The Relationship Between Board Diversity and Firm Performance in S&P 1500 Companies

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Abstract

This paper investigates the relationship of board diversity characteristics and firm performance within S&P 1500 companies. Drawing on upper echelon and resource dependency theories and analysing panel data from 2010 to 2022 using a fixed effects regression model, the findings reveal a significant positive effect of gender diversity on firm performance, measured by both return on assets and Tobin's Q. Conversely, age diversity shows a non-statistically significant relationship with ROA and a statistically significant negative relationship with Tobin's Q. Additionally, ethnic diversity shows a statistically significant positive effect on return on assets but is non-significant for Tobin's Q. The results remain robust after accounting for endogeneity concerns. These findings provide new evidence on the validity of the homogeneous versus heterogeneous board structures and highlight a positive impact of gender diversity on the board for firm performance in U.S. companies. The mixed outcomes regarding overall board diversity underscore the need for further research to explore the unobservable aspects of diversity.

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Abstrato

Este artigo investiga a relação entre as características da diversidade do conselho de administração e o desempenho das empresas do S&P 1500. Com base nas teorias de cúpula superior e de dependência de recursos e analisando dados em painel de 2010 a 2022 usando um modelo de regressão de efeitos fixos, os resultados revelam um efeito positivo significativo da diversidade de gênero no desempenho das empresas, medido tanto pelo retorno sobre ativos quanto pelo Tobin's Q. Por outro lado, a diversidade etária mostra uma relação não estatisticamente significativa com o ROA e uma relação negativa estatisticamente significativa com o Tobin's Q. Além disso, a diversidade étnica apresenta um efeito positivo estatisticamente significativo no retorno sobre ativos, mas não é significativa para o Tobin's Q. Os resultados permanecem robustos após levar em consideração preocupações com endogeneidade. Essas descobertas fornecem novas evidências sobre a validade das estruturas de conselhos homogêneos versus heterogêneos e destacam um impacto positivo da diversidade de gênero no conselho para o desempenho das empresas nos Estados Unidos. Os resultados mistos em relação à diversidade geral do conselho ressaltam a necessidade de mais pesquisas para explorar os aspectos não observáveis da diversidade.

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List of Abbreviations

RDT ..... resource dependency theory
ROA ..... return on assets
TQ..... Tobin's Q
UET ..... upper echelon theory

Decimal points are indicated by a period (.), and a comma separates thousands (,)

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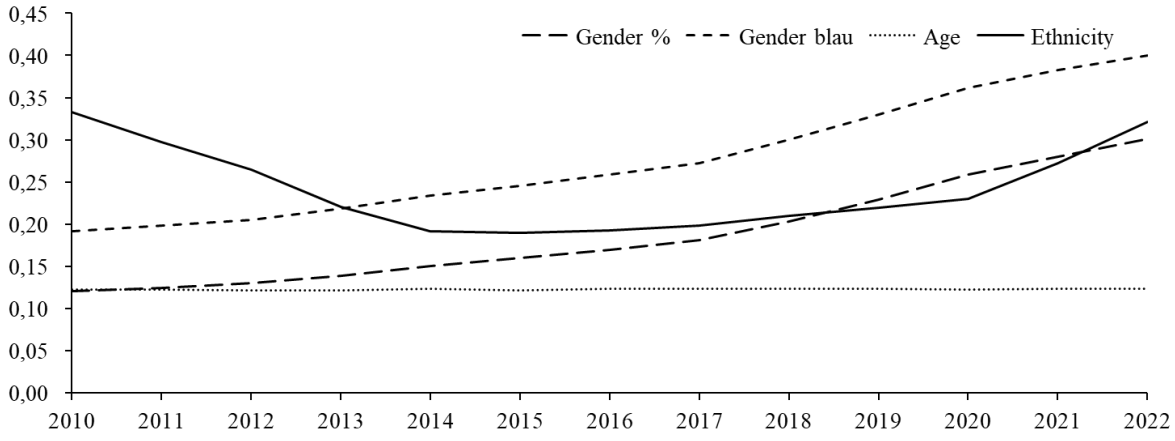
1 Introduction

Corporate governance has been an issue in how leaders practice profit maximization and sustenance of the profit. Given the many historical instances where the financial health of an organization was critically impacted by decisions from the leadership, corporations, and governments are focusing more on diversity. The Wells Fargo Fake Accounts Scandal (Kelly, 2020) and the creation of millions of unauthorized accounts serve as a recent example of the consequences of poor governance and a lack of accountability. Similarly, the 2015 Volkswagen emissions scandal, known as "Dieselgate" (Russell Hotten, 2015), revealed the dangers of unethical leadership, leading to substantial financial losses and severe damage to the company's reputation. Further, the 2008 bankruptcy of Lehman Brothers and the financial crisis of 2007-2009 (News, 2009), and the more recent Wirecard scandal (Reuters, 2022), highlighted the catastrophic effects of reckless risk-taking and decision-making at the executive level. These incidents underscore a complex set of factors influencing company performance, including ethical leadership, strategic decision-making, risk management, and financial oversight. (Goodstein, Gautam & Boeker, 1994) It raises the question of which role the senior decision-makers and, consequently, the board of a company play when thinking about long-term financial performance. In other words, **would things be different if corporate boards were more diverse?**

Board diversity is getting more and more relevant and an increasing number of academic papers investigating the impact on firm performance (Muhammad Akram Naseem, Akram Naseem, Xiaoming, Riaz & Ur Rehman, 2017). In response, companies like Google have focused on increasing leadership diversity (Google, 2024). Goldman Sachs, in 2020, introduced that companies it takes public have at least two diverse board members, including one woman (Goldman Sachs, 2024). Nasdaq in 2021, the US introduced rules requiring listed companies to disclose board diversity statistics to promote inclusivity in governance (Nasdaq, 2023). These initiatives by major organizations underscore the growing recognition and external pressure.

Studies on gender quotas reveal their impact on board composition, addressing concerns about appointing less experienced women to board roles due to these quotas (Casteuble, Lepetit & Ha Tran, 2023). After the introduction of quotas, female directors were more independent, experienced, geographically diverse, and academically qualified than those appointed before the quotas (Ferreira, Ferreira, Ginglinger, Laguna & Skalli, 2020). Additionally, Casteuble et al. (2023) discovered that the increase in female directors due to gender quotas did not affect firm performance in the short term. Soare, Detilleux and Deschacht (2022) found evidence of adverse effects of gender quotas on organisational performance, while Comi (Comi, Grasseni, Origo & Pagani, 2020) discovered an insignificant and negative effect of gender ratios on firm performance. This could be because gender quotas are not primarily made to increase firm performance, and second, they exclude other diversity factors like age and ethnicity. Figure 1-1 visualises the increase in gender diversity and ethnic diversity within the last years. Interestingly, on average, the percentage of women (Gender %) more than doubled over the whole-time span of 12 years. Age diversity (Age) stays constant for the US equity market over time.

Figure 1-1. Diversity measures of S&P 1500 companies from 2010 to 2022



Source: own illustration based on sample.

In a one-tier board model, which is predominantly the case for Anglo-American countries, both steering or decision-making and monitoring or supervisory roles are covered by board members (Ghezzi & Malberti, 2008). Resource dependence view finds increasing attention. It highlights the advisory and counselling role of the boards (Pfeffer & Salancik,

1978) and suggests that demographically diverse boards, equipped with the potential to gather further resources, are better set to provide practical guidance and find solutions for strategic decisions. This perspective reflects the idea that the arrangement of the board, with diversity in expertise and knowledge, can lead to superior advisory capabilities, access to external resources and improved organisational performance through effective decision-making (Aggarwal, Jindal & Seth, 2019).

Although literature notes the potential advantages of board diversity, including varied perspectives leading to better decision-making and increased innovation as it provided more relevant resources for problem-solving and which in turn leads to better firm performance (Dezsö & Ross, 2012; Forbes & Milliken, 1999), potential disadvantages such as coordination problems and longer decision-making processes have also been raised (Goodstein et al., 1994; Mahadeo, Soobaroyen & Hanuman, 2012). The following will list major and minor contributions coming from this study.

(i) This paper adopts a comprehensive approach to assessing firm performance by looking at ROA and Tobin's Q for robust results. This approach is meant to mitigate each of their limitations. While ROA can be manipulated, making it a less reliable standalone indicator, Tobin's Q offers a more holistic view by being both backward and forward-looking. However, Tobin's Q indirect market nature makes it challenging to directly attribute changes to factors like board diversity. By combining these two measures, the paper aims to provide a more balanced evaluation of the firm performance of board diversity.

(ii) Additionally, this paper concentrates explicitly on the context of U.S. companies, addressing a gap in existing research which often limits its focus to specific geographical regions or sectors (Dezsö & Ross, 2012; Goodstein et al., 1994). While Issa et al. (Issa, Yousef, Bakry, Hanaysha & Sahyouni, 2021) attempted to generalise findings across nations, such generalisations can be problematic due to different countries' varying institutional and socioeconomic factors. With the focus on U.S. companies, particularly those within the S&P 1500, this paper provides insights into a significant market. This focus is crucial as it covers a substantial portion of the market in terms of firm market capitalisation and revenue, offering a more robust understanding of the interaction of board diversity in the largest economy.

(iii) Lastly, this paper addresses the common downside of limited timeframes in existing research, often under 8 years. A period of 13 years extends most research and thus provides more robust insight.

The purpose of this study is to evaluate the varying effects on different dimensions of board diversity of S&P 1500 companies in the U.S., covering the years from 2010 to 2022 with an extensive set of variables. A panel data fixed effects regression accounting for endogeneity will lead to robust results contributing to providing new insights and practical implications of the dynamics of board diversity and firm performance. From the practical perspective, this paper can help regulators and investors account for the role of diversity on boards and more precise not only referring to gender but also the role of age and ethnicity in respect to firm financial performance.

The following sections highlight relevant theories, existing literature, and hypotheses. Section 3 highlights the sample, data collection, and methodology are described. Section 4. reports the results. Section 5 discusses the results, theoretical contribution, limitations, and research areas. Followed be the conclusion.

2 Theoretical Framework & Literature Review

2.1 Theoretical Perspectives

The investigation of what impact board characteristics have on firm performance is a widely researched are in corporate governance research (McDonald, Westphal & Graebner, 2008). Rick Molz (1995) for example, tried to explain performance with factors of diversity and independence. Therefore, he developed a pluralism index to classify boards into management-dominated and pluralistic. His model is limited to gender diversity, which may lead to the conclusion that diversity is not linked to firm performance. Following major literature, two ways of thinking should be taken into consideration: internal and external reasoning (Forbes & Milliken, 1999). An internal explanation can be rooted to the upper echelon theory (Hambrick & Mason, 1984; Hambrick, Cho & Chen, 1996) where firm performance and strategic decisions, can be explained by the characteristics of board members. The resource dependency view introduces the importance of external resources in shaping organizational actions and strategies. The theory posits that organizations are not autonomous but are heavily reliant on external resources, which can include funding, information, and legitimacy, provided by other entities such as governments, suppliers, and customers (Pfeffer & Salancik, 1978).

The literature on different measures of diversity is vast, and studies investigated various aspects of diversity, including social performance (Katmon, Mohamad, Norwani & Farooque, 2019) or financial performance (Issa et al., 2021). Research has especially shown relationships between gender diversity and firm performance. Table 7-1 summarizes some major studies in this field.

2.1.1 Upper Echelon Theory

To examine the relation of board diversity and firm characteristics. One perspective of literature is based on the upper echelon theory explanation by Hambrick and Mason (1984)(Hafsi and Turgut 2013; Giuseppe et al. 2021). It serves as a reasoning why institutions act in a specific way, the belief is that experiences, and values (demographic characteristics) of executives influence important strategic decisions, which leads to variance in firm outcomes (Hambrick 2007). It contrasts to external, economic, or technological factors and focuses on

top-level managers' cognitive and personal biases in shaping firm's strategies and performance. The upper echelon theory explains the limitations of managerial rationality and the influence of cognitive biases and suggests that managers interpret complex information based on their experiences and personal reasoning. This means that the individual contributions to the firm's strategic management is based on the diversity of board members (Hafsi and Turgut 2013; Hillman and Dalziel 2003).

Hambrick et al. (1996) discovered that diverse groups, in terms of education, backgrounds, and tenure (heterogenous), are "bolder in competitive actions than homogeneous teams." Additionally, they found that heterogeneous boards are slower in the execution than homogeneous boards. Contrary, as some research suggests that boards with similar demographics and educational backgrounds make more informed strategic choices than diverse ones (Issa et al., 2021)Nevertheless, in summary, more diverse boards will most probably bring greater diversity of viewpoints and methods of decision-making, potentially leading to more innovative and effective strategic choices and ultimately impacting firm performance. A deeper investigation of the influence factors will follow.

2.1.2 Resource Dependence Theory

The external perspective on explaining the mechanism behind board diversity and the effect on firm performance is often explained with the resource dependency theory (Brahma, Nwafor & Boateng, Agyenim, Boateng, 2021). Pfeffer and Salancik (1978) found that firms are heavily reliant on the larger network of organisations within the environment. This theory, proposed by Pfeffer and Salancik (2003), claims that boards, through their diverse composition, act as strategic resources for firms, facilitating access to crucial external resources and enhancing their connections with the environment (Pfeffer & Salancik, 2003).

Pfeffer and Salancik (1978) state that board composition is a response to the external environment. (i) For example, the number of directors is influenced by the need for external resources like capital. (ii) Board diversity can enhance the legitimacy of a board from the perspective of external entities, enabling it to have support from other organizations within its environment (Pfeffer & Salancik, 1978; Tuo, Chang, Tesfagebreal & Edjoukou, 2021). This support can lead to a better access to additional resources. (iii) Gender diversity on boards creates new channels of interaction with outside and makes easier access to specific information

(Tuo et al., 2021). The resource dependency theory argues that board diversity is a strategic asset that helps organisations to brings a new perspectives and skills that can lead the firm to better interact with and respond to its external environment (Pfeffer & Salancik, 2003), the stakeholder relationships are essential for crucial great performance (Luckerath-Rovers, 2013). A more heterogeneous board can better navigate challenging situations and incorporate stakeholders knowledge, skills and abilities (Giuseppe, Alessandro, Calabrese & Manello, 2021). So ultimately more diverse boards sets firms in a situation where better strategic choice can be made, which leads to firm performance (Ali, Ng & Kulik, 2014; Tuo et al., 2021).

2.2 Financial Performance Measures

Two measure of firm performance are often used in this research are: accounting measures and financial market measures (Wang & Clift, 2009). As seen in Table 7-1 the widely used measures for financial performance in empirical literature in this field are either ROA or Tobin's Q. In line with these studies, to improve robustness, this paper employs Tobin's Q, a market metric, in addition to ROA, an accounting measure.

Tobin's Q (forward looking) market value of equity divided by its book value of total assets. Bonomo-Braberman, Durán, Pardal, Safe and Rose (2007) explained that Tobin's Q represents a firm's capacity to enhance shareholder value. However, existing research also recognizes the negative effects of market manipulation, speculative investing, and extreme market responses to news. These factors contribute to market instability and can influence financial market measures. Further market measures generally can fail to capture the effects as they cover both actual and expected performance (Fernando et al., 2020).

ROA (backward looking) is calculated by firm's annual net income divided year-end total assets (Frijns, Dodd & Cimerova, 2016) and is derived from Compustat database. It seeks to measure firm strategic decisions on investments and productivity of the long-term assets (Klein, 1998). Nonetheless, executives can manipulate accounting measures. Literature shows that manipulation of earnings and financial statements is more common among male CFOs and financial statements than female CFOs (Gupta et al., 2020 // 2019).

2.3 Dimensions of Board Diversity

The section that follows presents the current literature and findings of the diversity variables, gender, age and ethnicity. Consequently, the following section will discuss the results of current work and lead to the development of hypotheses. By testing these hypotheses on the link between gender, age and ethnicity regarding firm performance, this study adds to the current understanding on this subject and provides insights into the impact of diversity on firm performance.

2.3.1 Gender

Gender diversity is often seen as a first step towards broader diversity and also one of the most visible or easily identifiable aspects, and consequently, many countries like Norway, France, and Germany implemented laws or quotas mandating a proportion of women on boards. Gender diversity in the view of upper echelon theory comes with a set of characteristics and cognitive bases of board influence organisational outcomes (Hambrick, 2007). The resource dependency theory concludes that firms with more gender diversity boards seek to appoint individuals with a range of social and human capital and bring a diverse range of expertise and legitimacy (Safiullah, Akhter, Saona & Azad, 2022).

Linked to a diverse cognitive base, Dezsö and Ross (2012) suggest women in top management enhances firm performance in US companies, especially in firms with high effort on innovation, where the benefits of gender diversity in groups decision-making are probably going to be particularly significant, which also sets the tone for board rooms. Brahma et al. (2021) showed a significant and positive effect of gender diversity on Tobin's Q and ROA for the UK financial sector, further highlighted the effect appears to be highly significant with three women or more on the board, which supports the critical mass theory[1] explained by Dotson (Dotson, 2011). Zhao et al. (2011) propose in a sample of Canadian firms that diversity in boards leads to better decisions through greater accessibility and the analytical quality of

[1] Torchia, Calabrò und Huse (2011), Liu, Beyrend-Dur, Dur und Ban (2014) demonstrated that the critical number of three women or more on boards boost innovation through strategic decisions. In line with further studies by Erkurt, Konrad und Kramer (2008) and Vicki, Alison und Sumru (2006, S. 500) .

decision making, which supports the upper echelon view and ultimately leads to better firm performance. External perspective reasoning can be brought into place as Giuseppe et al. (2021) discovered a positive relation between females on boards and profitability or firm risk, which is in consistent with (Khan & Vieito, 2013; Perryman, Fernando & Tripathy, 2016). They also discovered that having a diverse gender board lowers a company's risk level. It highlights the effect of improving legitimacy and support from diverse stakeholders to incorporate risk assessment based on communication and information from external entities. Adams et al. and Nguyen (Adams & Ferreira, 2009; Nguyen, Shuval & Yaroch, 2015) found that gender diversity increases monitoring and serves as a governance mechanism that benefits firms with weak governance. So, the resources that can be brought through diverse genders lead to better firm performance.

Contrary to Wellalage and Locke (Wellalage & Locke, 2013), a negative effect was found, reducing firms performance,and increasing agency costs. Lee and James (Lee & James, 2007) findings show a negative shareholders response to the announcement of female CEO. Chapple and Humphrey (2014) discovered a weak negative link between multiple women on boards and firm performance, but this depends on the industry. Farrell and Hersch (2005), (Bonomo-Braberman et al., 2007) found no significant relationship. As the literature shows mixed results relation between proportion of women and firm performance, the following hypothesis can be concluded.

H1a. The higher the gender diversity the higher firm's performance measured by ROA

H1b. The higher the proportion of woman the higher firm's performance measured by ROA

H1c. The higher the gender diversity the higher firm's performance measured by Tobin's Q

H1d. The higher the proportion of woman the higher firm's performance measured by Tobin's Q

2.3.2 Age

Kagzi and Guha (2018) showed that age diversity can enhance the board's collective experiences, resources, knowledge, and networks, potentially boosting bank profitability. This is supported by the idea that age diversity can increase of ideas, enhance creativity, and higher

innovation (Ali et al., 2014) based on upper echelon theory. Further, it can be argued a wide age distribution within the board leads to a more broad set of connections to external stakeholders for instance Akisimire, Masoud, Baisi and Orobia (2016) suggest that age diverse boards can more effectively meet customer needs across different age categories, potentially boosting firm revenues.

Ho-ule (1990) suggests divers boards in terms of age optimises labour division, with older members providing experience[2] and resources, middle-aged members managing executive tasks, and younger ones learning. Anderson, Reeb, Upadhyay and Zhao (2011) suggesting that younger board members tend to be more familiar with new technologies and more educated. Ararat et al. (2010) discovered that board diversity, including factors such as gender and educational background, influences the monitoring intensity of boards, which in turn affects firm performance in the context of the Istanbul market, leading to improved Tobin's Q (Ararat, Aksu, Tansel Cetin & Aksu, 2010).

On the opposite side Kipkirong Tarus and Aime (2014) suggests that age plays a relevant role strategic change. Talavera, Yin and Zhang (2018) found within a set Chinese bank that board age diversity is negatively related to profitability, they suggest that different views among managers on risk have a higher chance to conflicts within the decision making. Supported by (Hambrick et al., 1996) issues with trust and communication, which in turn lead to slower actions and responses from a heterogeneous team compared to a homogeneous arris, which may indicate a lack of interest in new ideas and strategies.

The few firms with higher age diversity face unique challenges coming from the need to reconcile or harmonise the differing perspectives, experiences, and expectations that individuals from various age groups bring to the table. The process of reconciling these differences across age groups can require effort and resources to integrate diverse viewpoints and work styles effectively, which makes it harder to focus on effectively address corporate social responsibility issues, which in turn can be seen as a new source of distraction. (Murray,

[2] According to Kim et al. (2010) investigated Korean firms and concluded that age has positive effects on firm valuation for independent outside directors.

1989) argues that homogenous boards, in terms of age, tend to have the same values and are impacted by the same past events, so they are more used to the firm values, leading to better communication, which may enhance response to external stakeholders, thus better managing external dependencies. Ali et al. (2014) explains the negative link between age diversity and ROA, supported by social identity theory, which suggests that age variation leads to divisions in thinking among board members, creating younger and older groups and fostering negative behaviours (Billig & Tajfel, 1973). Considering that age diversity can impact firm performance positively and negatively, the following is concluded.

H2a. The age diversity is negatively related to the firm's performance measured by ROA
H2b. The age diversity is negatively related to the firm's performance measured by Tobin's Q

2.3.3 Ethnicity

This section uncovers the impacts of ethnic diversity within boards, analysing its potential benefits and drawbacks. The term "ethnicity" covers ethnic backgrounds rather than nationality, though it's recognised that nationality can also impact the dynamics of a board. Considering the internal perspective of upper echelon theory. Katmon et al. (2019) suggest that ethnic background influences individuals' worldviews, leading to a board with high ethnic diversity being more open to innovative ideas and perspectives. Secondly, external resources depend on the assets of ethnic diversity, because a high degree of ethnic diversity may also make it easier for businesses to access foreign markets through personal connections to local expertise (Nathan, 2016).

The concept of majority and minority groups within this context is essential to note. Nemeth (1986) suggests that minority influence promotes more profound, more critical thinking and better decision making by encouraging consideration of diverse perspectives. Ethnic minorities can contribute human capital, outside networks, knowledge, expertise, and

other characteristics[3] to the board and can lead to improved governance, thereby enhancing the business's profitability (Fidanoski, Simeonovski & Mateska, 2014). Shore et al. (2009) pointed out that without proactive and effective management of ethnic diversity, businesses might experience decreased performance stemming from conflict and reduced participation from minority group members. Board members, therefore, benefit from varied ethnic origins and expand the range of viewpoints considered during the process of decision making. Swartz and Firer (2005) investigated the effect of board gender and ethnicity diversity on African boards and showed a positive and significant relationship between the proportion of colour (Africans, Indians and Coloureds) and firm performance, supporting the argument that the inclusion of an ethnic person potentially stimulates divergent thinking and decision-making process (Crano & Chen, 1998). Carter, Simkins and Simpson (2002) identified a positive effect of the proportion of minorities (African, Asian, and Hispanic) and Tobin's Q. Additionally, Erhardt, Werbel and Shrader (2003) discovered that the proportion of non-white board members in a sample of large U.S. companies has a positive relationship with ROA.

Frijns et al. (2016) indicates that the diversity in culture has more negative effects than positive ones, and factors like firm complexity and international presence can mitigate these effects. It could be explained by the potential challenges, as Hoogendoorn and van Praag (2012) noted that difficulties in communication and coordination associated with ethnic diversity could negatively influence team performance. The literature lags an overall investigation of ethnic diversity. Papers focus primarily on regions of where minority groups, namely African, Asian, and Hispanic, have their origin or are limited in sample size and time frame (Katmon et al., 2019; Swartz & Firer, 2005). In line with previous literature, the Blau index will also be used for ethnic diversity (Katmon et al., 2019; Richard, Murthi & Ismail, 2007). Based on the previous thoughts, the following is hypothesized.

[3] Additionally, it appears that Asian, Black, and Hispanic people approach tasks more collectivist cooperatively on an individual basis than do Anglo people. This is likely due to the collectivist cultural traditions that these people have rooted in Cox, Lobel und McLeod (1991).

H3a. Ethnicity diversity is positively related to a firm's performance, measured by ROA

H3b. Ethnicity diversity is positively related to a firm's performance, measured by Tobin's Q

3 Data and Method

The following chapter details the method adopted in this paper, starting with a comprehensive explanation of the data sources, the retrieved data, the initial sample and the reduction to the final sample, the variables used, and the methodological process.

3.1 Data and Sample

The analysis is based on the S&P 1500[4] from 2010 to 2022, as it is a comprehensive index intends to represent the U.S. (Standard & Poor's, 2023), making it a suitable choice for analysing board diversity and financial performance for several reasons (Dezsö & Ross, 2012). Firstly, the S&P 1500 covers companies with the highest market capitalisation, which provides a broad market representation and ensures that the analysis incroprates influential companies. Secondly, the large dataset of the S&P 1500 firms allows for a more robust analysis, as it includes a variety of industries, sizes, and structures. Additionally, the S&P 1500 index is widely recognised and extensively studied, ensuring that data is available for analysis, which is crucial for conducting thorough and reliable research.

The accounting data is retrieved from Compustat North America as the database allows the gathering of dependent and control variables over the full 13 year time period. The dataset contains 12 columns and 29,865 rows. The diversity data is retrieved from the ISS ESG Database over the same period, leading to a data set of 54 columns and 193,283 rows. Both databases serve as reliable sources and allow for a comprehensive analysis of various variables frequently used in previous studies (Anderson et al., 2011; Dezsö & Ross, 2012; HUANG & HILARY, 2018; Miller & Carmen Triana, 2009). The panel data, derived from matching CUSIP

[4] The S&P 1,500 is composed of S&P 500, the S&P 400, and the S&P 600 representing large, medium and small stock listed enterprises.

codes with GIC[5] codes reveal that while the initial list included 1,482 to 1,515 firms from the S&P 1500, the matched data captures 1,192 to 1,495 firms annually, showing gaps in the matching process that affect data completeness as shown in Table 3-1. The composition of the S&P 1500 changes significantly over time based on the GIC industry classification. A notable increase in listed firms, especially in the communication services and real estate industries, can be seen.

Table 3-1. Firm industry distribution from 2010 to 2022

Industries (GIC)[5)]	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industrials	186	193	199	203	213	222	231	231	228	231	241	239	238
Utilities	55	52	52	51	52	51	52	50	49	48	48	50	53
Financials	170	181	184	195	196	203	207	206	221	219	236	242	242
Health Care	142	138	141	141	146	149	155	162	160	160	169	174	186
Information Technology	202	195	198	199	190	181	174	172	172	166	163	162	168
Materials	77	84	86	86	85	86	82	83	76	82	85	84	86
Consumer Staples	61	65	67	72	70	68	70	72	70	75	75	77	81
Energy	49	54	57	64	65	66	63	67	71	70	68	61	64
Consumer Discretionary	183	185	194	191	184	189	206	214	204	210	209	203	213
Communication Services	21	26	31	31	35	36	43	44	44	47	47	45	49
Real Estate	46	54	56	60	68	72	80	91	96	102	113	108	115
Total # Firms[1)]	1,192	1,227	1,265	1,293	1,304	1,323	1,363	1,392	1,391	1,410	1,454	1,445	1,495
Total # Firms[2)]	1,482	1,470	1,497	1,515	1,499	1,505	1,508	1,515	1,506	1,526	1,519	1,491	1,515

Note: 1) Number after matching CUSIP code with GIC code; 2) initial list of S&P1500 CUSIP codes revived from ISS' U.S. Directors Database

Starting with the S&P 1500, which is supposed to be composed of about 1500 companies, leads us to an initial sample after matching the datasets for all variables containing 28,613 firm-year observations across various variables related to firm performance and board composition as shown in Table 3-2. Following previous literature, the Financial and Real Estate Sector is excluded because of notable variations in the capital structure, laws and business models, resulting in numerous challenges when analyzing their data (Aggarwal et al., 2019; Tuo et al., 2021). In line with Kim et al. (2010) the top 1% and bottom 99% of other accounting variables are winsorized. In addition, outliers within the different variables were excluded, 1% lowest and 1% highest in the sample (less 269) (Kao, Hodgkinson & Jaafar, 2019). Finally, missing

[5] GICS is an industry classification standard developed by MSCI (2024) and S&P Dow Jones Indices to provide investors with consistent and detailed industry definitions for global companies.

observations, which correspond to missing variables, are removed. This results in a balanced panel design with 3,666 firm-year observations belonging to 282 distinct firms.

Table 3-2. Sample selection

Step	Firm-year observation
Initial sample after matching both datasets	**28,613**
Less: Financial Sector & Real Estate	-6,058
Less: No full 13-year sample	- 16,952
Less: Outlier handling[1)] (trimmed at 1% | 99%)	-552
Less: No full 13-year sample after outlier handling	-1,385
Final sample	**3,666**

Note: This table presents the procedure to get to the final sample. The accounting data is retrieved from Compustat to gather dependent and control variables. The diversity data is retrieved from the ISS ESG Database to get the independent variables. Over the 12-year period, a total of 2201 unique company names appeared in the dataset. 1) accounting variables where winsorised.

3.2 Variables

The following chapter presents all variables used within the regression model and its calculation. The selection of variables can be seen in Table 3-3 and will be detailed in the following section.

Table 3-3. Variables

Measure	Acronym	Definition	Expected sign	Source
Dependent variables				
Return on Assets	ROA	The annual net income divided by the end of year total assets		Compustat North America
Tobin's Q	TQ	Calculated by market value of equity to total end of year asset		Compustat North America
Independent Variables				
Gender diversity of the boards	gender	Proportion of women directors on the board	+	ISS ESG
Gender diversity of the board	genderblau	The Blau index of directors gender diversity	+	ISS ESG
Age diversity of the board	age	The coefficient of variation	-	ISS ESG
Ethnic diversity of the board	ethnicity	The Blau index of directors' ethnic diversity	+	ISS ESG
Control variables				
Leverage	leverage	Total debt divided by total assets, representing the firm's debt ratio	-	Compustat North America
Firm size	size	The natural logarithm of the book value of total assets	+	Compustat North America
Board Size	boardsize	Number of board members	+	ISS ESG
Board ownership	ownership	The percentage of shares held by board members relative to the total number of outstanding shares	+	Computstat North America & ISS ESG
Board Tenure	tenure	The time a board member has served on the board	+	ISS ESG

Note: coefficient of variation = the standard deviation of director age divided by average age. The variable percentage of women on board serves as robustness, following the approach of Merve 2016, which uses both variables. Gender B will be used in a model following Raj 2016 and Proportion of women on board following Filip 2014

3.2.1 Dependent Variables

The dependent variables present firm's performance using two metrics: the ROA and Tobin's Q, which serve as indicators of firm performance. The selection of ROA and Tobin's Q is in line with methodologies applied in seminal works by (Fidanoski et al., 2014; Talavera et al., 2018) among others. ROA is measured as a firm annual net income divided by end of year total assets, aligning with the methodology used by Brahma et al. (2021). ROA stands as a critical indicator of how effectively a company is putting its assets to work, offering a clear lens into operational efficacy (Klein, 1998). This metric steps beyond the narrower focus of

ROI or ROE by covering all assets and providing a full review of resource utilisation. It directly links the company's operational profit to the boardroom's strategic decisions. ROA's ability to compare across various capital structures makes it an valuable tool for comparing diverse firms and ironing out the impacts that varying debt levels and equity might otherwise introduce. When paired with leverage as a control, ROA does an excellent job of highlighting a firm's actual operational profits, reflecting both the contributions of equity and debt to provide a fuller view of financial vitality (Barber & Lyon, 1997).

$$ROA = \frac{annual\ net\ income}{total\ assets\ end\ of\ year}$$

Tobin's Q is calculated with market value of equity divided by the book value of total assets as proposed by Bonomo-Braberman et al. (2007) and Richard et al. (2007). The market value component of Tobin's Q considers the stock market's assessment, which can be forward-looking and incorporate intangible assets not captured on the balance sheet. Tobin's q is handy in capturing the value of the marketplaces on a firm's investments and strategic initiatives, which may not be immediately apparent in accounting based metrics like ROA.

$$TBQ = \frac{market\ value\ of\ equity}{total\ assets\ end\ of\ year}$$

3.2.2 Independent Variables

This section will lay the foundation for the independent diversity variables used. The first two variables are the percentage of women and the Blau index as an estimate for gender diversity, which is in line with earlier research (Aggarwal et al., 2019; Fidanoski et al., 2014; Kılıç & Kuzey, 2016).

$$Percentage\ of\ woman = \frac{Number\ of\ female\ directors}{Total\ number\ of\ directors}$$

The use of a percentage of women may be misleading, a high percentage of women can lead to high gender diversity(Ararat et al., 2010) as an increase in female board members will contribute in most cases to a higher diversity, as generally board are male dominated (Table 4-1. Summary statistics). As Blau index is a measure of categorical variables, it can be used gender (Ararat et al., 2010; Kipkirong Tarus & Aime, 2014; Melsa Ararat et al., 2015). Building

on multiple studies, this paper measures gender diversity with the Blau index (Ali et al., 2014; Katmon et al., 2019; Song, Yoon & Kang, 2020) and is the sum of the squares of p_i from 1, where p_i indicates the percentage of people in each group, where n is the total number of members on the board. An index value of 0 implies the presence of a single gender, such as boards traditionally composed solely of males, whereas a higher value indicates a more balanced representation of genders (Song et al., 2020). The value is computed as follows:

$$BI = 1 - \sum_{i=1}^{n} p_i^2$$

In line with previous studies also, ethnic diversity is calculated with the Blau index (HUANG & HILARY, 2018; Katmon et al., 2019). Calculated as n number of categories, and p is the percentage of directors belonging to category i. Ethnicity is measured within the following groups:

1: Asian (excluding Indian / South Asian)
2: African American / Black
3: White Ethnic / Caucasian
4: Hispanic / Latin American
5: Indian / South Asian
6: Middle Eastern/North African

The Blau index is unsuitable for measuring age diversity, as age is a continuous variable (Chemers, Oskamp & Costanzo, 1995) and using different age subgroup classifications can lead to variability in the heterogeneity index (Song et al., 2020). Drawing on previous studies, the coefficient of variation is used to proxy age diversity (Aggarwal et al., 2019; Kipkirong Tarus & Aime, 2014; Song et al., 2020; Tihanyi, Ellstand, M. Daily & Dalton, 2000). It provides a scale-invariant proxy and is preferable to standard deviation or variance, as Allison (1978) mentioned. A coefficient of close to 0 represents a homogeneous age distribution within a board, and a higher coefficient of variation represents a greater diversity among the board (Tihanyi et al., 2000). It is computed as follows: simply the board's standard deviation divided by the board mean for a company in a given year (Kipkirong Tarus & Aime, 2014).

$$Coefficient\ of\ variation = \frac{Standard\ deviation}{Mean}$$

3.2.3 Control Variables

As larger companies may have the ability to enter new markets and utilize greater market power, their size may have an impact on their capacity to undertake strategic moves (Smith, Smith & Verner, 2006) or increases efficiency (Lee & James, 2007). On the other hand, larger firms can be less agile and resistant to strategic change (Tushman & Romanelli, 1985). So, its effect should be considered, as it is unclear. Adams and Ferreira (2009) found firm size correlates positively with Tobin's Q and return on assets. Carter et al. (2002) did not find a positive link of firm size and financial performance measures. In line with existing research, this paper uses the natural logarithmic from the book value of total assets to assess the firm's size (Aggarwal et al., 2019; Brahma et al., 2021; Fidanoski et al., 2014; Kılıç & Kuzey, 2016).

Another critical control variable to adress for omitted variable bias is leverage. Increased leverage makes it more likely that debt covenants will be broken and puts the company at higher risk of going bankrupt (Abdullah, 2014). Further, high leverage makes a firm more vulnerable to business shocks due to diminished capacity to repay debt (Kao et al., 2019). High cost of bankruptcy is typically related to a high level of debt (Kılıç & Kuzey, 2016). As a result, it is anticipated that leverage and firm performance will negatively correlate. In line with previous literature, firm leverage is calculated as the total debt divided by the total assets of the firm and represents the debt ratio (Brahma et al., 2021; Kılıç & Kuzey, 2016).

Previous studies have indicated that larger boards can adversely affect firm performance due to increased coordination costs and prolonged decision-making processes, heightening complexity and expenses (Nguyen et al., 2015). Yamak and Usdiken (2009) argue that large boards are likely to have multiple perspectives and, therefore, a favourable effect on decision making and, consequently, firm performance. Including board size as a control variable is essential to consider its possible impact and in line with the current literature (Aggarwal et al., 2019; Ararat et al., 2010; Brahma et al., 2021). It is expected to be positively related to firm performance and measured as the number of board members.

As board members gain experience over time, they contribute increasingly to board quality (Hambrick et al., 1996). Tenure significantly influences strategy development, board functioning, and network building (Hafsi & Turgut, 2013). Long-tenured boards accumulate firm-specific expertise, skills, and are familiarity with each other, reducing cognitive conflicts

(Forbes & Milliken, 1999). Conversely, short-tenured boards are more likely to draw on diverse perspectives from individual member's external experiences, potentially leading to a broader range of viewpoints on relevant matters (Forbes & Milliken, 1999). HUANG and HILARY (2018) found a U-shaped correlation between firm value and directors tenure, peaking at approximately 10 years. However, beyond the 10 year mark, there's a detrimental effect on ROA, which worsens up to 20 years (HUANG & HILARY, 2018). In summary, long-tenured boards are beneficial and correlate with enhanced performance. However, when taken to the extreme, it fosters groupthink and a reluctance to confront conflicts, potentially compromising sound decision-making. Therefore, this and other papers control for average tenure on the board (María del Carmen Triana, Toyah L. Miller & and Tiffany M. Trzebiatowski).

Increased ownership or shares held by managers can align the managers and public investors interests towards the common goal of maximising firm value (Chen, Sutton, Yi & Zheng, 2023). According to Morck, Shleifer and Vishny (1989), optimal firm performance can be achieved with moderate levels of management shareholding. Additionally, concentrated ownership can lead to a dominant shareholder appointing board members to benefit themselves, potentially at the expense of other shareholders' interests (Li, 1994). In Summary, including board ownership as a control variable in analyses helps prevent biased results and explores whether substantial shares held by board members prioritise actions solely to enhance firm performance to boost share value. The variable is calculated as a percentage of board members shares to the total outstanding shares. The above-listed control variables are essential to ensure unbiased results and exclude specific variances in the dependent variable.

3.3 Model Specification

The following section describes the regression model, which examines the relationship between board diversity and the firm financial performance. Standard cross-sectional data offers snapshots of multiple units at a specific time, while time-series data tracks changes within a single unit over numerous periods. Panel data, merging both dimensions, controlling for time-invariant (firm-specific characteristics) and time-varying (firm-invariant characteristics) factors by incorporating firm-fixed and time-fixed effects into the regression analysis. A panel data regression is used to test the hypothesis mentioned in the theoretical section. The approach follows Dezsö and Ross (2012) research design. Cross-sectional unit heterogeneity can be

controlled with panel data (Hsiao, 1985), and by incorporating individual-specific fixed or random effects, panel data regression can control for unobserved heterogeneity at the individual level.

The selection of diverse board members and firm performance may be impacted by factors that are not taken into account (omitted variables or unobserved effects) producing high correlation between board diversity and frim performance and misleading findings (Phillips & Sul, 2003). The commonly used approaches for panel data, like fixed effects or random effects models, minimise estimation bias by accounting for unobserved effects such as time and firm heterogeneity (Sarafidis & Wansbeek, 2012). Therefore, leveraging panel data methods is recommended to enhance the reliability and robustness of analyses when evaluating the relationship between board diversity and firm performance. In line with previous literature, the following equation is used to assess the hypothesis (Fidanoski et al., 2014).

$$ROA_{it} = \alpha + \sum_{i=i}^{n} \beta_i BDiveristy_{it} + \sum_{i=i}^{n} \beta_i Controls_{it} + \varepsilon_{it}$$

Where ROA is the financial performance proxy for return on assets, BDiversity stands for the variables representing board diversity (gender, age, ethnicity) and refers to the control variables (firm size, leverage, board size, board tenure, board share ownership). Following Ararat et al. (2010) a linear relationship between board diversity (independent variable), the control variable and firm performance (dependent variable) is assumed. Consistent with Anderson et al. (2011; Ararat et al.; Bonomo-Braberman et al.; Chapple & Humphrey) an OLS include fixed effects and random effects models that will be considered to estimate the coefficients.

The Fixed Effects model is used in panel data analysis to control for unobserved firm-specific characteristics that stay constant over time, as well as unobserved time-varying factors affecting all firms simultaneously, for example, factors like company culture or management style that remain constant for each firm throughout the study period (Hsiao, 1985). It allows for the control of both time-specific and firm-specific effects (Hill, Davis, Roos & French, 2020). The Random Effects model is also used in panel data analysis to account for variation across firms, assuming that the firm-specific effects are random and uncorrelated with the independent variables (Hsiao, 1985). Using a pooled OLS may lead to biased and inconsistent estimation,

bias in the omitted variable due to unobservable firm- and time-specific heterogeneities (Gujarati, 2003; Hambrick et al., 1996) so either a fixed effects or random effects model is appropriat. To evaluate which model fits the data set better, the fixed effects or random effects model is tested using the Hausman specification test (Hausman, 1978). According to the null hypothesis, states that the estimates produced by the FE and RE models do not significantly differ from another. In other words, the assumption is that there is no correlation between explanatory variables and the random effects, implying consistency between the fixed and random effects models (Kao et al., 2019) .The result rejects the null hypothesis, which implies a systematic difference between the random and fixed-effects models, leading to the use of the fixed-effects model.

4 Results

4.1 Descriptive Statistics of the Sample

Table 4-1 highlights the descriptive statistics of key variables from 2010 to 2022, with 3,666 observations related to firm and diversity characteristics. The key variables are ROA, Tobin's Q, gender- , age- , ethnic diversity, leverage, firm size, board size, board tenure and board ownership.

Focusing on the dependent variable, ROA, which represents a firm's profitability relative to its total assets, the data reveals an average of 6.6% with a standard deviation of 6.5%. The range of ROA from a low of -17.2% to a high of 28.9% highlights extreme variations in profitability and firm performance. Such a broad range suggests that while some firms are highly efficient in utilising their assets to generate earnings, others not, possibly due to strategic decision and operational or sectoral challenges and conditions. As the S&P 1500 index ranges across all major industries within the US, the interpretation of a concrete assessment is not part of this analysis. The 1st and 99th percentiles further illustrate this divergence, with the least profitable firms barely managing to mitigate losses and the top performers achieving exceptionally high returns on their assets. This is the baseline to explore how factors like board diversity might influence these profitability metrics.

The average percentage of women on boards across the S&P 1500 firms is 18.3%, reflecting moderate representation, with a standard deviation of 10.3%. This statistic shows the consistent presence of women in boardrooms across various firms, leaving room for improvement to achieve gender parity. The distribution interestingly ranges from boards with no female members to those where women represent 44.4% of the board. The 1st and 99th percentiles indicates that there is no gender diversity in the most homogeneous boards, with less than 1% of boards having more than 41.7% female representation, showing little commitment to gender inclusivity. The Blau index for gender (genderblau), at an average of 0.278, reveals a lower variance in gender diversity. This indicates that some firms have tried to improve gender diversity, but overall, it remains male-dominated, with many boards having only one or two female members. Understanding the effects of these gender representation levels on firm performance could clarify why creating diverse board is beneficial.

Representing the board members collective experience are two key variables: average age and average length of service within the board. Across companies, the board members average in age diversity measured by the standard deviation divided by the mean of 0.118, representing a homogenous board distribution. The average tenure is 9.496 years, showing consistent service durations across different companies, as evidenced by a standard deviation of 2.996 years. It may benefit firms by providing continuity and deep institutional knowledge but could hinder adaptability and fresh perspectives.

The variable ethnicity (ethnic diversity) on the boards of S&P 1500 firms is measured using the Blau index, with an average value of 0.231 and a standard deviation of 0.167. These figures suggest that there is moderate ethnic variation among board members. The index ranges from 0 (no diversity) to a maximum of 0.625, suggesting that while some boards achieve a high level of ethnic representation, others remain significantly homogeneous. This low diversity level indicates that boards are predominantly composed of members from similar ethnic backgrounds, which might limit the variety of viewpoints and experiences brought to decision-making processes.

The board average board size of 9.598 members leaves room for a diverse distribution of different characteristics. This means a representation of all measured ethnic group affiliations is possible on average. The standard deviation of 1.749 indicates a moderate variation within the size of boards as the data set represents only publicly traded companies from small, medium, and large enterprises. Further, the range from of 5 members at minimum to 15 members at maximum indicates that board size varies significantly among firms, potentially influenced by the company size, industry, and strategic needs or backgrounds.

The variable leverage represents the leverage ratio of companies, reflecting their debt financing practices. Among all observations, the mean leverage ratio stands at 0.247, with a standard deviation of 0.155, indicating some variation across companies. The 1st percentile is 0, suggesting that the lowest 1% of companies have no recorded leverage, while the 99th percentile is 0.642. It implies that most companies have conservative leverage strategies, with their long-term debt being a about one fourth the size of their total assets. The average firm size (size) is 2.12. The number indicates that while some companies are large (with a value of 2.497), there is a range of smaller firms with a logarithm value of 1.674.

Lastly, the ownership as a percentage of outstanding shares held by board members is highly volatile, with an average of 3.9% and a standard deviation of 7%. Interestingly, only one percent comes close to a percentage of 40.8% ownership. Such diversity in ownership levels can significantly impact board behaviour and firm governance, as higher board ownership typically aligns board members interests closer to those of shareholders, potentially enhancing the focus on shareholder value. It shows a different choice of ownership or governance structure, and there seem to be more independent boards to avoid over-concentration of power and potential conflicts of interest.

Table 4-1. Summary statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99
ROA	3,666	.066	.065	-.172	.289	-.151	.264
TQ	3,666	1.648	1.422	.196	8.575	.211	8.575
Gender	3,666	.183	.103	0	.444	0	.417
Genderblau	3,666	.278	.133	0	.494	0	.486
Age	3,666	.118	.032	.053	.233	.06	.204
Ethnicity	3,666	.231	.167	0	.625	0	.586
Leverage	3,666	.247	.155	0	.793	0	.642
Size	3,666	2.12	.156	1.674	2.497	1.764	2.452
Boardsize	3,666	9.598	1.749	5	15	6	14
Tenure	3,666	9.496	2.996	3.4	20.333	4.3	17.857
ownership	3,666	.039	.07	0	.414	0	.408

Note: The summary statistics for the dependent, independent, and control variables are shown in this table from 2012 to 2022

4.2 Correlation Matrix

This chapter will generate insights about whether pairwise correlation will lead to issues due to multicollinearity within the regression model. Secondly, the coefficients of the Pearson correlation matrix will be interpreted.[6]

Table 4-2 presents a pairwise correlation matrix with Pearson's parametric of the variables and the variance inflation factor (VIF) to check whether problematic multicollinearity exists in this model. Multicollinearity problems may exist when correlated at $|r| > 0.8$ (Gujarati,

[6] Additionally, homoscedasticity is not a serious problem, as the Breusch–Pagan/Cook–Weisberg test for heteroskedasticity shows. As prevention to control for heteroscedasticity in the model the stata command "robust" is used.

2003). Dormann et al. (2013) suggest not to use variables correlated at |r|> 0.7. VIF measures the correlation and strength between the explanatory variables in a regression model. If the value is close to 1, an explanatory variable's correlation with any other explanatory factors in the model is low. Further, if the value is greater than 10, multicollinearity exists in a meaningful degree (Dormann et al., 2013; O'brien, 2007). The correlation ranges from |0.027| to |0.577|, excluding the correlation of gender and genderblau. Gender and genderblau are used separately and serve as a robustness. Further, the VIF ranges from 1.06 to 1.835. As no value exceeds these two conditions of correlation greater than 0.7 and VIF greater than 10, the findings indicate that there is no significant multicollinearity in the model.

Table 4-2. Pairwise correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	VIF ROA	VIF TQ
(1) ROA	1.000												
(2) TQ	0.560*	1.000											
	(0.000)												
(3) Gender	0.059*	0.091*	1.000										1.177
	(0.000)	(0.000)											
(4) Genderblau	0.049*	0.081*	0.980*	1.000								1.192	
	(0.003)	(0.000)	(0.000)										
(5) Age	-0.005	0.019	-0.109*	-0.119*	1.000							1.089	1.088
	(0.759)	(0.251)	(0.000)	(0.000)									
(6) Ethnicity	0.047*	0.027	0.149*	0.145*	-0.056*	1.000						1.118	1.12
	(0.005)	(0.098)	(0.000)	(0.000)	(0.001)								
(7) Leverage	-0.242*	-0.243*	0.211*	0.220*	-0.042*	0.088*	1.000					1.171	1.169
	(0.000)	(0.000)	(0.000)	(0.000)	(0.010)	(0.000)							
(8) Size	0.020	-0.116*	0.320*	0.331*	-0.154*	0.248*	0.354*	1.000				1.831	1.835
	(0.237)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
(9) Boardsize	0.016	-0.095*	0.224*	0.250*	-0.029	0.246*	0.243*	0.577*	1.000			1.557	1.552
	(0.325)	(0.000)	(0.000)	(0.000)	(0.081)	(0.000)	(0.000)	(0.000)					
(10) Tenur	0.074*	0.065*	-0.209*	-0.210*	0.157*	-0.189*	-0.105*	-0.171*	-0.143*	1.000		1.181	1.182
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
(11) ownership	-0.029	-0.057*	-0.181*	-0.190*	0.218*	-0.114*	-0.044*	-0.260*	-0.096*	0.317*	1.000	1.237	1.236
	(0.082)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)			

*** *p<0.01*, ** *p<0.05*, * *p<0.1*

Note: This table presents the person correlation coefficients and the variance inflation factors of the dependent, independent and control variables

There is a weak positive and significant correlation between ROA and Gender (and Genderblau), suggesting that a higher proportion of female members might have slightly increased returns on assets or vice versa. Age and ROA having a low negative correlation. Ethnicity is barely positively correlated with ROA. Age and Gender (Genderblau) have a weak negative correlation, indicating that boards with a higher proportion of female members tend to have a low variation within age groups. This could mean that diversity in one category leads to lower diversity in the other category. A similar assumption can be drawn from the significant negative correlation between age and ethnicity. Gender (and Genderblau) and ethnicity show moderate positive correlations, indicating that boards with more gender diversity also tend to

have greater ethnic diversity. The strong positive correlation between board size and size suggests that larger firms tend to have larger boards. Tenure is mostly weak correlated with other variables, indicating that tenure does not vary significantly with factors like gender diversity or board size.

4.3 Regression Analysis Results

In this section, the hypothesis of whether board diversity affects firm performance is tested. As discussed in 2.1, the upper echelon and resource dependency theory help explain its relationship. Due to the Hausman test described in Section 3.3, a fixed effects model with the following model specification is employed:

$$ROA_{it} = \alpha + \sum_{i=i}^{n} \beta_i BDiveristy_{it} + \sum_{i=i}^{n} \beta_i Controls_{it} + \varepsilon_{it}$$

Where ROA is return on assets, BDiversity stands for the variables representing board diversity (gender, age, ethnicity) and refers to the control variables (firm size, leverage, board size, board tenure, board share ownership). The results are shown in Table 4-3.

Table 4-3. Regression results

Panel A	return on assets					
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
gender	0.0660**		0.0674**			
	(3.20)		(3.27)			
genderblau		0.0436**		0.0441**		
		(2.72)		(2.74)		
age	-0.0694	-0.0690			-0.0689	
	(-1.19)	(-1.17)			(-1.18)	
ethnicity	0.0216	0.0226*				0.0224*
	(1.91)	(2.00)				(1.99)
leverage	-0.213***	-0.212***	-0.213***	-0.212***	-0.209***	-0.210***
	(-9.86)	(-9.74)	(-9.77)	(-9.64)	(-9.32)	(-9.38)
size	0.150**	0.158**	0.153**	0.162**	0.204***	0.206***
	(2.95)	(3.08)	(3.00)	(3.13)	(4.36)	(4.44)
boardsize	-0.00146	-0.00158	-0.00134	-0.00145	-0.00126	-0.00173
	(-1.21)	(-1.31)	(-1.15)	(-1.24)	(-1.04)	(-1.45)
tenure	0.0000945	-0.0000204	0.0000156	-0.000113	-0.000587	-0.000401
	(0.15)	(-0.03)	(0.02)	(-0.18)	(-0.95)	(-0.65)
ownership	0.00316	0.00360	0.000850	0.00127	-0.00268	-0.00592
	(0.12)	(0.14)	(0.03)	(0.05)	(-0.10)	(-0.22)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	5051	5051	5051	5051	5051	5051

t statistics in parentheses
** p < 0.05, ** p < 0.01, *** p < 0.001*
Note: Genderblau serves as the primary measure for gender diversity; Model 2 represents baseline results

Panel B	Tobin's Q					
Variables	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
gender	1.838***		1.845***			
	(4.58)		(4.59)			
genderblau		1.390***		1.403***		
		(4.10)		(4.13)		
age	-2.643*	-2.616*			-2.739*	
	(-2.47)	(-2.43)			(-2.53)	
ethnicity	-0.0881	-0.0595				-0.0693
	(-0.45)	(-0.30)				(-0.34)
leverage	-1.462***	-1.448***	-1.478***	-1.465**	-1.363**	-1.379**
	(-3.38)	(-3.34)	(-3.36)	(-3.32)	(-3.06)	(-3.04)
size	0.407	0.452	0.496	0.535	1.867*	1.975*
	(0.47)	(0.51)	(0.57)	(0.60)	(2.22)	(2.32)
boardsize	-0.00197	-0.00560	-0.00966	-0.0129	-0.00527	-0.0111
	(-0.08)	(-0.23)	(-0.40)	(-0.53)	(-0.22)	(-0.46)
tenure	0.0144	0.0130	0.0168	0.0152	-0.000267	0.00107
	(0.95)	(0.86)	(1.11)	(1.01)	(-0.02)	(0.07)
ownership	-0.787	-0.748	-0.896	-0.854	-0.958	-1.069*
	(-1.52)	(-1.43)	(-1.71)	(-1.62)	(-1.92)	(-2.11)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	5051	5051	5051	5051	5051	5051

t statistics in parentheses
** p < 0.05, ** p < 0.01, *** p < 0.001*
Note: Genderblau serves as the main measure variable for gender diversity

In case of gender diversity, the results support H1a & H1b. in line with (Brahma et al., 2021; Dezsö & Ross, 2012; Mahadeo et al., 2012) reveals a positive and significant effect for both variables, gender with a coefficient of 0.066 ($p < .01$) and genderblau with an coefficient of 0.043610 ($p < .01$). More precisely, the coefficient of gender (as a percentage of women on boards) implies every 0.1 percentage point increase (decrease) of gender leads to an increase (decrease) of 0.0066 percent in ROA. These findings are contrary to Wellalage and Locke (2013) who found a reduction in firm performance and an increase in agency cost. The coefficient for Age (-0.069) is negative and not statistically significant, meaning the null hypothesis can't be rejected. Therefore, neither the results of Ali et al. (2014), which suggests a negative correlation exists between age diversity and firm performance, nor the findings of Ararat et al. (2010) that age diversity has a positive effect on ROA can be supported. The ethnicity results with a coefficient of 0.0226 ($p < .01$) are significant and positive, supporting H3a. These results are in line with Erhardt et al. (2003) and conclude that a higher ethnic diversity is favourable for companies' firm performance, and a change across ethnic affiliations impacts ROA.

Regarding the control variables, the coefficient for leverage is negative and significant for ROA (-0.212 | $p < .001$), suggesting higher levels of debt lead to lower ROA. This result is in line with Brahma et al. (2021), Liu, Beyrend-Dur, Dur and Ban (2014) and Kılıç and Kuzey (2016). The coefficient of size is positive and significant with 0.158 ($p < .01$), highlighting that firm size measured by total assets directly positively affects ROA for the sample. In line with findings from Adams and Ferreira (2009), Frijns et al. (2016) and Smith et al. (2006) who also find a positive contribution from firm size. A direct contribution from board size as Nguyen et al. (2015) and Frijns et al. (2016) concluded could not be found, meaning a higher number of board members does not lead to higher firm performance. Also, board tenure and ownership appear to be insignificant within the model.

4.4 Robustness tests and further analysis

A reverse causality test is used to improve the model. Firms with solid performance, e.g. high ROA, might be better positioned to attract a more diverse set of board members. Following Ali et al. (2014), who suggest this could be true for ROA increasing the number of females, the same logic can apply to attracting a more diverse range of board members regarding age and

ethnicity. Thus, gender, age and ethnicity as dependent variables are separately regressed on ROA as independent variables after controlling for leverage, firm size, board size, board tenure and board ownership. The results reported in Table 7-1 do not conclude that reverse causality within the baseline model exists and that return on assets does not predict board age or gender diversity. Secondly robustness will be tested by dropping major industries with a disproportionally large number of observations in the sample to exclude that these industries drive the overall findings. After dropping the Industrial and Consumer Discretionary Industries, is appears that only ethnicity reveals a significant effect on ROA ($\beta = 0.0326$ | n.s.), age ($\beta = -0.0413$ | n.s.) and ethnicity ($\beta = 0.0418$ | $p < 0.01$). Lastly, similar to prior literature, both ROA and TQ are utilised as proxies for firm performance to check the robustness of findings by having accounting and market measures (Ararat et al., 2010; Chapple & Humphrey, 2014). The results shown in Table 4-3 Panel B support the conclusions that the performance of a firm is positively and significantly impacted by gender diversity, based on TQ with a coeffiencet for genderblau of 1.390 ($p < 0.001$) in favour of H1c and gender with a coefficient of 1.838 ($p < 0.001$) not rejecting H1d. Age diversity is negative and statistically significant, with a coefficient of -2.616 ($p < 0.05$) supporting H2b. Ethnic diversity has no significant effect on TQ rejecting H3b.

Further, check for nonlinear (curvilinear) relationships of the explanatory variables genderblau, age and ethnicity by using the squared terms to check whether the impact is different on different levels of diversity. The coefficients of genderblau (negative) and genderblau^2 (positive) indicate a U-shaped relationship. Initially, as genderblau increases, ROA decreases, but beyond a certain point, further increases in genderblau lead to increases in ROA. The t-statistic is close to indicating a significant and nonlinear effect. The age (negative) and age^2 (negative) coefficients are not significant, indicating a nonlinear relationship in this model. Lastly, ethnicity (positive) and ethnicity^2 (negative) coefficients indicate an inverted U-shaped relationship. Initially, as ethnicity increases, ROA increases, but beyond a certain point, further increases in ethnicity lead to decreases in ROA. As the t-statistics for ethnicity and ethnicity^2 is insignificant, it indicates no significant nonlinear effect. These results are not in line with Ali et al. (2014) who, for example, discovered an inverted U-shaped for age diversity.

5 Discussion

5.1 Contribution

The results extend the current literature on board diversity by specific characteristics and firm performance on S&P 1500 firms from 2010 to 2022. Some findings support upper echelon theory that suggests the personal background and characteristics of board members affect strategic decisions and firm outcomes (Hambrick & Mason, 1984) and further supporting resource dependency theory, in which a diverse board composition acts as a strategic resource for firms, providing access to crucial external resources that lead to better firm outcomes. The analysis suggests three findings:

(1) Gender diversity among boards leads to superior firm performance, as measured with ROA and Tobin's Q;
(2) age diversity has negative negative and statistically significant for Tobin's Q; and
(3) diversity in ethnic backgrounds directly affects firm performance measured by ROA.

The descriptive gender analysis highlights that most companies appoint few women as board members. Still, the regression analysis concludes a strong positive and significant effect on firm performance from a higher percentage of women on boards and for overall mixed-gender boards measured by the Blau index. For the majority (about 99%) of observations, there are indeed more men than women on board. Therefore, an increase in women contributes to gender parity and firm perfromance.

The results are in line with the findings of Tuo et al. (2021), Dezsö, and Click (2012) and Brahma et al. (2021) that the proportion of women is positively associated with ROA and TQ. This effect potentially can be more favourable for smaller firms as board members may have more influence (Chen et al., 2023). Humphrey (2014) suggest that whether the women on board have negative or positive effects on the board depends on the performance of the industry firm. Insignificant or negative results are also found by Adams and Ferreira (2009). Bonomo-Braberman et al. (2007) explained that this could be because of the social adaption of "unconventional" board members (women are underrepresented) who adapt to the behaviours

and conventional (male) board members. Nevertheless, consistent with most of the research we conclude that improved decision making and better excess to external resources, leads to improved firm performance. So, the findings of the study contribute to the business case for gender diverse boards and quantifying the effects on return on assets.

Regarding age diversity, the descriptive analysis shows a small coefficient of standard deviation of 0.118 mean a relatively close range of age distribution within the board members. The regression analysis with a coefficient of -0.069 reveals a negative but not significant effect on ROA but a negative and significant effect on Tobin's Q ($\beta = -2.616 \mid p < 0.05$). The age diversity effect on Tobin's Q supports Murray (1989) argumentation that homogenous boards tend to have the same values and are influenced by the same historical event, leading to better communication. Still, this papers findings can't negate that age diversity may support a potential benefit coming from age diversity as it represents different generations which consider various strategic options and contribute to better dynamics (Mahadeo et al., 2012).

The results are not in line with upper echelon theory nor the logic of resource dependency theory. Further explanations, like social identity theory (Billig & Tajfel, 1973), serve as potential explanations for which age diversity can lead to grouping between younger and older board members and, in turn, trigger negative group behaviours. In line with prior research, the highlighting negative implications for business cases to increase age diversity. Further research is suggested as it may take time before the impact on return on assets due to the benefits of age diversity, such as better strategic decisions and linkage to diverse external resources.

For ethnic diversity, the descriptive statistics suggest that boards are predominantly composed of members from similar ethnic backgrounds, as the mean of Blau index 0.231 indicated. It might reduce the range of viewpoints and experiences that are brought to decision making procedures. Nevertheless, the regression analysis identifies a significant and positive relation between ethnic diversity and firm performance. Every 0.1 increase in ethnic diversity (e.g. from 0.23 to 0.33) increases return on assets by an average of 0.00226. The outcome could be explained by Fidanoski et al. (2014), who suggest that ethnic minorities can bring human capital, external networks, information, and know-how to the board. Research from Swartz and Firer (2005) and Shore et al. (2009) found similar results. Conversely, difficulties in communication and coordination associated with ethnic diversity could negatively influence

team performance (Hoogendoorn & van Praag, 2012). Frijns et al. (2016) discover a negative correlation between ethnic diversity and firm performance. We support upper echelon theory and resource dependency theory. Higher ethnic diversity potentially leads to improved decision making, better access to external resources, and, in turn, an increase in firm performance. By quantifying the impact on return on assets, the research findings support the business case for ethnically diverse boards.

5.2 Limitations & Further research

While this paper has clear strengths, the study is not without limitations, suggesting areas for future investigation. Firstly, because S&P1500 listed firms are analysed, the results primarily apply to boards of U.S.-based firms. Boards in other countries are typically in in other legal, and financial situations(Forbes & Milliken, 1999). Another limitation is the shortage of highly diverse companies in the dataset. For gender diversity is further explained by the critical mass theory (Erkurt, Konrad & Kramer, 2008). Joecks, Pull and Vetter (2012) found that a female representation 30% or more on boards leads to improvement in firm performance. Dotson (2011) suggest that the representation of one female on the board is symbolic, but three females are necessary to give them a voice. This potentially introduces biases in the empirical regression as there could be different effects within high levels of diversity. Further, this paper is facing the common limitation of a small set of board characteristics (Issa et al., 2021). This is because of a lack of database coverage and limited information within the disclosure of board characteristics. Lastly, while this paper assumes that boards significantly impact firms performance through their control and strategic decisions, this influence may not always be fully realised in practice. There is a potentially varying influence among boards, which should be controlled. Influenced by factors such as industry, size, location, and regulation. Some boards will have a greater or lesser ability to influence a firm's outcome (Chen et al., 2023). These limitations suggest the need for further research on board diversity and firm performance. Nevertheless, as shown in the robust section, the results are strong and make a number of contributions to current research.

Further research should address the expansion of diversity characteristics, like education prior to board experience or other relevant measures. This could widen the space of relevant considerations when developing board structures, both from an internal and external or

regulatory perspective. Future research should also consider incorporating other control variables to account for different levels of board influential power on firm performance as it varies across industries due to the differing levels of reliance on market trends and economic conditions. FICH and SHIVDASANI (2006) found that board decisions on strategy are critical in high-growth sectors like technology and pharmaceuticals. In stable industries such as utilities or consumer goods, external factors like market demand and economic conditions often are more critical than board decisions. The sole look at board diversity and the exclusion of subcommittees (e.g., audit, compensation, executive) may also fail to capture the drivers of decision-making and firm performance appropriately (Rhoades, Rechner & Sundaramurthy, 2001). These investigations depend heavily on the availability of sufficient data. Another aspect of research could address the topic related to the shortage of highly diverse companies in the dataset, which goes along with the conceptual question of whether the diversity of the board itself should be measured or the relative level of diversity compared to other factors.

6 Conclusion

This study investigates the link between board diversity characteristics and firm performance. Following the calls from Dezsö and Ross (2012) or for other research on this topic. By utilising a fixed effects regression on panel data with S&P 1500 firms from 2010 to 2022 containing 3,666 firm-year observations, we found that the effect of board diversity is multifactorial and does not have a positive or negative relation to firm performance. Using market- and accounting-based performance measures, which are often found in the literature (Dezsö & Ross, 2012; Fidanoski et al., 2014) The analysis adds clarity and shows the following robust results: **(1) a significant and positive effect of gender diversity on both ROA and Tobins'Q, (2) a significant and negative effect of age diversity on Tobin's Q and (3) a significant and positive effect of ethnic diversity and ROA.** The findings that gender and ethnic diversity have positive effects support upper echelon theory, suggesting that personal background and characteristics of board members affect strategic decisions and firm outcomes (Hambrick & Mason, 1984) and are in line with the resource dependency theory were diversity, act as strategic resources, providing access to crucial external resources leading to better firm outcomes. On the other hand, the social identity theory could explain the negative correlation between age diversity and firm performance (Billig & Tajfel, 1973), which suggests that age diversity can trigger negative group behaviours among younger and older board members.

The results lead to the following practical implications. Gender and Ethnic heterogeneity should be desirable when optimising firm performance. It possibly enhances ideas to manage challenging environments, provides a better foundation of knowledge and experiences leading to more innovative and effective strategic choices, and further increases linkage to external resources, ultimately impacting firm performance. Although it may seem counterintuitive, heterogenous age distribution can increase communication effort and is a potential source of conflicts. From a policy perspective, gender appears to improve performance within boards for accounting- and market-based performance measures, which is explained by better decision-making but also signalling and increasing legitimacy, especially for consumer-facing firms (Anderson et al., 2011). Theoretical implications support the notion that age diversity can potentially lead to disagreements and the importance of board diversity within firm performance. Further research could expand the set of board characteristics (e.g., education, technical background), account for externalities that affect the board's influence on firm

performance and investigate the relative diversity to other companies besides the absolute diversity within firms.

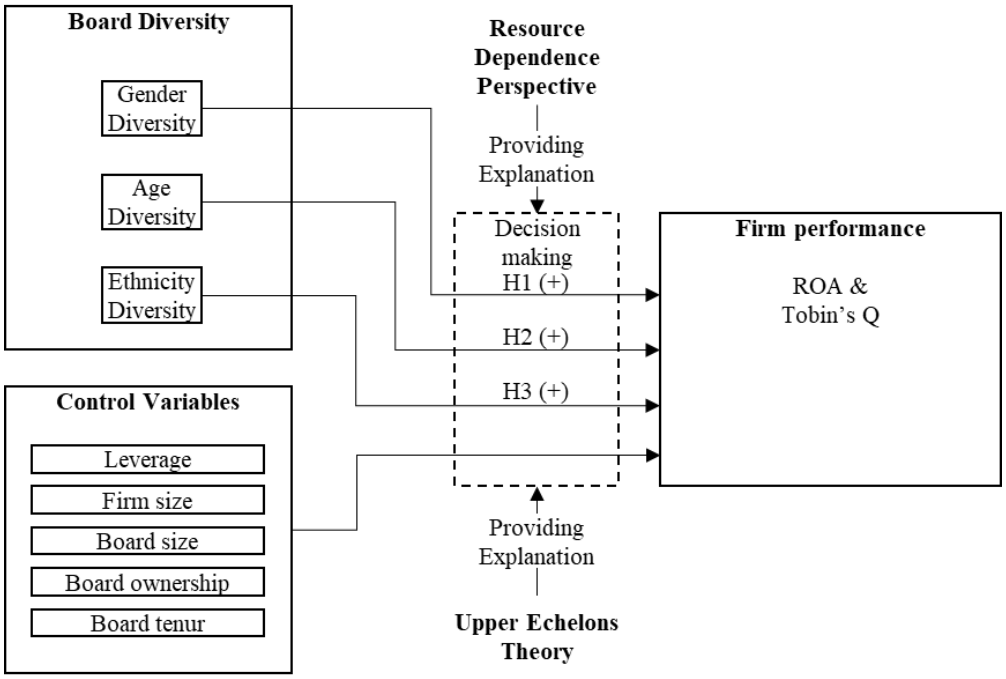
7 Appendix

Table 7-1. Overview of previous literature

Literature Review Board Diversity and Firm Performance

Study (Year, Authors)	Country/Region Sample Size Period	Method	IVs	DVs	Key Findings
Mahadeo et al. (2012)	Mauritius, 42 companies, 2007-2009	Fixed effects regression	Board composition variables (gender diversity, etc.)	Financial performance (ROA, Tobin's Q)	Board gender diversity is positively related with firm performance, particularly in terms of Tobin's Q.
Raj Aggarwal, Varun Jindal, Rama Seth (2019)	India, 1,707 firm-year observations, 2010-2015	Regression analysis, including fixed effects and GMM for robustness	Board diversity metrics, including gender	Firm performance (M&A, Tobin' s Q)	Board gender diversity has a significant and positive effect on both ROA and Tobin's Q..
Lee Allison, Yu Liu, Samuele Murtinu, Zuobao Wei (2022)	U.S., 1,939 firm-year observations, 1991-2011	OLS and 2SLS regression models	The proportion of female directors on the board	Firm value (Tobin's Q), Investment efficiency	A higher percentage of female directors is related to increased firm value and improved investment efficiency, indicating that board gender diversity on leads to better decision-making and resource allocation.
Sanjukta Brahma, Chioma Nwafor, Agyenim Boateng (2021)	UK, 301 firms, 2005-2017	Dynamic GMM model	Gender diversity on the board (percentage of female directors)	Financial performance (ROA, Tobin's Q)	A positive relationship between board gender diversity and firm performance, higher effect in non-financial firms than financial firms.
Cristian L. Dezso, David Gaddis Ross (2012)	U.S., S&P 1500 firms, 1992-2006	Panel data analysis with fixed effects and dynamic GMM	Female representation in top management	Firm performance (Tobin's Q)	Women in top management improves firm performance, especially in firms with focus on innovation..
Filip Fidanoski, Kiril Simeonovski, Vesna Mateska (2014)	Southeast Europe, 35 companies, 2008-2012	Regression analysis with the Blau index for heterogeneity	Gender diversity, Foreigners on board, educational diversity	Firm performance (ROA, Tobin's Q)	Gender diversity leads to overvalued companies, more foreigners on the board correlate with market undervaluation. Education may be positively correlated with firm performance
This Paper	**U.S., S&P 1500 firms, 5291 firm-year observations, 2010 - 2022**	**Panel data analysis with fixed effects with a comprehensive set of robustness testing**	**Gender diversity, Age diversity, Ethnic diversity**	**Firm performance (ROA, Tobin's Q)**	**Board gender diversity is significant and positively related to ROA and Tobin's Q; ethnic diversity is significant and positively related to ROA; and age diversity is significant and negatively related to Tobin's Q.**

Figure 7-1. Conceptual model



Soucre: own illustration according to to Fidanoski et al. (2014)

Table 7-2. Robustness testing & further analysis

	Reverse causality			Lagged & Less industries		Further analysis
	Genderblau	Age	Ethnicity	L.ROA	ROA	ROA
Variables	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18
Genderblau				-0.0178	0.0326	-0.0281
				(-0.98)	(1.35)	(-0.70)
Age				-0.0434	-0.0413	-0.0495
				(-0.81)	(-0.44)	(-0.18)
Ethnicity				0.0119	0.0418**	0.0644*
				(1.01)	(2.66)	(2.45)
Leverage	-0.0345	0.00632	0.0690	-0.178***	-0.246***	-0.214***
	(-1.02)	(0.64)	(1.62)	(-8.23)	(-7.44)	(-10.10)
Size	0.155	-0.0107	0.193	0.236***	0.206**	0.0945
	(1.79)	(-0.45)	(1.91)	(3.63)	(2.87)	(1.53)
Boardsize	0.00199	0.00244**	0.0113***	-0.00197	-0.00396*	-0.00115
	(0.86)	(3.13)	(3.70)	(-1.71)	(-2.05)	(-0.95)
Tenure	-0.00681***	-0.000732	-0.00300	0.000339	-0.000408	0.000250
	(-4.50)	(-1.66)	(-1.45)	(0.53)	(-0.42)	(0.39)
ownership	0.0173	0.0355	-0.0898	0.0121	0.0385	0.0103
	(0.23)	(1.12)	(-0.89)	(0.39)	(1.00)	(0.41)
ROA	0.0457	-0.0112	0.0801			
	(1.02)	(-0.90)	(1.44)			
Genderblau_sq						0.108
						(1.29)
Age_sq						-0.0509
						(-0.05)
Ethnicity_sq						-0.0991*
						(-2.06)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	5051	5051	5051	4535	2785	5051

t statistics in parentheses

** p < 0.05, ** p < 0.01, *** p < 0.001*

Notes: Model 17 excludes observation within the Industrials & Consumer Discretionary industry; Model 18 tests curvilinear

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