3]

We illustrate the SVM concept by assessing the overlap between these groups using a specific characteristic as an example. Directors are classified into Group 1 if they share the characteristic with others on the board, and into Group 2 if they are dissimilar to the rest but more akin to managers. Similarly, management team members are classified into Group 3 if they share characteristics with other managers, and into Group 4 if they are dissimilar to other managers but similar to directors. SVM categorizes directors in Group 1 and managers in Group 3 as correctly classified, while directors in Group 2 and managers in Group 4 are incorrectly classified. We label directors in Group 2 as "manager-like directors" and managers

[3] Management teams include senior executives with titles, such as CEO, president, vice president, and various chief officers (e.g., CFO, CIO, COO), as well as division executives (e.g., division CEO, division CFO, division COO, division president) and regional executives (e.g., regional CEO, regional CFO, regional COO, and regional president) reported in the BoardEx database (Custódio and Metzger, 2013; Chemmanur et al., 2019).

in Group 4 as "director-like managers," as they share similarities with individuals in the other group. Groups 2 and 4 share similar characteristics, whereas Groups 1 and 3 do not.

Expanding on this concept, we use SVM classification that optimally categorizes board members and top management team members into respective groups by identifying the hyperplane that best separates director-like managers and manager-like directors from others across multidimensional spaces reflecting various characteristics (Hastie, Tibshirani, and Friedman, 2009). We consider traits, such as demographics (age and gender), cultural backgrounds assessed using Hofstede's six dimensions of culture (Hofstede, 2001), and the educational and functional characteristics of directors and managers. These factors, identified in prior studies as important demographic and cognitive variables (e.g., Adams, Akyol, and Verwijmeren, 2018; Bernile, Bhagwat, and Yonker, 2018; Kang, Kim, and Oh, 2022) are discussed along with the variable construction process in Section 2.2. Our novel approach highlights individuals who diverge from their group's norms and provides insights into dynamic overlaps between the two groups, which are crucial for understanding the composition and functionality of the board and management teams.

A priori, it is unclear how board-management commonality affects firm value and policies. The commonality between board members and management accelerates consensus-building and improves the efficiency of boardroom decision-making, as suggested in theoretical models (e.g., Baranchuk and Dybvig, 2008; Malenko, 2014; Chakraborty and Yilmaz, 2017; Chemmanur and Fedaseyeu, 2018).[4] Shared backgrounds foster a mutual understanding of strategic imperatives and constraints, facilitating quicker agreement on strategy direction and execution. Manager-like directors, who understand operational realities, ensure that board directives are grounded in these realities, thereby improving the feasibility and effectiveness

[4] Baranchuk and Dybvig (2008) present a model highlighting consensus as a viable solution concept aligned with majority voting. This concept of 'consensus' promotes fairness, efficiency, and unity within the board, ensuring that shareholders' interests are prioritized in the board's decision-making process.

of strategic plan execution.[5] Furthermore, commonality can reduce 'dissent costs,' a concept explored by Chemmanur and Fedaseyeu (2017).[6] Manager-like directors, who share values with managers, enable clear communication and dissent without fear of negative outcomes. This reduction in dissent costs alleviates coordination issues among directors and prevents the board from adopting a 'suboptimally passive' stance, such as maintaining ineffective policies. Commonality also expands access to firm-specific information beyond formal communication channels, enabling more informed decisions regarding strategic initiatives, risk management, and resource allocation. Director-like managers bridge the gap between management and the board by understanding directors' informational needs and providing key insights accordingly. Collectively, these arguments suggest that board-management commonality positively affects firm value and performance.

However, shared views and perspectives between boards and management can lead to an overly harmonious relationship, potentially diminishing the board's effectiveness in providing independent oversight. In an environment with high commonality, the pressure to conform can be intense, making board members less likely to present alternative views or question prevailing wisdom. This limits the board's ability to explore a full range of strategic options or respond to external threats and opportunities, as suggested in theoretical models (e.g., Bikhchandani, Hirshleifer, and Welch, 1998). Bikhchandani, Hirshleifer, and Welch (1998) analyze how conformity can precipitate informational cascades within decision-making bodies such as corporate boards. When board members observe initial decisions or preferences set by management, they may align with these early cues instead of offering independent analyses or

[5] Boards play important roles in identifying and assessing projects, overseeing key strategies proposed by management, and monitoring managerial performance, while management initiates and implements these decisions (e.g., Fama and Jensen, 1983; Hermalin and Weisbach, 1998, 2003; Donaldson, Malenko, and Piacentino, 2020).

[6] Jiang, Wan, and Zhao (2016) and Kang, Kim, and Oh (2022) provide empirical evidence that director dissension brings diverse perspectives and opinions, leading to improved decision-making. This dissension benefits shareholder value by aligning directors with investors and disseminating value-relevant information.

insights. This dynamic can lead to unanimous board decisions that, while seemingly consensual, are founded on partial or erroneous information, thereby risking strategic and governance errors. Consequently, the board's ability to provide checks and balances on management proposals is compromised, and new business opportunities may be overlooked. Boards with high commonality with management are more likely to endorse management's strategies without adequate scrutiny, neglecting alternative viewpoints or potential pitfalls. This conformity impedes innovation and creativity, leading to challenges in identifying emerging market opportunities and developing novel ideas and innovative products and services. These arguments suggest that board-management commonality adversely impacts firm value and overall performance.

We examine the two competing views and find evidence supporting the positive impact of board-management commonality on firm value and outcomes. On average, firms with a higher degree of commonality between the board and management are significantly associated with an increase in firm value, as measured by Tobin's *q*. Our further analysis shows a curvilinear relationship between board-management commonality and firm value, indicating its nuanced impact: An initial increase in commonality positively affects firm value, but its impact diminishes as commonality continues to rise. To address concerns that a firm's board and management composition is endogenously determined, we conduct two-stage least squares (2SLS) regressions using the entropy-based index of regional labor market diversity as an instrument for *Board-management commonality*. As detailed in Section 3, the index captures labor market diversity in each company's headquarters county across four dimensions: age, race, education, and occupation by gender. Firms located in counties with more diverse labor pools tend to appoint directors and managers from varied backgrounds, thereby increasing board-management commonality. This suggests that our entropy-based index of regional labor market diversity fulfills the instrument's relevance requirement. However, it is unlikely that

this index directly influences firm value, except through its impact on commonality, thereby satisfying the exclusion condition of the instrument. Our inferences do not change.

Next, we examine whether the impact of board-management commonality varies across firms with different levels of board diversity. Despite increasing pressure from shareholders and society to diversify their boards (e.g., Gormley et al., 2023), achieving diversity can be hindered by search frictions and supply-side constraints (Adams, Akyol, and Verwijmeren, 2018; Schmid and Urgan, 2023). Commonality between the board and management may offer greater benefits for firms with lower board diversity. On less diverse boards, manager-like directors and director-like managers are expected to provide perspectives that differ from those of their respective groups. By acting as bridges, they introduce varied viewpoints within the board and management, thereby improving decision-making quality.[7]

To examine this issue, we divide our sample into two subgroups based on the level of board diversity in a given year. Our findings indicate that the positive impact of commonality on firm value is particularly pronounced when the board is less diverse. The results suggest that the shared perspectives and traits between the board and management can offset the potential costs associated with a lack of diversity in boardrooms.

We examine specific circumstances in which commonality is more beneficial for shareholder value. Compared with insiders, outside directors typically have limited access to information, and their effectiveness is influenced by the cost of acquiring information (e.g., Fama and Jensen, 1983; Duchin, Matsusaka, and Ozbas, 2010). When directors and managers share common traits, it facilitates information flow and fosters communication and cooperation, which helps mitigate the information disadvantage faced by outside directors and enables swift

[7] Baranchuk and Dybvig (2009) offer theoretical insights into the significance of manager-like directors and director-like managers in enhancing the variety of perspectives. Their model suggests that boards benefit from 'gray' directors who bring unique insights, particularly in settings with limited perspectives. Similarly, manager-like directors and director-like managers can introduce new ideas and information, potentially improving decision-making quality by broadening the range of options considered.

decision-making. This streamlined decision-making process enables firms to quickly adjust their strategies to unforeseen shifts in industry competition, not only during normal periods but also during periods of uncertainty.[8] Thus, the enhanced information processing and decision-making efficiency resulting from board-management commonality are especially beneficial for firms facing high levels of uncertainty associated with external factors such as industry shocks or economic policy, or for firms operating in poor information environments.

In line with these arguments, our findings indicate that the positive impact of board-management commonality is particularly pronounced among firms operating in opaque information environments, as measured by higher volatility of firm performance (i.e., ROA and stock returns), lower analyst forecast accuracy, and greater discretionary accruals. The benefits of commonality are also evident among firms experiencing industry shocks and those facing high levels of economic policy uncertainty.

We then explore corporate policies and a board's key decisions to gain deeper insights into the link between board-management commonality and firm value. First, we investigate innovation output and success, considering that corporate innovation is inherently risky and multi-stage, often requiring long-term endeavors to achieve positive outcomes (e.g., Holmstrom, 1989). In the uncertain innovation process, board-management commonality plays a role in fostering consensus among opinions, particularly on riskier projects. Supporting this hypothesis, we find that firms with board-management commonality exhibit increased innovation output and productivity, as evidenced by high levels of patenting activities and patent citations. Next, we examine whether board-management commonality facilitates timely

[8] A 2019 report by McKinsey & Company underscores the significance of the interaction between the board and senior management as an important, albeit frequently disregarded, component of crisis preparedness. Based on in-depth interviews with directors and senior executives from over 80 U.S. and U.K. institutions, the report identifies 'inconsistent or poor information flows' between boards and management teams as a significant challenge, particularly during crisis periods. This tension is exacerbated as board members increasingly demand more information to fulfill their duty of care. At the same time, management faces challenges in resolving pressing issues and managing board communication, which consumes significant time and energy.

decision-making in circumstances requiring prompt responses. We find that firms with higher board-management commonality are more responsive to market feedback regarding their capital expenditure (capex) investment forecasts, leading to subsequent adjustments in their investment decisions.

We conduct several additional tests. First, we assess whether any specific component predominantly drives the relation between board-management commonality and firm value. The overall positive and significant impact on firm value persists even when individual components, such as demographic, cultural, educational, or functional characteristics, are excluded. These findings imply that decision-making dynamics between the board and management are influenced by the collective effects of various shared traits within these groups. Second, we conduct a director/manager-level analysis using the death events of directors/management members. These events could cause changes in board and management composition, which occur independently of the firm's pre-existing conditions, as suggested in prior research (Bruce Johnson et al., 1985; Nguyen and Nielsen, 2010; Fracassi and Tate, 2012; Schmid and Urgan, 2022). If directors or managers who share commonality play a valuable role in decision-making and contribute to firm value, their deaths should adversely affect stock prices. Our analysis, using both a full sample of death events and a subsample of events that are largely unanticipated by the stock market, corroborates our findings that board-management commonality enhances firm value. Third, our analyses using variables measuring board decision-making efficiency in prior research (Fahlenbrach, Low, and Stulz, 2017; Giannetti and Zhao, 2019) suggest that firms with higher levels of commonality exhibit efficiencies in board decision-making (i.e., fewer nonexecutive meetings, lower director turnover, and fewer 8-K filings regarding material changes that are likely to result from erratic decision-making). Finally, we conduct placebo tests, which corroborate our findings that the

positive impact of manager-like directors/director-like managers is driven by their shared similarities with individuals in other groups rather than their specific characteristics.

Our study contributes to the literature in at least three ways. First, our study contributes to the literature on board and top management team composition. In the current governance landscape, where CEOs often dominate as the sole insiders on many boards, firms must adapt their management team compositions to align with the increasing diversity of boards.[9] Surprisingly, scant attention has been devoted to the role of management team diversity, including executives outside boardrooms, and the interaction between boards and management. While prior research has predominantly focused on the impact of the board-CEO nexus on specific shared attributes or connections on the board's monitoring and advising role (Adams and Ferreira, 2007; Fracassi and Tate, 2012; Berger, Cai, and Qiu, 2023), our study highlights the importance of the commonality between outside directors and executives beyond the CEO in various dimensions, such as demographics, education, and work experience.

Second, it extends the literature on board diversity and its effects on board effectiveness and firm value (Bernile, Bhagwat, and Yonker, 2018; Giannetti and Zhao, 2019; Hoitash and Mkrtchyan, 2022; Kang, Kim, and Oh, 2022; Gormley et al., 2023). While regulatory mandates and initiatives by institutional investors predominantly emphasize diversity within the board, the overall impact of diverse boards should be assessed by considering the broader composition of both the board and management. In contrast to previous studies that investigate diversity within singular groups and its effects on decision-making performance such as voting behavior (e.g., Kang, Kim, and Oh, 2022), our research explores the impact of commonality – shared attributes between board members and management team members – on board diversity and the alignment and cohesion between these two distinct groups.

[9] In our sample, CEOs serve as the sole board members in over 92% of firms on average, with some fluctuations observed during the sample period from 2003 to 2021.

Third, our approach to measuring the degree of commonality between the board and management using the inherent properties of the SVM classification algorithm contributes to the literature applying machine learning in finance and economics. Previous studies (Boudoukh et al., 2018; Chen, Wu, and Yang, 2019; Lerner and Seru, 2021; Fedyk and Hodson, 2023) have typically used the SVM to find universal rules that correctly classify data points, such as patent filings and news articles. Our study deviates from conventional SVM applications by introducing a novel approach that focuses on misclassified data points, which serve as insightful occurrences that gauge the commonality level between two groups across multiple dimensions.[10]

The remainder of this paper is organized as follows. Section 2 describes the sample and defines the key variables. Section 3 examines the impact of board-management commonality on firm value, using a full sample and subsamples based on different levels of board diversity, industry and market uncertainty, and information environments. Section 4 explores the effect of commonality on corporate policies, such as innovation activity and capex investment decisions. Section 5 presents the results of additional tests, including the analysis of director and manager deaths and the examination of board decision-making efficiency. Finally, Section 6 concludes the paper.

2. Data and Variable Definitions

2.1 Sample and variable definitions

We initially match BoardEx firms with those covered in Compustat and the Center for Research in Security Prices (CRSP), creating the BoardEx-Compustat-CRSP merged database. The sample period spans from 2003 to 2021. We start the sample period from 2003 to mitigate

[10] The SVM, a supervised machine learning algorithm, has been used to train on a dataset of news articles to learn the patterns and features and classify news articles into different categories or event types (Boudoukh et al., 2018; Fedyk and Hodson, 2023). Similarly, Chen, Wu, and Yang (2019) use the textual data from the filings to learn patterns to classify patent filings into different categories of FinTech innovation.

the confounding effects of significant regulatory changes introduced by the Sarbanes-Oxley Act of 2002 on board composition and the role of outside directors (e.g., Duchin, Matsusaka, and Ozbas, 2010).[11] Financial and stock return data are from Compustat and CRSP, respectively. We exclude firms in financial industries (Standard Industry Code (SIC) 6000-6999) and those with missing values for the key variables from the sample. Our final sample consists of 44,115 firm-year observations related to 5,213 firms after requiring nonmissing values for the key variables.

2.2 Measure of *Board-management commonality*

Our key explanatory variable, board-management commonality, gauges the extent of characteristic overlap between the board and management by considering demographic, cultural, educational, and functional characteristics identified as important demographic and cognitive factors in prior research (e.g., Adams, Ali, and Patrick, 2018; Bernile, Bhagwat, and Yonker, 2018; Kang, Kim, and Oh, 2022).[12] For the sake of simplicity, if we consider only two characteristics of directors and managers, we could represent these characteristics on a two-dimensional plane to visually identify overlapping members of the board and management by observing those with similar characteristics, i.e., overlapping values. However, this intuitive graphical method faces significant limitations. Manual inspection is time-consuming in each firm-year case and impractical for considering multiple characteristics (more than two) through such an approach.

To overcome these challenges, we employ the SVM algorithm, which is designed to separate two groups based on multiple characteristics by computing an optimal hyperplane.

[11] The BoardEx database of U.S. firms is also more comprehensive starting in 2003 (Fracassi and Tate, 2012).

[12] We assess commonality in demographics by focusing on age and gender and diversity in the cultural background by using Hofstede's measures (power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, and indulgence) (Hofstede, 2001). To assess commonality in educational backgrounds, we consider individual members' college, Ph.D., MBA, and Ivy League university education. Lastly, for commonality in functional characteristics, we consider financial expertise, same industry experience, non-industry experience (e.g., NGO, academia), tenure, CEO experience, technology experience, foreign experience, and legal expertise (e.g., Adams, Akyol, and Verwijmeren, 2018).

This allows automated identification of overlapping members between the board and management. While the SVM effectively divides groups, it imperfectly separates those with partially overlapping values, resulting in misclassified members. The degree of overlap between the board and management corresponds to the number of misclassified members. By utilizing SVM's properties, we measure overlap by the proportion of misclassified members as a metric of board-management commonality. We use a rigid linear kernel to prevent overfitting, deviating from conventional SVM applications that seek a common rule for group identification across cases. Instead, we conduct separate SVM analyses for each firm in a given year to classify board and management members and identify misclassified individuals.[13]

We obtain data on the demographic, educational, and functional characteristics of board members and management teams from the BoardEx database, excluding cultural background. For cultural background, we use OnoGraph to estimate the probability of the country of origin based on the first and last names of directors and managers (Mateos, 2007; Giannetti and Wang, 2022; Berger, Cai, and Qiu, 2023). Their cultural values are then derived from Hofstede's (2001) national culture model, which includes six dimensions: power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, and indulgence.[14] To ensure comparability across different units of measurement, we standardize continuous variables such as tenure, age, and Hofstede's cultural values to range from zero to one. We demean all 20 characteristic variables by industry (SIC two-digit codes) and year to adjust for industry-specific and annual trends. This enhances data compatibility, allowing classification based on the intrinsic characteristics of board members and management teams rather than external industry or temporal factors. For each characteristic, we use the SVM classifier with a linear kernel to classify board and management members. The overlap between board and

[13] As our objective is not to establish a universal dividing rule applicable across firms at different time periods, distinguishing between training and test samples is unnecessary.

[14] We obtain the six-dimension data from Hofstede's website (https://geerthofstede.com/research-and-vsm/dimension-data-matrix/).

management characteristics is measured by the fraction of 'misclassified' directors (i.e., manager-like directors) and 'misclassified' managers (i.e., director-like managers), which is one minus the accuracy (fraction of 'correctly classified' members) of the SVM classification as shown in Figure 1.[15]

$$\text{Commonality} = \frac{\text{No.of director}-\text{like managers} + \text{No.of manager}-\text{like directors}}{\text{Total no.of management team mebers} + \text{Total no.of directors}}$$

After measuring commonalities for each characteristic, we compute the first principal component to create a comprehensive *Board-management commonality* index. This index reflects the level of overlap between board members and management across multiple dimensions. A higher index value indicates a greater level of commonality between the board and management, suggesting more shared characteristics, values, experiences, or perspectives.

The SVM classification-based measure offers advantages over conventional group centroid-based distance measures. Employing centroid-based distance measures for classifying board members and managers based on multiple characteristics may seem appealing due to its simplicity. However, as illustrated in Figure 2, a key drawback of such measures lies in their inability to adequately capture diversity within groups. In the scenarios depicted in the lower part of the figure, where high internal diversity within groups results in considerable overlap, centroid-based measures fall short because they only consider the distance to the group's centroid without assessing the dispersion of individual members. Therefore, when dealing with diverse characteristics among board members and managers, SVM offers advantages by focusing on overlap and individual point distribution. It effectively distinguishes among

[15] Internet Appendix A.1 provides descriptive statistics on the board committees that manager-like directors serve and the positions held by director-like managers. Manager-like directors are actively engaged in key board committee work, with over half of them serving as chair of the board or committee chair. The most common roles held by these directors include serving on the audit committee (39.14%), compensation committee (31.86%), and nomination committee (29%). Similarly, director-like managers are involved in high-level operational decisions, often holding positions, such as president or vice president (36.9%), CEO (26.72%), CFO (13.42%), and COO (4.91%). These findings highlight the significant roles played by manager-like directors and director-like managers as conduits for facilitating communication and sharing firm-specific information.

individuals compared to centroid-based measures, which might erroneously group diverse individuals based solely on average group characteristics.

Our SVM-based board-management commonality is not merely a function of the diversity levels within the groups. Unlike traditional methods that rely on aggregated group metrics, SVMs classify individuals based on their specific characteristics. This granularity enables accurate identification of overlaps between individuals from different groups (directors and managers) by evaluating their unique traits or attributes. By calculating a *Board-management commonality* index through the first principal component of commonalities for each characteristic, the method provides a comprehensive measure that reflects the level of overlap between board members and management across multiple dimensions, irrespective of the diversity within each group. Appendix B provides a detailed technical description of measuring board-management commonality using the SVM.

2.3 Summary statistics

Table 1 presents the summary statistics of the main variables and various firm characteristics for sample firms in the BoardEx-Compustat-CRSP merged database. The mean (median) *Board-management commonality* is 1.63 (1.68). The median (mean) board size and management size are six (6.55) and nine (9.76), respectively.[16] Figure 3 shows a continuous increase in *Board-management commonality* over time, reaching 1.7 by 2021, after experiencing a general downward trend to a record low of 1.59 in 2013. All continuous variables are winsorized at the 1st and 99th percentiles. As indicated in Figure 4, the level of overall management diversity surpasses that of overall board diversity.[17] It is also noteworthy

[16] As the number of data points increases, the SVM tends to improve its ability to differentiate between classes (citations). Given the inherently small total number of directors and managers in our dataset, we conduct a sensitivity analysis to address potential concerns about the SVM's classification performance with a limited number of data points. Specifically, we exclude cases where both the board size and management size are four, falling into the bottom ten percentile of the sample distribution. Our findings remain consistent.

[17] *Board diversity* and *Management diversity* are computed using the PCA applied to the same set of demographic, cultural, educational, and functional characteristics used in constructing *Board-management commonality*, respectively.

that both levels of board and management diversity significantly decreased over our sample period. In Internet Appendix Figure A.1, we further examine the time trends of board diversity across individual components. Boards exhibit the highest level of diversity in functional backgrounds, with a steady increase over the sample period. However, diversity in other dimensions, such as culture, demographics, and education, remains relatively low, with minimal variation observed over time, except for diversity in demographics, which has shown downward trends in recent years. A close examination of the recent downward trends in board diversity in demographics reveals that outside directors have notably aged, while gender diversity has experienced a significant increase, particularly after 2017, reflecting regulatory and social pressures (Gormley et al., 2023).[18]

3. Board-management Commonality and Firm Value

3.1 Impact of board-management commonality on firm value: Using the full sample

We first examine the impact of board-management commonality on firm value using the full sample. On one hand, when board members have similar experiences or backgrounds as the management team, it facilitates clearer communication and understanding, allowing for more effective oversight and faster decision-making. This shared perspective can enhance the board's role in ratifying management proposals and the management's ability to achieve strategic plans developed by the board. However, shared views and perspectives between boards and management can reduce critical evaluation, diminishing the likelihood of directors' dissent in management proposals. This could compromise the board's ability to provide checks and balances in the execution of management proposals and in exploring potential new business

[18] In Internet Appendix Figure A.2, management teams exhibit high diversity in education but lower diversity in cultural, demographic, and functional aspects. Similar to the downward trends observed in board diversity in demographics, there has been a significant decrease in management diversity in this aspect. We also observe an increase in the average age of management teams, along with a steady rise in gender diversity. Notably, management diversity in functional backgrounds has experienced a steady decline over the sample period.

opportunities. The former view suggests a positive association between board-management commonality and firm value, while the latter view implies the opposite association.

The results from ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* are presented in Table 2. The regressions control for various firm characteristics that affect the composition of boards and management and firm value, such as firm size, past performance (stock returns, ROA), return volatility, leverage, R&D intensity, governance characteristics (i.e., proportion of independent directors, institutional ownership), log (board size) and log (management size). We also control for board diversity and management diversity and board-management social networks.[19] Board-management social networks are computed as the ratio of the number of management team members connected to outside directors through past employment, the same educational institutions, or social activities to the total number of board members and management team members (Fracassi and Tate, 2012; Cao et al., 2015).

In column (1), in which we control for industry and year fixed effects in addition to various firm-level characteristics, we find that the coefficient on *Board-management commonality* is positive and significant at the 1% level. The result does not change when we replace industry fixed effects with firm fixed effects in column (2) and year fixed effects with industry-year fixed effects in column (3). The coefficient estimates of 0.147 to 0.196 indicate that a one-standard-deviation increase in *Board-management commonality* leads to a 1.93% ((0.147 ×

[19] While both commonality and social networks, as documented in prior studies (Fracassi and Tate, 2012; Cao et al., 2015) play a role in information flows, they exhibit nuanced differences in mechanisms. Commonality between the board and management can foster a cohesive decision-making process, facilitating better information flow due to shared understanding and aligned goals. Conversely, social networks among executives and directors, which may stem from external sources or informal interactions, might not be accessible through formal channels. While social connections can ease outside directors' access to information, they can also introduce biases or conflicts of interest, depending on the nature of the shared information and the relationship involved. Supporting this notion, Cao et al. (2015) demonstrate that directors connected to senior executives often possess an informational advantage, as evidenced by higher returns from their stock sales transactions, particularly in firms with high information asymmetry and those with greater executive influence.

0.276)/2.106) to 2.57% increase in firm value when evaluated at the mean levels of firm value, which is economically large and significant.[20]

In untabulated tests, we explore the curvilinear relationship between board-management commonality and firm value by including the square of Board-management commonality (*Board-management commonality*^{2}) as an additional key variable in the regressions. We find that the coefficients on *Board-management commonality* are positive while the coefficients on *Board-management commonality*^{2} are negative across all regressions. These coefficients are significant, except in column (1) where industry and year fixed effects are controlled. The findings suggest a nonlinear association between board-management commonality and firm value: Tobin's *q* initially increases with higher levels of commonality, but then decreases as commonality further rises. Firm value reaches its maximum when the commonality level is 2.04 (1.91) in column (2) (column (3)), indicating the nuanced impact of board-management commonality on firm value.

One key concern of these results is that a firm's decision to select directors and management members is endogenously determined. Certain unobservable firm characteristics, such as corporate culture and strategic priorities, could influence both the likelihood of board-management commonality and firm value. For example, firms with a collaborative culture and robust communication channels may naturally cultivate alignment and shared objectives between the board and management, leading to higher board-management commonality, and enhanced firm value through superior strategic outcomes. It is also plausible that well-performing firms possess more resources and motivation to create a harmonious board-management relationship, resulting in a positive relation between commonality between the board and management and firm value. To mitigate these concerns, we use an instrumental

[20] Given that the mean value of Tobin's *q* in our sample firms is 2.106, the change from the 25th percentile to the 75th percentile of *Board-management commonality* corresponds to about a 2.79% increase in Tobin's *q* (0.147 × (1.851-1.451)/2.106).

variable (IV) approach. We calculate an entropy index (Massey and Denton, 1988) to measure labor market diversity in counties where firms are headquartered, by taking into account four dimensions of diversity: age, race, education, and occupation by gender.[21] Our instrument for *Board-management commonality* is *Regional labor market diversity*, which is calculated as the sum of standardized values across these four entropy indices. We discuss the details of the construction of our IV in Appendix C.[22] A higher regional labor market diversity indicates greater diversity in the local workforce. Consequently, firms located in more diverse counties are likely to appoint directors and managers from a wider range of backgrounds, thus enhancing a firm's board-management commonality and satisfying the relevance requirement of the IV. *Regional labor market diversity* is considered relatively exogenous because it is measured based on the population native to the state of residence, which was established many years ago. Therefore, it is unlikely to correlate with current labor market changes (Modestino, Shoang, and Balance, 2020) and is thus unlikely to directly influence firm value, except through its impact on *Board-management commonality*, which satisfies the exclusion criteria of the IV.

The results are presented in Table 3.[23] In column (1), consistent with expectations, *Regional labor market diversity* is positively and significantly associated with the endogenous variable *Board-management commonality* at the 1% level. The first-stage Cragg-Donald *F*-statistic for weak identification is 23.31, rejecting the null hypothesis of a weak instrument. In column (2), we estimate the second-stage regression in which we regress Tobin's *q* on the instrumented *Board-management commonality* and control variables. We find that the coefficient on instrumented *Board-management commonality* is positive and significant at the

[21] In untabulated tests, we use an alternative measure of diversity in the regional labor market based on the same four dimensions, the Blau index, which is calculated as one minus the Herfindahl Hirschman (HHI) index. We find that the results using the alternative measure of our IV are similar.

[22] We interpolate values for the years 2003 to 2009 using data from 2000, a method commonly used in estimating regional characteristics (e.g., Hilary and Hui, 2009; Shu et al., 2012). In Internet Appendix A.3, we address missing data using two approaches: First, we replace missing values with those from 2010. Second, we replace missing values from 2003 to 2005 with values from 2000, and missing values from 2006 to 2009 with values from 2010. Our results are similar across both approaches.

[23] We end the sample period in 2020 because the race data is available until 2020.

1% level, indicating that firm value is higher for firms where board members share commonality with management teams. In columns (3) and (4), we find that the results are similar when we replace year fixed effects with industry-year fixed effects. To further address potential concerns that our IV, which measures a firm's access to diverse workforce supply, is related to regional-specific economic or demographic conditions, we include three additional control variables: the unemployment rate and total population at the county level as well as the state economic condition index (Baumeister, Leiva-Leon, and Sims, 2024)[24] in columns (5)-(8). The results do not change.

Overall, the results suggest that board-management commonality accelerates consensus-building and improves the efficiency of boardroom decision-making[25] and thus positively affects firm value and performance.

3.2 Board-management commonality and board diversity: Subsample analysis

We explore whether commonality between the board and management can alleviate the adverse effects of limited diversity in boardrooms. Despite growing pressure for board diversity from stakeholders and regulators, many firms encounter obstacles in achieving diversity due to search frictions and supply-side constraints (Adams, Akyol, and Verwijmeren, 2018; Gormley et al., 2023; Schmid and Urgan, 2023). Building on Baranchuk and Dybvig's (2009) theoretical insights, we posit that commonality can be particularly beneficial for firms with less diverse boards. In such contexts, manager-like directors and director-like managers play pivotal roles by providing unique perspectives that complement those of their peers. These individuals serve

[24] In our analysis, we use the annual average of the weekly index. We thank Baumeister, Leiva-Leon, and Sims for making the state-level economic condition indices publicly available (https://sites.google.com/view/weeklystateindexes/dashboard).

[25] In Section 5.3, we examine whether firms with high levels of commonality achieve efficiencies in the decision-making process and experience fewer conflicts in the boardroom using three variables that measure board decision-making efficiency from prior studies (e.g., Fahlenbrach, Low, and Stulz, 2017; Giannetti and Zhao, 2019). We find that firms with higher commonality hold fewer nonexecutive board meetings, experience less frequent turnover of independent directors, and submit fewer 8-K filings regarding material changes in their financial conditions and operations.

as critical bridges, fostering diverse viewpoints that enhance communication and understanding between the board and management. This enhanced diversity facilitates effective information flow, ensuring that crucial operational insights and a deep understanding of the firm's challenges and opportunities are integrated into the decision-making process. Even in less diverse boardrooms, commonality helps ensure that vital governance aspects are not overlooked, promoting the informed, stable, and predictable decision-making that is essential for sustainable firm performance.

To examine how commonality mitigates the adverse effects associated with a lack of board diversity, we divide the full sample into two subgroups based on whether a firm's board diversity is below or above the sample median value in a given year. We then reestimate the regressions in Table 2 with the same control variables, except for *Board diversity*. In Table 4, we find that the coefficients on *Board-management commonality* are positive and significant at the 1% level only among a subgroup of firms with lower board diversity. The magnitudes of the coefficients on *Board-management commonality* for the subgroups of firms with lower board diversity are larger than those of the corresponding coefficients for the subgroups of firms with higher diversity, although the difference between the two coefficients is insignificant.

Our findings suggest that in boardrooms lacking a diverse range of perspectives, commonality contributes to enhanced firm performance. The commonalities between directors and managers facilitate effective consensus-building based on shared perspectives, streamlined information exchange, and aligned decision-making. Such benefits, however, are less pronounced in highly diverse boards, where a wide range of viewpoints can complicate consensus-building and hinder swift decision-making.

3.3 Board-management commonality and industry and market uncertainty

Board-management commonality plays a role in mitigating conflicts arising from divergent perspectives, thereby facilitating swift decision-making. This effect is likely to be

particularly pronounced when industries and market environments are uncertain, during which the ability to respond promptly to evolving risks is highly appreciated. Furthermore, during periods of uncertainty, the shared commonality and collaborative efforts between the board and management can enable decisive management action supported by the board. Thus, we expect the positive impact of commonality on firm value to be more pronounced when firms face high levels of uncertainty arising from external factors such as industry shocks and policy fluctuations.

To examine this issue, we consider industry shocks (Custódio, Ferreira, and Matos, 2013) and economic policy uncertainty (Baker, David, and Levy, 2022). To measure industry shocks, we compute the difference between industry (two-digit SIC code) sales growth and average sales growth across all industries. We measure the economic policy uncertainty faced by firms using local and national economic policy uncertainty indices ($EPU_{composite}$ indices).[26] We then divide the sample into the bottom and top quartiles of the sample based on each measure and separately estimate the regression in column (2) of Table 2.

The results are presented in Table 6. We find that the coefficients on *Board-management commonality* are positive and significant at the 5% level or better among the subsample of firms experiencing high industry shocks and those operating in environments with higher levels of economic policy uncertainty. The results suggest that board-management commonality enhances firm value, particularly in environments where industry and market uncertainties are higher. In such periods, timely decision-making and the ability to swiftly implement business strategies based on shared understanding are crucial for effectively navigating crises.

3.4 Board-management commonality and information environment

[26] We compute the local and national economic policy uncertainty index using the annual average of the monthly $EPU_{Composite}$ index derived from the state in which firms are headquartered. The $EPU_{Composite}$ index is computed using articles featuring terms associated with the economy and uncertainty, along with terms from a composite set that includes state-specific policy terms and a set of national policy terms (Baker, David, and Levy, 2022). We appreciate Baker, David, and Levy for providing access to the dataset (https://www.policyuncertainty.com/state_epu.html).

Next, we examine whether the value-enhancing role of commonality varies with firms' information environment. Prior research suggests that the effectiveness of outside directors is contingent upon firms' information environments (e.g., Adams and Ferreira, 2007; Harris and Raviv, 2008; Duchin, Matsusaka, and Ozbas, 2010). Specifically, higher information asymmetry presents greater challenges for outside directors in acquiring relevant information, leading to increased information acquisition costs. Commonalities between directors and managers can mitigate these challenges by promoting the communication, cooperation, and consensus actions necessary for effective and well-informed board decisions (Baranchuk and Dybvig, 2008). For example, director-like managers serve as effective communicators, bridging the informational gap between the board and the operational side of the business. Their understanding of governance and strategic imperatives enables them to articulate the operational impacts of board decisions clearly and convey ground realities back to the board. This two-way communication is crucial in poor information environments, where accurate information significantly impacts decision quality. Consequently, commonality can play an incremental role in enhancing decision-making efficiency, particularly in environments with high information asymmetry. Thus, we expect these benefits of commonality to be particularly pronounced for firms operating in poor information environments, where misaligned expectations between directors and managers are more likely due to limited information access for outside directors.

To examine this issue, we measure firms' information asymmetry using the volatility of firm performance (ROA and stock returns), analyst forecast accuracy, and discretionary accruals (e.g., Clement and Tse, 2005; Ferreira and Laux, 2007; Hazarika, Karpoff, and Nahata, 2012). We then include each measure of information asymmetry and its interaction with *Board-management commonality* in the regressions. The results are presented in Table 5. Consistent with our predictions, we find that the positive impact of board-management commonality on

firm value is more evident when firms have higher idiosyncratic risk, greater discretionary accruals, lower analyst forecast accuracy, and wider bid-ask spreads. The findings underscore the importance of commonality between the board and management, especially in firms facing higher levels of information asymmetry.

4. Board-management commonality and corporate policy

4.1 Innovation activity

To gain deeper insights into how board-management commonality improves firm value, we examine how board-management commonality affects corporate policies. We focus on innovation policies since they are risky and multi-stage, and typically require long-term effort to result in positive outcomes (e.g., Holmstrom, 1989). A common identity between the board and management can lead to enhanced cohesion, trust, and shared objectives, including collective tolerance of risks and acceptance of failures as part of the innovation process. If board-management commonality fosters consensus among diverse opinions and aids in agreeing on riskier policies, firms with higher levels of such commonality are expected to exhibit a more efficient innovation process.

To measure a firm's innovation activity, we obtain patent-related data from Kogan et al. (2017).[27] The results are presented in Table 7. The dependent variables are the natural logarithm of one plus the number of patents issued to a firm scaled by the firm's total assets in columns (1) and (2) and the natural logarithm of one plus the number of citations received by patents granted to a firm scaled by the firm's total assets in columns (3) and (4). The former variables measure a firm's innovation output, and the latter variables measure citations-based innovation efficiency (Hirshleifer, Hsu, and Li, 2017). In addition to the control variables in Table 2, we include additional firm-level variables that may affect corporate innovation, such as firm age,

[27] We thank Kogan, Papanikolaou, Seru, and Stoffman for providing access to the patent data, which is publicly available for use on Noah Stoffman's website (https://kelley.iu.edu/nstoffma/).

book-to-market ratio, cash/assets, and investment intensity (R&D/assets, PPE/assets, and Capex/assets), as suggested by prior research (e.g., Balsmeier, Fleming, and Manso, 2017; Hirshleifer, Hsu, and Li, 2017) in the regressions. We find that the coefficients on *Board-management commonality* are positive and significant at the 5% level or better across all regressions. The findings suggest that directors and managers who share views and objectives, including collective tolerance of risks and acceptance of failure through effective communication and consensus-building on complex issues, foster a more efficient innovation process, resulting in a significant increase in innovation output and productivity.

4.2 Capex investment adjustment

The models of board decision-making (e.g., Chemmanur and Fedaseyue, 2018) suggest that commonality between board members and management can significantly enhance the flow of quality information. Board members who align with management are likely to have access to more detailed and timely information, which is crucial for making informed decisions and taking prompt corrective action. We focus on capex investment decisions, a setting employed in prior studies to assess whether firms take timely corrective actions when necessary (e.g., Jayaraman and Wu, 2019; Bae, Biddle, and Park, 2021). Given that commonality between directors and managers can facilitate consensus-building based on shared views and efficient information flow, we expect firms with higher board-management commonality to adjust their annual capex investment upward (downward) in response to positive (negative) market reactions to their announced forecasts. We obtain annual capex forecast information for our sample firms from the I/B/E/S Guidance database. We keep analyst capex forecasts issued early in the fiscal year, as they are less likely to be influenced by information provided by management to analysts compared to forecasts issued later in the year. This approach enables a more accurate analysis of managers' decisions to adjust capex in response to market expectations. The results are presented in Table 8. The dependent variable is *Capex adjustment*,

which is the percentage deviation between the annual capex and the forecasted amount. In columns (1) and (2), the key variable of interest is the interaction term between *CAR (-1, 1)*, cumulative abnormal returns from one day before to one day after a firm's capex forecast announcement date, and *Board-management commonality*. In addition to the controls used in Table 2, we further control for variables. *Asset tangibility*, *Cash/assets*, and *Capex/assets*, which are identified as important factors affecting firms' capex investment decisions; *Earnings surprise* is the difference between the quarter's earnings-per-share and that of the same quarter of this year; and *Earnings announcement* is an indicator that takes the value of one if a firm's capex announcements are accompanied by earnings announcements, and zero otherwise. We control for *Earnings announcement* to mitigate concerns about confounding events in the regressions (e.g., Jayaraman and Wu, 2019). We find that the coefficients on the interaction terms between *CAR (-1, 1)* and *Board-management commonality* are positive and significant, indicating that firms with higher commonality are more likely to adjust their annual capex based on market feedback on their original investment plans. The results are similar when we use CARs in the five days surrounding the forecast date as an alternative window.

The findings suggest that the commonality between the board and management fosters the firm's agility and responsiveness to market signals, which allows it to take timely corrective actions based on market reactions and adapt its investment strategies in line with external feedback, thereby enhancing financial performance and shareholder value.

5. Additional tests

5.1 Decomposition of board-management commonality

As a firm's board-management commonality is measured with different dimensions, we assess the impact of each component of the commonality measure on the baseline results by excluding each dimension from the measure. The results in Table 10 suggest that no single dimension significantly influences our main results. Overall, these results imply that the

combined variation in different aspects of board-management commonality influences decision-making rather than any single dimension of commonality.

5.2 Impact of board-management commonality on firm value: Using the deaths of directors and managers

The deaths of directors and managers could cause changes in board and management composition independently of firm conditions (Bruce Johnson et al., 1985; Nguyen and Nielsen, 2010; Fracassi and Tate, 2012; Schmid and Urgan, 2022). If directors (managers), who share commonality with managers (directors), play a value-enhancing role in decision-making and contribute to firm value, the stock price should decline following the deaths of directors and managers with such commonality. We identify 815 deaths through searches of BoardEx, news reports, SEC filings, and other sources. Our SVM approach, which classifies directors and managers based on their contributions to board-management commonality prior to their largely unexpected demise, allows for a more nuanced analysis, separating the effects of board-management commonality from the external shocks caused by the unexpected loss of key human capital. Using SVM in this context significantly enhances the credibility of our causal inferences by methodically identifying the roles that directors and managers play in either increasing or diminishing the similarity between the board and management. Thus, this approach mitigates potential endogeneity concerns by elucidating the direct impact of the change in board management dynamics on firm value.

The results are presented in Table 11. In column (1), the key variable of interest is *Manager-like director/director-like manager (indicator)*, an indicator that takes the value of one for the death of directors (managers) who share similarity across four dimensions with managers (directors). In addition to the firm-level controls used in Table 2, we further include individual-level controls: a *CEO* indicator, a *Board chair* indicator, director (manager) age in years, and the number of years a director (manager) has served on the board (management team)

as a director (officer). We find that the coefficient on *Manager-like director/director-like manager (indicator)* is negative and significant at the 5% level, suggesting that directors and managers sharing commonality are valued more by outside investors. In column (2), when we replace *Manager-like director/director-like manager (indicator)* with two indicators, *Manager-like director (indicator)* and *Director-like manager (indicator)*, we find that both coefficients are negative and significant, indicating that the incremental values of both manager-like directors and director-like managers are larger. In columns (3)-(6), we further exclude death events that are largely unanticipated by the stock market, such as suicides, cancer, and deaths of individuals over 75 years of age. The results are similar, although the coefficient on *Director-like manager (indicator)* loses its significance in column (6). Overall, these results echo those from our firm-level analyses, suggesting that manager-like directors/director-like managers perform value-enhancing roles.

5.3 Board-management commonality and board decision-making

To assess whether board-management commonality eases friction in board decision-making, we conduct analyses using three variables that measure board decision-making efficiency from prior studies (e.g., Fahlenbrach, Low, and Stulz, 2017; Giannetti and Zhao, 2019). The first variable is the frequency of board meetings, which tends to increase when firms face significant challenges in decision-making. The frequency of board meetings will be lower for firms with a higher level of board-management commonality because a greater alignment between the board and management reduces the occurrence of significant disagreements or conflicts. In such environments, there is typically a higher level of trust and communication efficacy, which diminishes the need for frequent separate meetings of nonexecutive directors. The second measurement we use is director turnover. High director turnover, often resulting from frequent disagreements among directors and management, is

typically associated with idiosyncratic factors rather than firm performance.[28] Given that disagreement among directors and management can be resolved more effectively when firms have a higher level of board-management commonality, we expect director turnover to be lower in firms with higher commonality. Third, we use the number of substantial and material events requiring 8-K filings as a measure of erratic decision-making within a company. If board-management commonality reduces friction in consensus-building, it is expected to lead to a reduction in unpredictable decisions and frequent strategic shifts, thus potentially decreasing the need for 8-K filings that report such changes. The findings reported in Internet Appendix A.2, support these predictions. We find that firms with higher levels of commonality exhibit fewer nonexecutive board meetings, lower director turnover unrelated to firm performance, and fewer 8-K filings regarding material changes in financial conditions and operations.

5.4 Subsample analysis based on board diversity

Our previous findings, as discussed in Section 3.2, highlight the importance of alignment and shared understanding between the board and management, particularly in firms with limited board diversity. While less diverse boardrooms may experience volatile firm outcomes due to a lack of diverse viewpoints, our results suggest that commonality can streamline decision-making and reduce friction. Director-like managers and manager-like directors broaden perspectives and enhance the quality of available information, facilitating quicker consensus on issues. We further examine whether the positive impact of board-management commonality on firm value is more pronounced in firms with low board diversity, particularly when they face uncertain business conditions (Table 5) and poor information environments (Table 6) and when they engage in innovation activities (Table 7) and capx investment adjustments (Table 8). In Internet Appendixes A.4 and A.5, we find consistent results across

[28] Directors depart for various reasons and have an incentive to conceal the true reason for their departure. In some cases, directors may leave due to disagreements or conflicts with other board members, management, or the company's overall direction (e.g., Fahlenbrach, Low, and Stulz, 2017).

these analyses, except for capex adjustment decisions. Overall, our findings, along with earlier evidence, highlight the importance of fostering commonality, particularly in less diverse boardrooms, to mitigate the adverse effects of a lack of diverse perspectives.

5.5 Placebo tests

It is plausible that commonalty directors and executives have some unique characteristics that enable them to provide value-enhancing roles rather than their shared characteristics with individuals in other groups. To address this alternative explanation of our results, we conduct placebo tests where we construct *Placebo board-management commonality*, computed as the ratio of the number of placebo manager-like directors and director-like managers to the total number of directors and managers. Placebo manager-like directors/director-like managers are those identified as manager-like directors/director-like managers in other firms during a given year, but not in the focal firm. We repeat all our analyses after replacing *board-management commonality* with *Placebo board-management commonality*. We find that none of the coefficients on *Placebo board-management commonality* are significant, indicating that our findings on the positive impact of manager-like directors/director-like managers are not driven by their specific characteristics but by their shared similarities with individuals in other groups.

6. Conclusion

We investigate how the commonality between boards and management ("board-management commonality") influences the effectiveness of the board and consequently affects firm outcomes and value. To measure board-management commonality, we utilize the inherent properties of the SVM algorithm, which identifies overlapping individuals by separating the two groups based on demographic, cultural, educational, and functional characteristics.

Consistent with the positive role of *Board-management commonality* in enhancing communication, accelerating consensus-building, and improving decision-making processes, we find that board-management commonality is significantly associated with an increase in firm

value measured by Tobin's *q*. Our additional analysis shows a curvilinear relationship between board-management commonality and firm value, highlighting the nuanced impact of this commonality on firm value. Our findings do not change when we use an entropy-based regional labor market diversity index as an instrument for *Board-management commonality*. Our findings complement existing research on board diversity by highlighting the role of *board-management commonality* in enhancing communication between directors and managers and facilitating a board's timely decision-making, especially in firms with limited diversity. We further find that the benefits of enhanced information processing and decision-making efficiency due to board-management commonality are pronounced in firms operating in poor information environments where information flow to outside directors is limited. Moreover, commonality plays a particularly important value-enhancing role in firms facing uncertain business conditions, such as industry shocks and economic policy fluctuations. We further find that firms with high board-management commonality undertake more innovative activities, achieve greater innovation efficiency, and make timely investment decisions, as evidenced by prompt capex expenditure adjustments in response to market feedback.

Finally, while board diversity typically broadens perspectives in boardrooms and enhances board decision-making, our findings indicate that firms with limited board diversity can partially offset the inefficiencies in their decision-making by fostering a higher level of commonality between the board and management. This result highlights the significance of achieving a nuanced equilibrium between board diversity, which encourages diverse viewpoints, and commonality, which promotes alignment and cohesion in executing strategic objectives. While diversity enriches board deliberations with varied perspectives, commonality ensures sufficient alignment to implement decisions effectively. For less diverse boards, the equilibrium tilts toward benefiting from commonality, as manager-like directors and director-

like managers play a pivotal role in broadening perspectives and opinions, thereby enhancing firm performance through more efficient decision-making and strategic alignment.

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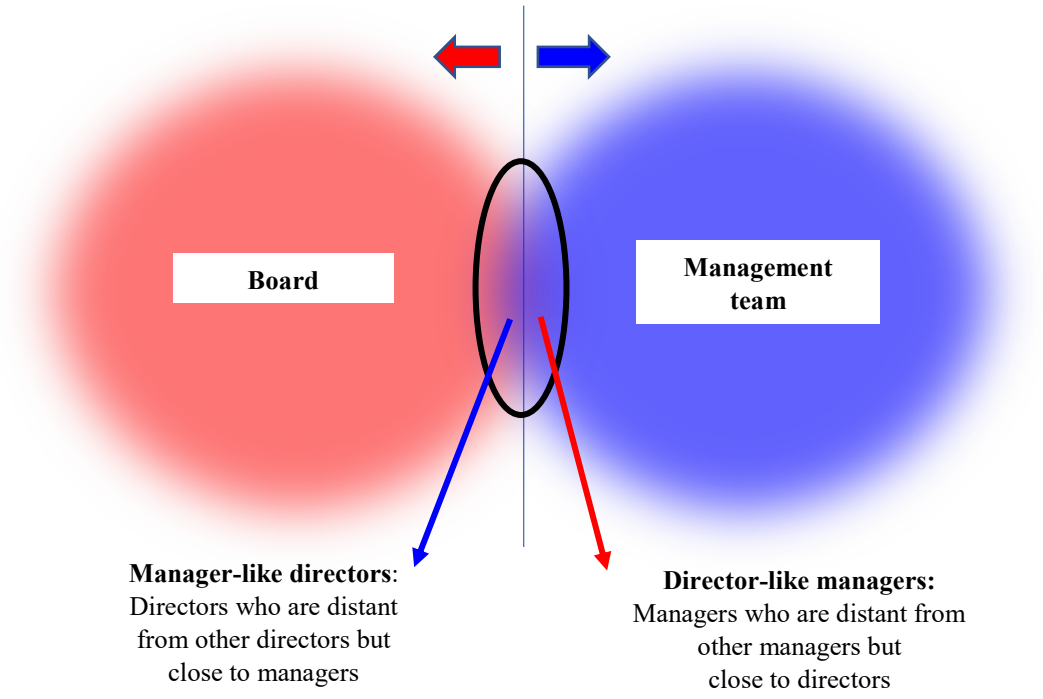


Figure 1. Support Vector Machine-based Board-management commonality

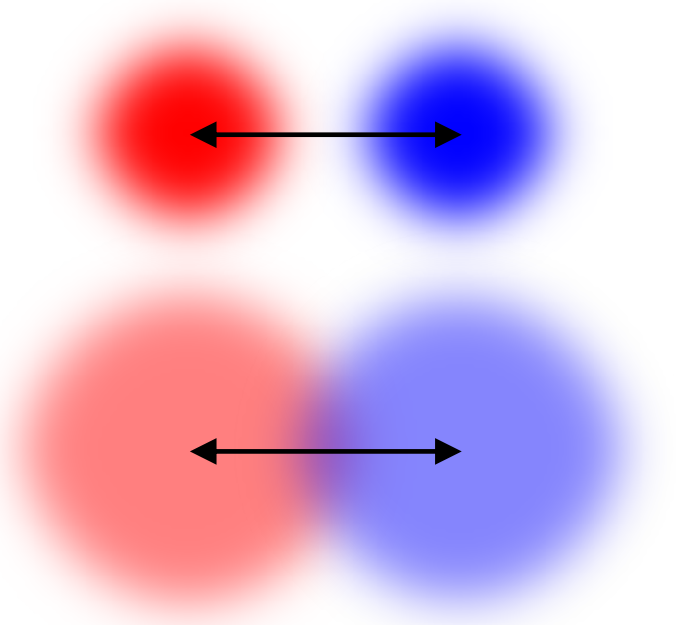


Figure 2. Pitfalls of centroid-based distance

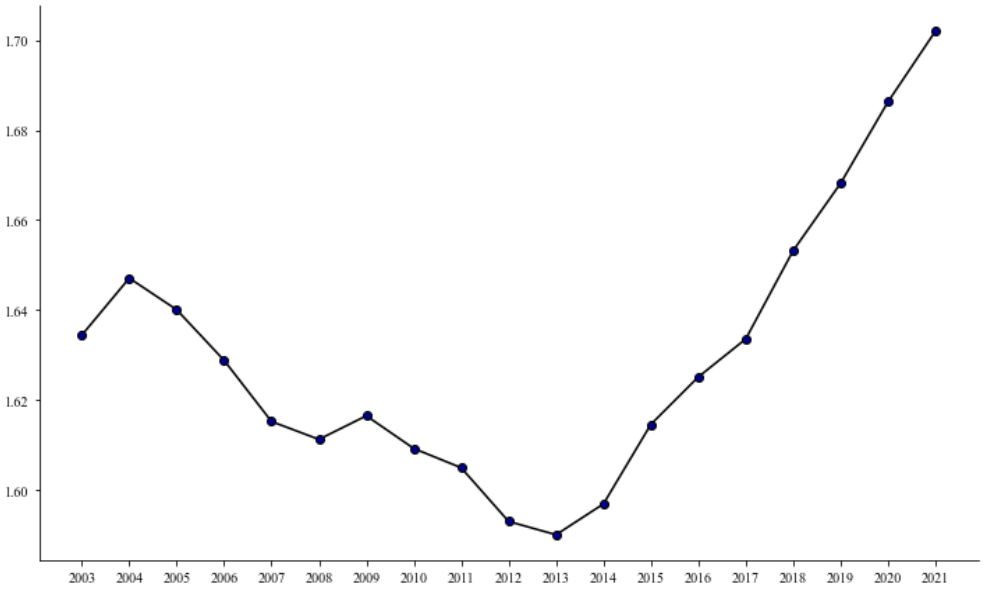


Figure 3. Time trends of Board-management commonality (average) over the period 2003-2021

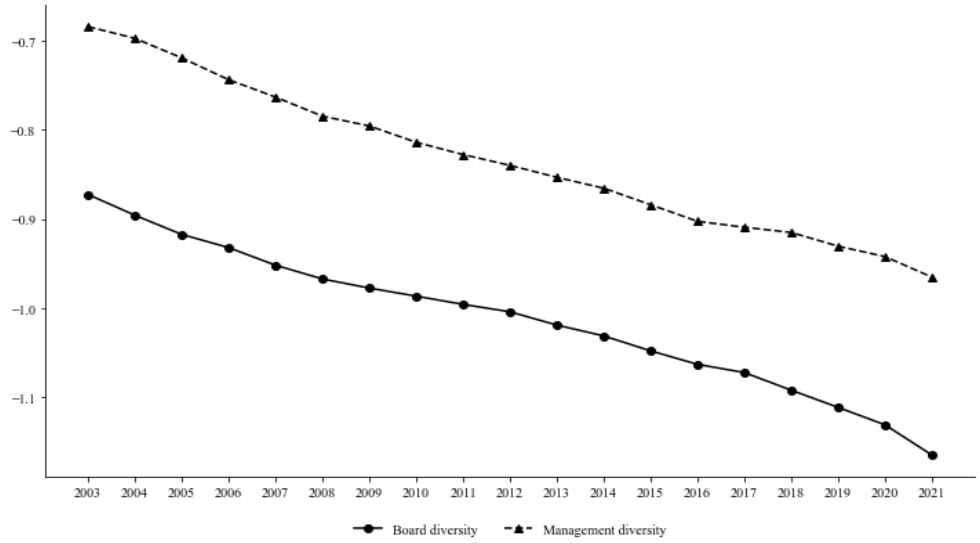


Figure 4. Time trends of board/management diversity index (average) over the period 2003-2021

Table 1
Summary statistics

This table presents summary statistics for firm characteristics. The sample consists of 44,115 firm-year observations in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. Appendix A provides a detailed description of the construction of the other variables.

	Mean	SD	P10	Median	P90
Board-management commonality	1.629	0.276	1.227	1.683	1.945
Market capitalization (US$ billion)	4.466	23.667	0.043	0.669	9.013
Stock return	0.299	1.113	-0.528	0.083	1.074
Return volatility	0.032	0.016	0.015	0.028	0.054
ROA	0.005	0.225	-0.231	0.061	0.17
Leverage	0.227	0.22	0	0.190	0.521
R&D	0.061	0.122	0	0.004	0.187
Board size	6.552	2.117	4	6	9
Management size	9.758	5.366	4	9	17
Board diversity	-1.003	0.254	-1.302	-1.038	-0.653
Management diversity	-0.824	0.250	-1.128	-0.853	-0.483
Proportion of independent directors	0.765	0.131	0.571	0.800	0.9
Board-management social networks	0.307	0.265	0	0.250	0.714
Institutional ownership	0.572	0.352	0	0.667	0.967

Table 2
Board-management commonality and firm value

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's *q*		
Independent variable	(1)	(2)	(3)
Board-management commonality	0.196***	0.147***	0.158***
	(0.001)	(0.000)	(0.000)
Firm size	0.411***	0.345***	0.335***
	(0.000)	(0.000)	(0.000)
Stock return	0.066***	0.031***	0.032***
	(0.000)	(0.000)	(0.000)
Return volatility	6.396***	4.730***	5.121***
	(0.000)	(0.000)	(0.000)
ROA	-0.127	0.052	0.055
	(0.468)	(0.650)	(0.643)
Leverage	0.084	0.327***	0.338***
	(0.336)	(0.000)	(0.000)
R&D/assets	4.613***	2.774***	2.703***
	(0.000)	(0.000)	(0.000)
Log (board size)	-0.598***	-0.267***	-0.248***
	(0.000)	(0.000)	(0.000)
Log (management size)	-0.390***	-0.239***	-0.228***
	(0.000)	(0.000)	(0.000)
Board diversity	0.141*	0.117*	0.143**
	(0.057)	(0.071)	(0.029)
Management diversity	0.294***	0.263***	0.275***
	(0.000)	(0.000)	(0.000)
Proportion of independent directors	-0.152	-0.192*	-0.144
	(0.163)	(0.059)	(0.162)
Board-management social networks	-0.060	-0.032	-0.052
	(0.302)	(0.639)	(0.456)
Institutional ownership	-0.269***	-0.170***	-0.183***
	(0.000)	(0.001)	(0.000)
Year fixed effects	Yes	Yes	No
Industry fixed effects	Yes	No	No
Firm fixed effects	No	Yes	Yes
Industry-year fixed effects	No	No	Yes
Observations	44,115	44,115	44,115
Adjusted R^2	0.311	0.651	0.657

Table 3
Board-management commonality and firm value: Using an instrumental variable approach

The table presents estimates of two-stage least squares (2SLS) regressions in which we use *Regional labor market diversity* as the instrumental variable for *Board-management commonality*. We discuss the details of the construction of the IV in Appendix C. The dependent variables are *Board-management commonality* in columns (1), (3), (5), and (7), and Tobin's *q* ((total assets – book equity + market value of equity) / total assets) in columns (2), (4), (6), and (8). The sample consists of 41,277 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2020. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. *Unemployment* is the unemployment rate of the county in which the firm is headquartered. We obtain the unemployment data from the U.S. Bureau of Labor Statistics. *Log (population)* is the natural logarithm of the population of the county in which the firm is headquartered. We obtain the population data from the U.S. Census Bureau. *State-level economic condition index* is computed based on four state-level indicators for nonfarm payroll employment, average hours worked in manufacturing, unemployment rate, and wage and salary disbursements deflated by the Consumer Price Index (U.S. city average) (Baumeister, Leiva-Leon, and Sims, 2021). All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted at the county-by-year level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	Board-management commonality	Tobin's *q*	Board-management commonality	Tobin's *q*	Board-management commonality	Tobin's *q*	Board-management commonality	Tobin's *q*
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regional labor market diversity	0.006***		0.006***		0.007***		0.006***	
	(0.000)		(0.001)		(0.000)		(0.000)	
Instrumented: board-management		5.492**		4.121*		4.820**		3.344*
commonality		(0.021)		(0.060)		(0.025)		(0.087)
Unemployment					0.056	-1.092	0.064	-1.105
					(0.614)	(0.225)	(0.578)	(0.161)
Log (population)					-0.006**	0.021	-0.006**	0.025
					(0.039)	(0.357)	(0.029)	(0.230)
State-level economic condition index					0.004**	-0.017	0.005***	-0.013
					(0.041)	(0.272)	(0.007)	(0.378)
Other control variables (Same as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No	Yes	Yes	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Observations	40,883	40,405	40,883	40,324	40,549	40,075	40,549	39,994
Adjusted R^2	0.700	--	0.703	--	0.699	--	0.702	--
Cragg-Donald F-statistic		13.769		11.851		15.228		13.500
Kleibergen-Paap Wald		12.612		11.190		13.752		12.519
10% maximal IV size		16.38		16.38		16.38		16.38
15% maximal IV size		8.96		8.96		8.96		8.96

Table 4
Board-management commonality and board diversity

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. Columns (1) and (3) (Columns (2) and (4)) include a subgroup of firms where *board diversity* is below (above) the sample median value in a given year. *Board diversity* is computed using Principal Components Analysis (PCA) to measure the degree of diversity among outside directors across four dimensions: demographics (age and gender), cultural background (Hofstede's measures: power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, indulgence), educational (college, Ph.D., MBA, and Ivy League university graduate), and functional characteristics (financial expertise, same industry experience, nonindustry experience (e.g., NGO, academia), tenure, CEO experience, technology experience, foreign experience, and legal expertise). *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's *q*			
	Low board diversity	High board diversity	Low board diversity	High board diversity
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality	0.240***	0.069	0.224***	0.092
	(0.001)	(0.193)	(0.002)	(0.100)
Control variables (same as in Table 2, except for *board diversity*)	Yes	Yes	Yes	Yes
F-test for equality of two coefficients (*p*-value)	0.354		0.518	
Year fixed effects	Yes	Yes	No	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	No	Yes	Yes
Observations	24,240	19,875	24,240	19,875
Adjusted R^2	0.657	0.675	0.662	0.675

Table 5
Board-management commonality and industry and market uncertainty

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. Column (1) (Column (2)) includes a subgroup of firms experiencing high (low) industry shock, where the difference between industry (two-digit SIC codes) sales growth and average sales growth across all industries (Compustat) falls within the top (bottom) quartile of the sample. Column (3) (Column (4)) includes a subgroup of firms where the annual average of the monthly economic policy uncertainty index, $EPU_{composite}$ index (Baker, David, and Levy, 2022), which is derived from the state in which firms are headquartered, is in the top (bottom) quartile of the sample. ***Board-management commonality*** is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's *q*			
	Industry shock		$EPU_{composite}$ index	
	High	Low	High	Low
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality	0.207**	0.071	0.235***	0.024
	(0.014)	(0.208)	(0.006)	(0.709)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	9,347	10,657	13,755	12,444
Adjusted R^2	0.658	0.697	0.641	0.682

Table 6
Board-management commonality and information environment

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. *ROA volatility* is the standard deviation of ROA from $year_{t+1}$ to $year_{t+5}$. *Stock return volatility* is the standard deviation of stock returns from $year_{t+1}$ to $year_{t+5}$. *Analyst forecast accuracy* is the average of the difference between the maximum absolute forecast error for analysts who follow the firm minus the absolute forecast error of the analyst following the firm scaled by the range of absolute forecast errors for analysts following the firm (Clement and Tse, 2005). *Discretionary accruals* is absolute discretionary accruals estimated from the performance-augmented modified Jones (1991) model. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's *q*															
	ROA volatility				Stock return volatility				Analyst forecast accuracy				Discretionary accruals			
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Board-management commonality	0.196***	0.067	0.223***	0.082*	0.153**	0.083	0.165***	0.103*	0.182*	0.174**	0.144	0.182**	0.152**	0.045	0.165**	0.079
	(0.004)	(0.115)	(0.001)	(0.067)	(0.010)	(0.130)	(0.007)	(0.082)	(0.059)	(0.023)	(0.161)	(0.027)	(0.032)	(0.361)	(0.025)	(0.126)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Observations	21,973	21,979	21,973	21,979	21,971	21,981	21,971	21,981	13,700	13,736	13,700	13,736	18,365	18,374	18,365	18,374
Adjusted R^2	0.610	0.745	0.612	0.755	0.610	0.753	0.609	0.762	0.690	0.701	0.696	0.702	0.636	0.689	0.635	0.704

Table 7
Board-management commonality and innovation activity

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is the natural logarithm of one plus the number of patents (the number of citations received by patents granted to a firm in a year) scaled by total assets in columns (1) and (2) (columns (3) and (4)). The sample consists of 44,088 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. *Firm age* is the natural logarithm of one plus the number of years since a firm was first covered by Compustat. *Book-to-market* is the ratio of the book value of equity divided by the market value of equity. *Cash/assets* is the ratio of cash and short-term investments to total assets. *PPE/assets* is the ratio of property, plant, and equipment to total assets. *Capex/assets* is the ratio of capital expenditure to total assets. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Log (1+ no. of patents/assets)		Log (1+ no. of citations/assets)	
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality	0.002**	0.001**	0.014**	0.013**
	(0.014)	(0.024)	(0.011)	(0.019)
Firm age	-0.006***	-0.005***	-0.063***	-0.055***
	(0.000)	(0.000)	(0.000)	(0.000)
Book-to-market	-0.001***	-0.001***	-0.004*	-0.006***
	(0.003)	(0.001)	(0.057)	(0.008)
Cash/assets	0.007***	0.006***	0.047***	0.033***
	(0.000)	(0.000)	(0.000)	(0.007)
PPE/assets	0.006***	0.002	0.044***	-0.003
	(0.001)	(0.411)	(0.001)	(0.829)
Capex/assets	-0.002	0.003	-0.017	0.034
	(0.380)	(0.259)	(0.473)	(0.153)
Other control variables (Same as in Table 2)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes
Observations	44,088	44,088	44,088	44,088
Adjusted R^2	0.581	0.589	0.466	0.498

Table 8
Board-management commonality and capital expenditure (capex) adjustments

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is the percentage deviation between the annual capex and the forecasted amount (i.e., Capex adjustment). We obtain the information about forecast announcement dates from the IBES Guidance database and match it with BoardEx-Compustat-CRSP universe nonfinancial firms. The sample consists of 10,295 firm-year observations over the period 2003 to 2021. *CAR (-2, 2)* is cumulative abnormal returns from two days before to two days after a firm's capex forecast announcement date. Abnormal stock returns are calculated using the Fama-French-Carhart (Carhart, 1997) four-factor models. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. *Asset tangibility* is (0.715 × total receivables + 0.547 × inventories + 0.535 × net property plant and equipment + cash and short-term investments) / total assets. *Cash/assets* is the ratio of cash and short-term investments to total assets. *Capex/assets* is the ratio of capital expenditure to total assets. *Earnings surprise* is the difference between the quarter's earnings-per-share and that of the same quarter of this year. *Earnings announcement (indicator)* takes the value of one if a firm's capex announcements are accompanied by earnings announcements, and zero otherwise. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Capex adjustment	
Independent variable	(1)	(2)
Board-management commonality: a	-0.019	-0.018
	(0.441)	(0.500)
CAR (-2, 2): b	-0.170*	-0.212**
	(0.094)	(0.034)
a × b	0.139**	0.172**
	(0.039)	(0.010)
Asset tangibility	0.227***	0.260***
	(0.005)	(0.002)
Cash/assets	-0.354***	-0.367***
	(0.000)	(0.000)
Capex/assets	-0.328***	-0.364***
	(0.002)	(0.002)
Earnings surprise	0.010***	0.007***
	(0.000)	(0.000)
Earnings announcement (indicator)	-0.017**	-0.017*
	(0.045)	(0.054)
Other control variables (same as in Table 2)	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	No
Industry-year fixed effects	No	Yes
Observations	10,295	10,295
Adjusted R^2	0.242	0.244

Table 9
Board-management commonality, excluding each component

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's *q*							
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Board-management commonality, excluding demographics	0.163***	0.174***						
	(0.000)	(0.000)						
Board-management commonality, excluding cultural background			0.180***	0.195***				
			(0.000)	(0.000)				
Board-management commonality, excluding education					0.148***	0.161***		
					(0.001)	(0.000)		
Board-management commonality, excluding functional background							0.148***	0.160***
							(0.003)	(0.002)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Industry fixed effects	No	No	No	No	No	No	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	44,115	44,115	44,115	44,115	44,115	44,115	44,115	44,115
Adjusted R^2	0.651	0.657	0.651	0.657	0.650	0.657	0.650	0.657

Table 10
Impact of board-management commonality on firm value: Using deaths of manager-like directors and director-like managers

The table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is the CAR from one day before to one day after the sudden death date of directors and management team members. The sample consists of 815 deaths involving 283 directors and 532 management team members over the period 2003 to 2017. Abnormal stock returns are calculated using the Fama-French-Carhart (Carhart, 1997) four-factor model. The four factors used in the Fama-French-Carhart four-factor model are CRSP value-weighted index, SMB, HML, and UMD (daily return difference between the returns on high and low prior return portfolios). *Manager-like director (indicator)* takes the value of one for directors who share similarity across four dimensions (i.e., demographic, cultural, educational, and functional characteristics) with managers, and zero otherwise. *Director-like manager (indicator)* takes the value of one for managers who share similarity across four dimensions (i.e., demographic, cultural, educational, and functional characteristics) with directors, and zero otherwise. *CEO (indicator)* takes the value of one for CEOs, and zero otherwise. *Board chair (indicator)* takes the value of one for the chair of the board of directors, and zero otherwise. *Age* is the age of a director/management team member in years. *Tenure* is the number of years a director (manager) has served on the board (the company) as a director (officer). All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	CAR (-1, 1)					
	Full sample		Subsample			
			Excluding deaths from suicide and cancer		Excluding suicides, cancer, and individuals over 75	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Manager-like director/director-like manager (indicator)	-0.013**		-0.017**		-0.026***	
	(0.033)		(0.014)		(0.010)	
Manager-like director (indicator)		-0.011*		-0.015**		-0.027**
		(0.063)		(0.034)		(0.012)
Director-like manager (indicator)		-0.027*		-0.038**		-0.024
		(0.098)		(0.031)		(0.245)
CEO (indicator)	-0.002	-0.001	-0.001	-0.000	-0.000	-0.000
	(0.845)	(0.927)	(0.893)	(0.974)	(0.986)	(0.978)
Board chair (indicator)	0.001	0.001	0.001	0.001	0.005	0.005
	(0.784)	(0.800)	(0.868)	(0.883)	(0.407)	(0.410)
Age	0.000	0.000	0.000	0.000	0.000	0.000
	(0.292)	(0.302)	(0.192)	(0.206)	(0.622)	(0.622)
Tenure	0.001***	0.001***	0.001***	0.001***	0.001*	0.001*
	(0.002)	(0.002)	(0.006)	(0.006)	(0.085)	(0.087)
Other control variables (Same as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	815	815	675	675	474	474
Adjusted R^2	-0.002	-0.003	-0.015	-0.016	0.002	-0.001

Appendix A
Variable Definitions

This appendix provides detailed descriptions of all variables used in the tables.

Variable name	Definition	Source
Board diversity (Management diversity)	The degree of diversity among outside directors (management team members) is measured across four dimensions: demographics (age and gender), cultural background (Hofstede's measures: power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, indulgence), educational (college, Ph.D., MBA, and Ivy League university graduate), and functional characteristics (financial expertise, same industry experience, nonindustry experience (e.g., NGO, academia), tenure, CEO experience, technology experience, foreign experience, and legal expertise), computed using Principal Components Analysis (PCA)	BoardEx, Hofstede (2001), OnoGraph
Board-management social networks	Ratio of the number of management team members connected to outside directors through past employment, same educational institutions, or social activities to the total number of board members and management team members (Fracassi and Tate, 2012)	BoardEx
Firm size	Natural logarithm of market capitalization	Compustat
Institutional ownership	Ratio of the number of shares held by all institutional investors to the total number of common shares outstanding	Thomson/Refinitiv 13F
Leverage	Ratio of the sum of long-term debt and debt in current liabilities to total assets	Compustat
Log (board size)	Natural logarithm of the number of directors	BoardEx
Log (management size)	Natural logarithm of the number of the top management team	BoardEx
Proportion of independent directors	Ratio of the number of independent directors to the total number of directors	BoardEx
R&D/assets	Ratio of R&D expenses to total assets	Compustat
Return volatility	Standard deviation of daily excess stock returns over the fiscal year	CRSP
ROA	Ratio of operating income after depreciation to total assets	Compustat
Stock return	Market-adjusted annual stock return, where market index is CRSP value-weighted return	CRSP

Appendix B
Board-management commonality measurement with support vector machine (SVM)

Problem setup for SVM

Consider a $n \times p$ data matrix X, consisting of n members from the board and management, each with p characteristics (p-dimensional space),

$$x_1 = \begin{pmatrix} x_{11} \\ \vdots \\ x_{1p} \end{pmatrix}, \cdots, x_n = \begin{pmatrix} x_{n1} \\ \vdots \\ x_{np} \end{pmatrix}.$$

Each member is categorized into one of two classes, $y_1, \cdots, y_n \in \{-1,1\}$, where -1 represents one class (e.g., board) and 1 represents the other class (e.g., management). The separating hyperplane is defined by the equation:

$$f(x_{i1}, \cdots, x_{ip}) = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip} = 0.$$

When the hyperplane coefficients are normalized (i.e., $\sum_{j=1}^{p} \beta_j^2 = 1$), the value of $f(x_{i1}, \cdots, x_{ip}) = M$ represents the shortest distance from the hyperplane to the corresponding data point. The SVM algorithm aims to find the hyperplane that optimally separates these two groups.

Hyperplane and the shortest distance from a data point: A two-dimensional example

In a two-dimensional space defined by (x_1, x_2), a hyperplane can be represented by

$$f(x_1, x_2) = \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}} x_1 + \frac{1}{\sqrt{2}} x_2 = 0.$$

For the point $(\frac{1}{2}, \frac{1}{2})$,

$$f(0,0) = \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}} \frac{1}{2} + \frac{1}{\sqrt{2}} \frac{1}{2} = 0,$$

indicating that it lies on the hyperplane.

For the point (0,0),

$$f(0,0) = \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}} 0 + \frac{1}{\sqrt{2}} 0 = \frac{-1}{\sqrt{2}} < 0,$$

showing that it lies below the hyperplane, and the shortest distance to the hyperplane is $\frac{-1}{\sqrt{2}}$.

For the point (1,1),

$$f(1,1) = \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}}1 + \frac{1}{\sqrt{2}}1 = \frac{1}{\sqrt{2}} > 0,$$

indicating that it lies above the hyperplane, and the shortest distance to the hyperplane is $\frac{1}{\sqrt{2}}$. Thus, for a point (x_{i1}, x_{i2}), the function $f(x_{i1}, x_{i2}) = \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}}x_{i1} + \frac{1}{\sqrt{2}}x_{i2} = M$ calculates the shortest distance from the point to the hyperplane when the hyperplane equation is normalized. The sign of M indicates the position of the point relative to the hyperplane: if $M > 0$, the point lies above the hyperplane; if $M < 0$, it lies below the hyperplane.

Step 1. Optimally dividing the sample using SVM

i) The fully separable case

If the data representing board and management members can be perfectly separated by a hyperplane, an infinite selection of possible hyperplanes exists. The optimal hyperplane is the one possessing the largest margin, implying that it is positioned at the maximum distance from all the data points. This is determined by computing the perpendicular distance from each data point to the hyperplane and selecting the hyperplane that maximizes this minimum distance. This process can be formally described as finding the solution to the optimization problem:

$$\max_{\beta_0,\cdots,\beta_p,M} M$$

$$Subject\ to \sum_{j=1}^{p} \beta_j^2 = 1,$$

$$y_i(\beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip}) \geq M, \forall i = 1, \cdots, n.$$

In optimizing for a hyperplane, the first constraint, $\sum_{j=1}^{p} \beta_j^2 = 1$, serves to normalize the coefficients, thus ensuring that M represents the shortest distance from the hyperplane to any given point. The second constraint $y_i(\beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip}) \geq M$ ensures that every data point not only resides on its correct side of the hyperplane but also maintains a distance from it that is no less than M.

ii) The non-separable case

Often, a hyperplane that perfectly separates all points does not exist. In such scenarios, one cannot find a solution where $M > 0$ for the optimization problem as defined previously. To address this, the model's concept of a separating hyperplane is expanded to include a 'soft margin,' which allows for some misclassifications. This approach is formally defined as the optimization problem:

$$\max_{\beta_0,\cdots,\beta_p,\epsilon_1,\cdots,\epsilon_p,M} M$$

$$Subject\ to \sum_{j=1}^{p} \beta_j^2 = 1,$$

$$y_i\left(\beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip}\right) \geq M(1 - \epsilon_i), \forall i = 1, \cdots, n,$$

$$\epsilon_i \geq 0,$$

$$\sum_{i=1}^{n} \epsilon_i \leq C,$$

where C is a nonnegative tuning parameter, and similar to the previously discussed case of perfect separability, M represents the width of the margin. ϵ_i denotes a slack variable, allowing individual data points to be positioned on the incorrect side of the margin or the hyperplane. If $\epsilon_i = 0$, then the i-th data point is on the correct side of the margin. This means that it is correctly classified. If $0 < \epsilon_i \leq 1$, then the i-th data point is on the incorrect side of the margin but has not crossed the hyperplane. This is a soft violation of the ideal conditions set by the SVM algorithm for classifying data points with a margin. This is not a misclassification. If $\epsilon_i > 1$, then the i-th data point has crossed the hyperplane and is on the side of the opposite class. This is a misclassification. C controls the sum of the slack variables ϵ_i, thus determining the number and extent of acceptable margin violations and hyperplane crossings.

In summary, the SVM algorithm is designed to identify a hyperplane that either perfectly separates board and management members with complete accuracy or, in instances where perfect separation is unachievable, finds a hyperplane that accomplishes separation with the fewest possible violations, such as the misclassification of board and management members.

Step 2. Measuring *Board-management commonality*

Following the optimal separation of board and management members by the SVM based on specified characteristics, commonality is measured by calculating the proportion of 'misclassified' directors (i.e., manager-like directors) and 'misclassified' managers (i.e., director-like managers) to the total number of directors and managers:

$$\text{Commonality} = \frac{\text{No.of director}-\text{like managers} + \text{No.of manager}-\text{like directors}}{\text{Total No.of management team mebers} + \text{Total No.of directors}}$$

While the preceding section described the SVM algorithm in the context of p-dimensional spaces, this study tailors the SVM approach to assess each characteristic of board and management members independently. This approach yields p-commonality measures, corresponding to the respective dimensions. To aggregate individual p-commonality measures, dimensionality reduction is conducted using principal component analysis (PCA). To derive a *Board-management commonality* index, we calculate the first principal component of commonalities for p characteristics for all firm-years. This index reflects the level of overlap between board members and management across multiple dimensions.

Appendix C
Instrument Construction

We obtain county-level data on age, race, education, and occupation by gender from the U.S. Census Bureau for the years 2000 and 2010 to 2021. The population is categorized into six age groups: 1) 24 years and younger, 2) 25 to 34 years, 3) 35 to 44 years, 4) 45 to 54 years, 5) 55 to 64 years, and 6) 65 years and older. The race groups include: 1) White, 2) Black or African American, 3) American Indian and Alaskan Native, and 4) Asian and other races. Educational attainment is divided into five subgroups: 1) less than a high school graduate, 2) a high school graduate, 3) a college or associate degree, 4) a bachelor's degree, and 5) a graduate or professional degree. The female labor workforce in the region (civilian employed population 16 years and over) is categorized into five occupation subgroups: 1) management, 2) service, 3) sales, 4) nature (natural resources, construction, and maintenance occupations), and 5) production-related (production, transportation, and material moving occupations).

For our sample period from 2003 to 2009, we use 2000 data and estimate values by linear interpolation, a widely accepted method for estimating regional characteristics (e.g., Hilary and Hui, 2009; Shu et al., 2012). We include only data pertaining to individuals born in the state of residence for all variables except those from 2000. Each component is then normalized using its mean and standard deviation to ensure that its scale is comparable. For each variable, we compute the entropy-based index (Massey and Denton, 1988), calculated as the sum $[p(x) \times \log(1/p(x))]$, where if $p(x)=0$, then $\log(1/p(x)) = 0$. Our instrumental variable, *Regional labor market diversity*, is derived as the sum of the standardized values of the four entropy indices.

Internet Appendix

Board-Management Commonality, Firm Value, and Board Decision-Making

June 2024

This appendix presents tables for additional analyses that are discussed but not reported in the paper. Specifically, the appendix includes the following:

- Figure A.1: Time trends of the board diversity index by each component over the period 2003-2021
- Figure A.2: Time trends of the management diversity index by each component over the period 2003-2021
- Table A.1: Manager-like directors' board service and director-like managers' positions
- Table A.2: Robustness test for missing census data
- Table A.3: Board-management commonality and board decision-making
- Table A.4: Board-management commonality, industry and market uncertainty, and information environment: Subsample analysis based on board diversity
- Table A.5: Board-management commonality, innovation outcomes, and capex adjustment decisions: Subsample analysis based on board diversity

Figure A.1 Time trends of the board diversity index by each component over the period 2003-2021

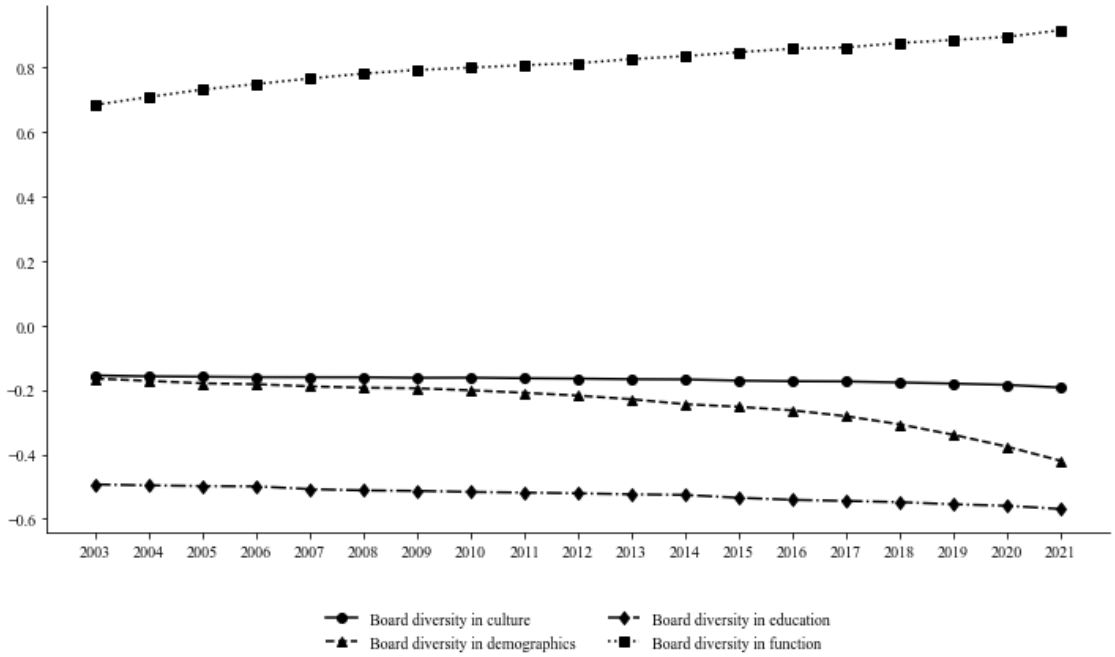
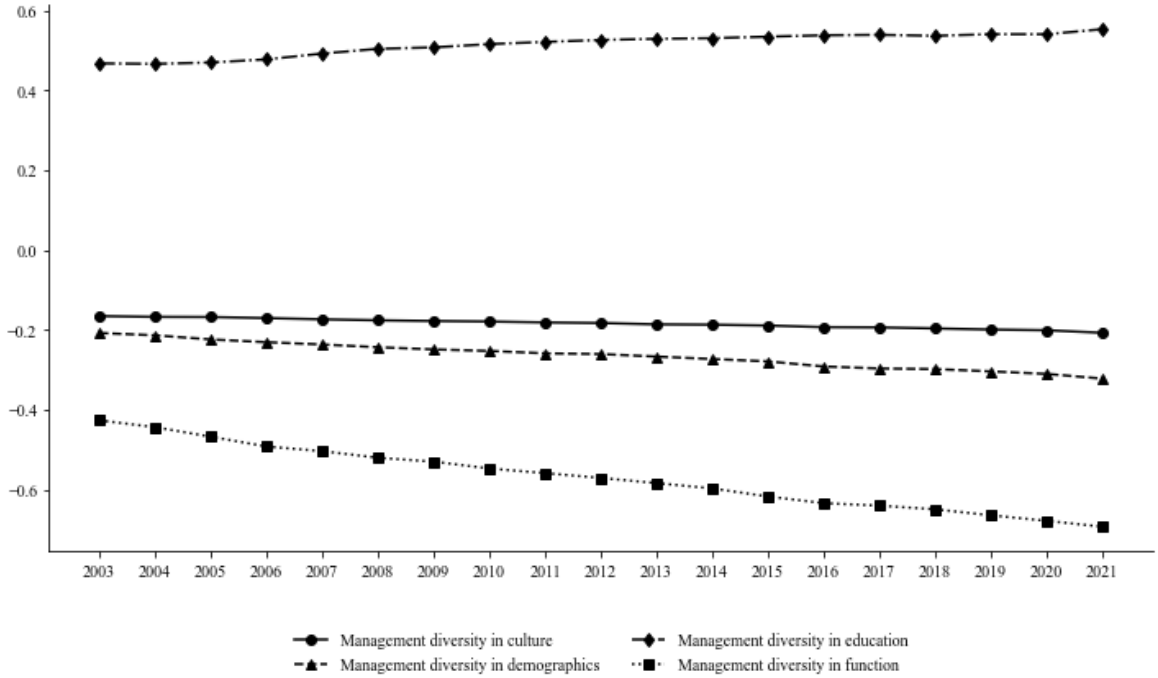


Figure A.2 Time trends of the management diversity by each component over the period 2003-2021



Appendix A.1
Manager-like directors' board service and director-like managers' positions

This table presents descriptive statistics regarding the board service of manager-like directors and the positions held by director-like managers in our sample over the period 2003-2021. *Manager-like directors (Director-like managers)* are directors (managers) who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) with managers (directors).

Position	Percentage
Manager-like directors' board service	
Chairperson (including committee chair)	50.30
Audit committee member	39.14
Compensation committee member	31.86
Nominating committee member	29.00
Director-like managers' position	
CEO	26.72
CFO	13.42
COO	4.91
President, Vice President	36.90
Other	18.06

Appendix A.2
Robustness test for missing census data

The table presents estimates of two-stage least square (2SLS) regressions in which we use *Regional labor market diversity* as the instrumental variable for *Board-management commonality*. The dependent variables are *Board-management commonality* in columns (1) and (2), and Tobin's *q* ((total assets – book equity + market value of equity) / total assets) in columns (3) and (4). The sample consists of 40,549 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2020. We obtain county-level data on age, race, education, and occupation by gender from the U.S. Census Bureau for the years 2000 and 2010 to 2021. In Panel A, missing values are replaced with data from 2010. In Panel B, missing values from 2003 to 2005 are replaced with data from 2000, while missing values from 2006 to 2009 are replaced with data from 2010. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted at the county-by-year level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	1st stage		2nd stage	
	Board-management commonality		Tobin's *q*	
Independent variable	(1)	(2)	(3)	(4)
Panel A. Replacing missing values with data from 2010				
Regional labor market diversity	0.006***	0.006***		
	(0.000)	(0.001)		
Instrumented: Board-management commonality			4.814**	3.257*
			(0.029)	(0.098)
Control variables (same as in Column (5) of Table 3)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes
Observations	40,549	40,549	40,075	39,994
Adjusted R^2	0.699	0.702	--	--
Panel B. Replacing missing values from 2003 to 2005 with data from 2000, and missing values from 2006 to 2009 with data from 2010				
Regional labor market diversity	0.007***	0.007***		
	(0.000)	(0.000)		
Instrumented: Board-management commonality			4.814**	3.257*
			(0.029)	(0.098)
Control variables (same as in Column (5) of Table 3)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes
Observations	40,549	40,549	40,075	39,994
Adjusted R^2	0.699	0.702	--	--

Appendix A.3
Board-management commonality and board decision-making

Panel A of the table presents estimates of ordinary least squares (OLS) regressions (Poisson regressions) in which the dependent variable is the number of board meetings in columns (1)-(4) (columns (5)-(8)). *No. of full board meetings* is the total number of meetings held for a firm's entire board of directors during a year, as reported in its proxy filing. *No. of nonexecutive board meetings* is the number of meetings held exclusively for nonexecutive board members during a year. We obtain the data on firms' board meetings from MSCI GMI. The sample consists of 22,738 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2017. Panel B presents estimates of Linear Probability Model (LPM) in which the dependent variable is *Departure of independent director (indicator)*, an indicator that takes the value of one if at least one independent director leaves the firm during a given year, and zero otherwise. A director is considered to have left the board if she is no longer listed in subsequent proxy statements (Fahlenbrach, Low, and Stulz, 2017). Panel C presents estimates of ordinary least squares (OLS) regressions (Poisson regressions) in which the dependent variable is the number of 8-K filings obtained from the SEC Analytics Suite database in columns (1)-(2) (columns (3)-(4)). Log (1 + No. of analyst coverage) is the natural logarithm of one plus the number of analysts who follow the company obtained from the IBES database. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. *No. of business segments* is the natural logarithm of one plus the number of business segments reported in Compustat Historical Business segment data. *Book-to-market* is the ratio of the book value of equity divided by the market value of equity. *CEO-chair duality (indicator)* is an indicator that takes the value of one if the CEO is also the chair of the board, and zero otherwise. *CEO only insider (indicator)* is an indicator that takes the value of one if the CEO is the only insider on the board, and zero otherwise. *Firm age* is the natural logarithm of one plus the number of years since a firm was first covered by Compustat. *No. of independent directors close to retirement* is the natural logarithm of one plus the number of independent directors aged 70 years or older. *CEO's departure (indicator)* is an indicator that takes the value of one if the CEO leaves during a given year, and zero otherwise. *Analysts forecast dispersion* is the standard deviation of forecasts provided by analysts who follow the firm, as reported in the IBES database. *External financing dependence (indicator)* is an indicator that takes the value of one if the ratio of the total amount from sales of common and preferred stocks and long-term debt issuance to total assets exceeds 10% in a given year, and zero otherwise. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Using board meeting frequency as a measure of board decision-making efficiency

	OLS				Poisson			
	Log (No. of full board meetings)		Log (No. of nonexecutive board meetings)		No. of full board meetings		No. of nonexecutive board meetings	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Board-management	-0.018	-0.023	-0.116**	-0.129***	-0.044	-0.050*	-0.121*	-0.122**
commonality	(0.400)	(0.279)	(0.018)	(0.009)	(0.118)	(0.068)	(0.057)	(0.048)
No. of business segments	0.010	0.009	0.011	0.019	0.001	-0.002	-0.004	-0.001
	(0.313)	(0.408)	(0.684)	(0.483)	(0.940)	(0.898)	(0.884)	(0.976)
Book-to-market	0.047***	0.050***	-0.002	-0.009	0.053***	0.059***	0.023	0.012
	(0.000)	(0.000)	(0.943)	(0.761)	(0.000)	(0.000)	(0.463)	(0.711)
CEO-chair duality (indicator)	-0.055***	-0.058***	-0.026	-0.026	-0.070***	-0.075***	-0.019	-0.013
	(0.000)	(0.000)	(0.220)	(0.245)	(0.000)	(0.000)	(0.450)	(0.611)
CEO only insider (indicator)	-0.015*	-0.013	0.018	0.021	-0.031**	-0.028**	0.038	0.042
	(0.085)	(0.150)	(0.406)	(0.339)	(0.010)	(0.019)	(0.154)	(0.120)
Log (No. of full board meetings)			0.190***	0.191***			0.590***	0.573***
			(0.000)	(0.000)			(0.000)	(0.000)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	22,738	22,738	19,716	19,716	22,737	22,737	17,196	17,140
Adjusted R^2/Pseudo R^2	0.476	0.474	0.552	0.549	0.162	0.169	0.290	0.301

Panel B. Using independent director departure as a measure of board decision-making efficiency

	LPM			
	Departure of independent director (indicator)			
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality: a	-0.025*	-0.027*	-0.025*	-0.027*
	(0.095)	(0.087)	(0.095)	(0.087)
ROA: b	-0.044*	-0.029	-0.052	-0.019
	(0.087)	(0.276)	(0.649)	(0.867)
a × b			0.005	-0.006
			(0.941)	(0.931)
Firm age	-0.019	-0.021	-0.019	-0.021
	(0.202)	(0.194)	(0.203)	(0.193)
No. of business segments	0.003	0.007	0.003	0.007
	(0.734)	(0.443)	(0.734)	(0.443)
No. of independent directors close to retirement	0.060***	0.060***	0.060***	0.060***
	(0.000)	(0.000)	(0.000)	(0.000)
CEO-chair duality (indicator)	-0.000	-0.001	-0.000	-0.001
	(0.950)	(0.916)	(0.950)	(0.916)
CEO's departure (indicator)	0.007	0.005	0.007	0.005
	(0.418)	(0.542)	(0.418)	(0.543)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes
Observations	40,586	40,586	40,586	40,586
Adjusted R^2	0.123	0.121	0.123	0.121

Panel C. Using material event frequency requiring 8-K filings as a measure of board decision-making efficiency

	OLS		Poisson	
	Log (No. of 8-K reported items)		No. of 8-K reported items	
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality	-0.027*	-0.022	-0.036**	-0.032**
	(0.096)	(0.187)	(0.025)	(0.048)
Log (1 + No. of analyst coverage)	-0.011	-0.007	-0.018**	-0.016*
	(0.184)	(0.414)	(0.027)	(0.060)
Analysts forecast dispersion	0.184*	0.174*	0.136	0.125
	(0.087)	(0.096)	(0.113)	(0.111)
No. of business segments	0.001	0.001	-0.000	-0.000
	(0.876)	(0.884)	(0.960)	(0.989)
External financing dependence (indicator)	0.105***	0.104***	0.105***	0.105***
	(0.000)	(0.000)	(0.000)	(0.000)
Control variables (same as in Table 2)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	Yes	Yes	Yes
Industry-year fixed effects	No	Yes	No	Yes
Observations	26,386	26,386	26,386	26,386
Adjusted R^2/Pseudo R^2	0.490	0.492	0.161	0.168

Appendix A.4
Board-management commonality, industry and market uncertainty, and information environment: Subsample analysis based on board diversity

The table presents estimates of OLS regressions in which the dependent variable is Tobin's *q* ((total assets – book equity + market value of equity) / total assets). The sample consists of 44,115 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. In Panel A., columns (1) and (2) (columns (3) and (4)) include a subgroup of firms experiencing high (low) industry shock, where the difference between industry (two-digit SIC codes) sales growth and average sales growth across all industries (Compustat) falls within the top (bottom) quartile of the sample. Columns (5) and (6) (Columns (7) and (8)) include a subgroup of firms where the annual average of the monthly economic policy uncertainty index, $EPU_{composite}$ index (Baker, David, and Levy, 2022), which is derived from the state in which firms are headquartered, is in the top (bottom) quartile of the sample. In Panel B., we use four variables of information asymmetry. *ROA volatility* is the standard deviation of ROA from $year_{t+1}$ to $year_{t+5}$. *Stock return volatility* is the standard deviation of stock returns from $year_{t+1}$ to $year_{t+5}$. *Analyst forecast accuracy* is the average of the difference between the maximum absolute forecast error for analysts who follow the firm minus the absolute forecast error of the analyst following the firm scaled by the range of absolute forecast errors for analysts following the firm (Clement and Tse, 2005). *Discretionary accruals* is absolute discretionary accruals estimated from the performance-augmented modified Jones (1991) model. We divide the full sample into two subgroups of firms where *board diversity* is below (above) the sample median value of board diversity in a given year. *Board diversity* is computed using Principal Components Analysis (PCA) to measure the degree of diversity among outside directors across four dimensions: demographics (age and gender), cultural background (Hofstede's measures: power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, indulgence), educational (college, Ph.D., MBA, and Ivy League university graduate), and functional characteristics (financial expertise, same industry experience, nonindustry experience (e.g., NGO, academia), tenure, CEO experience, technology experience, foreign experience, and legal expertise). *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Industry and market uncertainty

	High industry shock		Low industry shock		High economic policy uncertainty		Low economic policy uncertainty	
	Low diversity	High diversity	Low diversity	High diversity	Low diversity	High diversity	Low diversity	High diversity
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Board-management commonality	0.388**	0.178	0.154	-0.026	0.441***	-0.008	0.095	0.038
	(0.045)	(0.228)	(0.262)	(0.815)	(0.003)	(0.938)	(0.360)	(0.660)
Control variables (same as in Table 2, except for *board diversity*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test for equality of two coefficients (*p*-value)	0.681		0.604		0.428		0.701	
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,951	4,396	5,764	4,893	7,907	5,848	6,491	5,953
Adjusted R^2	0.676	0.667	0.746	0.679	0.638	0.684	0.690	0.704

Panel B. Information environment

	Tobin's *q*							
	ROA volatility		Stock return volatility		Analyst forecast accuracy		Discretionary accruals	
	Low diversity	High diversity	Low diversity	High diversity	Low diversity	High diversity	Low diversity	High diversity
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Board-management commonality: a	0.178**	0.089	0.118	0.061	0.096	0.085	0.089	0.057
	(0.024)	(0.111)	(0.242)	(0.459)	(0.519)	(0.574)	(0.266)	(0.309)
Information asymmetry: b	-0.518	0.825	0.790	2.960	-0.556	-0.085	-0.183***	-0.021
	(0.583)	(0.340)	(0.862)	(0.442)	(0.100)	(0.823)	(0.000)	(0.622)
a × b	0.649	-0.349	3.972	0.070	0.269	-0.011	0.179***	0.090**
	(0.285)	(0.524)	(0.128)	(0.975)	(0.217)	(0.965)	(0.000)	(0.014)
Control variables (same as in Table 2, except for *board diversity*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test for equality of two coefficients (*p*-value)	0.388		0.326		0.156		0.874	
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,164	19,788	24,164	19,788	17,088	10,348	20,176	16,563
Adjusted R^2	0.658	0.676	0.658	0.676	0.697	0.714	0.662	0.680

Appendix A.5
Board-management commonality, innovation outcomes, and
Capex adjustment decisions: Subsample analysis based on board diversity

Panel A of the table presents estimates of ordinary least squares (OLS) regressions in which the dependent variable is the natural logarithm of one plus the number of patents scaled by assets in columns (1) and (2) and the natural logarithm of one plus the number of citations received by patents granted to a firm in a year scaled by assets in columns (3) and (4). The sample consists of 46,294 firm-year observations covered in BoardEx-Compustat-CRSP universe nonfinancial firms over the period 2003 to 2021. Panel B of the table presents estimates of OLS regressions in which the dependent variable is the percentage deviation between the annual capex and the forecasted amount (i.e., Capex adjustment). We obtain the information about forecast announcement dates from the I/B/E/S Guidance database and match it with BoardEx-Compustat-CRSP universe nonfinancial firms. The sample consists of 10,295 firm-year observations over the period 2003 to 2021. *CAR (-2, 2)* is cumulative abnormal returns from two days before to two days after a firm's capex forecast announcement date. Abnormal stock returns are calculated using the Fama-French-Carhart (Carhart, 1997) four-factor models. *Board-management commonality* is the ratio of the number of directors and managers who share similarity in four dimensions (i.e., demographic, cultural, educational, and functional characteristics) to the total number of directors and managers, using the support vector machine (SVM) classification approach. We divide the full sample into two subgroups based on the sample median value of *board diversity* in a given year. *Board diversity* is computed using Principal Components Analysis (PCA) to measure the degree of diversity among outside directors across four dimensions: demographics (age and gender), cultural background (Hofstede's measures: power distance, individualism, muscularity, uncertainty avoidance, long-term orientation, indulgence), educational (college, Ph.D., MBA, and Ivy League university graduate), and functional characteristics (financial expertise, same industry experience, nonindustry experience (e.g., NGO, academia), tenure, CEO experience, technology experience, foreign experience, and legal expertise). All other variables are defined in Appendix A. *P*-values reported in parentheses are based on standard errors adjusted for heteroscedasticity and clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Innovation activity

	Log (1+ no. of patents/assets)		Log (1+ no. of citations/assets)	
	Low diversity	High diversity	Low diversity	High diversity
Independent variable	(1)	(2)	(3)	(4)
Board-management commonality	0.004***	0.000	0.031***	-0.001
	(0.002)	(0.758)	(0.000)	(0.842)
Control variables (same as in Table 7, except for *board diversity*)	Yes	Yes	Yes	Yes
F-test for equality of two coefficients (*p*-value)	0.324		0.183	
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	24,225	19,863	24,225	19,863
Adjusted R^2	0.621	0.573	0.515	0.473

Panel B. Capex adjustment decision

	Capex adjustment	
	Low diversity	High diversity
Independent variable	(1)	(2)
Board-management commonality: a	0.086	-0.043
	(0.108)	(0.278)
CAR (-2, 2): b	-0.183	-0.333*
	(0.239)	(0.075)
a × b	0.101	0.280**
	(0.342)	(0.021)
Control variables (same as in Table 8, except for *board diversity*)	Yes	Yes
F-test for equality of two coefficients (*p*-value)	0.467	
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	4,434	3,575
Adjusted R^2	0.277	0.245